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**PRICE TRANSMISSION THEORY AND APPLICATIONS TO  
AGROINDUSTRY:  
AN ANNOTATED BIBLIOGRAPHY**

by

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## **Abstract**

This annotated bibliography presents an overview of the price transmission literature and reviews its application to agricultural product markets. The bibliography includes three types of articles: (i) theoretical pieces (early underpinnings through recent developments); (ii) empirical work on price transmission for agricultural products; and (iii) selected articles on specific agricultural products and the food industry. A brief synthesis of the articles is presented in the introduction.

## Key Words

ARCH model  
asymmetry  
Canada  
causality  
concentration  
cooperatives  
data  
derived demand  
empirical tests  
food industry  
GLS  
lags  
linear-feedback model  
marketing margins  
marketing order  
mark-up model  
monopoly  
monopsony  
oligopoly  
policy  
processing  
price-cost margins  
rational expectations model  
relative model  
retail  
semi-log model  
spatial model  
stochastic dominance  
theory  
VAR model  
weekly prices  
wholesale prices  
Wolffram model

### Commodities

beef  
catfish  
chicken  
citrus  
coffee  
dairy  
flowers  
organic produce  
pork  
rice  
shrimp  
vegetables

# INTRODUCTION

## Price Transmission Overview

The study of price transmission (or marketing margins) examines how price changes at one market level affect prices at other market levels. In agricultural markets this process is clearly of interest to both producers and consumers. Both groups sometimes believe that price changes between market levels are not fair (e.g. the result of actual added value or cost changes) but rather involve exploitation through "price gouging". Specifically, consumers may be concerned that price decreases at the farm level are not translated into price decreases at retail markets. Conversely, producers tend to believe that they are unjustly getting an increasingly smaller share of the retail food dollar. Concerns over unfair pricing practices in agricultural markets have resulted in Congressional antitrust hearings (Novakovic, 1991) and in some cases legislation to regulate prices.<sup>1</sup>

A critical examination of changing marketing margins for agricultural goods indicates that there are complex and interwoven temporal, spatial and economic relationships at work. Economic factors affecting marketing margins include both competitive supply and demand shifters and changes in firm concentration at different market levels. In addition, product differentiation driven by advertising and rigidities in traditional business practices also affect margins. It is also important to consider how the speed of transmission of information about these factors affects the size and variability of margins. The question of whether margins are too large is distinct from whether information transfer is too slow. Finally, some transmission effects may be due to the way data are collected. Relevant issues in this regard include: the timing of the collection of prices at various levels, the level of aggregation represented

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<sup>1</sup> New York State milk prices are regulated by law. The 1991 Regular Session of Laws of New York includes an act amending agricultural and markets law, the general business law and the state administrative procedure act, in relation to pricing and price gouging of milk (Chapter 84, S.5156, A 8135, p.127).



by the prices, and whether or not price specials at retail and/or other market levels are captured in the data (Economic Research Service 1976b).

Theoretical and empirical modelling techniques, combined with industry case studies, provide the basis for analysis of asymmetries in the price transmission process in agricultural markets. In general, much research in the past has focused on identifying asymmetries and estimating the speed of transfer of price changes from one level to another. Less emphasis has been placed on explaining the fundamental reasons for the observed behavior. The results of the traditional type of analysis have been used by industry specific decision-makers or as an input to improvements in government policies affecting the agricultural/food industry -- especially pricing policy. Progress in explaining observed price transmission behavior is clearly also an important input for policy-makers and further work in this area is needed to complement more traditional price asymmetry analysis.

This annotated bibliography presents an overview of the price transmission literature and reviews its application to agricultural product markets. The bibliography includes three types of articles: (i) theoretical pieces (early underpinnings through recent developments); (ii) empirical work on price transmission for agricultural products; and (iii) selected articles on specific agricultural products and the food industry. A brief synthesis of the articles is presented below followed by suggestions on how to use this bibliography.

### Theory and Empirical Applications

Four main factors are commonly considered in the study of price transmission: *causality* (the direction of effect between changes in price from one market level to another); *lags* (the amount of time it takes for prices at other market levels to adjust to an initial change); *asymmetry* (price increases may

affect other market prices differently than price decreases); and *market structure* (the effect of market size, number, product type and information on the price transmission process).

*Causality* is based on the concept of predictability. Hence, if past values of a market price increase the ability to predict another price, causality is said to occur. The direction of causality may flow up or down the system (e.g. from farm to wholesale to retail, *visa versa* or some other combination). Causality tests are referred to throughout the price transmission literature. Granger (1969) made a major contribution to the conceptual underpinnings of causality theory and Sims (1972) developed some basic empirical tests. Bishop (1979) explores the assumption of causality as defined by Granger and the use of Sims' empirical causality test. Blank and Schmiesing (1988) develop causality path (CP) analysis by combining Granger based causality tests and Wright's path analysis. They use causality tests to assess the relationship between pairs of variables and path analysis estimates the relative strengths of the ordered relationships. Finally, Conway et al. (1984) present an alternative view by arguing that Granger's notion of causality is flawed. They present a logical and philosophical discussion of causality concepts and suggest some alternatives to causality tests.

Gardner's landmark (1975) article on determining the relationship between retail and farm level prices is an applied causality problem. In this article he develops a theoretical justification for the markup model outlined by Waugh in 1964. "Waugh argued that consumer (primary demand) is the determining factor in the relationship between farm and retail prices; thus, food prices are determined at the primary level and farm prices are simply retail prices minus costs of marketing inputs" (Lyon and Thompson, 1993, p.524). Gardner used a simple static equilibrium framework which assumes equality of supply and demand in producer, wholesale and retail markets. He begins with the assumption that there is zero elasticity of substitution between farm product inputs and marketing inputs and then considers the result

of relaxing the assumption. The main effect being that the greater (smaller) the substitutability between farm and marketing inputs the less (more) volatile changes in the marketing margin are in response to changes in demand, supply of agricultural products, or marketing inputs supply. Both Heien (1980) and Wohlgenant (1989) build on Gardner's work. Heien (1980) presents a dynamic model of farm and retail prices and quantities which assumes that increases in wholesale prices are transmitted to the retail level via markup-type pricing behavior. The markup hypothesis is tested using causality tests based on Granger and Sims' work. Markup-type price relationships are estimated for twenty-two food commodities and shown to be mainly unidirectional from wholesale to retail. Wohlgenant's (1989) model considers the effects of changes in retail demand, farm product supplies, and costs of food marketing on retail and farm prices. He places no restrictions on input substitutability or diversity among firms in the industry. Results from estimation of retail and farm prices for eight food commodities indicate that the elasticity of substitution between the farm outputs and marketing inputs is an important parameter characterizing marketing behavior.

*Asymmetry and lags* are often analyzed together. Leads and lags in price may occur because of imperfect information, structural rigidities in the system and cumulative effects of previous price changes. Several articles have been written detailing the methods of determining lag length (Akaike 1970, Akaike 1974, and Darrat 1988). After examining length of lags, the next logical step in the analysis of price transmission is consideration of possible asymmetries in the reaction of prices at a given market level to changes in price at another market level. Such asymmetries may be due to imperfect information and structural rigidities but also may be due to the relative market power of firms. Wolfram (1971) developed a technique for testing asymmetry by segmenting independent variables in regression analysis into increasing and decreasing components to isolate effects. Houck (1977) built onto Wolfram's methods and tested the hypothesis that short- or long-run supply curves are more output responsive for

price increases than for price decreases because of asset fixity or other rigidities. He applied his tests to milk and pinto bean data and found the hypothesis to be supported in both cases. Wohlgenant (1985) developed a rational expectations model which "focuses on costs of holding inventories and demonstrates that current retail price will lag wholesale (or farm-gate) prices" (Lyon and Thompson, 1993, p.524). Finally, Lee (1985) presents the view that a feedback mechanism exists which helps explain long lags in price transmission. He posits that higher farm prices (or increases in input prices such as wages) increase retail food prices which can ultimately effect wage negotiations and in turn increase marketing costs, leading to another increase in retail prices completing the cycle.

Ward (1982) measures the linkages among retail, wholesale and shipping point prices for a group of fresh vegetables using Wolfram's asymmetry model. He also applies Granger's causality test to show direction of the price linkage. The results indicate that wholesale prices lead both retail and shipping point prices and that wholesale price decreases are more fully passed through to both retail and shipping point than are wholesale price increases. The price asymmetry may be due to relative differences in concentration and ability to assimilate information at different levels of the market (wholesalers may have an advantage) and the relative perishability of vegetables.

Kinnucan and Forker (1987) apply Houck's method for estimating non-reversible functions to test for asymmetry in the farm-retail price-transmission process in the dairy industry (milk, butter, cheese and ice cream). Results indicate that retail dairy product prices adjust more rapidly and fully to increases in the farm price of milk than to decreases. The reasons suggested for the observed price asymmetry include: industry concentration; government price support activities; and/or whether marketing margin changes are due to retail-level demand shifts or farm-level supply shifts. Pick, Karrenbrock and Carman (1990) also use Houck's (1977) model. They provide both a discussion of the formal relationship

between price asymmetry and marketing margins and an empirical application to analysis of weekly prices and margins for fresh lemons and Navel oranges in four retail markets. Pick et al find asymmetry in the short run (retail prices and margins for both products were more responsive to FOB price increases than they were to decreases) but not in the long run.

Nyankori (1991) tests hypotheses about the direction of causality between farm and wholesale prices in the catfish industry. The analysis departs from cross-correlation methods typically used to test causality and instead employs a linear feedback model (incorporating a lag structure) to fit the response to price change impulses. The results indicate that the direction of causality in the catfish industry is from the farm level to the wholesale level for frozen and processed catfish prices with a three-month lag due to non-immediate adjustment of market and institutional mechanisms.

An analysis of lags and asymmetry for beef markets is provided by Marsh and Brester (1989). They estimate an intertemporal reduced form model for boxed beef, carcass, and slaughter prices on a weekly basis. The results indicate that the existence of market uncertainty entails significant intertemporal lags between market levels such that prices stabilize 9-14 weeks subsequent to a market shock. Marsh and Brester indicate that certain characteristics of beef markets affect the price transmission process. They suggest that the fact that red-meat market structure is not perfectly competitive implies risk and uncertainty in pricing and production decisions. Ward, Kinnucan and Forker, and Marsh and Brester all suggest that market structure may be affecting the price transmission process.

*Market structure* analysis (with respect to price transmission) focuses on the effect of imperfect competition on the price spread between market levels. Several authors (Holloway 1991, Cotterill 1991 and Marion 1986) indicate that more research is needed on modelling price transmission with imperfect

competition as an accurate description of current industry organization and performance. Two articles are included in the bibliography which give a relatively general but useful discussion of the effect of increased concentration in the food industry on prices. Marion (1986) provides an excellent summary of the relationships between the structure of markets and the competitive behavior and performance of firms in those markets. He concludes that it is not possible in all cases to assert that concentration (at any given market level) leads to price increases. Weaver, Chattin and Banerjee (1989) examine the effect of concentration in retail grocery market structure on the speed of adjustment of retail food prices to changes in producer prices, real wages, and the cost of energy. Their analysis (which covers all U.S. Standard Metropolitan Statistical Areas) rejects the hypothesis that increased concentration reduces market efficiency as reflected in speed of retail price adjustment.

There have been a number of empirical studies on whether and how concentration affects marketing margins in the food industry. Holloway (1991) is a key article in this vein. It addresses the issue of whether or not non-competitive behavior exists in food industries and the likely effect on the retail-farm price ratio. Holloway develops Gardner's model of perfect competition in the marketing sector into a conjectural variations oligopoly model with endogenous entry and symmetric equilibria. Using data from Wohlgenant (1989), tests are made of the hypothesis that food industries are perfectly competitive in their pricing behavior. The results indicate any departures from competition are relatively insignificant. Holloway extends Gardner's analysis of the effects on the retail-farm price ratio of shifts in demand for agricultural products, and supply of inputs (agricultural and non-agricultural) to include consideration of market power. He concludes that competition in food industries leads to a reduction in the volatility of price ratio response to both changes in demand for food products and supply of agricultural inputs. However, he finds that competition leads to an increase of volatility in the price ratio response to changes in the price of marketing services. Schroeter and Azzam (1991) provide a conceptual

and empirical framework for analyzing marketing margins in a non-competitive food-processing industry facing output price uncertainty.

Several empirical studies of the effects of concentration have been done for meat markets. Babula, Bessler and Schuler (1991) examine relationship between corn and broiler price changes since the 1950s. Corn price increases are now more likely to be passed on to broiler consumers, and more immediately. Evidence further suggests that since the early period, significant change has occurred at the retail level, and that corn price has become a more important broiler price determinant. The principal finding is that farm/wholesale margins are more consistent with competitive performance now than they were fifteen years ago. Hall, Schmitz, and Cothorn (1979) examine the relationship of wholesale-retail marketing margins and concentration in the U.S. retail beef industry. They use an error components model to examine the hypothesis that dominant retailers raise prices without corresponding cost increases and/or secure differentiated procurement arrangements resulting in lower costs and higher price/cost margins without passing these savings on to consumers. The study concludes that the degree of concentration in a market does indeed affect the price-cost marketing margin in a particular region. Azzam (1992) models U.S. farm-wholesale beef price spreads using data from 1988-91 to test whether price spreads contain monopoly markup and/or a monopsony markdown. The Azzam model departs from the structure-performance model used by Hall et al (1979) and directly links the formation of price spreads and the profit maximizing behavior of the participants in the food marketing channel. The results of the model indicate, as do Hall et al, that the farm/wholesale beef price spread is not wholly explained by marginal processing cost. However, Azzam argues, that the additional spread is due to monopsony power only and not due to monopoly market power.

These results have been shown to differ by country. Rizvi and Uhm (1982) look at the effect of concentration on food markets in Canada. They use an empirical model to evaluate the nature of industrial performance influenced by market structure variables in 25 farm input and food processing industries in Canada during the 1970's. They conclude that concentration may be less important than anticipated and that the degree of foreign ownership is perhaps a more important explanatory variable when examining Canadian food industry behavior.

Another aspect of market structure which may affect price transmission is government control. Thompson and Lyon (1989) conducted a study on the effect of an 18 week suspension of volume control on California Arizona navel oranges. They found that FOB-retail price spreads narrowed during the prorated suspension period. However, they note that the temporary lifting of the prorated was expected by the industry and reactions reflected this. Powers (1991) criticizes Thompson and Lyon's 1989 article chiefly for not considering changes in the composition of shipments in terms of grades and sizes, failure to include all suspension periods, and lack of adequate justification as to why prorates influence the farm-retail price spread. Powers conducts his own empirical work and concludes that the marketing margin increased by nearly 1 cent per pound during a suspension. He argues that this shift is due to the higher proportion of lower quality produce during a suspension (which increases waste and thus marketing costs) and not attributable to market power. Thompson and Lyon (1991) reply that the 1985 suspension of prorated was fundamentally different than other short non-prorated periods. Thus, the lifting of prorated due to yearly seasonal supply changes -- which lead to quality changes and thus increased shrink (as illustrated by Powers model) -- is in fact a different effect than the 1985 prorated suspension.



## Related Publications

Articles are included in the bibliography which do not discuss marketing margins directly but rather provide insights into pricing behavior in agricultural/food markets. Background information on pricing behavior and the factors affecting it (within or across sub-sectors) provides a context within which price transmission theory can be used to examine specific problems. The dynamics of price changes at a single market level (either over time or a cross-section) provide insight into why changes occur in price spreads between market levels.

The first group of articles in this section have a broad scope. Holdren (1960) discusses price structures and price policies for a range of food products and store types including an excellent review of supermarket chain versus independent pricing strategies. A series of articles by Grinnell (1980) provide background information on the structure of the U.S. grocery retailing industry coming into the 1980's. Domowitz, Hubbard and Peterson (1986) use panel data to examine changes in price-cost margins in 284 manufacturing industries between 1958 and 1981. They find a dramatic narrowing of the spread between the margins of concentrated and unconcentrated industries over this period -- most pronounced in the producer goods sector. The cause of the narrowing is the greater sensitivity to price-cost margins in more concentrated industries to demand fluctuations. Cotterill (1991) reviews in detail the debate on the need for antitrust legislation in the food retailing industry and concludes that non-competitive pricing behavior in some cases does warrant more rigorous enforcement of antitrust laws.

The second group of articles discuss price dynamics across markets (spatial effects at the same market level). Brorsen, Chavas and Grant (1991) present a method for testing the relationship between market structure and spatial price dynamics using time series models. Their results show that regional concentration effects on price adjustment were slower as regional submarket concentration increased and

were faster in the regions with a higher market share. Benson and Faminow (1985) develop a spatial economic model to describe and analyze consumer choice, seller behavior, and price determination. Houston and Nieto (1988) provide an applied discussion of spatial effects on prices with some discussion of the relationship between market levels. They examine the relationship between supply factors and ex-vessel shrimp prices in regional fisheries and analyze regional price behavior in the Gulf Coast, South Atlantic and Georgia markets as affected by size and species. The study uses an interregional trade model to examine the effect of income and supply changes in one region on market prices in all regions. It also uses the seemingly unrelated regressions (SUR) technique in estimating regional price response functions taking into consideration effects of non-measured variables -- such as policy alternatives, government restrictions, and consumer tastes and preferences -- that influence prices in all regions.

The third group of related articles discuss pricing issues for horticultural products (fruit and vegetables, and flowers). Perishable commodities -- both horticultural and meat products -- have often been the subject of price transmission studies.<sup>2</sup> These sub-sectors are often characterized by large margins between farm gate prices and retail prices, volatile price changes, and price asymmetry between market levels in the short term. Horticultural commodities, in particular, are often sold to consumers without much apparent processing. This makes price transmission in such markets especially interesting as the increased price at market level is not always due to obvious value-added.

The horticultural articles cover issues such as the factors underlying price changes faced by farmers, the path of produce from the farm to retail level, and the pricing strategies of wholesalers and retailers. King and Martin (1958) provide a broad and detailed survey of efficiency of vegetable

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<sup>2</sup> The background to meat price transmission is covered fairly well in the articles in the price transmission theory and applications section

marketing in the Southeastern U.S. in the 1950's and discuss factors affecting prices. Hinson, Huh and Lee (1990) use stochastic dominance analysis to evaluate terminal market price risk for four vegetable crops across five market locations. The results of the study indicate that substantial differences in terminal market price variability existed between commodities and across terminal markets for a single commodity. McIntyre and Griffith (1988) provide an in-depth look at the factors determining rose prices at different market levels. Linden (1988) provides insight into U.S. vegetable growers and shippers perspective on price protection or price adjustment after sale in vegetable markets -- especially volatile crops like iceberg lettuce. Franco (1989) discusses the market for organic produce focusing on growth in volume, price increases and volatility and the industry's need for better consistent market information. There has been an increased spread between grower and wholesale prices between 1985 and 1987. This may be due to increased marketing costs, capital requirements for rapid expansion, or monopolistic rents. Relative price stability, for organic versus conventional produce, may be related to both excess demand and relatively inelastic demand. Ashley and Epperson (1989) identify the barriers, opportunities, and factors influencing the international marketing of the U.S. vegetables and vegetable products and their respective impact upon the potential of any given commodity in the world market. The data for the analysis were obtained from a survey of 2017 vegetable importers in 66 countries. Griffith, Jamandre and Piggott (1992) discuss the factors affecting vegetable pricing in Australian markets. They test and reject the hypothesis of price levelling and price averaging in Sydney retail vegetable price spreads.

### Use of the Annotated Bibliography

The annotated bibliography identifies and summarizes a selection of articles on price transmission theory and its application to the agricultural/food industry. It is intended to provide readers with a broad overview of the topic and specific information about individual articles. The articles are divided into those which directly discuss price transmission (theory and/or empirical focus) and those which provide additional background on the relevant commodity markets and factors affecting prices. The bibliography should provide a useful review to anyone conducting research on price transmission. There are three types of article listings. They are (1) brief annotation with additional details on analysis and results, (2) brief annotation only, and (3) reference without annotation. The listings which include additional details were chosen for their relative importance to the literature on price transmission. At the front of the annotations is a complete list of all the articles. We suggest that readers first look at the list of articles then turn to the annotations for further information.

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## ANNOTATIONS

### Note Regarding Citations

In the annotations section, the reference "(abstract)" is used to indicate direct quotation from the original abstract accompanying the paper. The reference "(adapted from abstract)" indicates that portions of the original abstract are paraphrased with points added. All other referencing follows normal conventions: quotes from the original text are cited with page numbers, paraphrases from the original text are cited only with the author and year.

## PRICE TRANSMISSION THEORY

### CAUSALITY

#### Section 1: Brief Summaries plus Detailed Annotations

Gardner, Bruce L. 1975. "The Farm-Retail Price Spread in a Competitive Food Industry." *American Journal of Agricultural Economics* 57(3):399-409.

KW: marketing margins, theory, mark-up model, policy

#### Brief Summary

This article develops the theoretical relationships between different market levels in the food industry. Many articles in the price transmission literature build on Gardner's model combined with empirical techniques based on causality theory. "Gardner sets out the basic determinants of retail and farm level prices in a framework consisting of a six-equation model which determines (for some given commodity) the retail price and quantity, the farm price and quantity, and the price and quantity of other retail inputs (e.g. marketing services). The basic concept employed is a static equilibrium framework which assumes the equality of supply and demand in each of the three markets" (Heien, 1980, p.10). The key benefit of using a mathematical model to derive the results presented in the paper is to examine the effect of relaxing the assumption that there is zero elasticity of substitution between farm product inputs and marketing inputs. The main effect is that the greater (smaller) the substitutability between the inputs the less (more) volatile changes in the marketing margin are in response to changes in demand, supply of agricultural products, or marketing inputs supply. Gardner concludes that "no single markup pricing rule...can in general accurately depict the relationship between the farm and retail price" (p.406). This is due to the different nature of changes in prices relative to the source of the change. In the literature causality tests are commonly used to test these relationships in empirically.

#### Analysis and Results

The competitive food marketing industry is modeled including two factors of production: (a) purchased agricultural commodities and (b) other non-agricultural inputs to produce food sold at retail (x). This industry is assumed to have constant returns to scale. Retail food demand is

defined as a function of retail price of food and exogenous shifters (e.g. population). Firms demand profit maximizing levels of agricultural inputs and non-agricultural inputs - thus the value of the marginal product of each equals its price. There are input supply equations for both agricultural and non-agricultural inputs. Solving the system yields a unique equilibrium for given values of the exogenous variables and the farm-retail spread is calculated with those values. The measures focused on in the paper are: (i) retail price to farm price ratio; (ii) the percentage margin (the former ratio minus 1); and (iii) the farmer's share of the food dollar (the value of purchased agricultural commodities divided by the value of food sold at retail). The analysis covers the effect of changes in supply and demand factors on the retail farm price ratio. For each factor, a range of cases are covered in terms of the relative own price supply elasticities of agricultural inputs ( $e_a$ ) and non-agricultural inputs ( $e_n$ ).

The first factor discussed is a change in the retail demand for food. If the supply elasticity of agricultural inputs ( $e_a$ ) is less (more) than the supply elasticity of non-agricultural inputs ( $e_n$ ) when demand for food shifts out this is likely to lead to a drop (rise) in the retail farm price ratio. If the supply elasticities are equal the ratio is unchanged and a fixed percentage markup rule is viable. However, this case is the exception. The less possible substitution is between agricultural inputs and non-agricultural inputs, the more volatile changes in the retail-farm price ratio are in response to changes in demand. Second, when farm product supply shifts out (e.g. due to technological change) retail and farm prices both decrease. However, additional non-agricultural inputs are required if  $x$  is to increase. No matter what  $e_a$  is, if  $e_n$  is positive, the price of non-agricultural inputs will go up relative to farm inputs and the ratio will increase. The magnitude of the change again depends on the substitutability between agricultural inputs and non-agricultural inputs (in the very short run  $e_n$  is probably small and thus the ratio relatively volatile). An odd case would be if economies of scale in marketing activities led to decreased prices of non-agricultural inputs with an increase in agricultural input supplies causing a reduction in the ratio. Conversely, when non-agricultural inputs are perfectly elastic their supply price would not change, but as the price of agricultural inputs falls, the ratio would still increase. Third, if the price of non-agricultural inputs rises due to a tax, for example, the ratio will also increase as price of  $x$  increases relative to price of agricultural inputs. However, it is difficult to aggregate across the components of non-agricultural inputs here as changes in the costs of marketing are likely to be relatively specialized to product or activity.

Additional results are presented for different types of government regulation on prices: (i) an effective price ceiling on retail food will usually reduce the price of agricultural inputs thus the retail to farm price ratio will increase (decrease) if  $e_a$  is less (greater) than  $e_n$ ; (ii) "supporting the price of farm products above the unrestricted market equilibrium level will reduce the retail to farm price ratio" (p.407). Finally, the farmer's share of the food dollar is analyzed in the same manner as the retail farm price ratio using different cases in terms of substitutability between agricultural inputs and non-agricultural inputs. In the short run, most farmers face elasticity of supply of non-agricultural inputs ( $e_n$ ) that is greater than the supply elasticity of agricultural inputs ( $e_a$ ) and the elasticity of substitution between agricultural and non-agricultural inputs is negative. In this case, the farmers' share of the food dollar would increase as demand increases. Gardner stresses that farmers' share of the food dollar and farm-retail price spreads are not the same. For example, farmers' share of vegetable shortening prices decreased by about 30% between the 40's and the 60's; whereas the retail farm price ratio increased about 17% during the same period. The price of soybeans increased relative to price of shortening but other inputs replaced soybeans to the extent that farmers' share of each shortening dollar has fallen.

Heien, Dale M. 1980. "Markup Pricing in a Dynamic Model of the Food Industry." *American Journal of Agricultural Economics* 62:10-18.

KW: marketing margins, theory, mark-up model

### Brief Summary

The paper presents a dynamic model of farm and retail prices and quantities which assumes that increases in wholesale prices are transmitted to the retail level via markup-type pricing behavior. This behavior is shown to be consistent with firm optimization under the assumption of constant returns to scale and Leontif production technology at the retail level. The markup hypothesis is tested using the Granger-Sims causality test. Markup-type price relationships are then estimated for twenty-two food commodities and shown to be mainly unidirectional from wholesale to retail. (adapted from abstract)

### Analysis and Results

Gardner's (1975) assumption of static equilibrium is less accurate for shorter time periods because markets require time to clear. Thus, Heien modifies Gardner's model by: including dynamic change ("the time path from one equilibrium point to another" (p.10)); adding the wholesale level; leaving out demand and supply relations for other factor inputs; and eliminating the assumption that supply and demand are equal in product and factor markets. Heien derives the model for both the short run and long run. In the short run he assumes fixed-proportions of inputs for each output and zero substitution between inputs (Leontif technology and constant returns to scale). However, in the long run inputs vary (stores can become more capital intensive etc.) Therefore, a CES production function is used to derive initial supply and demand equations which allow for non-zero elasticity of substitution but incorporates a restriction for the short run of fixed proportions. A two-level market model (farm and retail) is used to assess the effect of a change in demand at the retail level. As inventories fall, increased demand in the next period for retail goods is reflected in higher farm and retail prices. This causes a restriction of retail demand and inventories adjust to a new stable equilibrium over several periods. Thus wholesale prices and other input prices provide "signals" to store managers on which to base their mark-up pricing. Mark-up pricing rules will differ according to how prices at farm and retail levels change in response to different shifters. Farm to wholesale price markups are more difficult to analyze due to: difficulty of obtaining independent farm and wholesale price measures; extreme seasonality; and speculative inventory behavior. Causality tests on 22 commodities indicate that 57% of commodities analyzed exhibit unidirectional causality -- wholesale toward retail prices.

Regarding asymmetry, the hypothesis tested is that "increases in prices are passed on fully, while decreases are not, mainly so that other costs (wages) can be 'worked' in" (p.16). The Tweeten and Quance (1971) method for estimating supply with asymmetrical price response is used but two variables are added representing upward and downward shifts in wholesale prices. Monthly data on 22 commodities are used. "The relations are structurally stable and the hypothesis of asymmetric pricing behavior is rejected" for 17 of 22 commodities (p.16). It is not rejected for soft drinks, potatoes, rice, pork, and butter. One possible reason discussed in the article is that, there are costs involved with changing prices on items already on the shelf. Store managers may want to avoid big jumps in prices as much as possible.



Wohlgenant, Michael K. 1989. "Demand for Farm Output in a Complete System of Demand Functions." *American Journal of Agricultural Economics* 71:241-252.

KW: theory, marketing margins, relative model

### Brief Summary

The paper presents a conceptual and empirical framework for estimating demand relationships for farm outputs which "are important in providing linkages between retail and farm prices so that the effects of changes in retail demand, farm product supplies, and costs of food marketing on retail and farm prices can be consistently estimated" (p.241). A key aspect of the model is that no restrictions are placed on input substitutability or diversity among firms in the industry. The model is used to estimate retail and farm prices for eight food commodities. The results indicate that the elasticity of substitution between the farm outputs and marketing inputs is an important parameter characterizing marketing behavior and is necessary for more accurate estimation of derived demand elasticities (p.251-2).

### Analysis and Results

The article includes econometric analysis of the determinants of farm and retail prices for eight different commodities (beef and veal, pork, poultry, eggs, dairy products, fresh fruits, fresh vegetables, and processed fruits and vegetables). The equations are estimated by joint GLS with and without symmetry and constant returns to scale restrictions imposed. The unrestricted OLS estimates indicate that retail demand shifters and farm output variables are generally highly significant in determining farm and retail prices and the relationship is usually positive (except for fresh fruit -- where the retail demand variable is negative and not significant). The index of marketing costs is not significant and tends to give the "wrong" sign. F tests indicate that the restricted model is an improvement over the unrestricted (except for fresh fruits). Thus "food marketing and processing behavior can be characterized as competitive with constant returns to scale in food processing and marketing" (p.248). For all commodities (processed fruits and vegetables and fresh fruits are not calculated) the elasticity of substitution is positive and in some cases quite large and significant in most cases (except poultry). "Therefore, it is important to allow for input substitutability between farm outputs and marketing inputs in food processing and marketing" (p.250). The results for farm level derived demand are consistent with previous work but the main difference is that the variable input proportions model gives estimates which are close to or greater than the retail demand elasticities due to the opportunities for substitution. In fact except for poultry, the own-price elasticities of farm-level derived demand with variable inputs are at least 40% larger in absolute value than with fixed proportion restriction.

Wohlgenant advises caution in using the traditional method whereby the "derived demand for farm products is calculated by subtracting per unit marketing costs from the retail demand function for the product" (p.242). He notes that Gardner (1975) indicates that the method of using the product of elasticities of demand at the retail level and the elasticity of price transmission between retail and farm prices as the derived demand elasticity can only be used in the case of fixed proportions. Thus, it is best to use "reduced-form derived demand specifications for farm outputs in order to obtain more realistic estimates of derived demand" (p.252). Simply put, a model based on derived demand for farm outputs defines the marketing margin as a function of retail price, quantity and marketing input costs versus the mark-up model where the margin is a function of only retail price and marketing input costs and a time trend (Lyon and Thompson, 1993).

## Section 2: Brief Summaries

Bishop, Robert V. 1979. "Construction and Use of Causality Tests." *Agricultural Economics Research* 31(4):1-6.

KW: causality, theory

This paper explores the assumption of causality as defined by Granger and the use of Sim's empirical causality test. Sim's test is discussed in detail such as: methods of filtering out white noise; choice of lag structure; leads and lags; and application of test statistics (e.g. F tests, Durbin Watson statistic). Limitations and caveats of the test are also presented. The two key problems are measurement error and the difficulty of capturing the complex relationship underlying the variables using pair-wise ordering.

Blank, Steven C. and Brian H. Schmiesing. 1988. "Modeling of Agricultural Markets and Prices Using Causality and Path Analysis." *North Central Journal of Agricultural Economics* 10(1):35-48.

KW: causality, theory

The study proposes and evaluates a new procedure Causality Path (CP) analysis for use in examining agricultural markets and prices. Causal models of both corn and wheat prices are presented as empirical examples. Results have implications for both grain market structure and the robustness of Granger-type causality tests (abstract). Causality tests, developed by Granger, and path analysis, developed by Wright, are discussed in terms of their individual weaknesses. Then it is argued that they are complementary methods: causality identifying if there is a significant relationship between pairs of variables and the direction of the influence and path analysis estimating the relative strengths of the ordered relationships. The paper includes an application of Causality Path (CP) analysis to major markets for corn and wheat. The CP procedure is especially useful when theoretical expectations include indirect, as well as direct, effects between variables in a model.

Conway, Roger K., P.A.V.B. Swamy, John F. Yanagida, and Peter von zur Muehlen. 1984. "The Impossibility of Causality Testing." *Agricultural Economics Research* 36(3):1-19.

KW: causality, theory

This article argues that Sims' and Granger's causality are flawed. The authors discuss problems of forming conditional operations based on linear models. They critique Granger causality theory and the tests proposed by Sims. In conclusion they state, "'causality' as used by Granger...has been erroneously identified with feedback or dependence and loosely with correlation" (p.15). They prefer traditional approaches of scientific philosophers surveyed in an article by Zellner (1979). The authors also argue that a more recent Granger article (1980) indicates that he himself may have modified his views since writing the classic 1969 article.

Darrat, Ali F. 1988. "Have Large Budget Deficits Caused Rising Trade Deficits?" *Southern Economic Journal* 54(4):879-887.

KW: causality, lags

Following Geweke, Meese and Dent's (1983) research, the author applies Granger-type multivariate causality tests to the relationship between budget and trade deficits. He uses Akaike's final predictor error (FPE) criterion (1970) to specify the appropriate lag lengths. Finally, Full Maximum Likelihood estimators are used to generate efficient causality results from the system of equations. Bi-directional causality was identified between the budget and trade deficits. The multivariate analysis results also indicate that variables other than the budget deficit cause changes in the trade deficit (e.g. exchange rates, interest rates, and the monetary base).

Geweke, John, Richard Meese, and Warren Dent. 1983. "Comparing Alternative Tests of Causality in Temporal Systems." *Journal of Econometrics* 21(2):161-194.

KW: causality, theory, lags

This paper builds on Granger (1969), Sims (1972) and the Pierce and Haugh (1977) methodology review. Eight alternative tests of the absence of causal ordering are reviewed. "Their behavior under the alternatives is compared analytically using the concept of approximate slope, and these results are supported by the outcomes of Monte Carlo experiments. The implications of these comparisons for applied work are unambiguous: Wald variants of a test attributed to Granger, and a lagged dependent variable version of Sims' test introduced in this paper, are equivalent in all relevant respects and are preferred to the other tests discussed." (abstract)

Granger, Clive William. 1969. "Investigating Causal Relations by Econometric Models and Cross Spectral Methods." *Econometrica* 37:424-38.

KW: causality, theory

This is the classic paper in which Granger presents his theory of causality (as the culmination of earlier related pieces). As noted in the introduction, the objective of the paper is to "throw light on the relationships between certain classes of econometric models involving feedback and the functions arising in spectral analysis" (p.424). "Testable definitions of causality and feedback are proposed and illustrated by use of simple two-variable models. The important problem of apparent instantaneous causality is discussed and it is suggested that the problem arises due to slowness in recording information or because a sufficiently wide class of causal variables has not been used. It can be shown that the cross spectrum between two variables can be composed into two parts, each relating to a single causal arm of a feedback situation. Measures of causal lag and causal strength can then be constructed." (abstract)

Lyon, Charles C. and Gary D. Thompson. 1993. "Temporal and Spatial Aggregation: Alternative Marketing Margin Models." *American Journal of Agricultural Economics* 75(3):523-536.

KW: mark-up model, relative model, rational expectations model, theory

The effects of temporal and spatial aggregation on the performance of alternative marketing margin models is assessed using monthly, quarterly, and semiannual fluid milk prices from three U.S. cities. Nonnested tests for multivariate and single equation models with serial correlation are used to choose among alternative models at each aggregation level. While model choice is affected by temporal and spatial aggregation, model choice becomes more difficult as data are temporally or spatially aggregated. (abstract) Four models (all single equation specifications) are covered in the paper: (i) the simple Waugh mark-up model wherein the farm-to-retail margin is a function of price at retail, marketing inputs costs and a time trend; (ii) a relative model which brings quantity marketed into the model; (iii) a marketing cost model which sets the margin up as a function of quantity of farm output and the marketing firms cost function; and (iv) Wohlgenant's (1985) rational expectations model. Models (ii) and (iii) are based on Wohlgenant and Mullen (1987). Choice of models is affected by market structure, product characteristics and/or type of data used. The article gives a thorough analysis of the specific situations where each model is most applicable.

Nyankori, James C.O. 1991. "Price Transmission in the Catfish Industry with Specific Emphasis on the Role of Processing Cooperatives." *Southern Journal of Agricultural Economics* 23(1):247-252.

KW: linear-feedback model, cooperatives, catfish

The paper presents the implications of farmer-owned processing cooperatives for pricing in the catfish industry and tests hypotheses about the direction of causality between farm and wholesale prices in the catfish industry. The paper uses a linear-feedback model (which incorporates a lag structure) to fit the response to price change impulses -- this method is a departure from cross-correlation analysis typically used to address the causality question. The results indicate that the direction of causality in the catfish industry is from the farm level to the wholesale level for frozen and processed catfish prices with a three-month lag due to non-immediate adjustment of market and institutional mechanisms (p.251). The article argues that to maintain competitiveness, the catfish industry should try to minimize increases in wholesale and retail prices. "By holding unit farm production cost down, or increasing returns to production resources with present aquaculture technology, and minimizing price variations, the farm price of catfish, and hence wholesale and retail prices, can be maintained at a relatively stable and competitive levels" (p.251). In addition, it is advisable to try to stimulate demand through advertising and promotion to offset possible affects from price increases.

Pierce, David A. and Larry D. Haugh. 1977. "Causality in Temporal Systems." *Journal of Econometrics* 5(3):265-293.

KW: causality, theory

This article includes three main sections. First a formal discussion of patterns of causality possible between two series X and Y. Second, a review of existing and new work on alternative theoretical characterizations of causality events. Finally, a review of procedures for empirical detection of causal relationships between variables. A key difference in the procedures is how they handle autocorrelation. The conclusion also discusses ways of limiting spurious regressions. This article together with Geweke, Meese and Dent (1983) and Conway et al (1984) provide a thorough review (pros and cons) of causality theory and testing procedures.

Sims, Christopher A. 1972. "Money, Income and Causality." *American Journal of Agricultural Economics* 62:540-52.

KW: causality, lags, empirical tests

This article introduces a direct test for the existence of unidirectional causality. Sims develops Granger's causality theory and draws out some new implications for empirical testing. He emphasizes that "many commonly applied distributed lag estimation techniques are valid only if causality runs one way from independent to dependent variable" (p.545). Sims elaborates on the use of pre-filtering to ensure that residuals are serially uncorrelated prior to applying F tests for causal direction. After developing the unidirectional causality test in theory he applies it to the relationship between money and income. "The main empirical finding is that the hypothesis that causality is unidirectional from income to money agrees with the postwar U.S. data, whereas the hypothesis that causality is unidirectional from income to money is rejected."

### **Section 3: Additional References**

Granger, Clive William. 1980. "Testing for Causality: A Personal Viewpoint." *Journal of Economic Dynamics and Control* 2(4):329-352.

Sarkar, R. 1990. "Testing Causality in Economics: A Review." University of Guelph Working Paper. 90/12.

Waugh, Frederick V. 1964. "Demand and Price Analysis: Some Examples from Agriculture." USDA Technical Bulletin 1316. USDA: Washington DC.

## ASYMMETRY AND LAGS

### Section 1: Brief Summaries plus Detailed Annotations

Marsh, John M. and Gary W. Brester. 1989. "Intertemporal Price Adjustments in the Beef Market: A Reduced Form Analysis of Weekly Data." *Western Journal of Agricultural Economics* 14(2):235-245.

KW: beef, lags, weekly prices

#### Brief Summary

An intertemporal reduced form model is estimated for boxed beef, carcass, and slaughter prices on a weekly basis. The results indicate that prices respond jointly to changes in economic information with weeks  $t$  and  $t-1$ , supporting time series studies showing farm and wholesale prices to be nearly instantaneously related. However, the existence of market uncertainty entails significant intertemporal lags, revealed by prices stabilizing 9-14 weeks subsequent to a market shock.(abstract) Additional key elements affecting price transmission between beef market levels include: (1) delays due to transactions costs associated with different forms of price discovery (such as cash negotiation, forward contracting, or formula pricing); (2) the red-meat market structure is not perfectly competitive which implies risk and uncertainty in pricing and production decisions; and (3) traders may depend on seasonal pricing trends and react to weekly price and production variations with caution.

#### Analysis and Results

This article adds to the literature on beef price behavior by measuring intertemporal price behavior by using weekly data to examine distributed lag responses based on a set of reduced form difference equations (p.235). The results provide information on the source and time path of price changes at different market levels. "The econometric model used in this study consists of weekly slaughter, carcass, and boxed beef prices that are vertically and intertemporally linked within a set of reduced form equations incorporating market dynamics" (p.236). Reduced form prices are estimated to calculate the direct and indirect effects of changes in market information. Price data covers a period from first week of January 1982 to the last week of December 1985 (209 weekly observations). "The statistical tests indicate that second-order difference equations with ARMA (1,1) disturbances best characterized the behavior of carcass and slaughter prices, and a first-order difference equation without an ARMA-process best characterized the behavior of boxed beef price" (p.239). Results indicate that "live cattle, carcass, and boxed beef prices respond relatively quickly to changes in economic information" (p.240). There are two reasons offered for this: (i) relatively uniform information across buyers and sellers; and (ii) "quick coordination of input-output activities between cattle feeders and meat packers and processors" (p.240). The results do not support other studies which show that farm prices lead wholesale prices.

The econometric results indicate that market participants adjust quickly to changes in key pieces of information. However, the authors argue that the adjustment process is actually longer than indicated by the distributed lag analysis due to expectation lags and institutional rigidities (examples are given in the brief summary above). The authors consider the number of weeks

for beef prices to reach a stabilization period after a change in the three variables with the largest impact on beef prices: beef production; poultry production; and wages. The results indicate that "the major price impacts of changes in economic information are contained in one or two quarters" (p.243). The time path of price adjustment differs for different beef categories due to: different degrees of concentration (e.g. feeding competitive, retail concentrated); negotiated transactions (packers and feeders) versus formula pricing (packers and retail); factors underlying marketing decisions (e.g. delaying sale of live cattle to wait for a price peak may invite yield grade problems due to overfinishing). Finally, the authors note that changes in a number of key exogenous factors may occur at once which would "yield different net percentage price effects and stabilization periods" (p. 244).

Ward, Ronald W. 1982. "Asymmetry in Retail, Wholesale and Shipping Point Pricing for Fresh Vegetables." *American Journal of Agricultural Economics* 64:205-212.

KW: vegetables, lags, Wolfram model, wholesale prices

### Brief Summary

The linkages among retail, wholesale and shipping point prices for a select group of fresh vegetables is measured using Wolfram's asymmetry model (1971). Procedures for dealing with discontinuous time series are shown, and Granger's causality test is used to show direction of the price linkage. Wholesale prices are shown to lead both retail and shipping point prices. Asymmetry in the retail-wholesale response indicates that wholesale price decreases are reflected at retail more so than are wholesale price increases. Wholesale price decreases are more fully passed through to the shipping point relative to wholesale increases (abstract). Ward's empirical examination of asymmetric price transmission, reinforces the view that "no single markup pricing rule can in general accurately depict the relationship between the farm and retail price" (Gardner, 1975). Two main reasons are suggested for the price asymmetry: relative differences in concentration and ability to assimilate information at different levels of the market (wholesalers have an advantage) and the relative perishability of vegetables.

### Analysis and Results

Compared to other commodities, perishables should have stronger price linkages between the farm and retail levels due to the relatively low importance of marketing inputs. In addition, supplies are inelastic (in the short run), so changes in demand should lead to direct price adjustments through all the marketing levels. Ward examines these concepts empirically. He hypothesizes that the speed of actual adjustment is a function of "quality and timing of information received at each pricing level" (p.205). The speed of price adjustments provides some information about structural rigidities and cumulative effects of price changes, thus a distributed lag model is used. The model is based on the idea that retail prices are a function of current and lagged wholesale prices and incorporates Wolfram's procedure for estimating

asymmetric parameters.<sup>1</sup> "Retail, wholesale and shipping point price data for seventeen fresh vegetables were included in the study" (p.208). Granger's causality testing procedure was used for both continuous and discontinuous series. Ward employs a dummy variables technique which allows use of the Granger technique on discontinuous series. The results for 11 of the commodities indicate that: (i) retail prices tend to lag wholesale (as expected); (ii) wholesale prices tend to lead shipping-point (probably due to wholesalers relative concentration and ability to assimilate information compared to generally diverse shipping-points with less complete information).

In terms of asymmetric linkages, "the retail results, without exception, lead to one of two conclusions. Either the responses are symmetric, or retail markets respond more to declining wholesale prices than to rising prices" (p.209). This result indicates that there is some retail resistance to price rises. Perhaps in order to keep high turnover for perishable products and/or due to oligopolistic structures among large retail outlets. Ward indicates that "on average, the retail response to rising wholesale prices in the current period is approximately 50% of the retail response to equivalent falling wholesale prices" (p.210). In terms of wholesale to shipping point linkage, wholesale price decreases are more fully felt at the shipping point than increases - however the asymmetry is not as great as from wholesale to retail.<sup>2</sup> In general, lag decays are fairly rapid so the full extent of the response to price changes from wholesale to the other two levels should be evident immediately. The trend regarding changes in the spread between wholesale, retail and shipping is towards a larger retail-wholesale spread. Results are mixed and generally statistically insignificant for changes in spread between shipping point and wholesale.

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1 This is based on the concept of including variables for both rising and falling wholesale prices. The test is to see if "Beta rise" = "Beta fall" or not.

2 This is indicated by differences in the cumulative effects of changes for rises versus falls at the shipping point which are more pronounced at retail.



## Section 2: Brief Summaries

Akaike, Hirotugu. 1970. "Statistical Predictor Identification." *Annals of the Institute of Statistical Mathematics* 22(2):203-217.

KW: lags, theory

This article provides several methods for realizing a good approximation to the optimum choice of lag length given stationary independent variables and a linear predictor. Akaike's goal is thus to find the number of past period observations on a variable which still have an effect on the estimator. Three methods are presented: Anderson type, Final Predictor Error (FPE), and Minimum FPE. The three are then compared in terms of their ability to pick lag length closest to optimal. Minimum FPE was best and Anderson worst. Specification of lag length is important in that inappropriate lag length "could distort estimates and yield misleading causality inferences" (Darrat, 1988, p.881).

Akaike, Hirotugu. 1974. "Stochastic Theory of Minimal Realization." *IEEE Transactions on Automatic Control* AC-19(6):667-674.

KW: lags, theory

This article presents a fairly technical discussion of how to choose the minimal realization of a system of equations. The minimal realization is any special basis of the predictor space of the corresponding stochastic system defined with a white noise input. A predictor space being the linear space spanned by predictors (of some variable) in a Gaussian system.

Babula, Ronald A., David A. Bessler and Gerald E. Schuler. 1991. "Corn/Broiler Price Transmissions and Structural Change Since the 1950s." *Agribusiness* 7(3):269-284.

KW: marketing margins, chicken, VAR model

Monthly autoregressions of corn, farm broiler, and retail broiler prices were estimated for 1956-1968 and 1973-1985 and then validated 36 months beyond each sample. Statistically significant evidence suggests that the dynamic manner in which corn price increased elicit broiler price changes has changed since the 1950s. Corn price increases are now more likely to be passed on to broiler consumers, and more immediately. Evidence further suggests that since the early period, significant change has occurred at the retail level, and that corn price has become a more important broiler price determinant. The results indicate that, since the early 1970's, "a shock in corn price may be felt for about half a year in the farm and retail broiler sectors. Further, corn price appears highly exogenous, while retail meat price appears highly endogenous. The retail price is highly influenced by the farm broiler price." Broiler producer/processors which are more vertically integrated are "somehow able to pass rises in corn-based feed costs on to consumers in a more direct, significant, and immediate manner than during the early period.

Boyd, Milton S. and B. Wade Brorsen. 1988. "Price Asymmetry in the U.S. Pork Marketing Channel." *North Central Journal of Agricultural Economics* 10(1):103-109.

KW: weekly prices, lags, causality, Wolfram model

This paper tests the existence of price asymmetry within the U.S. pork marketing channel using an asymmetric pricing model. Asymmetry is tested both for the sum of price adjustments and the speed of price adjustments. Results show that wholesale (packer) prices respond similarly to price decreases and increases. Also there is no significant difference between retailers response to wholesale price increases and their response to wholesale price decreases. (abstract)

Houck, James P. 1977. "An Approach to Specifying and Estimating Non-reversible Functions." *American Journal of Agricultural Economics* 59(3):570-572.

KW: Wolfram model, empirical tests, causality

This paper discusses empirical testing options for the nonreversibility hypothesis which states that short- or long-run supply curves may be more output responsive for price increases than for price decreases because of asset fixity or other rigidities. Houck discusses the pros and cons of segmenting data into increasing and decreasing components -- consistent with the Wolfram method and provides some empirical results. The non-reversibility hypothesis is supported in studies of both milk and pinto beans. In neither case does variable segmentation cause alteration of the estimated coefficients of other variables. A problem with these estimation methods is that data segmentation and transformation consume two degrees of freedom and inter-correlations among explanatory variables could be increased.

Kinnucan, Henry W. and Forker Olan D. 1987. "Asymmetry in Farm-Retail Price Transmission for Major Dairy Products." *American Journal of Agricultural Economics* 69:285-292.

KW: asymmetry, dairy, marketing margins

An econometric model is used to estimate the net relationship between changes in the farm-level price of milk, butter, cheese, and ice cream. Results indicate that the farm-retail price-transmission process in the dairy industry is asymmetric. Retail dairy product prices adjust more rapidly and fully to increases in the farm price of milk than to decreases. The role in pricing asymmetry of retail demand versus farm supply shifts is tested via a Chow-type test. Asymmetry is tested using the Houck procedure for estimating non-reversible functions.(abstract) The reasons suggested for the observed price asymmetry include: industry concentration; government price support activities; and/or whether marketing margin changes are due to retail-level demand shifts or farm-level supply shifts. A model was developed, based on Gardners' (1975) to examine the difference between these last two elements. "The results showed a substantially larger price transmission elasticity is obtained when retail demand shifts are relevant vis-a-vis farm supply shifts" (p.289). It is pointed out that the assumption that farm prices lead retail -- relevant for dairy products as a whole -- does not always hold for individual products. For example, retail demand shifts were important for butter and cheese -- although the effects are neutralized in some years by the existence of a large inventory of the product.

Lee, David R. 1988. "Labor Market Dynamics in the U.S. Food Sector." *American Journal of Agricultural Economics* 70(1):90-102.

KW: food industry, retail, mark-up model

A simultaneous equation model is estimated to explain labor market phenomena (including wages, employment, and labor productivity) and food prices at manufacturing and retail levels of the U.S. food industry. Dynamic simulation results show that endogenizing input costs in a fully specified mark-up pricing model leads to a complex long-run pattern of food price determination. Wage determination is found to play a central role linking general price levels to food sector prices and labor market behavior. Energy price changes are shown to significantly affect food prices. Food sector labor productivity is found to decline in response to exogenous commodity price shocks. (abstract)

Pick, Daniel H., Jeffrey Karrenbrock and Hoy F. Carman. 1990. "Price Asymmetry and Marketing Margin Behavior: An Example for California - Arizona Citrus." *Agribusiness* 6(1):75-84.

KW: citrus, marketing margins, weekly prices

The formal relationship between price asymmetry and marketing margins is derived and illustrated with a weekly analysis of prices and margins for fresh lemons and Navel oranges in four retail markets. In the short-run, retail prices and margins for both products were more responsive to FOB price increases than they were to decreases, except for lemons in the Atlanta and Dallas markets and Navel oranges in the Atlanta market. Over time, retail price and margin adjustments to FOB price changes appear to be symmetric with respect to price increases and decreases (abstract). The approach follows the work of Kinnucan and Forker (1987) for dairy, Ward (1982) for vegetables, and Heien (1980) for a basket of products. The analysis uses Houck's (1987) model for estimating non-reversible functions to test for asymmetric retail price movements. The analysis uses weekly retail and FOB prices (for size categories) for 123 weeks from Feb 1985 to June 1987 for four markets: Atlanta, Dallas, Detroit and Denver. The short-run findings "tend to counter Ward's finding that retail vegetable prices adjust more fully to wholesale price decreases than to increases and his argument that retailers are reluctant to increase prices" (p.83). "Allowing for lagged adjustments of retail prices and margins there is no statistical evidence that asymmetry persists for more than four weeks in the lemon and Navel orange markets studied" (p.83). The authors note that there are important differences in price transmission between product type, level in the marketing channel and market. Transmission is generally more rapid for fresh products versus processed and thus weekly data are preferred for study of fresh product markets. In addition, the level of competition must be considered as a factor affecting retail price changes.

Schroeder, Ted C. 1988. "Price Linkages Between Wholesale and Retail Pork Cuts." *Agribusiness* 4(4):359-369.

KW: marketing margins, pork, lags

This article investigates the price transmissions of specific pork cuts between wholesale and retail

markets. It examines retail price rigidity and symmetry in relation to changes in wholesale prices. Results indicate that different cuts possess different lag lengths. There is also some evidence that retailers react more quickly to increasing wholesale prices than decreasing wholesale prices; however, the cumulative effects are very similar.

Young, Trevor. 1980. "Modelling Asymmetric Consumer Responses with an Example." *Journal of Agricultural Economics* 31(2):175-186.

KW: coffee, asymmetry

This paper attempts to provide a method by which differing consumer responses to upwards and downward price movements may be accommodated in applied work. Three reasons for asymmetry in demand are discussed -- addiction to the product, addiction to competing products and limited information -- and appropriate forms of the estimating equation are considered. For example, during a prolonged high price period, consumers may become accustomed to substitutes to the extent that the original item cannot recapture its market share if prices fall. A study of UK consumer instant coffee buying behavior provides some evidence of asymmetry -- short-run response to price increases is half the response to price decreases. However, there is a more elastic response in the long run. (adapted from the abstract)

### Section 3: Additional References

Faminow, Merle D. and J.M. Laubscher. forthcoming. "Empirical Testing of Alternative Price Spread Models in the Southern African Maize Market." *Journal of Agricultural Economics*.

Hall, Lana L., William G. Tomek, D.L. Ruther, and S.S. Kyerine. 1981. "Case Studies in the Transmission of Farm Prices." Dept of Agricultural Economics. A.E. Res. 81-12: Cornell University.

Novakavic, Andrew M. 1991. "Price Formation and the Transmission of Prices Across Levels of Dairy Markets." Department of Agricultural Economics. A.E. Res. No. 91-8: Cornell University.

Popkin, Joel. 1974. "Consumer and Wholesale Prices in a Model of Price Behavior by Stage of Processing." *Review of Economics and Statistics* 56:486-501.

Tweeten, L. and L. Quance. 1971. "Techniques for Segmenting Independent Variables in Regression Analysis: A Reply." *American Journal of Agricultural Economics* 53:359-60.

Wohlgenant, Michael K. 1985. "Competitive Storage, Rational Expectations, and Short-run Food Price Determination." *American Journal of Agricultural Economics* 67:739-48.

Wohlgenant, Michael K. and John D. Mullen. 1987. "Modeling the Farm-Retail Price Spread for Beef." *Western Journal of Agricultural Economics* 12:119-25.

Wolffram, Rudolph. 1971. "Positivistic Measures of Aggregate Supply Elasticities: Some New Approaches – Some Critical Notes." *American Journal of Agricultural Economics* 53:356-59.

## **MARKET STRUCTURE**

### **Section 1: Brief Summaries plus Detailed Annotations**

Hall Lana, Andrew Schmitz and James Cothorn. 1979. "Beef Wholesale-Retail Marketing Margins and Concentration." *Economica* 46:295-300.

KW: beef, concentration, GLS, marketing margins

#### **Brief Summary**

The paper investigates the relationship of wholesale-retail marketing margins and concentration for the U.S. retail beef industry. The study builds on earlier studies relating price-cost margins to market structural variables (e.g. concentration, capital intensity) which looked across industries. This study adds to the literature by focusing on only one industry, thus avoiding inter-industry analysis problems. The study uses an error components model to examine the hypothesis that dominant retailers raise prices without corresponding cost increases and/or secure differentiated procurement arrangements resulting in lower costs and higher price/cost margins without passing these savings on to consumers. The results of the study indicate that, "[t]he degree of concentration existing in a market does appear to be an important factor affecting the price-cost marketing margin in a particular region." (p.299) The authors indicate that future research is needed on the social costs of such concentration.

#### **Analysis and Results**

"In the U.S., since 1963 more than 90% of the increase in the farm-retail price spread for beef has occurred in the wholesale-retail segment of the spread" (p.296). This is in part due to specific changes in the pricing and buying policies of retailers. Packer concentration has also increased but there have not been large increases in farm-wholesale margins. The authors hypothesize that the large increases in wholesale-retail margins versus farm-wholesale margins indicate that the wholesale level is relatively competitive compared to retail. Further, they suggest that large retail chains may have costs savings from: large volume meat purchasing due to central buying; and/or by buying from large packers who have lower prices due to economies of scale. If the retailers have market power they may not pass on cost-savings to customers.

To test the above hypotheses, the authors use an error-components model which combines time-series and cross-sectional data and estimate the model using both OLS and GLS and compare results. The error-components model helps avoid mistaking short-run effects of competitive adjustments (when margins are high) for stable oligopolistic or monopolistic conditions. The GLS and OLS results of the econometric analysis indicate that increased retail concentration has a positive impact on beef wholesale-retail marketing margins. The coefficient of the concentration level variable indicates that a 10% increase in the concentration level would lead to a 4% increase in the price margin.

Holloway, Garth J. 1991. "The Farm-Retail Price Spread in an Imperfectly Competitive Food Industry." *American Journal of Agricultural Economics* 73:979-989.

KW: concentration, marketing margins

### Brief Summary

Holloway extends Gardner's (1975) model of perfect competition in the marketing sector to a conjectural variations oligopoly model with endogenous entry. Revising Gardner's comparative statics on the "farm-retail price ratio", tests of hypotheses about food industry conduct are derived. Using data from a recent article by Wohlgenant, which employs Gardner's framework, tests are made of the validity of his maintained hypothesis -- that the food industries are perfectly competitive. No evidence is found of departures from competition in the output markets of food industries of eight commodity groups: (a) beef and veal; (b) pork; (c) poultry; (d) eggs; (e) dairy; (f) processed fruits and vegetables; (g) fresh fruit and (h) fresh vegetables. (abstract)

### Results and Analysis

The article provides a conceptual framework for the analysis of imperfect competition in food industries. Holloway assumes that firms have beliefs about how their output decisions will affect those of other firms (conjectural variation) and thus the common industry price. The magnitude of firm's conjectural elasticities,  $\Theta_i$ , is determined by multiplying two market structure variables (the responsiveness of demand for a firm's products and the size of fixed costs incurred upon entering the market).  $\Theta_i$  will equal 0 in the case of perfect competition or 1 in the case of monopoly (intermediate values are the result of Cournot competitor behavior). The analysis assumes symmetric equilibria such that all firms have the same technology, produce a homogeneous product, have identical levels of output upon entry and that  $\Theta_i = \Theta_j$ , there is no government intervention, and adjustments to new equilibria are instantaneous.

Solving for  $\Theta$  they find that elasticity of industry output is zero when demand is perfectly inelastic or the entry fee is zero. As fixed costs increase, the equilibria approach a monopoly situation. Thus, inferences regarding firm conduct and performance can be made from observations on demand elasticity (generally available) and fixed cost share (generally not available or unreliable). Holloway tests the hypotheses of  $\Theta$  equal to 0 or other values representing alternative modes of conduct. Key assumptions underlying the analysis are: the elasticity of demand with respect to change in population is 1; farm-commodity supplies are exogenous; supply of non-farm inputs to the industry is perfectly elastic (long run non-specific factor case in Gardner).

Assuming Cournot competitor behavior, the effect of competition is to reduce the volatility of the effect of a shift in either demand or supply of agricultural inputs on the retail-farm price ratio. However, in the case of an increase in the price of marketing services, the effect of changes on the price ratio is greater, the larger the initial number of firms in the industry. The simulated model indicates that "under perfect competition the proportional effects on the (price) ratio are equal in magnitude but opposite in sign" (p.984). This result can be formalized and thus the hypothesis of perfect competition can be tested by checking sufficiency conditions. In sum, two hypotheses are tested:  $\Theta = 0$ ; and the sufficiency conditions for competition of equal magnitude with opposite sign (for the latter test the null hypothesis of  $\sigma$ , substitutability of inputs, equal to zero). The results indicate that  $\sigma = 0$  is rejected at the 5% level for all commodities except beef and veal and pork. It is rejected at the 1% level for dairy, processed and fresh fruits and vegetables. In general, any departures from competition are relatively insignificant.

The weakness of the analysis is that the results depend on fairly strict assumptions. First, product homogeneity is assumed. However, some food products are heterogenous in which case entry deterrence may occur through product proliferation and/or excessive promotion. However, equilibria for homogeneous and differentiated product settings have monotonic relationships between conjectures prices and quantities. So the homogeneous products model may be able to describe direction of effects for differentiated products cases. Second, the model is static. A dynamic setting may "allow closer scrutiny of the effects of potential entry, and strategies to deter such entry, on incumbent firms' conduct and the long-run performance of food markets. The present model considers entry in a rather simplified manner that prohibits the persistence of strictly positive profits. Such profits have been shown to exist in a dynamic variant of the current model" (p.989). Clearly with the lag structure of agriculture a dynamic setting may be appropriate. Finally, government intervention and international trade have important roles in many food marketing systems which are not addressed in the current model. Gardner gives a discussion of how to analyze price supports and production controls. However, adding a foreign marketing sector would greatly increase the model's complexity.

Schroeter, John and Azzeddine Azzam. 1991. "Marketing Margins, Market Power, and Price Uncertainty." *American Journal of Agricultural Economics* 73(4):990-999.

KW: ARCH model, concentration, marketing margins, pork

### Brief Summary

This paper provides a conceptual and empirical framework for analyzing marketing margins in a noncompetitive food-processing industry facing output price uncertainty. The framework allows the decomposition of observed margins into components reflecting the marginal cost of the processing industry, oligopoly/oligopsony price distortions, and an output price risk component. The empirical procedure is applied to a time series of spreads between wholesale pork prices and farm prices of market hogs. The principal finding is that, while farm/wholesale margins are more consistent with competitive performance now than they were fifteen years ago, the output price risk component persisted throughout the sample period. (abstract)

## Analysis and Results

This is a divergence from the analysis carried out by Brorsen et al (1985) which applies Sandmo's (1971) concepts of price uncertainty to Gardner's model for competitive firms. The authors relax the assumption of competitive behavior for marketing firms and look at the case of firms with market power. The analysis assumes that firms have a degree of monopoly power but cannot predict the realized output price. They do know the marginal effects of changes in their own outputs on expected price. (p.991) There are four components in the calculation of the expected marketing margin faced by firms in a given region (which uses conjectural elasticities as indices of the firms output and input market power): (1) marginal processing cost; (2) terms reflecting oligopoly pricing distortions (3) terms reflecting oligopsony pricing distortions; and (4) adjustment for the effects of output price uncertainty on a risk-averse expected-utility maximizing firm's decisions (p.992). To calculate the margin for a region on an industry-wide basis would require the development of averages for each of the components. The equation developed based on these 4 components is used to test the significance of market power and output price risk components of the farm-wholesale margin for pork.

A price-forecasting model is developed using an ARCH specification for the error-term (consistent with the fact that there is very little informal forward contracting between hog packers/processors and their customers). The scenario is basically one of periodic high price risk. The results of the analysis indicate that if price risk is considered the farm-wholesale margin is consistent with the competitive case even though concentration has increased dramatically at the wholesale level. It is noted that this result is "mildly surprising" but no explanation is suggested.

Thompson, Gary D. and Charles C. Lyon. 1989. "Marketing Order Impacts on Farm-Retail Price Spreads: The Suspension of Prorates on California-Arizona Navel Oranges." *American Journal of Agricultural Economics* 71:647-660.

KW: citrus, marketing margins, marketing order

## Brief Summary

The 1985 18 week suspension of the prorate (volume control) on California Arizona navel oranges decreased FOB retail price spreads in Atlanta and San Francisco by about 1.3 cents per pound. Four reduced form models of price-spreads were estimated with seemingly unrelated regressions for price spreads in Atlanta, Dallas, and San Francisco. Nested and non-nested hypothesis testing procedures indicated a markup model as the most plausible one for explaining short-run changes in price spreads. However, all models - except the cost of marketing model - indicate statistically significant decreases in the farm-retail price spreads for the prorate suspension period in Atlanta and San Francisco. Statistically insignificant increases in price-spread took place in Dallas due to extremely limited Texas supplies of citrus during the three seasons analyzed. "Thus, the preponderance of evidence favors the inference that FOB-retail price spreads narrowed during the prorate suspension period." These results are "short-run indicators of the price-spread effects of removing quantity controls under a marketing order" (p.657). In addition, the temporary lifting of the prorate was expected by the industry and reactions reflected this. A completely unexpected lifting of unknown length would probably have



different effects on marketing margins. The long-run effect of lifting quantity restrictions is more difficult to predict. Long-run adjustments could shift primary supply and demand schedules and change relationships between primary and derived demand.

### Analysis and Results

The analysis examines how the FOB - retail price spread for navel oranges has changed due to temporary elimination of the quantity flow restrictions applied under the marketing order. The authors conduct scenarios with and without restrictions. Producers and handlers favoring the restrictions argued that the price spread increased as FOB prices fell while retail prices stayed at the same level. Consumer advocates argued that availability of greater quantity and a wider variety benefitted consumers and narrowed price spreads. Hypothesis tests are employed to decide which of the following four single-equation models is most consistent with the data on navel orange farm-price spreads during the period under examination.

- (1) the Buse-Brandow model (farm-retail price spread assumed to be function of retail price, quantity of commodity marketed, and other variables such as time trends) which assumes that markets for unprocessed perishable commodities clear through adjustments in retail price due to pre-determined quantity at a point in time;
- (2) the Markup model (Waugh) in which farmgate prices are determined by subtracting the transport and processing costs from retail price which is determined by consumer demand.
- (3) the Cost of Marketing Services model (used by Wohlgenant and Mullen) conceptualizes farm-retail prices spreads as the cost of a bundle of marketing services with agricultural commodity supply and retail demand exogenous to the model. Price of bundle of marketing services based on the supply of a nd demand for such services.
- (4) the Relative model including interaction between retail price and quantity is derived from the Gardner model and includes: commodity supplies, retail demand, and cost of marketing inputs.

All four models were specified as linear seemingly unrelated regressions. No definitive choice emerges from hypothesis testing -- using pairwise testing for non-nested models or classical nested hypothesis tests -- but the markup model seems better than the other three (p.656). "The short-run retail decision rule of a simple markup appears to depict the price spread behavior as well as, or better than, any of the other models" (p.656). This is primarily due to the lack of any significant shifts in demand although supply shifted considerably. These results differ from the case of beef studied by Wohlgenant and Mullen (1987) where there were significant shifts in both supply and demand and a "relative" model was needed.

Results indicate that during the suspension period, price spreads in Atlanta and San Francisco were reduced by just over 1 cent/pound. There was a statistically insignificant increase in the price spread in Dallas due to a severe shortage of Texas citrus supplies. Truck rates were not found to be significant which is counter intuitive as they represent the primary source of marketing costs. The lack of significance is due to: high collinearity between truck rates and quantity marketed; and weekly data unable to capture daily truck rate variability which affects shipment decisions. Although not exact substitutes, the availability of Valencias at the end of the navel orange season depressed the FOB-retail price spread by 2 to 3 cents per pound. The trend variable indicates increasing real price spreads over the three seasons.

## Section 2: Brief Summaries

Adams, Charles M., Fred J. Prochaska and Thomas H. Spreen. 1987. "Price Determination in the U.S. Shrimp Market." *Southern Journal of Agricultural Economics* 19(2):103-111.

KW: causality, monopsony, marketing margins

The monthly and quarterly price determination processes for medium and small shrimp were examined to determine price leadership between market levels. Causal relationships were assessed using Haugh-Pierce, Sims and Granger methods. Price models at the retail, wholesale and exvessel market levels were estimated. Economic factors analyzed were income, prices of competing products, landings and imports of raw headless shrimp, total retail supply, beginning stocks and marketing costs. Monthly prices generally exhibited unidirectional causality from exvessel to retail price. Quarterly prices were determined interdependently among market levels. Price responses between market levels were found to be symmetric with beginning stocks, landings and imports of own-size shrimp the most important determinants of price. (abstract)

Azzam, Azzeddine M. 1992. "Testing the Competitiveness of Food Price Spreads." *Journal of Agricultural Economics* 43(2):248-256.

KW: marketing margins, monopoly, beef

The article models U.S. farm-wholesale beef price-spreads using data from 1988-91 to test whether price-spreads contain monopoly markup and/or a monopsony markdown. The model used departs from the structure-performance model used by Hall et al (1979) and "makes an explicit link between the formation of price spreads and the profit-maximizing behavior of the participants in the food marketing channel" (p.248). Cattle feedlots (which are relatively competitive) sell to slaughter houses who in turn sell to meat buyers. Meat buyer concentration is fairly high, about 55-60 per cent of beef sold directly to the top four grocery chains (1989 figure). The results of the model suggest that the farm/wholesale beef price spread is not wholly explained by marginal processing cost but that the additional spread is due to monopsony only and not due at all to monopoly (p.254).

Cotterill, Ronald W. 1991. "A Response to the Federal Trade Commission/Anderson Critique of Structure-Performance Studies in Grocery Retailing." Food Marketing Policy Center, Research Report 13, Department of Agricultural and Resource Economics, University of Connecticut: Storrs.

KW: concentration, policy

This research report reviews the debate on the necessity to enforce antitrust legislation more rigorously in the food retailing industry. Cotterill concludes that there is a case for more rigorous enforcement. This is a good reference on anti-trust law and enforcement guidelines. The introductory discussion on anti-trust guidelines includes a discussion of coordinated versus noncoordinated activities. The former referring to "either tacit or overt collusion, price leadership, and concerted strategic retaliation-conduct that requires concurrence of rival to work

out profitability" the latter refers to "firm's independent decisions about prices and output - decisions that do not rely on the concurrence of rivals or on coordinated responses by rivals". The rest of the report covers a range of topics related to the debate on market power and concentration. Structure-price studies have been criticized for not adequately controlling for differences in the cost of retailing food (labor costs, product costs). It has been argued that perhaps more highly concentrated markets have higher costs.

Domowitz, Ian, R. Glenn Hubbard and Bruce Peterson. 1986. "Business Cycles and the Relationship Between Concentration and Price-Cost Margins." *Rand Journal of Economics* 17(1):1-17.

KW: price-cost margins, concentration

This article uses panel data to examine changes in price-cost margins in 284 manufacturing industries between 1958 and 1981. A key finding is a dramatic narrowing of the spread between the margins of concentrated and unconcentrated industries over this period. The cause of the narrowing is the greater sensitivity to price-cost margins in more concentrated industries to demand fluctuations. The article includes some evidence on patterns in price-cost margins over time (1958 - 1981) both by level of concentration and by category of production. The decline in price-cost margins has been most pronounced in the producer goods sector (especially between 1974-1981) as well as the narrowing of the dispersion of price-cost margins by concentration quintile. In addition, the greater the level of concentration, the more price-cost margins change cyclically over time versus lower levels of concentration where price-cost margins tend to rise steadily and gradually over time (see figure 1). The article warns about the instability of results from earlier studies using cross-sectionally estimated equations. The article discusses intertemporal instability of the concentration-margins relationship and the role of fluctuations in demand. Price-cost margins tend to be reduced by the entry of foreign suppliers more in relatively concentrated industries. However, the study concludes that aggregate demand effects are more important in explaining movements in price-cost margins than local demand effects and that own and aggregate demand changes on the concentration margin relationship are robust to the inclusion of measures of import competition.

Economic Research Service. 1965. "Marketing Economics Research Publications: A Reference List." ERS-205. Marketing Economics Division of ERS, USDA: Washington D.C.

KW: data, weekly prices, food industry, wholesale prices, marketing margins

Publications from the 1950's through mid 1960's which cover pricing and price spreads for a wide range of commodities. The information ranges from general to fairly specific (such as price spreads for a particular commodity in a small area) and the list of articles is extensive.

Lopez, Ramon E. 1984. "Measuring Oligopoly Power and Production Responses of the Canadian Food Processing Industry." *Journal of Agricultural Economics* 25(2):219-230.

KW: oligopoly, Canada, processing

The study is concerned with the measurement of factor demand responses and other production characteristics of the food processing industry in Canada. An important feature of the study is that it allows for non-competitive behavior of the industry and thus permits an estimation of the degree of oligopoly power. The major results of the study are that the hypothesis of (output) price-taking behavior is statistically rejected and that the average degree of oligopoly power is significant. Moreover, the industry appears to be quite responsive to changes in the factor price structure. Labor and energy are the most responsive inputs while raw food materials and capital show substantially less sensitivity to price variations. (abstract)

Marion, Bruce W. 1986. "Interrelationships of Market Structure, Competitive Behavior, and Market/Firm Performance: The State of Knowledge and Some Research Opportunities." *Agribusiness* 2(4):443-453.

KW: theory, policy

The article focuses on "the relationships between the structure of markets and the competitive behavior and performance of firms in those markets" (p.443). Since 1970 several new theories and alternative interpretations have challenged the traditional industrial organization view of market competition. As theories have changed this has led to changes in Federal policies regarding competition and thus to changes in the decision-making environment faced by agribusiness managers. During the early 1970's there were alternative views starting to form. Some, such as Weiss, held the traditional view that concentrated industries have relatively higher margins because high concentration encourages collusion. Alternatively, it was argued by Demsetz that industry concentration is positively related to large firms with high profits but negatively related to small firms with high profits. Thus, scale economies (or just superiority of a few firms) in some industries lead to concentration due to cost advantages rather than higher prices due to collusion (superior efficiency theory). This implies that concentration should be encouraged as a move to increased efficiency versus exploitation of the consumer.

A variety of further arguments have been presented against the traditional view including the theory of strategic groups and behavior which argues that industries are made up of groups of firms with barriers preventing easy movement between groups. Some groups may have considerable market power with others (in the same industry) experience competitive profits. In the food manufacturing industry an application of strategic group theory is brand oriented firms versus private label/generic firms. In the early 1980's the theory of contestable markets provided another view focusing on entry and exit barriers. If markets are perfectly contestable a new firm may enter costlessly, grab profits, and exit whereby concentration becomes irrelevant. However, few industries fit the assumptions of perfect contestability. There is a need for empirical research to test these alternative views.

In general, there is a need for research on the interrelationships between market or industry organization, competitive behavior and market or firm performance. There are a number of

specific topics under this umbrella: the role of entry and mobility barriers larger; advantages and disadvantages of large firm size and/or of conglomerates in different industries and strategic groups; technological change and forces affecting the evolution of industries and markets; internationalization of agribusiness and the U.S. food system; impacts of various institutional arrangements and public policies on the behavior and performance of market and industries.

**Powers, Nicholas J. 1991. "Marketing Order Impacts on Farm-Retail Price Spreads: Comment." *American Journal of Agricultural Economics* 73:507-510.**

**KW:** citrus, marketing order, marketing margins

The comment includes four key criticisms of Thompson and Lyon's (TL) article: (1) non-consideration of changes in the composition of shipments in terms of grades and sizes -- price spread widens when proportion of undesirable produce is high; (2) failure to include all suspension periods; (3) failure to use an instrumental variable (needed because retail and FOB prices and shipments are determined at the same time as handler's supply and retail demand for navels); (4) vague explanation of the reason why prorates influence the farm-retail price spread. Powers remodels the problem using monthly data (for the US) and a relative model based on Wohlgenant and Mullen (1987) including retail price, marketing input prices, seasonal dummy variables for April, May and June (versus only May for TL), and a dummy for suspension which identifies all suspension periods. Powers argues that because of the way the prorate is estimated and administered, monthly data are adequate for estimating the effect of a suspension. Powers finds, contrary to TL, that the marketing margin increased by nearly 1 cent per pound during a suspension. He argues that this is not due to a shift in market power between retail buyers and handlers; rather, to the higher proportion of lower quality produce during a suspension which leads to more waste ("shrink") and thus higher marketing costs. The prorate encourages handlers to only ship highest quality for "fresh use" because they bring the highest grade and have the smallest "shrink". Without the prorate, "profit incentives encourage handlers to ship all navels to fresh use which meet the minimum fresh use quality requirements and will be sold at a price above the marginal variable marketing cost (p.510)."

**Rizvi, Saiyed H. and Ihn H. Uhm. 1982. "Market Structure and Economic Performance of the Food Processing and Farm Input Industries in Canada" *Canadian Farm Economics* 17(4):1-8.**

**KW:** price-cost margin, oligopoly, concentration, Canada

An empirical model is used for evaluating the nature of industrial performance influenced by market structure variables in 25 farm input and food processing industries in Canada during the 1970's. Performance is represented by two variables -- the price-cost margin and the percentage change in price. The estimated equation for the price-cost margin exhibits a lack of statistical significance of the concentration variable, while foreign ownership and income elasticity are positively related to the price-cost margin and are statistically significant. (abstract) The paper argues that concentration may have been given too much weight as an explanatory variable for industrial performance and that the degree of foreign ownership is important -- for Canada -- and has been neglected in earlier quantitative studies. The authors suggest that further study is needed "to obtain a better understanding of the effects of the oligopolistic nature of the Canadian food

processing and farm input industries on the welfare of farmers as they purchase inputs from and sell products to such industries" (p.7).

Taylor, Timothy G. and Richard Kilmer. 1988. "An Analysis of Market Structure and Pricing in the Florida Celery Market." *Southern Journal of Agricultural Economics* 20(2):35-43.

KW: marketing order, vegetables, oligopoly, marketing margins

The pricing behavior of the Florida celery industry under the current federal marketing order was examined by analyzing the implied market structure of the industry. Point estimates of the degree of oligopoly power index suggest that some degree of price enhancement above that which would be characterized by a perfectly competitive market may have occurred. However, the bulk of statistical evidence suggests that the departure from marginal cost pricing implied by the industry's pricing behavior is not statistically significant. (abstract)

Thompson, Gary D. and Charles C. Lyon. 1991. "Marketing Order Impacts on Farm-Retail Price Spreads: Reply." *American Journal of Agricultural Economics* 73:511-514.

KW: citrus, marketing order, marketing margins

In this reply to Power's comment TL address the four criticisms made and the alternative model of the problem. The weekly price series did in fact take into consideration grades and sizes. The weighted FOB price series closely conformed to the retail prices series and the three prices series explicitly captured quality effects. Thus there was no problem with bias due to ignoring grade and size changes. TL argues that the aggregate monthly data used by Powers in fact does suffer from this sort of bias and therefore calls into question the conclusion that price spreads increase at the end of the season due to poorer quality and increased "shrink". The lifting of the prorate in 1985 was longer, less expected than other suspensions, and happened when there was an unusual situation of shortage and majority of the fresh crop not yet shipped and hence represented an "unanticipated supply-side policy shock". The simultaneity issue is considered less of a problem for short term analysis using weekly data versus the longer term with monthly data used by Powers. TL argue that weekly data was needed for both statistical reasons and to capture the market flows of the industry more accurately. TL provide evidence regarding the administration of the prorate to counter Powers claim that monthly aggregated figures reflect industry behavior. "Vagueness" was purely due to misinterpretation. The reestimation of the model is criticized for using monthly data and not adequately capturing price variation. TL reestimate their own model including all suspensions, versus just 1985. They find that with all suspensions lumped together into one dummy variable the removal of prorate is insignificant. When the prorates periods are separated into two dummy variables for 1985 and other seasons the results are "strikingly similar" to those reported in the original article. The key assumption is that the 1985 suspension of prorate was fundamentally different than other short non-prorated periods. Thus the lifting of prorate due to yearly seasonal supply changes -- which lead to quality changes and thus increased shrink (illustrated by Powers model) -- is in fact a different effect than the 1985 prorate suspension.

Weaver, Robert D., Peter Chattin and Aniruddha Banerjee. 1989. "Market Structure and the Dynamics of Retail Food Prices." *Northeastern Journal of Agricultural and Resource Economics* 18(2):160-170.

KW: lags, concentration, oligopoly

"The effect of retail grocery market structure on the speed of adjustment of retail food prices to changes in producer prices, real wages, and the cost of energy was examined for SMSAs (Standard Metropolitan Statistical Areas). Evidence failed to support the implication of the Maison-Bain paradigm that increased concentration reduces market efficiency as reflected in speed of retail price adjustment. Evidence of strong intertemporal relationships between change in producer prices and retail prices found that the categories meat, poultry, fish, eggs and cereal and bakery products provide support to the hypothesis of cost-push inflation." (abstract)

Wohlgenant, Michael K. and Richard C. Haidacher. 1991. "Approaches to Modeling Retail-Farm Price Spreads and Derived Demand Relationships for Food Commodities: A Selected Annotated Bibliography." ERS Staff Report No. AGES 9136. Commodity Economics Division, Economic Research Service, USDA: Washington D.C.

KW: marketing margins, retail, derived demand, theory

The bibliography is divided into two sections: Derived Demand for Food Commodities and Theory of Derived Demand. This division is made to separate historical approaches to modeling price spreads and derived demand for food commodities from the more theoretical publications dealing with the general theory of derived demand. The first section contains literature on modeling retail to farm demand linkages for food commodities. The second section focuses on literature discussing derived demand for factors of production at both the firm and industry level. This section includes studies that focus on either shortrun or longrun adjustment of the firm and industry to factor price changes. Most of the citations assume a competitive market structure, although a few explore the implications of alternative structures, including monopoly and sales maximization behavior. (abstract)

### **Section 3: Additional References**

Clarke, R., S. Davies, and M. Waterson. 1984. "The Profitability-Concentration Relation: Market Power or Efficiency?" *Journal of Industrial Economics* 32:435-450.

Collins, Norman and Lee Preston. 1966. "Concentration and Price-cost Margins in Food Manufacturing Industries." *Journal of Industrial Economics* 14:226-240.

Connor, John M., R.T. Rogers, B.W. Marion, and W.F. Mueller. 1985. The Food Manufacturing Industries: Structure, Strategies, Performance, and Policies. Lexington Books: Lexington.

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- Marion, Bruce W. and Kim Donghwan. 1991. "Concentration Change in Selected Food Manufacturing Industries: The Influence of Mergers vs. Internal Growth." *Agribusiness* 7(5):415-431.
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## RELATED PUBLICATIONS

### GENERAL FOOD INDUSTRY

Grinnell, Gerald. 1980a. "Grocery Retailing: Trends in Market Concentration." *National Food Review* Spring:7-8.

KW: concentration, retail, food industry

The article provides historical overview of changing concentration in the industry. A key issue is that larger chains seem to have difficulty maintaining their position without substantial continued investment in renewal activities. Meanwhile discarding obsolete stores can open the door for a new competitor to enter the market. "Natural competitive forces tend to reduce excessive market power in local markets. However, in markets where a leading firm maintains a high market share over time, an evaluation may be warranted to determine whether its success stems from responsiveness to consumers' needs or the use of unfair competition tactics which limit the entry and growth of competitors. Several leading chains are continuing to grow through geographic expansion. At the same time, obsolete stores and managerial diseconomies of size have caused financial problems and loss of national ranking for other chains. Competitive pressures in local markets would appear to erode the size (and buying power) of large chains if they are unable to expand geographically." (p.8)

Grinnell, Gerald. 1980b. "Diversification of Food Retailers." *National Food Review* Spring:11-13.

KW: concentration, retail, policy, food industry

Grocery retailers often diversify into manufacturing or wholesaling as they have a ready outlet for their products and merchandising experience. Diversification usually requires additional financing, technical capability to manufacture and or wholesale products, and the ability to generate sales large enough to achieve economies of size. (p.11) The 1966 National Commission on Food Marketing found the main reasons for retailers to undertake wholesale activities include: technological economies; improve product quality; eliminate uncertainties; avoid processors selling costs (including promotions for national brands); avoid high cost distribution methods used by processors; to avoid government price controls; and to earn non-competitive profits. During the 60's and 70's, the leading chains accounted for most of the food manufacturing by retailers. "By 1963, the 40 largest chains accounted for 90% of the food manufacturing by all chains but only 3.7% of the value of shipments of all food manufacturing plants.(p.11)

Holdren, Bob R. 1960. The Structure of Retail Market and the Market Behavior of Retail Units Prentice Hall Inc.: Englewood Cliffs.

KW: theory, marketing margins

The study looks at retailing in general but focuses on grocery store markets from the 30's through the 50's. Information is gathered from nine grocery stores in a sample "small city". The stores

include both independents and chains. All chapters have useful information related to marketing and underlying the price transmission process. Chapter 4 specifically, covers price structures and price policies for a range of food products and store types. This chapter includes an excellent review of supermarket chain versus independent pricing strategies. Some of the issues which were pertinent to the U.S. at the time of this books writing are now important in countries with relatively less advanced marketing systems.

### SPATIAL EFFECTS AT A SINGLE MARKET LEVEL

Benson, Bruce L. and Merle D. Faminow. 1985. "An Alternative View of Pricing in Retail Food Markets." *American Journal of Agricultural Economics* 67(2):296-306.

KW: spatial model

The pricing mechanism of intracity retail food markets has received the attention of agricultural economists who are interested in the competitive nature of food price determination. Attention has focused on the information-theory paradigm and potential impact of publicly available comparative price reports. In this paper, a spatial economic model is developed to describe and analyze consumer choice, seller behavior, and price determination in retail food markets. Empirical evidence is then used to test hypotheses -- regarding effects of price changes across cities -- developed from the spatial model. It is concluded that the spatial model offers added explanatory power of observed foodmarket responses to retail price reporting. (abstract) This article does not address price transmission between market levels but does provide insights into the effects of market structure on pricing behavior in the food industry.

Brorsen, B. Wade, Jean-Paul Chavas and Warren R. Grant. 1991. "Market Structure and Spatial Price Dynamics." *Southern Journal of Agricultural Economics*. 23(2):65-73.

KW: lags, concentration, VAR model, rice, theory

A method was developed with time series models to test hypotheses about the relationship between market structure and spatial price dynamics. Long-run multipliers measuring the magnitude of lagged adjustment for spatial milled rice prices were calculated for a time series model that included a number of factors expected to influence price determination. Results show that price adjustments were slower as regional submarket concentration increased and were faster in the regions with a higher market share. Arkansas, the state with the largest market share, was consistently a price leader. (abstract)

Houston, Jack E. and Amelia Nieto. 1988. "Impact of Regional Shrimp Production, Consumer Income, and Imports on Ex-Vessel Prices." Georgia Agricultural Experiment Stations, College of Agriculture, University of Georgia: Athens.

KW: shrimp, policy, spatial model

The objectives of this study were to examine the relationship between supply factors and ex-vessel shrimp prices in regional fisheries and to analyze regional price behavior in the Gulf Coast, South Atlantic and Georgia markets as affected by size and species. The study uses an interregional trade model to examine the effect of income and supply changes in one region on market prices in all regions. It also uses the seemingly unrelated regressions (SUR) technique in estimating regional price response functions taking into consideration effects of non-measured variables -- such as policy alternatives, government restrictions, and consumer tastes and preferences -- that influence in all regions.

## HORTICULTURAL PRODUCTS

Ashley George A. and James E. Epperson. 1989. "An Analysis of Potential International Market Penetration of U.S. Vegetables: Foreign Importers' Perspective." Georgia Agricultural Experiment Stations, University of Georgia: Athens.

KW: vegetables, data

The central focus of this study is the identification of the barriers, opportunities, and factors influencing the international marketing of the U.S. vegetables and vegetable products and their respective impact upon the potential of any given commodity in the world market. The general objective of the study is to determine the potential for increased trade of vegetable exports from the U.S. to all world markets. The data for the analysis were obtained from a survey of 2017 vegetable importers in 66 countries

Franco, Jacques. 1989. "An Analysis of the California Market for Organically Grown Produce." *American Journal of Alternative Agriculture* 4(1):22-27.

KW: organic produce, data, marketing margins

The market for organic produce is discussed focusing on growth in volume, price increases and volatility and the industry's need for better consistent market information. There has been an increased spread between grower and wholesale prices between 1985 and 1987. This may be due to increased marketing costs, capital requirements for rapid expansion, or monopolistic rents. Prices for organically grown produce are significantly higher than for conventional produce; however, in spite of weekly volume volatility, organic prices appear to be less volatile than prices for conventional produce (which have more consistent supply). Analysis done mainly on organic broccoli indicates organic premiums frequently exceed 100% (figure 4). Relative price stability may be related to both excess demand and relatively inelastic demand. In addition, the proportion of organic produce demand from restaurants is greater than conventional produce demand from restaurants. Finally, stable grower/distributor relationships plus infant industry

behavior may contribute to price stability. With present growth rates (> 50% increase in broccoli price and vol. from 1986-87) price premiums could decrease over the long term -- especially as organic produce penetrates the conventional distribution channels. Organic produce retail prices should fall as technology improves and competition increases. Unit transport costs should decrease due to economies of scale. Higher prices for conventional produce could result from additional costs of regulations on current production practices. Undersupply may be exaggerated in OMNIS reports. Recommends that data collection for organic produce should be taken over by the Market News Service.

Hinson, Roger and Mooyul Huh and John Lee. 1990. "Evaluation of Selected Fresh Vegetable Terminal Markets: A Stochastic Dominance Approach." *Southern Journal of Agricultural Economics* 22(2):39-48.

KW: stochastic dominance, data, vegetables

This study used stochastic dominance analysis to evaluate terminal market price risk for four vegetable crops (broccoli, bell peppers, cabbage, and cucumbers) across five market locations (Atlanta, Dallas, New Orleans, and St. Louis). Increased interest in vegetables as an alternative to row crops has led to research on "identification of potential markets where price exceeds estimated cost of production" called "market-window analysis" (p.39). This study used historic terminal market price data to compare weekly prices to identify "best" market week and location (based on price variability and average price level). This study assumes that different degrees of risk aversion could result in different interpretations of market characteristics and parameters that constitute acceptable performance. Thus, stochastic dominance analysis is done with respect to a function to rank alternative CDFs of weekly vegetable prices at different terminal markets over a defined risk aversion space. The study also assumes that production vagaries may lead to inability to exactly follow marketing strategies and incorporates sensitivity analysis to address this. The results of the study indicate that substantial differences in terminal market price variability existed between commodities. Price volatility also varies across terminal markets for a single commodity. In terms of marketing decisions, the analysis implies that "an extremely risk-averse individual would make a large expected-price tradeoff for a slight reduction in price variance (p.46)." However, it is presumed that most sellers are willing to accept some risk for higher prices. Specific strategy recommendations on market location and timing are given for growers with different risk profiles.

Linden, Tim. 1988. "No Price Adjustment Stirs Controversy." *Western Grower and Shipper* October.

KW: marketing margins, retail, weekly prices

Grower and shipper perspective on price protection or adjustment after sale in vegetable markets - especially volatile crops like iceberg lettuce. Pro view is that no-price adjustment leads to a more stable marketing environment for both retailers and sellers. Con view is that the policy leads to a loss of flexibility in marketing arrangements in an industry where oral agreements and price adjustment are common. There is general disagreement about the source of inaccuracy in price forecasting by buyers and sellers. Some participants on sides (buying and selling) feel the other side is taking advantage through price adjustments. An additional view is that brokers are a source of price volatility through "rolling" loads causing price declines. Finally, some market participants feel the no price adjustment policy will spread.

McIntyre, Heather C.H. and Marilyn Griffith. 1988. "Wholesale Pricing of Locally Grown Cut Roses in Fairbanks, Alaska." *Agroborealis* 20(1):5-10.

KW: flowers, marketing margins, weekly prices

The primary objective of the study was to examine the flexibility of the wholesale market for high-quality, locally (Alaskan) grown cut roses (it also looks at the retail market). Wholesale prices of shipped and locally grown roses are compared for the northeastern U.S. and for Fairbanks. The information is intended to help growers evaluate profitability of growing cut roses for the local market. Overall the demand for roses is highly seasonal. Price variation in roses at the grower level is caused by production cost differentials (climatic etc), shipping costs and other elements. In terms of local versus shipped roses distinguishing factors are: quality (vase life and ability to open may be better for locally grown) and availability (shipped roses have some lag but can be available within 24 hours). Problems with market timing lead to risk for local producers. Unexpected increases in wholesale supply of shipped roses can lead to production losses for local growers (cheap surplus for shipped wholesale means that local growers can only sell the top quality fancy grades). Some suppliers vary price weekly in accordance with supply and demand and some maintain constant year-round price by increasing mark-ups during the high supply/lower demand summer period.

Seale, Arthur D., Richard A. King, and Loyd C. Martin. 1958. "Vegetable Prices and Market Structure in Southeastern North Carolina." Technical Bulletin No. 134. North Carolina Agricultural Experiment Station. North Carolina State College: Raleigh.

KW: data, semi-log model, vegetables

A broad and detailed survey of efficiency of vegetable marketing in the Southeastern U.S. in the 1950's (a period of many changes in the industry). Includes sections on: organization of vegetable producing farms; organizations of auction markets; factors affecting season average prices in North Carolina; factors affecting daily average prices at Clinton; factors affecting lot prices on auction markets; and alternative courses of action. Market outlets are covered in some detail. The information is broadly relevant for this period in the U.S. The study indicates that day to day price changes were closely positively associated with changes on the N.Y. wholesale market. The paper uses a basic semi-logarithmic function to estimate relationships between daily price changes and date of sale, quality, and lot size and finds them all to be significant in most markets tested. In addition, a significant amount difference existed between the prices paid to growers in different markets (all markets lie within a 20-mile radius). The study concludes with an argument for market re-organization to minimize farmer perception of risk due to price fluctuation and inter-market price differences. Pooled sales and establishment of grading stations are suggested to minimize price variation between comparable lots.

OTHER A.R.M.E. RESEARCH BULLETINS  
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