A SIMULTANEOUS EQUATIONS MODEL AND ANALYSIS OF THE U.S. CATFISH MARKETING SYSTEM

By

WILLIAM BRANCH

Bachelor of Science
University of Wyoming
Laramie, Wyoming
1982

Master of Science
University of Wyoming
Laramie, Wyoming
1986

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Thesis Approved:

Daniel S. Tilley
Thesis Advisor

Michael J Applegate

Francis M. Epplin

Norman N Durham
Dean of the Graduate College

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CHAPTER I

INTRODUCTION

Background

Aquaculture is the fastest growing sector of U.S. agriculture, increasing at a rate of over 20 percent annually in terms of pounds of production and value of production from 1980 to 1987. This expansion has been due primarily to increases in the production and value of crawfish, trout, Pacific salmon, oysters and channel catfish (Ictalurus punctatus), the major contributor in both categories [1].

Aquacultural production of channel catfish has existed in the U.S. for over 50 years. However, it has only been the last ten years in which the industry has evolved from a primarily import based industry to a domestic-production based industry. Production and processing is presently centered in the Delta region of Mississippi (where over 75 percent of the market size food-fish are produced annually) although, the industry is developing rapidly throughout the South. The system exhibits a high degree of vertical integration with a relatively large number of producers raising or purchasing four to six inch fingerlings to grow-out in earthen ponds. The grow-out period lasts six to seven months with the primary season being from the first of April until September and October although, fish are grown and harvested year round. The input supply and processing sectors are characterized by a few large plants that supply the main input to production (feed, accounting for 35 - 50 percent of production costs) and handle 80 percent of the food-size fish marketed by producers annually. The input supply and processing companies have primarily been producer-owned cooperatives but recently a number of privately and\or publicly held corporations have entered the system. A fairly homogeneous resource base and controlled input and marketing infrastructure characterizes the catfish production and processing sectors in the Delta region.

The catfish marketing system has grown rapidly during the past decade and at times a degree of instability has existed between the various sectors of the system. In 1980 and 1981 the supply of live-fish exceeded processing capacity. Today, processing capacity is double demand. At times new consumer markets have been available but a lack of fish has prevented the industry from moving into these new markets. At other times (1989) sales have fallen well below expectations. Adding to this instability are other factors including off-flavor (a situation where the fish pick-up distasteful flavors from their pond environment and become unmarketable), migratory bird losses, non-competitive market structure at the input supply and processing levels, inconsistent processing standards and poor product image at the consumer level [12,6].

Public and private interest has increased with the success of the catfish marketing system as has research to meet the informational needs of interested parties. Published research has generally focused on industry description, production practices (stocking levels, water maintenance, feed types, feeding rates, et cetera.) and cost budgeting. Empirical work to estimate the basic economic parameters of the system has focused on aggregate demand parameters in a limited scope that has not allowed generalization of results to the system as a whole [19]. Estimates of supply response parameters for the system are not available. The lack of a system-wide analysis of relationships limits the ability of industry participants to understand, forecast and respond to industry events in a directed, timely manner.

Objectives

The primary objective of this research is to provide an understanding of the economic relationships that exist in the U.S. catfish marketing system. The objectives are:

1. To determine the price and quantity interrelationships between live-fish at the producer level of the system and the six basic processed fish products that are produced and

marketed at the processor level. This information will provide an understanding of the current structure of the industry as well as a standard with which to compare future analyses;

2. To evaluate the sources, influences and impact of the omission of yield and price risk on short-run harvest response at the producer level and on monthly sales volume of the six processed fish products produced by processors; and
3. To evaluate the dynamics and sensitivity of the relationships within the system to change. In particular, with respect to changes in the price paid by producers for feed, changes in the price of substitutes in the processing sector and in the level of price variability at both the farm and processing levels.

Method of Analysis

This dissertation will delineate a non-linear three stage least squares (3SLS) estimation and subsequent analysis of the parameters of a simultaneous equations model of the U.S. catfish marketing system. The model includes sixteen estimable behavioral equations detailing the harvesting and price relationships of food-size channel catfish at the producer level of the system as well as the production, sales and price relationships that occur with respect to the six basic processed fish products that are produced and marketed at the processing level of the system. Six accounting identities describing the equilibrium conditions for processed fish at the processing level of the system as well as a processed fish production identity are also included in the model. The period of estimation for the model is February 1986 to June 1990.

A theoretical short-run harvest equation incorporating harmonic and production-price risk variables is hypothesized to explain the monthly harvest of marketable food-size fish. The average monthly price paid to producers for food-size fish is assumed to be a harmonic function over time of the price received by processors for their primary product in terms of sales, frozen filleted fish.

Product prices at the processing level are assumed to be a function of the price received by processors for their primary product in terms of sales, frozen filleted fish, along with the level of current sales or the level of current ending inventory, depending upon the product in question. Fresh product prices are assumed to be a function of current fresh product sales while frozen product prices are assumed to be a function of current frozen product ending inventory. The price of frozen filleted fish is assumed to be based on the current period's ending inventory and price paid to producers. Processor sales for each individual product type are hypothesized to be a harmonic function over time of own-price and substitute prices.

Dissertation Organization

Chapter II presents an examination of selected literature relevant to the model and analysis in this dissertation. In the first section past empirical economic analyses associated with the catfish marketing system are reviewed. Section two outlines the use of harmonic analysis in the study of time series and finally, section three discusses the topic of aggregate risk analysis in production agriculture.

In Chapter III the assumptions, hypotheses and data used to model the U.S. catfish marketing system are introduced. Chapter IV presents the results of estimation and a discussion of the appropriateness and statistical fit of the estimated model both in terms of individual equations and with respect to historical or ex post simulation of the endogenous variables. Chapter V discusses model dynamics, stability and sensitivity to change. Chapter VI presents a summary, conclusions and recommendations.

CHAPTER II

LITERATURE REVIEW

Introduction

Three areas of study pertaining to the research in this dissertation are examined. First, a review of the research dealing with the economic structure of the U.S. catfish marketing system is made. This is followed by a less extensive outline of the research in harmonic analysis and finally by a summary of the research in aggregate risk analysis.

Empirical Economic Analysis

Analysis of the economic structure of the U.S. catfish marketing system has been limited in quantity and scope due primarily to the lack of adequate data. The focus of analysis has been on aggregate processed product demand at the wholesale and retail levels.

Russell made one of the first attempts to model retail and wholesale demand in 1970. One year of monthly data was available on processed fish sales and prices. Price-quantity equations for the total demand of processed fish at the retail level were estimated using regression and a technique outlined by Working whereby shifts in supply are used to outline a simple linear demand function. Own-price elasticities of -0.358 and -1.176 were estimated by the two techniques respectively. Though a negative relationship between price and quantity was estimated in each case, the lack of data make the results questionable. Russell suggested that as more data becomes available a seasonal demand model incorporating harmonics may be an appropriate direction for analysis.

Raulerson and Trotter estimated a supermarket retail demand curve for fresh whole frozen processed fish and the resulting price elasticities for the city of Atlanta in 1973. A producer-level demand function was also derived based on the above results. Due to the lack of primary price and quantity data, a Latin Square experimental design was utilized to generate data. Test prices ranged from $0.79 to $1.29 per pound of processed fish in $0.10 increments. Three functional forms for the quantity/price relationship were modeled. A linear form yielded own-price elasticities of demand ranging from -1.23 to -8.93. A log-linear form yielded elasticities ranging from -2.07 to -3.38 and a log-log form yielded an elasticity of -2.67. Retail prices were converted to producer-level price estimates based on costs of processing, wholesaling and retailing and on dress-out and retail-lose percentages. A log-linear relationship between producer supply and the estimated producer price was then used to estimate the producer-level own-price elasticity of demand. For producer prices ranging from $0.135 to $0.397 per pound elasticities of -0.65 to -1.93 were derived.

Hu summarized the results of four household seafood consumption surveys taken between 1969 and 1981. His analysis covered per capita consumption (frozen versus fresh and at-home versus away from home) for various finfish and shellfish species based on several socio-demographic characteristics. Catfish was ranked eighth in terms of per capita consumption of the 29 seafood species analyzed in 1981. Southern, rural, uneducated, low income blacks were the predominate consumers of catfish. Expenditure and quantity elasticities with respect to consumer income of -0.28 and -0.25, respectively, were derived indicating that catfish is considered to be an inferior good by consumers.

In 1986 Kinnucan and Sullivan attempted to quantify the possible losses that could be incurred by west Alabama producers as they face a monopsonistic processing situation. The scale of producer own-price supply elasticity influences the degree to which the monopsonistic processor exploits his power; the lower the elasticity of supply the greater the exploitation. The authors derived the elasticity of producer supply using a technique suggested by Houck. Assuming:

1) Profit maximization by the producer,
2) Constant production elasticities over the relevant range of the production surface,
3) Non-increasing returns to scale and
4) Known output and input prices.

Then:

$$\epsilon = v/(1-v)$$

where

ϵ = Aggregate producer supply elasticity

$v = \sum_{i=1}^{n} k_i \qquad i = 1,2,3,\ldots,n$

$k = p_i x_i / p_q q$

= The factor share for the ith producer input

Own-price supply elasticities ranging from 1.86 to 8.10 were estimated using the above equation and factor share data for variable inputs based upon Alabama Cooperative Extension Service budget data for the most recent four year period. Potential losses of \$0.6 to \$2.4 million dollars in producer surplus were estimated for 1984.

Kinnucan et al. used a three equation system to estimate processor demand and the price-markup relation between the prices received by processors and the price paid to producers for five processors during the period 1980 to 1983. The processors represented 93 percent of the processing market. Processor-level and producer-level demand elasticities were derived based upon the estimated system and a measure of the social welfare gain from off-flavor research was calculated. Processor-level demand elasticities of -0.44 to -1.59 were estimated with an average elasticity of -1.28. Demand elasticities of -0.08 to -0.69 with an average of -0.37 were estimated for the production-level. These results indicate a possible social welfare gain of twelve percent of 1983 producer revenue or $10.0 million if off-flavor could be eliminated.

Dellenbarger et al. developed a limited-dependent-variable, regional, household-expenditure model for fresh processed catfish fillets using the results from a household consumption survey conducted in 1986 along with the Tobit modeling technique. Selected characteristics for the model included household income and size, household income and size squared, race, religion, worker status (blue or white collar), number of children in the household and other demographic factors relative to residency in the state of Louisiana. Results indicate that the marginal rate of expenditures on fresh catfish fillets is increasing at a decreasing rate with respect to household income and size. The elasticity of unconditional expected value of expenditures with respect to income, $\eta E(y)$, was estimated to be -0.099. This indicates that fresh catfish fillets are an inferior good with respect to the Louisiana consumer. Dellenbarger et al. conclude that future analysis must consider socio-economic factors as well as seasonal explanatory variables in order to draw accurate conclusions concerning catfish demand.

Sindelar et al. analyzed the affect of off-flavor on short-run aggregate farm revenues. Off-flavor impacts the catfish marketing system at all levels. At the consumer level off-flavor causes higher prices due to short supplies of processed fish and weakens consumer confidence and acceptability of the product. At the processor level off-flavor increases the cost of inputs and introduces uncertainty, with respect to the timing and quantity of fish deliveries, into the input procurement plan of the processing plant operator. At the producer level three additional sources of cost due to off-flavor are cited by Sindelar et al. These are:

1. The cost associated with holding market-size fish in inventory:
    a. Opportunity cost of delayed harvesting,
    b. Maintenance (primarily feed) costs and
    c. Costs of disease and predation loses.
2. The cost of unstable output prices due to market disequilibrium.
3. The short-run loss of aggregate gross farm income due to the off-flavor imposed marketing restriction in conjunction with an elastic demand with respect to own-price at the producer level.

A two stage least squares technique to estimate the demand for live catfish and test the hypothesis of an elastic own-price elasticity of demand was used to derive an average own-price elasticity of demand at the producer level of -1.8. Based on this estimate Sindelar et al. show that a fifteen percent increase in live-fish marketing (potential from off-flavor control) would have led to an $8.3 million increase in total producer revenues for the year 1985.

It appears the quantity data used by Sindelar et al. to develop the own-price elasticity of demand at the producer level in this analysis was total processor sales of ice packed and quick frozen processed fish. The analysis then appears to be generating a processor input-price elasticity of supply rather than a producer output-price elasticity of demand. The results in this paper are opposite of those reported by the same authors [Kinnucan et al., 19] as outlined above.

Lo developed a seven equation simultaneous equations model to analyze the production and processing sectors of the U.S. catfish marketing system for the period of January 1981 to December 1986. Results indicate an own-price supply elasticity at the producer level of 0.90 and an input-price elasticity of -1.33 where input-price represents the cost of feed. At the processing level, own-price demand elasticity for all processed fish products was estimated to be -1.43. An elasticity of disposable consumer income was estimated at 3.36 and a cross-price relationship between catfish demand and the wholesale price of chicken was found to be insignificant.

Table 1 below summarizes the results of the analyses outlined above. In terms of the various elasticity values estimated, it is clear that a wide discrepancy exists as to the structural character of the U.S. catfish marketing system.

Harmonic Analysis

Harmonic analysis is a form of time series analysis that utilizes some though not necessarily all of the cyclical auto-correlation patterns that exist in a set of data as a means of predicting future values of the series. These patterns may include institutional, seasonal and biological cycles in data as well as longer-term cyclical patterns.

Results from simple harmonic analyses do not generally yield any direct information concerning the economic structure that underlies a set of data. However, the technique can produce results that aid in later structural analysis. Waugh and Miller indicate that harmonic analysis tells where a data series stands at any given point in time with respect to its underlying cyclical pattern(s). Knowledge of the relative present trend of the series will improve predictions of future values of the series. Additionally, apparent linear trends existing in series may in fact be low frequency cyclical patterns that would be better represented with harmonics. Waugh and Miller also

TABLE 1

A COMPARISON OF THE RELATIVE SIZE OF PRICE, QUANTITY AND INCOME AFFECTS ON THE SUPPLY, DEMAND AND EXPENDITURES ASSOCIATED WITH LIVE AND PROCESSED CATFISH

	Article							
Elasticity of	(29)	(27)	(12)	(17)	(19)	(6)	(32)	(21)
Retail Demand wrt[1] Own-price	-0 36 -1 18	-1 23 to -8 93						
Processor Demand wrt Own-price					-0 44 to -1 59			-1 43
Producer Demand wrt Own-price		-0 65 to -1 93			-0 08 to -0.69		-1.80	
Consumer Expenditure wrt Consumer income			-0 28			-0 10		
Consumer Quantity Purchased wrt Consumer income			-0 25					
Processor Demand wrt Consumer Income								3.36
Producer Supply wrt Own-price				1 86 to 8 10				0 90
Producer Supply wrt Input-price								-1.33

[1] wrt = with respect to

show that harmonic estimation of time series can be useful in the estimation of long-term flexibilities and elasticities.

Franzmann and Walker used harmonic analysis to study pricing lead/lag relationships in the U.S. cattle industry for three market levels as a means of testing causality. Their hypotheses as to causality were generally confirmed although expected phase angle periods where not confirmed.

Rausser and Cargill discuss the variability in time series data indicated through harmonic analysis and its relationship to market structure for the U.S. poultry industry. As market structure becomes less atomistic vertically, the flow of information between consumers and producers becomes smoother thus eliminating to some degree the variability in prices and quantities seen in the market.

Aggregate Risk Analysis

Research in the area of aggregate supply response to risk in agriculture has been limited to a handful of studies (Behrman, Just, Lin, Traill, Winter and Whittaker, Hurt and Garcia, Tronstad and McNeill). In these studies the level of a producer determined choice variable (acreage planted, farrowings) is assumed to be affected by the level of price (input, output or both) and/or yield risk existing in the particular industry. In extensions of this basic theme, Brorsen et al. analyzed the affect of price and yield risk on supply and marketing margins through a market equilibrium model for the production and marketing sectors of the U.S. rice industry.

Schoney analyzed the aggregate supply response of wheat farmers to price and yield risk in southwestern Saskatchewan. To over come the short-comings of typical supply response studies (lack of an underlying neoclassical economic foundation and the micro-foundations of risk analysis) an attempt was made to determine the individual farm-level supply response to risk for "clusters" of farmers with similar risk attitudes and production facilities and characteristics. These individual responses were then weighted and summed based on the clusters relative proportion of the total number of farmers in order to determine the total level of supply response. In all, Schoney was able to show that supply response is influenced by the nature of price and yield distributions, risk attitudes and individual farmers production costs and financial structure.

The justification for these types of studies has been to determine the degree to which price and yield risk influence the estimated level of production for a given crop or livestock commodity in comparison to non-risk models. Additionally, these studies attempt to evaluate the influence of farm programs by identifying areas of impact and measuring the value of intervention.

Generally, risk is introduced into the supply response model as either some function of the deviation(s) between an actual price or returns variable and an expected price or returns variable or as a weighted moving average of the standard deviations of past actual prices or yields. The expected price or returns variables have taken on many forms including simple moving averages of past prices, weighted moving averages of past prices, rationally formulated expected prices and lagged prices. In comparing various price expectations models, Fisher and Tanner elicited expectations data from 55 farmers in eastern Australia. They found that the data suggested that farmers form expectations based on weighted averages of past prices following the form of the adaptive expectations distributed lag model.

The results from a majority of the studies yield conclusions consistent with hypothesized results. Risk variables produce a negative response when included in aggregate supply response models. This response is influenced by the structure of the industry for the commodity in question. The importance of risk increases as the level of government control over the commodity decreases, when the substitutability of other products for the commodity is low and when the possibility for shifting risk (futures markets for example) does not exist. Additionally, risk appears to be more important at the farm level than at the processing or wholesale level. As you move up the marketing ladder the risk associated with any one commodity becomes less important because that commodity generally accounts for a smaller proportion of the entire marketing level.

The magnitude of risk response in most empirical studies has been small and as a result the inclusion of risk variables generally does not increase the explanatory value of the model strikingly in and of itself. However, inclusion of a risk variable can have a significant affect on the influence of other variables, particularly own-price, on supply. Hurt and Garcia state that the omission of price risk may substantially bias the estimated responsiveness of supply to own-price changes.

CHAPTER III

CONCEPTUAL MODEL, METHODOLOGY AND DATA

Introduction

The price and quantity interrelationships between live-fish at the producer level of the U.S. catfish marketing system and the six basic processed fish products that are produced and marketed at the processor level are expressed in a simultaneous system of equations model containing sixteen estimable behavioral equations and seven accounting identities. The model and its underlying assumptions and hypotheses are presented in the next section.

An expansion of the basic model to incorporate the influences of various types of aggregate risk is presented in the second section. Risks' hypothesized to be associated with the catfish marketing system include production, input, and output price risk at the production level and substitute price risk at the processing level.

Linear and non-linear three stage least squares will be used to estimate the behavioral relationships of the simultaneous equations models. The appropriateness of these methods and the subsequent direction of the analysis of the estimated non-risk and risk models is discussed in section four. Sources of the data used in estimating the models are outlined in the final section of the chapter.

Hypothesized Non-Risk Model

A linear, short-run, seasonal, equilibrium structure is hypothesized for the U.S. catfish marketing system with frozen filleted fish assumed to be the primary product at the processing level driving the system. This assumption is based on three reasons. First, frozen filleted fish currently represent the greatest share of processor sales in terms of pounds of fish sold and has shown the greatest increase in sales in terms of pounds of fish sold during the period of 1986 to 1989. Second, frozen filleted fish represent the largest share in terms of average value of total sales for the processing level, $125,351,280 or 33.64 percent of average value of total processor sales in 1989. Third, the storeability characteristics of frozen filleted fish allow the product to act as an equilibrator between the harvest of marketable food-size fish and the demand for processed fish products.

Two additional points should be made about the filleted fish categories of processed fish and frozen filleted fish in particular. First, while frozen filleted fish demand and prices appear to drive the system over the period of analysis, it should be noted that the importance of frozen filleted fish to the industry is a relatively recent phenomena. Initially and until as recently as the early 1980's the system's primary products were whole processed fish. Had the system been modeled based on the demand and prices for whole processed fish, different conclusions could have been reached. Second, the filleted fish categories do not represent a single product but rather several types of fillets (regular, shanks, strips) as well as several sizes of fillets (3 to 5 ounce fillets, 5 to 7 ounce fillets). Within this group it may well be that a single product (3 to 5 ounce regular fillets?) is the leading force driving the system but at this time with the data available, it is impossible to determine the exact product relationships that exist within the system.

Figure 1 illustrates the price-quantity structure of the system with respect to the frozen filleted fish market. The other five processed products are assumed to follow the same basic structure subject to minor differences as noted in the Assumptions and Hypotheses section below. Definitions of the variables associated with both the non-risk and risk models are listed in Table 2.

In general, the production of frozen filleted fish (Profnf) is based on the level of live fish harvested (Livwts), the dressing rates or processing yields associated with each processed product and the distribution pattern of live fish to processed fish production. Live fish harvested

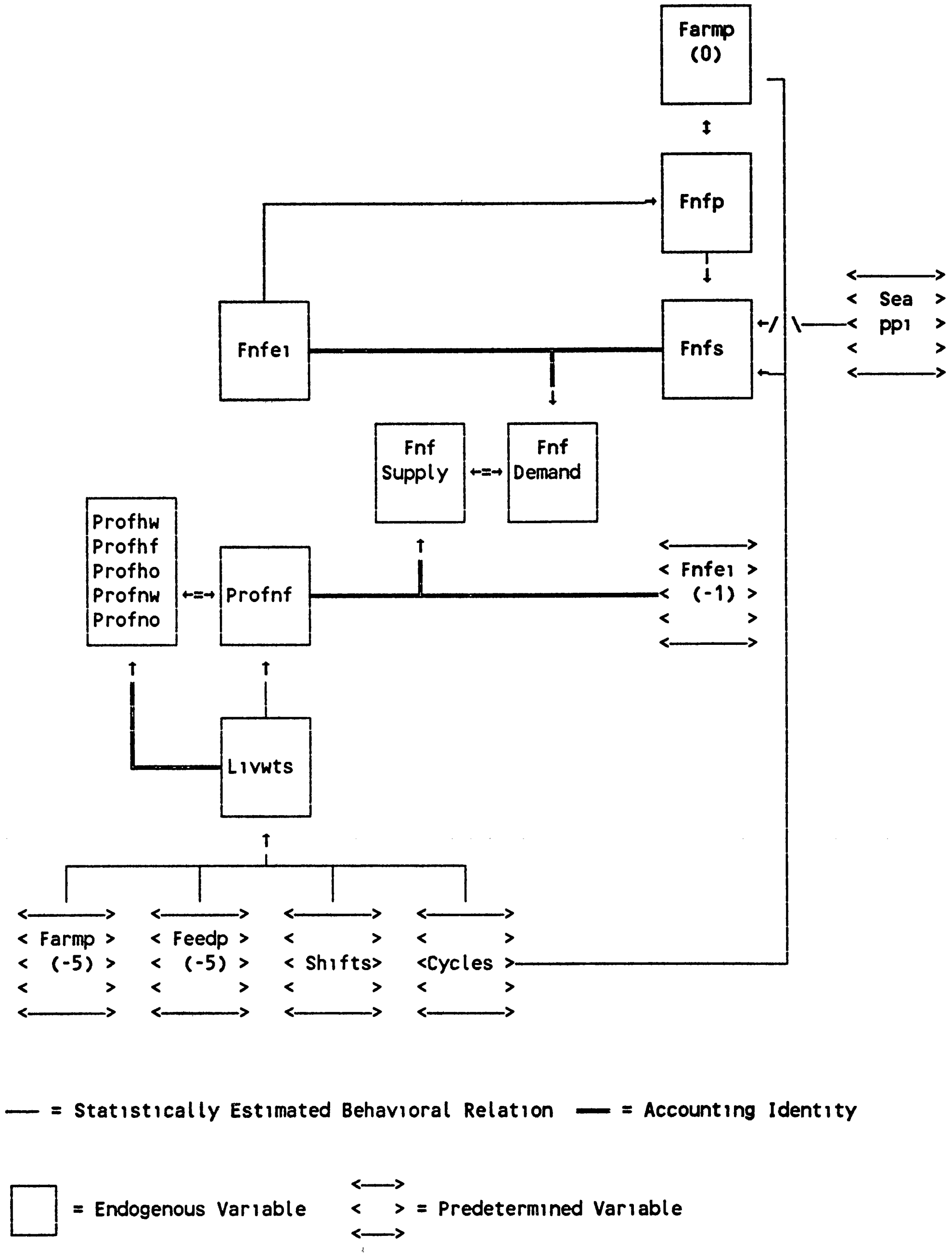

Figure 1. Flowchart of Structural Relationships: Frozen Filleted Fish

TABLE 2

VARIABLE DEFINITIONS

Endogenous Variables

Livwts - Total monthly weight of food-size fish processed, 1,000,000 lbs.

Farmp(0) - Average monthly price received by producers for farm-raised fish, dollars per pound.

Fhwp - Average monthly price received by processors for fresh whole processed fish, dollars per pound.

Fhfp - Average monthly price received by processors for fresh filleted fish, dollars per pound.

Fhop - Average monthly price received by processors for other fresh processed fish products, dollars per pound.

Fnwp - Average monthly price received by processors for frozen whole processed fish, dollars per pound.

Fnfp - Average monthly price received by processors for frozen filleted fish, dollars per pound.

Fnop - Average monthly price received by processors for other frozen processed fish products, dollars per pound.

Fhws - Monthly processor sales of fresh whole processed fish, 1,000,000 lbs.

Fhfs - Monthly processor sales of fresh filleted fish, 1,000,000 lbs.

Fhos - Monthly processor sales of other fresh processed fish products, 1,000,000 lbs.

Fnws - Monthly processor sales of frozen whole processed fish, 1,000,000 lbs.

Fnfs - Monthly processor sales of frozen filleted fish, 1,000,000 lbs.

Fnos - Monthly processor sales of other frozen processed fish products, 1,000,000 lbs.

TABLE 2 (Continued)

Profhw - Monthly production of fresh whole processed fish, 1,000,000 lbs.

Profhf - Monthly production of fresh filleted fish, 1,000,000 lbs.

Profho - Monthly production of other fresh processed fish products, 1,000,000 lbs.

Profnw - Monthly production of frozen whole processed fish, 1,000,000 lbs.

Profnf - Monthly production of frozen filleted fish, 1,000,000 lbs.

Profno - Monthly production of other frozen processed fish products, 1,000,000 lbs.

Fnwei - Frozen whole processed fish monthly ending inventory, 1,000,000 lbs.

Fnfei - Frozen filleted fish monthly ending inventory, 1,000,000 lbs.

Fnoei - Other frozen processed fish products monthly ending inventory, 1,000,000 lbs.

Oprisk - The square of a twelve month (t-1 through t-12) weighted moving average of past average monthly prices received by producers for farm-raised fish, as represented by Farmp(0), less the current average monthly price received by producers for farm-raised fish if the difference is positive, zero otherwise.

Predetermined Variables

C - Constant

S6 - Sine variable with a six month periodicity.

C6 - Cosine variable with a six month periodicity.

S12 - Sine variable with a twelve month periodicity.

C12 - Cosine variable with a twelve month periodicity.

TABLE 2 (Continued)

Seappi - The U.S. Dept. of Labor's Producer Price Index for finished consumer fish goods unadjusted for seasonality.

Farmp(-5) - Average monthly price received by producers for farm-raised fish, lagged five months, dollars per pound.

Feedp(-5) - Monthly weighted average composite price of the major components of commercial catfish feed, lagged five months, dollars per pound. The component prices and weights (in parenthesis) are: the average monthly price received by farmers per pound for corn (0.30), the average monthly wholesale price per pound for high protein soybean meal (0.48) and the average monthly wholesale price per pound for 67 percent protein, East Coast, fishmeal (0.10). Weights are based on an average of the compositions of several "practical" commercial feeds (Dupree and Huner).

Fnwei(-1) - Frozen whole processed fish monthly ending inventory, lagged one month, 1,000,000 lbs.

Fnfei(-1) - Frozen filleted fish monthly ending inventory, lagged one month, 1,000,000 lbs.

Fnoei(-1) - Other frozen processed fish products monthly ending inventory, lagged one month, 1,000,000 lbs.

Shift1 - Dummy variable indicating a rapid increase in the pond acreage used in catfish production, Jan. 1986 through Feb. 1987 = zero, Mar. 1987 through present = one.

Shift2 - Dummy variable indicating an increase in the monthly demand for filleted fish, Jan. 1986 through Dec. 1987 = zero, Jan. 1988 through present = one.

Shift3 - Dummy variable indicating an increase in the monthly demand for other fresh processed fish products, Jan. 1986 through Jan. 1989 = zero, Feb. 1989 through present = one.

TABLE 2 (Continued)

Shift4 - Dummy variable indicating an increase in the monthly demand for frozen whole processed fish, Jan. 1986 through Apr. 1988 = zero, May 1988 through present = one.

Shift5 - Dummy variable indicating an increase in the monthly demand for other frozen processed fish products, Jan. 1986 through Jan. 1987 = zero, Feb. 1987 through present = one.

Yrisk - A seasonality measure of the probability that off-flavor will occur in a given month of the year.

Iprisk - The square of a twelve month (t-1 through t-12) weighted moving average of past composite feed prices, as represented by Feedp, less the current composite feed price if the difference is negative, zero otherwise.

Searsk - The square of a three month (t-1 through t-3) weighted moving average of past U.S. Dept. of Labor Producer Price Index values for finished consumer fish goods unadjusted for seasonality less the current U.S. Dept. of Labor Producer Price Index value for finished consumer fish goods unadjusted for seasonality.

is hypothesized to be a production-cycle based function of producers expected output and input prices, Farmp(-5) and Feedp(-5) respectively, at the beginning of the production period. The wholesale demand for frozen filleted fish (as represented by current sales, Fnfs) is hypothesized to be an own-price (Fnfp) and substitute price (Seappi) based seasonal function. Own-price is expected to be a function of the cost of producing the product (as represented by the price paid to producers for live fish, Farmp(0)) and the level of current ending inventory (Fnfei).

Model

The sixteen behavioral equations and seven accounting identities of the hypothesized non-risk model are presented in Table 3 as are the hypothesized signs of the affects of the predetermined variables.

Assumptions and Hypotheses

Producer Harvest

Producer harvest (Livwts) is hypothesized to be a harvest-cycle based harmonic function of producer expectations with respect to output and input prices. S6 and C6 are sine and cosine variables used as proxies for the harvest-cycle variation [10] that exists in the production of food-size fish. January 1986 is time zero for the two

TABLE 3

HYPOTHESIZED NON-RISK MODEL
(Hypothesized signs of the affects of the predetermined variables are in parenthesis)

Behavioral Relationships[1]

Producer Harvest:

$$\text{Livwts} = f(C, S6, C6, \underset{(+)}{\text{Farmp}(-5)}, \underset{(-)}{\text{Feedp}(-5)}, \underset{(+)}{\text{Shift1}})$$

Producer Price:

$$\text{Farmp}(0) = f(C, S6, C6, S12, C12, \underset{(+)}{\text{Fnfp}})$$

Processor Prices:

$$\text{Fhwp} = f(C, S12, C12, \underset{(-)}{\text{Fhws}}, \underset{(+)}{\text{Fnfp}})$$

$$\text{Fhfp} = f(C, \underset{(-)}{\text{Fhfs}}, \underset{(+)}{\text{Fnfp}})$$

$$\text{Fhop} = f(C, \underset{(-)}{\text{Fhos}}, \underset{(+)}{\text{Fnfp}}, \underset{(+)}{\text{Shift3}})$$

$$\text{Fnwp} = f(C, \underset{(-)}{\text{Fnwei}}, \underset{(+)}{\text{Fnfp}}, \underset{(+)}{\text{Shift4}})$$

$$\text{Fnfp} = f(C, \underset{(-)}{\text{Fnfei}}, \underset{(+)}{\text{Farmp}(0)})$$

$$\text{Fnop} = f(C, \underset{(-)}{\text{Fnoei}}, \underset{(+)}{\text{Fnfp}}, \underset{(+)}{\text{Shift5}})$$

Processor Sales:

$$\text{Fhws} = f(C, S6, C6, S12, C12, \underset{(-)}{\text{Fhwp}}, \underset{(+)}{\text{Seappi}})$$

$$\text{Fhfs} = f(C, S6, C6, S12, C12, \underset{(-)}{\text{Fhfp}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Shift2}})$$

TABLE 3 (Continued)

$$\text{Fhos} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fhop}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Shift3}})$$

$$\text{Fnws} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fnwp}}, \underset{(+)}{\text{Seappi}})$$

$$\text{Fnfs} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fnfp}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Shift2}})$$

$$\text{Fnos} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fnop}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Shift5}})$$

Processor Production:

$$\text{Profnw} = f(\text{C}, \text{S12}, \text{C12}, \underset{(+)}{\text{Fnws}}, \underset{(+)}{\text{Livwts}})$$

$$\text{Profno} = f(\underset{(+)}{\text{Fnos}})$$

Accounting Identities

Processor Production:

$$\text{Profhw} = \text{Fhws}$$

$$\text{Profhf} = \text{Fhfs}$$

$$\text{Profho} = \text{Fhos}$$

$$\text{Profnf} = 0.4*\text{Livwts} - 0.6779661*\text{Profhw} - \text{Profhf} - 0.8333333*\text{Profho} - 0.6779661*\text{Profnw} - 0.8333333*\text{Profno}$$

TABLE 3 (Continued)

Frozen Processed Product Ending Inventory:

Fnwei = Profnw + Fnwei(-1) - Fnws

Fnfei = Profnf + Fnfei(-1) - Fnfs

Fnoei = Profno + Fnoei(-1) - Fnos

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[1] Estimation period: February 1986 - June 1990.

variables and at time zero S6 and C6 equal zero and one, respectively. The two variables and their estimated coefficients can be transformed by means of a trigonometric identity[1] [24, p.64] to form a single cosine variable that indicates the estimated harmonic peaks and troughs associated with the harvest cycle of food-size fish.

Farmp(-5) and Feedp(-5) are postulated to represent producer expectations with respect to output and input prices at the beginning of the production process. The coefficients for the variables are hypothesized to have positive and negative signs respectively. As expected output prices increase, producers are encouraged to increase

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[1] The identity is:

$$a\cos(x) + b\sin(x) = \sqrt{(a^2 + b^2)}\cos(x - \theta)$$

where:

$$\theta = \begin{cases} \arctan(b/a) & , a > 0 \\ \arctan(b/a) + \operatorname{sgn}(b)\pi & , a < 0 \\ \operatorname{sgn}(b)\pi/2 & , a = 0 \end{cases}$$

and

$$\operatorname{sgn}(b) = \begin{cases} 1 & , b \geq 0 \\ -1 & , b < 0 \end{cases}$$

$\sqrt{(a^2 + b^2)}$ is the amplitude of the harmonic cycle variable and θ is the phase angle or horizontal shift of the harmonic cycle variable.

the supply of food-size fish by increasing stocking rates. High output prices may also encourage producers to continue to produce from ponds that may be scheduled for renovation or otherwise removed from production. The expected price of feed at the beginning of the production cycle is hypothesized to be negatively related to the intensity of production and total harvest.

The variable Shift1 represents the early 1987 increase in the pond acreage used in catfish production. The coefficient for the variable is expected to be positive.

Producer Price

Producer price (Farmp(0)) is a harvest/wholesale-demand cycle based harmonic function of the price received by processors for their primary product in terms of sales, frozen filleted fish. A positive relationship is hypothesized to exist between the price received by producers and the price of frozen filleted fish (Fnfp).

S6 and C6 are sine and cosine variables used to account for the harvest cycle variation in the production of market-size fish while S12 and C12 are sine and cosine variables used to represent the wholesale-demand cycle variation that exists in the marketing of processed catfish products. Both cyclical patterns are expected to influence the month to month price received by producers for market-size fish. As outlined above, S6, C6, S12 and C12 are used to estimate the cyclical peaks and troughs associated with the dependent variable.

Processor Prices

As noted above, frozen filleted fish are assumed to be the principal product at the processing level. The prices of all other processed catfish products are assumed to be a function of the price of frozen filleted fish, along with those products level of current demand or level of current ending inventory, depending upon the product in question. It is hypothesized that fresh products are produced based strictly on demand (sales) while frozen products are storable. This leads to the assumption that fresh product prices are a function of the current level of fresh product demand while frozen product prices are a function of the current level of frozen product ending inventory.

The price for fresh whole processed fish (Fhwp) is hypothesized to be a wholesale-demand cycle based function (S12 and C12 as outlined above) of the demand for fresh whole processed fish as represented by the current sales of the product (Fhws) and the price of frozen filleted fish (Fnfp). Current product sales are hypothesized to have a negative influence on the price of fresh whole processed fish while the price of frozen filleted fish is expected to have a positive impact.

The fresh filleted fish price (Fhfp) is hypothesized to be a function of the demand for fresh filleted fish as represented by the current sales of the product (Fhfs) and the price received by processors for frozen filleted fish (Fnfp). Hypothesized impacts of the variables are negative and positive respectively.

Other fresh processed fish product prices (Fhop) are hypothesized to be a function of the demand for other fresh processed fish products as represented by the current sales of other products (Fhos), the price received by processors for frozen filleted fish (Fnfp) and a 0,1 dummy variable (Shift3) indicating a shift in the monthly demand for other fresh processed fish products that began around February of 1989. The frozen filleted fish price and shift variables are hypothesized to have a positive impact on the price of other fresh processed fish products while the sales variable is expected to have a negative influence.

Frozen whole processed fish prices (Fnwp) are hypothesized to be a function of the current level of frozen whole processed fish ending inventory (Fnwei), the price received by processors for frozen filleted fish (Fnfp) and a 0,1 dummy variable (Shift4) indicating a shift in the monthly demand for frozen whole processed fish that began in May of 1988, approximately. The frozen filleted fish price variable and shift variable are hypothesized to have a positive impact on the price of frozen whole processed fish while the current ending inventory variable is expected to have a negative influence. The level of ending inventory indicates the level of product demand for whole processed fish. Increases in ending inventory indicate a decrease in demand. Processors will then lower product prices in order to stimulate demand and reduce inventories.

The price received by processors for frozen filleted fish (Fnfp) is hypothesized to be a function of the current monthly level of frozen filleted ending inventory (Fnfei) and the average monthly price received by producers for farm-raised fish (Farmp(0)). Ending inventory is expected to have a negative impact on the price of frozen filleted fish while the price paid to producers is expected to have a positive impact. Live fish are the primary input in the production of frozen filleted fish in terms of cost. As the cost (price) of this input increases it is expected to have a positive affect on the price the processor charges in the sale of the product.

Other frozen processed fish product prices (Fnop) are hypothesized to be a function of the other fresh processed fish products ending inventory (Fnoei), the price received by processors for frozen filleted fish (Fnfp) and a 0,1 dummy variable (Shift5) indicating a shift in the monthly demand for other frozen processed fish products that began in February of 1987. The frozen filleted fish price and shift variables are hypothesized to have a positive impact on the price of other frozen processed fish products while the ending inventory variable is expected to have a negative influence.

Processor Sales

Processor sales are assumed to be harvest/wholesale cycle based harmonic functions of the specific processed products own-price and the wholesale prices of other consumer fish products as represented by the Producer Price Index for Finished Consumer Goods - Fish (Seappi). Specifically, monthly sales of fresh whole processed fish (Fhws) are assumed to be a function of S6, C6, S12 and C12, the sine and cosine variables whose affect has been described previously, the current average monthly price received by processors for fresh whole processed fish (Fhwp) and the wholesale prices of other consumer fish products (Seappi). The hypothesized affect of own-price on sales is negative while the affect of other prices is expected to be positive.

Monthly sales of fresh filleted fish (Fhfs) are assumed to be a function of S6, C6, S12, C12, the current average monthly price received by processors for fresh filleted fish (Fhfp), the wholesale prices of other consumer fish products (Seappi) and a 0,1 dummy variable (Shift2) indicating a shift in the monthly demand for filleted fish relative to wholefish that began in January of 1988, approximately. The hypothesized affect of own-price on sales is negative while the affects of other prices and the dummy variable are expected to be positive.

Monthly sales of other fresh processed fish products (Fhos) are assumed to be a function of S6, C6, S12, C12, the current average monthly price received by processors for other fresh processed fish products (Fhop), the wholesale prices of other consumer fish products (Seappi) and a 0,1 dummy variable (Shift3) indicating a shift in the monthly demand for other fresh processed fish products that began in February of 1989. The hypothesized affect of own-price on sales is negative while the affects of other prices and the dummy variable are expected to be positive.

Monthly sales of frozen whole processed fish (Fnws) are assumed to be a function of S6, C6, S12, C12, the current average monthly price received by processors for frozen whole processed fish (Fnwp) and the wholesale prices of other consumer fish products (Seappi). The hypothesized affect of own-price on sales is negative while the affect of other prices is expected to be positive.

Monthly sales of frozen filleted fish (Fnfs) are assumed to be a function of S6, C6, S12, C12, the current average monthly price received by processors for frozen filleted fish (Fnfp), the wholesale prices of other consumer fish products (Seappi) and as with fresh filleted fish sales, a 0,1 dummy variable (Shift2) indicating a shift in the monthly demand for filleted fish relative to wholefish that began in January of 1988 roughly. The hypothesized affect of own-price on sales is negative while the affects of other prices and the dummy variable are expected to be positive.

Monthly sales of other frozen processed fish products (Fnos) are assumed to be a function of S6, C6, S12, C12, the current average monthly price received by processors for other frozen processed fish products (Fnop), the wholesale prices of other consumer fish products (Seappi) and a 0,1 dummy variable (Shift5) indicating a shift in the monthly demand for other frozen processed fish products that began in approximately February of 1987. The hypothesized affect of own-price on sales is negative while the affects of other prices and the dummy variable are expected to be positive.

Processor Production

The six processor production equations combine to relate the level of marketable fish harvest with the supply of processed fish available for sale. Additionally, the three fresh product equations act as equilibrating functions linking the production level and harvest to the processing level and demand for fresh catfish products.

The level of processed fish production for each processed product will be a function of the pounds of marketable fish available for processing, Livwts, the dressing rate or yield of processed product per pound of marketable fish processed and the number of pounds of marketable fish allocated to the production of the processed product in question. This implies that,

(3.1) $\text{Livwts} = (\text{WF\%})\text{Profhw} + (\text{F\%})\text{Profhf} + (\text{O\%})\text{Profho} + (\text{WF\%})\text{Profnw} + (\text{F\%})\text{Profnf} + (\text{O\%})\text{Profno}$

where

WF%, F% and O% = the dressing rates for whole processed fish, filleted fish and other processed fish products respectively.

The level of production for any processed good can be found given the weight of live fish processed and the production level of the other five processed goods. It is assumed that fresh processed products (whole processed fish, filleted fish and other fresh processed fish) are produced to meet sales and that only immaterial levels of product supply are maintained in monthly ending inventory. Thus:

(3.2) $\text{Profhw} = \text{Fhws}$

(3.3) $\text{Profhf} = \text{Fhfs}$

(3.4) $\text{Profho} = \text{Fhfo}$

Frozen whole processed fish production (Profnw) is assumed to be a wholesale cycle based harmonic function of the level of frozen whole processed fish sales (Fnws) and the quantity of marketable live fish harvested and available for processing (Livwts). The affects of own-sales and availability of marketable fish on production are both hypothesized to be positive.

Other frozen processed fish production (Profno) is assumed to be a positive function of the level of other frozen processed fish sales (Fnos).

Given that Livwts, Profhw, Profhf, Profho, Profnw and Profno are known and assuming that WF%, F% and O% equal 59%, 40% and 48% respectively, then (3.1) can be rewritten to yield the following processor production function for frozen filleted fish (Profnf):

$$\begin{aligned} \text{Profnf} = {} & 0.40*\text{Livwts} - 0.68*\text{Profhw} - \\ & \text{Profhf} - 0.83*\text{Profho} - \\ & 0.68*\text{Profnw} - 0.83*\text{Profno} \end{aligned} \tag{3.5}$$

Processed Product Ending Inventory

As was stated above, it is assumed that fresh processed products (whole processed fish, filleted fish and other fresh processed fish) are produced to meet sales and that only immaterial levels of product supply are maintained in monthly ending inventory. Three identities are assumed to hold that specify the levels of frozen processed product inventory at the end of each month. These identities also act to equilibrate the production level and harvest to the processing level and demand for frozen catfish products. The identities are:

$$\text{Fnwei} = \text{Profnw} + \text{Fnwei}(-1) - \text{Fnws} \tag{3.6}$$

(3.7) $$\mathrm{Fnfei} = \mathrm{Profnf} + \mathrm{Fnfei}(-1) - \mathrm{Fnfs}$$

(3.8) $$\mathrm{Fnoei} = \mathrm{Profno} + \mathrm{Fnoei}(-1) - \mathrm{Fnos}$$

Hypothesized Risk Model

The linear, short-run, seasonal, equilibrium structure hypothesized for the non-risk model is expanded in the risk model by introducing several variables hypothesized to represent various forms of risk assumed to be present in the U.S. catfish marketing system. These sources of risk include production, input, and output price risk at the production level in the producer harvest equation and other consumer products competitive price risk in the processor sales equations at the processing level. The input and output price risk variables at the production level are assumed to be conditional, asymmetric functions of past price levels. This conditional form introduces a degree of non-linearity to the model that alters the estimation techniques available for use in estimating the risk model.

Model

Definitions of the variables associated with the risk model were listed in Table 2. The sixteen behavioral equations and eight accounting identities of the hypothesized risk model are presented in Table 4 as are the hypothesized signs of the affects of the predetermined variables.

TABLE 4

HYPOTHESIZED RISK MODEL
(Hypothesized signs of the affects of the
predetermined variables are in parenthesis)

Behavioral Relationships[1]

Producer Supply:

$$\text{Livwts} = f(\text{C, S6, C6, }\underset{(+)}{\text{Farmp(-5)}}, \underset{(-)}{\text{Feedp(-5)}}, \underset{(+)}{\text{Shift1}}, \underset{(-)}{\text{Yrisk}}, \underset{(+)}{\text{Iprisk}}, \underset{(+)}{\text{Oprisk}})$$

Producer Price:

$$\text{Farmp(0)} = f(\text{C, S6, C6, S12, C12, }\underset{(+)}{\text{Fnfp}})$$

Processor Prices:

$$\text{Fhwp} = f(\text{C, S12, C12, }\underset{(-)}{\text{Fhws}}, \underset{(+)}{\text{Fnfp}})$$

$$\text{Fhfp} = f(\text{C, }\underset{(-)}{\text{Fhfs}}, \underset{(+)}{\text{Fnfp}})$$

$$\text{Fhop} = f(\text{C, }\underset{(-)}{\text{Fhos}}, \underset{(+)}{\text{Fnfp}}, \underset{(+)}{\text{Shift3}})$$

$$\text{Fnwp} = f(\text{C, }\underset{(-)}{\text{Fnwei}}, \underset{(+)}{\text{Fnfp}}, \underset{(+)}{\text{Shift4}})$$

$$\text{Fnfp} = f(\text{C, }\underset{(-)}{\text{Fnfei}}, \underset{(+)}{\text{Farmp(0)}})$$

$$\text{Fnop} = f(\text{C, }\underset{(-)}{\text{Fnoei}}, \underset{(+)}{\text{Fnfp}}, \underset{(+)}{\text{Shift5}})$$

Processor Sales:

$$\text{Fhws} = f(\text{C, S6, C6, S12, C12, }\underset{(-)}{\text{Fhwp}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Searsk}})$$

TABLE 4 (Continued)

$$\text{Fhfs} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fhfp}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Shift2}}, \underset{(+)}{\text{Searsk}})$$

$$\text{Fhos} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fhop}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Shift3}}, \underset{(+)}{\text{Searsk}})$$

$$\text{Fnws} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fnwp}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Searsk}})$$

$$\text{Fnfs} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fnfp}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Shift2}}, \underset{(+)}{\text{Searsk}})$$

$$\text{Fnos} = f(\text{C}, \text{S6}, \text{C6}, \text{S12}, \text{C12}, \underset{(-)}{\text{Fnop}}, \underset{(+)}{\text{Seappi}}, \underset{(+)}{\text{Shift5}}, \underset{(+)}{\text{Searsk}})$$

Processor Production:

$$\text{Profnw} = f(\text{C}, \text{S12}, \text{C12}, \underset{(+)}{\text{Fnws}}, \underset{(+)}{\text{Livwts}})$$

$$\text{Profno} = f(\underset{(+)}{\text{Fnos}})$$

Accounting Identities

Processor Production:

Profhw = Fhws

Profhf = Fhfs

Profho = Fhos

TABLE 4 (Continued)

Profnf = 0.4*Livwts - 0.6779661*Profhw - Profhf - 0.8333333*Profho - 0.6779661*Profnw - 0.8333333*Profno

Frozen Processed Product Ending Inventory:

Fnwei = Profnw + Fnwei(-1) - Fnws

Fnfei = Profnf + Fnfei(-1) - Fnfs

Fnoei = Profno + Fnoei(-1) - Fnos

Production Level Output Price Risk

If

[.15385*Farmp(-1) + .14103*Farmp(-2) + .12821*Farmp(-3) +
.11538*Farmp(-4) + .10256*Farmp(-5) + .08974*Farmp(-6) +
.07692*Farmp(-7) + .06410*Farmp(-8) + .05128*Farmp(-9) +
.03846*Farmp(-10) + .02564*Farmp(-11) + .01282*Farmp(-12) -
Farmp] > 0

Then Oprisk =

[.15385*Farmp(-1) + .14103*Farmp(-2) + .12821*Farmp(-3) +
.11538*Farmp(-4) + .10256*Farmp(-5) + .08974*Farmp(-6) +
.07692*Farmp(-7) + .06410*Farmp(-8) + .05128*Farmp(-9) +
.03846*Farmp(-10) + .02564*Farmp(-11) + .01282*Farmp(-12) -
Farmp]^2

Otherwise Oprisk = 0

---

[1] Estimation period: February 1986 - June 1990.

Assumptions and Hypotheses

Production Level Risk

Major sources of risk to producers arise from production, input price and output price factors. Each is outlined below.

Production Risk. A principal element of production risk is the occurrence of a condition in fish known as "off-flavor" where by fish pick-up distasteful flavors from their pond environment and become unmarketable. Algae growth in the ponds is believed to be one of the leading causes of off-flavor but to date the exact causes and solutions are unknown. To clear the off-flavor the fish are moved to a cleaner pond or the algae growth is controlled in the existing pond. However, the time for the off-flavor to clear can take from several days to several months. During this time the fish must be maintained. The costs of maintaining the fish in the ponds include physical costs and opportunity costs. Physical costs of maintaining fish are related to water temperatures and aeration required. Opportunity costs are related to the market price for the fish and interest rates.

Yrisk is a proxy to represent the monthly level of off-flavor fish that occurs throughout the year. The variable is roughly based on data from Keenum and Waldrop[2]. Occurrence of off-flavor in food-size fish may be a function of the time of year at which you attempt to harvest and market. Generally off-flavor problems are low at the beginning of the year and increase throughout the spring, summer and early fall. As winter approaches the problem tends to decrease[3]. As the risk of off-flavor (Yrisk) increases, the available supply of harvestable food-size fish is expected to decrease.

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[2] Yrisk was established as follows: the quarterly levels of unmarketable fish were assumed to be levels of unmarketable fish for the third month of each quarter for the first three quarters of the year. First and second month levels of unmarketable fish were assumed to equal one-third and two-thirds, respectively, of the third months level of unmarketable fish. For the fourth quarter of the year, the quarterly level of unmarketable fish was assumed to be the level of unmarketable fish for the first month of the quarter. The second and third month levels of unmarketable fish were assumed to equal two-thirds and one-third, respectively, of the first months level of unmarketable fish. This weighing scheme yields a negatively skewed distribution for the unmarketable fish with its mode occurring in the month of September each year.

[3] Obviously the off-flavor problem is not a function of time per se but rather, is a function of the changes that occur over time. For example, as production progresses through the year weather conditions change from generally cold weather to warm and hot weather and longer days. These changing conditions may allow the growth of algae that influences the flavor of fish thus causing marketing problems at the end of the summer and into early fall. As temperatures begin to cool and the days shorten with the approach of winter, the growth of the algae may decrease and the problems with flavor begin to decrease. Thus, time is simply used as an indicator of when the affects of off-flavor arise, not as a factor that actually causes the off-flavor problem.

Input Price Risk. Input price risk is due predominately to unexpected upward changes in the price producers pay for feed and to a lessor extent is due to unexpected changes in the price paid for fingerlings. Iprisk is a measure of the perceived risk associated with continuing to hold fish in pond inventory in light of an increase in the current price of fish feed relative to an expected feed price. Expected feed price is represented by a weighted average of feed prices from the immediate past. If the current price of feed is below a weighted average of past prices, there is assumed to be no price risk and Iprisk is zero. If the current price of feed is above a weighted average of past prices, Iprisk is the square of that difference. Figures 2 and 3 present a comparison of the current price of fish feed, as represented by Feedp, with a twelve month arithmetically declining weighted moving average of past feed prices[4] and the resulting value of Iprisk respectively. The influence of Iprisk on the harvest of food-size fish is hypothesized to be positive. Holding fish in the pond as inventory becomes more expensive as the price and resulting risk associated with feed prices increases above expectations.

---

[4] Three, six and twelve month arithmetically declining weighted moving averages of past feed prices and past fish prices were considered in defining Iprisk and Oprisk. Twelve month averages of past prices were found to yield the most significant results for both Iprisk and Oprisk.

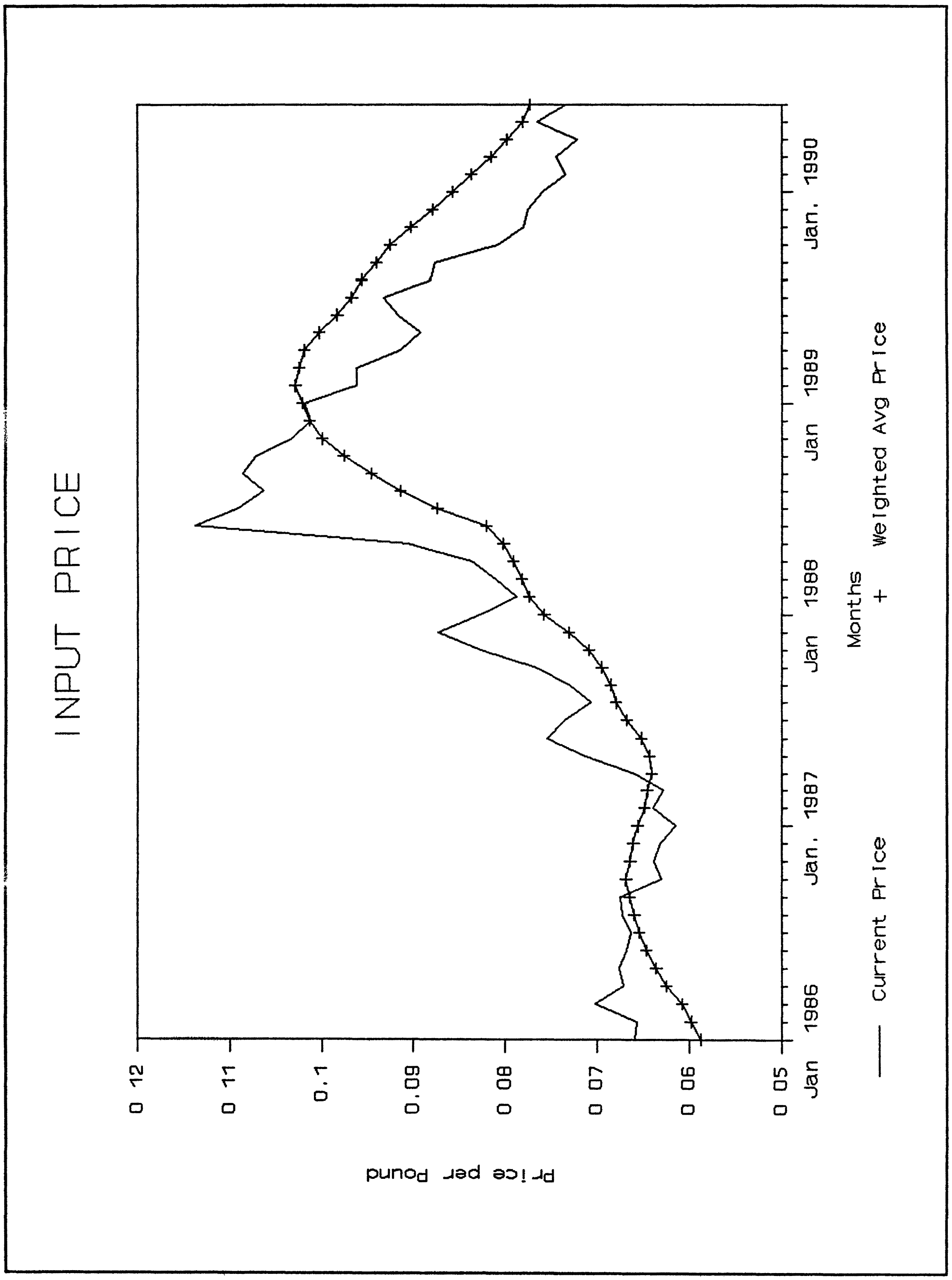


Figure 2. Input Price - Feedp

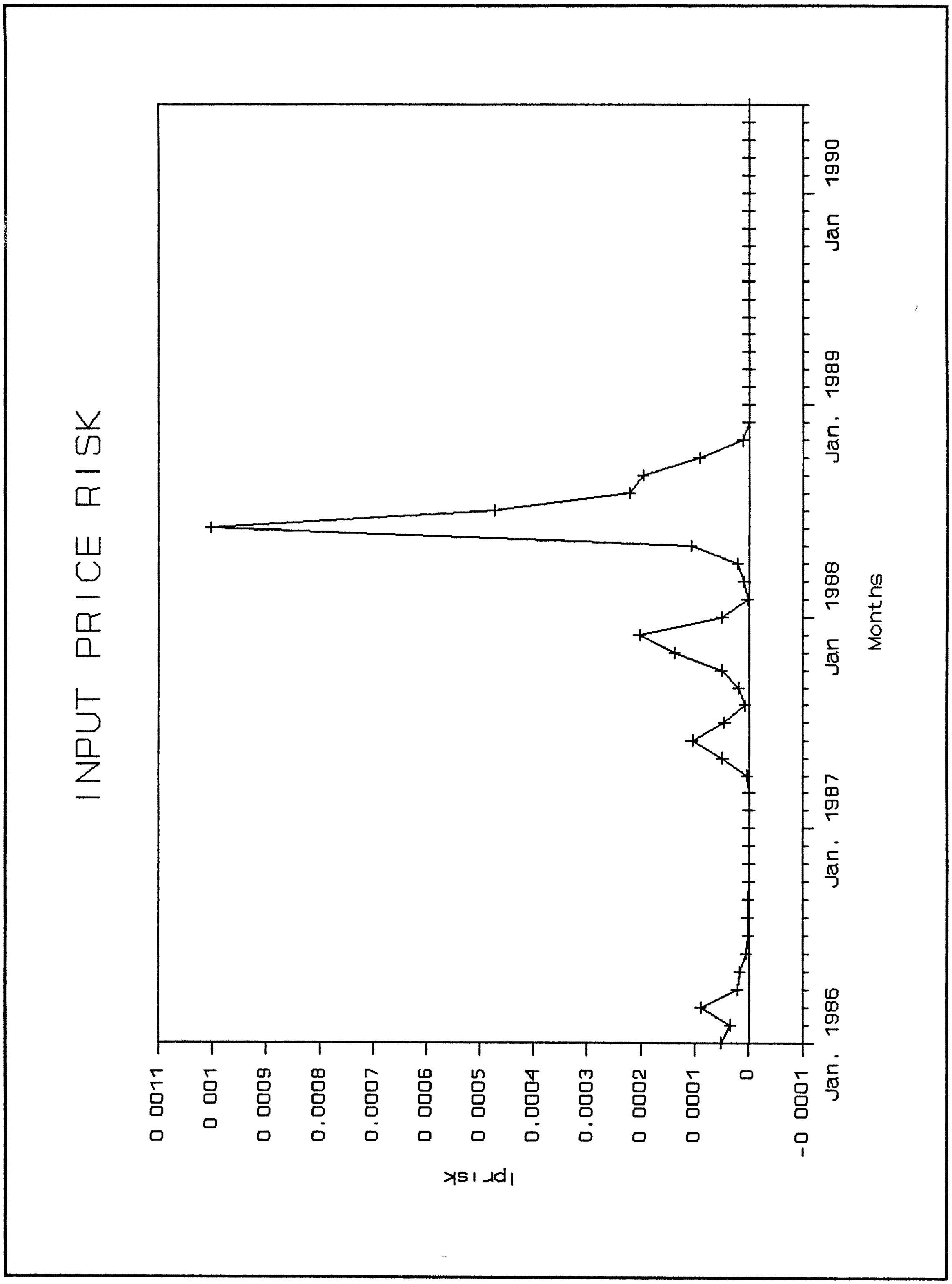


Figure 3. Input Price Risk

Output Price Risk. Output price risk is due to unexpected downward changes in the price received by producers for food-size fish. Oprisk measures the extent to which the current price for marketable fish varies from an expected price as represented by a weighted average of fish prices from the immediate past. If the current price of fish is above a weighted average of past prices, there is assumed to be no price risk and Oprisk is zero. If the current price of fish is below a weighted average of past prices, Oprisk is the square of that difference. Figures 4 and 5 present a comparison of the current price of fish, as represented by Farmp(0), with a twelve month arithmetically declining weighted moving average of past fish prices and the resulting value of Oprisk respectively. Again, the influence of price risk on the harvesting of food-size fish is hypothesized to be positive. Holding fish in the pond as inventory becomes more expensive as the risk associated with fish prices increases and so producers harvest and market their fish.

The input and output price risk hypotheses appear to be contrary to those expressed in past aggregate supply risk research. Past research has attempted to model the affect of risk on producer choices as to production intensity at the beginning of the production process. Modeling for example, acres planted or number of farrowings to determine the initial level of input use. Risk associated with

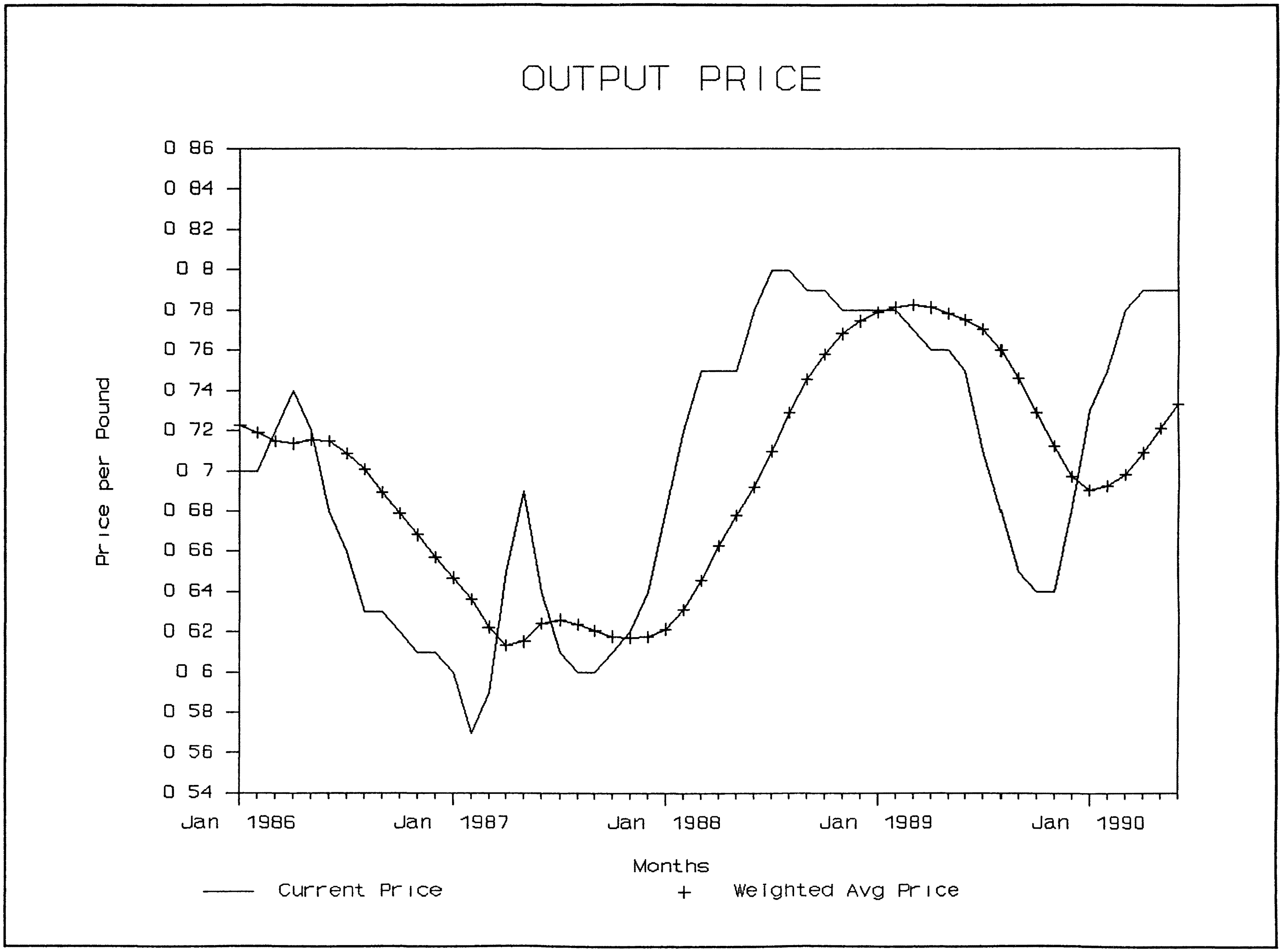


Figure 4. Output Price - Farmp(0)

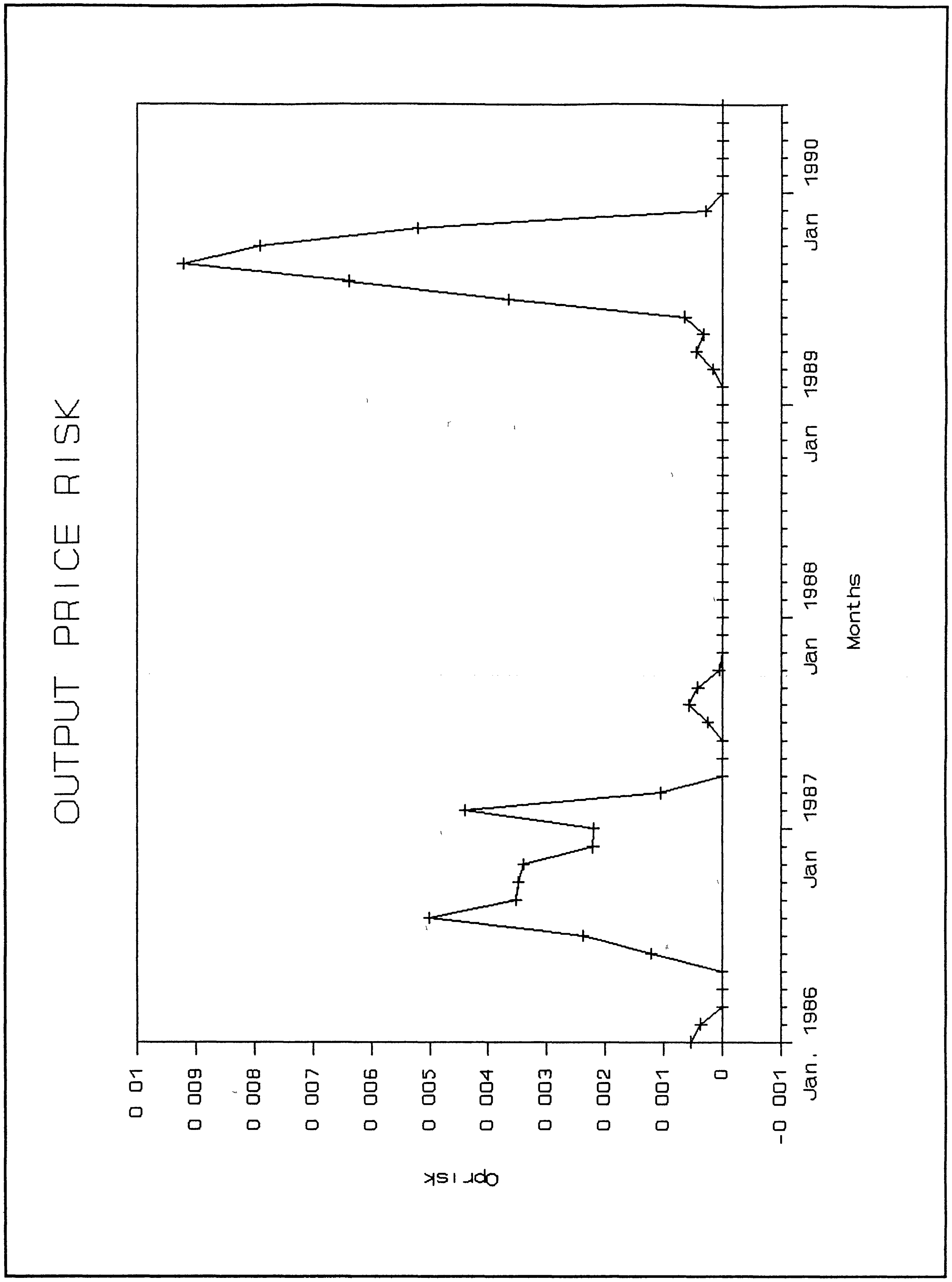


Figure 5. Output Price Risk

related input and output prices would cause some hesitation in the risk averse producer resulting in less production intensity and lower levels of supply. Thus, the hypothesized negative relationships between risk and aggregate supply. In this model, supply as represented by harvest levels is modeled at or near the end of the production process. Price risk arising at this point in time will influence the producers' decisions to continue the current production process or to harvest and market. Adverse changes in either input or output prices will encourage the producer to harvest and market rather than hold the fish as pond inventory thus, increasing the harvest of fish.

Processing Level Risk

Competition Price Risk. Price risk arises at the processing level due to unexpected changes in the price of other competitive consumer fish products. As outlined above, the Producer Price Index for Finished Consumer Goods - Fish (Seappi) is used to represent the wholesale price of other consumer fish products. The squared difference between the current price for other competitive consumer fish products and an expected price for other competitive consumer fish products as represented by a three month arithmetically weighted declining moving average of the immediate past other competitive consumer fish product prices (Searsk) is assumed to represent the level of competitive price risk that exists at the processing level. Searsk is expected to have a positive affect on the sales of all processed catfish products marketed. As the variability of other competitive consumer fish product prices increases, the sales of processed catfish products are expected to increase.

Methodology

Both the linear non-risk model and non-linear risk model were estimated using the SAS/ETS non-linear three stage least squares (3SLS) estimation procedure (PROC SYSNLIN) available in the SAS System data analysis software system. Three stage least squares estimation is used because the estimations are consistent and are generally more asymptotically efficient than other system of equations estimators. In the case of the non-risk model the non-linear estimation technique reduces to a linear estimation technique in the presence of a linear model yielding results identical to linear three stage least squares estimation (PROC SYSLIN). Additionally, results from the non-linear estimation of the risk model are identical to estimated results from a linear version of the risk model where Oprisk is assumed to be exogenous. This is due to the nature of the Oprisk non-linearity in the risk model. Oprisk is conditional and this leads to the non-linearity however, Oprisk is also an identity and as such is not estimable. Though the risk model is in fact a linear model in terms of estimation, under simulation the non-linearity of the Oprisk variable will affect the results and a non-linear simulation procedure will have to be followed. The SAS PROC SIMLIN and PROC SIMNLIN procedures were used to perform ex post simulations of the non-risk and risk models respectively.

Data

U.S. catfish marketing system data used in this analysis is available semi-annually in the Aquaculture Situation and Outlook Report [1]. The period of estimation used was dependent upon the availability of market data. Though production and aggregate processing data have been available since the early 1970's, individual processed product data has only been available since 1986. Pricing data used in the construction of Feedp and other competitive consumer fish product price index data are available in the Feed Situation and Outlook Report [8] and Producer Price Indexes Data [26], respectively. The means and standard deviations for the variables used in the analysis are listed in Table 5.

TABLE 5

MODEL VARIABLES: MEANS AND STANDARD DEVIATIONS
(February 1986 - June 1990)

Variable	Mean	Standard Deviation
<u>Endogenous Variables</u>		
Livwts	24.5483	4.9382
Farmp(0)	0.7008	0.0712
Fhwp	1.5392	0.1040
Fhfp	2.6526	0.1196
Fhop	1.6879	0.1694
Fnwp	1.6468	0.1059
Fnfp	2.6245	0.1134
Fnop	1.9564	0.1397
Fhws	3.4505	0.5233
Fhfs	2.0210	0.6576
Fhos	0.4927	0.1369
Fnws	1.4820	0.1840
Fnfs	3.3120	0.7694
Fnos	1.9325	0.4666
Profhw	3.4501	0.5390
Profhf	2.0234	0.6596
Profho	0.4956	0.1430
Profnw	1.5090	0.2585
Profnf	3.3297	0.8373
Profno	1.9588	0.5449
Fnwei	1.4727	0.6482
Fnfei	2.4015	0.9579
Fnoei	1.4555	0.6455
Oprisk	0.0012	0.0023
<u>Predetermined Variables</u>		
S6	0.0000	0.7206
C6	-0.0189	0.7069
S12	0.0704	0.7171
C12	0.0000	0.7071
Seappi	1.4723	0.1280
Farmp(-5)	0.6934	0.0663
Feedp(-5)	0.0796	0.0154
Fnwei(-1)	1.4457	0.6069
Fnfei(-1)	2.3838	0.9551
Fnoei(-1)	1.4292	0.6363

TABLE 5 (Continued)

Variable	Mean	Standard Deviation
Shift1[1]	0.7547	N/A
Shift2[1]	0.5660	N/A
Shift3[1]	0.3208	N/A
Shift4[1]	0.4907	N/A
Shift5[1]	0.7736	N/A
Yrisk	0.1587	0.1560
Iprisk	0.00005	0.0002
Searsk	0.0056	0.0118

[1] Means of dummy variables indicate the percentage of observations with a value of 1 and standard deviations are not applicable.

CHAPTER IV

RESULTS OF ESTIMATION AND SIMULATION

Introduction

The results of the non-linear three stage least squares estimation of the sixteen non-risk and risk model equations along with several statistics of fit based upon the estimation and ex post simulations of each equation are presented in Tables 6 through 21. Statistics of fit based upon the ex post simulations of the seven accounting identities and the output price risk variable in the risk model are presented in Tables 22 through 29.

The signs of the estimated coefficients of the individual equations generally coincide with hypotheses and a high level of significance is achieved as indicated by the associated t-values. Overall the equations fit the data well. Ex post simulation indicates that the risk model generally simulates the historical data better than the non-risk model however, the risk model does have problems simulating during periods of rapid change in the risk variables. This was particularly true during an increase in feed prices that occurred in 1987 and early 1988.

Unrealistic values were estimated for the endogenous variables for the entire risk model and these inaccurate estimates resulted in poor statistics of fit for some equations. During periods of no input price risk the risk model appears to fit the actual data better than the non-risk model. An analysis of each of the equations relative to the non-risk and risk models is presented below.

Producer Harvest

For the non-risk model (Table 6) the hypothesized six month periodicity yields a set of coefficients that are large relative to their standard errors and a 1.602 month shift in the cycle from January is indicated based upon the trigonometric identity outlined in chapter III. This implies that the greatest volume of food-size fish available for processing exists in mid-February and mid-August while the lowest volume occurs in mid-May and mid-November. The signs on the pre-production price coefficients (Farmp(-5) and Feedp(-5)) are opposite of those hypothesized. The dummy variable accounting for an increase in the pond acreage used in catfish production (Shift1) is yielded a coefficient that is large relative to its standard error.

When the risk variables are included the hypothesized six month periodicity is again yields a coefficient that is large relative to its standard error. The coefficients on the periodic variables indicate a 1.604 month shift in the

TABLE 6

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: LIVE WEIGHT OF FISH HARVESTED - (LIVWTS)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	14.76791 (4.382)	9.57359 (2.645)
S6	2.18994 (4.106)	2.47787 (5.054)
C6	-0.23402 (-0.448)	-0.27149 (-0.602)
Farmp(-5)	-1.06777 (-0.146)	12.74906 (1.544)
Feedp(-5)	82.65659 (2.220)	-2.63618 (-0.061)
Shift1	5.22566 (5.308)	9.22669 (7.854)
Yrisk	--	-10.16199 (-3.821)
Iprisk	--	-126.96521 (-0.068)
Oprisk	--	814.65870 (3.651)

TABLE 6 (Continued)

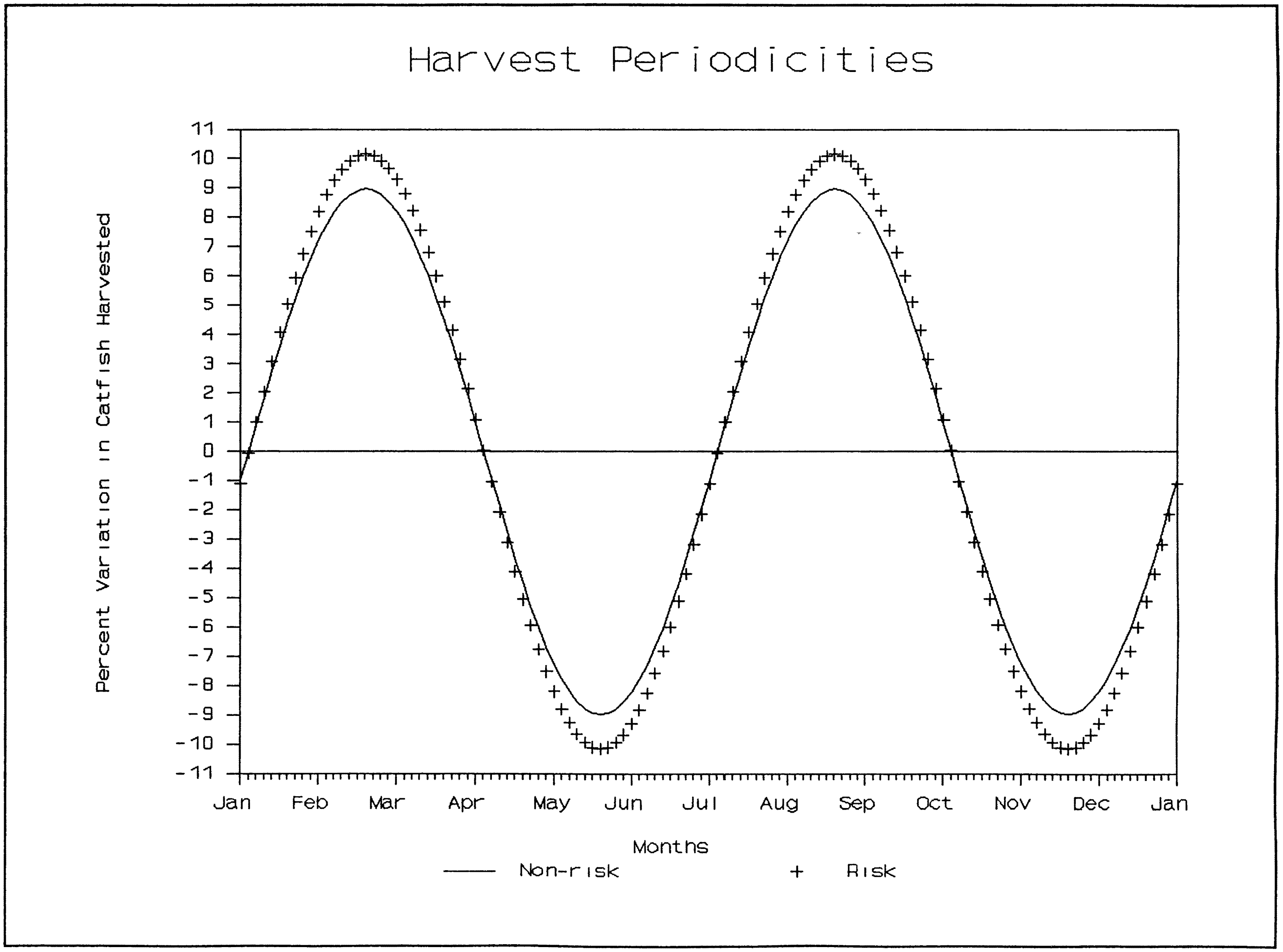
Predetermined Variables/Statistics	Without Risk	With Risk
Summary Statistics		
Root Mean-Square Error	2.908	12.107
Theil's Inequality: U_1	0.1162	0.4837
Proportions of Inequality:		
Bias	0.0004	0.025
Variance	0.2854	0.381
Covariance	0.7142	0.594
Regression	0.0498	0.824
Disturbance	0.9498	0.150

cycle from January. This implies that the peaks and troughs indicated by the risk estimate of food-size fish harvest occur only slightly later in the same months as compared with the non-risk model. Figure 6 shows the relationship between the periodicities of the two estimated equations. The figure shows the periodic change in harvest as a percentage of the average harvest level over the model estimation period. As stated, both estimated equations indicate approximately the same monthly high and low levels of harvest throughout the year. However, inclusion of the risk variables increases the amplitude of the estimated cycle.

The signs of the coefficients on the pre-production price variables are as hypothesized and neither yield large coefficients relative to their standard errors. The sign on the coefficient of the Shift1 dummy variable is positive as expected and does yield a large coefficient relative to its standard error.

The production risk variable (Yrisk) yielded a large negative estimated coefficient relative to its standard error. This indicates that the general timing of the occurrence of off-flavor has strongly impacted the harvesting and marketing decisions of catfish producers. The estimated peak harvest level occurring in August each year and an assumed high level of off-flavor occurring in September implies that producers may be attempting to

Figure 6. Harvest Periodicities



harvest and market their fish just prior to an anticipated period of high off-flavor occurrence each year.

The estimated coefficient for the input price risk variable (Iprisk) yielded a small negative coefficient relative to its standard error, opposite of that hypothesized. Feed costs represent a major portion of the cost of producing fish and any changes in these costs can dramatically affect producer returns (Keenum and Waldrop, Branch and Tilley) and should affect producer harvesting decisions. One possible reason for the lack of significance of the Iprisk variable may be the relative lack of risk that can be associated with feed prices over the period of estimation. With the exception of approximately sixteen months during 1987 and early 1988, feed prices have been stable or falling. Periods of stable or falling prices would not be considered risky to the fish producer based upon the asymmetric definition of price risk used and as such the general lack of input price risk for the period of estimation may have contributed to the insignificance of the Iprisk variable. Although the input price risk variable was not shown to significantly affect the level of producer harvest it did affect the simulation results of the Livwts equation in the risk model. The model was not able to adjust to the rapid upward change in input prices that occurred in 1987 and in early 1988 and very unrealistic values were estimated for the endogenous variable during this period. These poor estimates resulted in poor statistics of fit for the risk model Livwts equation. However, during periods of no input price risk the risk model appears to fit the actual data better than the non-risk model.

The output price risk variable (Oprisk) yielded a positive sign as expected that was large relative to its standard error. These results suggest that producers can be encouraged to continue to hold fish if output prices are increasing.

Producer Price

Table 7 presents the estimation results and statistics of fit for the producer price equation (Farmp(0)). The hypothesized six month periodicity did not yield a set of coefficients that were large relative to their standard errors for either the non-risk or risk model while the hypothesized twelve month periodicity did yield a set of coefficients which were large relative to their standard errors for both models. Figure 7 shows the combined affect of the estimated periodicities on the percent of mean change in prices received by producers for live fish. The six month production cycle tends to prolong the late spring\early summer trough in producer prices due to the twelve month wholesale demand cycle. In combination the

TABLE 7

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: PRICE RECEIVED BY PRODUCERS FOR LIVE FISH - (FARMP(0))

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
Variables		
Constant	-0.93288 (-12.220)	-0.95022 (-11.980)
S6	-0.00178 (-0.589)	-0.00086 (-0.297)
C6	0.00064 (0.218)	0.00051 (0.181)
S12	-0.00266 (-0.843)	-0.00217 (-0.672)
C12	0.00786 (2.496)	0.00836 (2.617)
Fnfp	0.62250 (21.399)	0.62910 (20.814)

TABLE 7 (Continued)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Summary Statistics</u>		
Root Mean-Square Error	0.094	0.568
Theil's Inequality: U_1	0.1336	0.8071
Proportions of Inequality:		
Bias	0.5159	0.053
Variance	0.0499	0.748
Covariance	0.4341	0.200
Regression	0.1993	0.932
Disturbance	0.2848	0.015

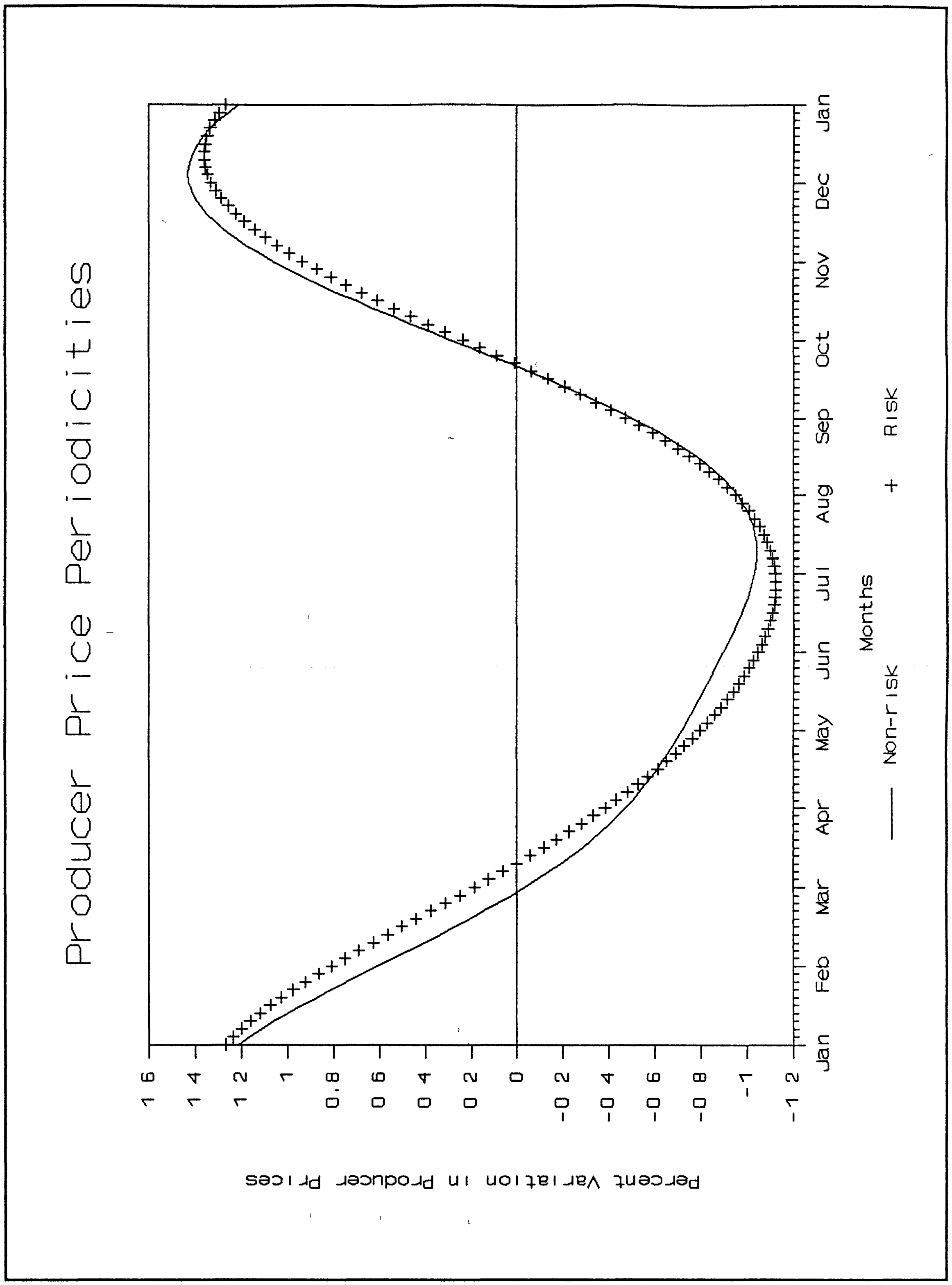


Figure 7. Producer Price Periodicities

cyclical variables indicate a peak in producer prices during early December each year, following the high supply period of fall and just prior to the high wholesale demand period of Lent.

The non-risk and risk models both show a highly significant positive relationship between the price received by producers and the price of frozen filleted fish (Fnfp). Both model equations also tend to over estimate the price received by farmers, particularly the risk model.

Processor Prices

The non-risk and risk model estimates of prices received by processors for processed fish are essentially the same both in terms of the magnitude of the estimated coefficients and in terms of their statistical significance. As with the price received by producers, the risk model tends to overestimate the prices received by processors for processed fish.

The hypothesized twelve month periodicity of the non-risk model fresh whole processed fish price (Fhwp) equation (Table 8) indicates a 1.957 month shift in the wholesale demand cycle from January. This implies that the greatest price paid for fresh whole processed fish occurs in late February while the lowest price paid occurs in late August (Figure 8). When the risk variables are included in the model, the twelve month periodicity indicates a 1.917 month

TABLE 8

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES
OF NON-RISK AND RISK EQUATION COEFFICIENTS
NORMALIZED VARIABLE: FRESH WHOLE
FISH PRICES - (FHWP)
(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	-0.59776 (-5.180)	-0.61323 (-5.413)
S12	0.00413 (0.817)	0.00377 (0.755)
C12	0.00251 (0.566)	0.00240 (0.549)
Fhws	-0.03100 (-3.919)	-0.02886 (-3.767)
Fnfp	0.85490 (22.127)	0.85798 (22.556)
<u>Summary Statistics</u>		
Root Mean-Square Error	0.149	0.889
Theil's Inequality: U_1	0.0965	0.5761
Proportions of Inequality:		
Bias	0.5159	0.051
Variance	0.0572	0.739
Covariance	0.4269	0.209
Regression	0.2194	0.935
Disturbance	0.2647	0.013

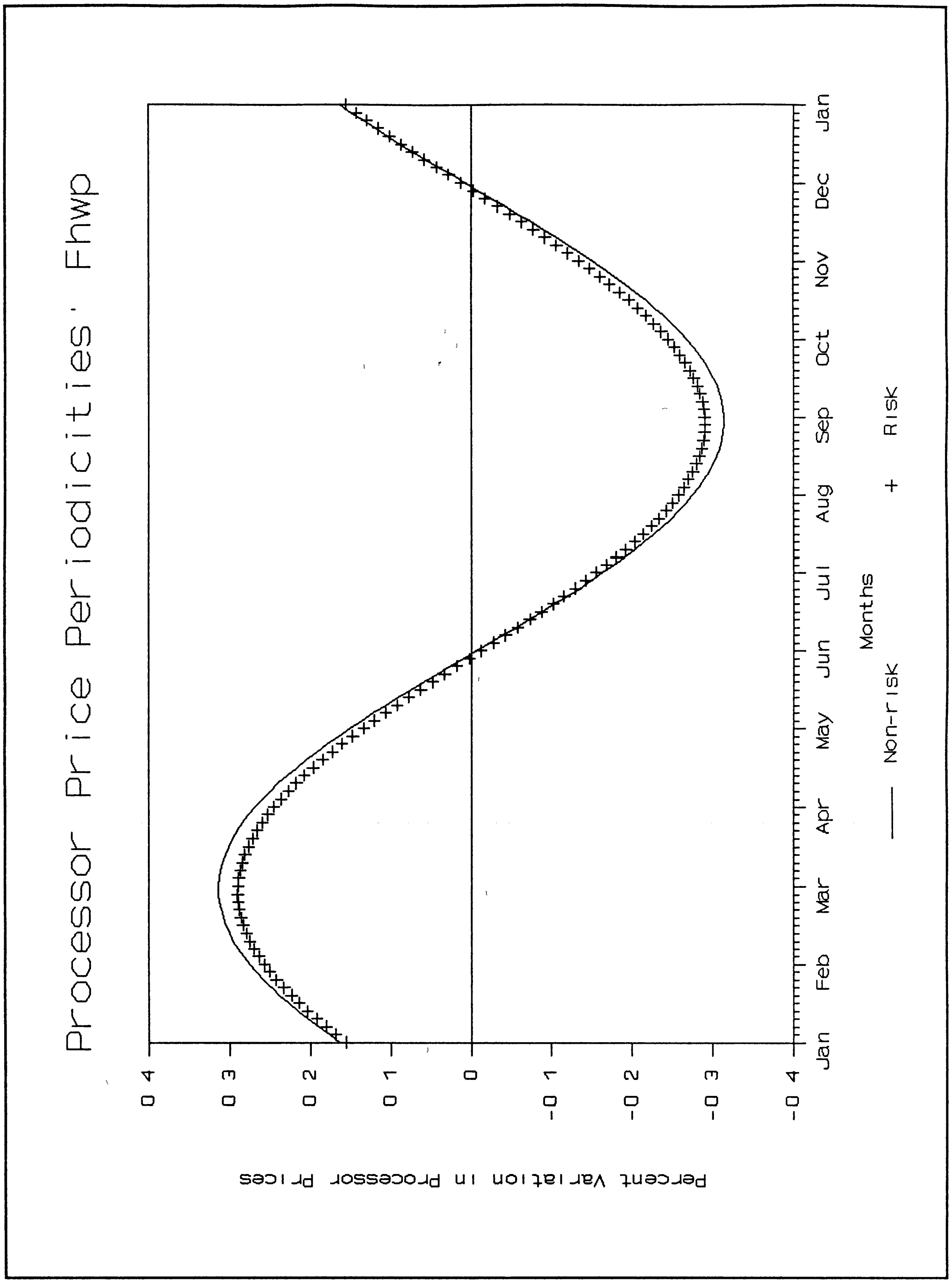


Figure 8. Processor Price Periodicities: Fhwp

shift in the cycle from January. This implies that the peaks and troughs indicated by the risk estimate of the price received by processors for fresh whole processed fish occurs only slightly later in the same months as compared with the non-risk equation. The hypothesized relationship between fresh whole processed fish sales (Fhws) and the price received by processors for fresh whole processed fish yielded a large negative relationship with respect to its standard error for both the non-risk and risk models as was the hypothesized and a large positive relationship with respect to its standard error between the price received by processors for frozen filleted fish (Fnfp) and the fresh whole processed fish price.

The hypothesized negative relationship between fresh filleted fish sales (Fhfs) and the price received by processors for fresh filleted fish (Fhfp) (Table 9) was large relative to its standard error for both the non-risk and risk models. The hypothesized positive relationship between the price received by processors for frozen filleted fish (Fnfp) and the fresh filleted fish price was also large relative to its standard error.

Both the non-risk and risk models estimated a positive relationship between the price received by processors for other fresh processed fish products (Fhop) and the sales of other fresh processed fish products (Fhos) (Table 10). A negative relationship was hypothesized.

TABLE 9

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FRESH FILLETED FISH PRICES - (FHFP)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	-0.13781 (-1.550)	-0.12988 (-1.476)
Fhfs	-0.02425 (-5.553)	-0.02180 (-5.037)
Fnfp	1.08189 (31.301)	1.07698 (31.433)
<u>Summary Statistics</u>		
Root Mean-Square Error	0.177	1.056
Theil's Inequality: U_1	0.0668	0.3975
Proportions of Inequality:		
Bias	0.5152	0.052
Variance	0.0525	0.752
Covariance	0.4322	0.197
Regression	0.2211	0.936
Disturbance	0.2637	0.012

TABLE 10

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FRESH OTHER FISH PRICES - (FHOP)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	-0.36049 (-1.122)	-0.29651 (-0.968)
Fhos	0.47613 (1.740)	0.21828 (0.920)
Fnfp	0.67815 (5.929)	0.69474 (6.216)
Shift3	0.10799 (1.491)	0.16845 (2.670)
<u>Summary Statistics</u>		
Root Mean-Square Error	0.133	0.671
Theil's Inequality: U_1	0.0782	0.3953
Proportions of Inequality:		
Bias	0.3628	0.050
Variance	0.0033	0.535
Covariance	0.6339	0.415
Regression	0.0883	0.889
Disturbance	0.5489	0.061

Estimation of the frozen whole processed fish prices (Fnwp) equation (Table 11) yielded significant relationships with respect to large coefficients relative to standard errors for both frozen whole processed fish ending inventory (Fnwei) and frozen filleted fish prices (Fnfp). These relationships were negative and positive respectively, as hypothesized. A significant positive relationship between frozen whole processed fish prices and a dummy variable indicating a shift in the monthly demand for frozen whole processed fish (Shift4) was also estimated.

The price received by processors for frozen filleted fish (Fnfp) is assumed to be the basis from which all other processed prices are derived, as outlined in chapter III. Both the hypothesized negative relationship between frozen filleted prices and frozen fillet monthly ending inventory (Fnfei) and the hypothesized positive relationship with prices received by producers (Farmp(0)) were large relative to their standard errors for both the non-risk and risk models (Table 12). The risk model does appear to overestimate frozen fillet prices compared to the non-risk model.

Both models yielded a negative estimated relationship between other frozen processed fish products ending inventory (Fnoei) and the price received by processors for other frozen processed fish products (Fnop) (Table 13). Neither were large relative to their standard errors.

TABLE 11

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FROZEN WHOLE FISH PRICES - (FNWP)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	-0.24594 (-2.027)	-0.22671 (-1.919)
Fnwei	-0.02509 (-4.436)	-0.02468 (-4.515)
Fnfp	0.72393 (15.569)	0.71602 (15.794)
Shift4	0.06048 (7.103)	0.06241 (7.509)
<u>Summary Statistics</u>		
Root Mean-Square Error	0.105	0.658
Theil's Inequality: U_1	0.0635	0.3986
Proportions of Inequality:		
Bias	0.3704	0.086
Variance	0.0111	0.663
Covariance	0.6185	0.252
Regression	0.1481	0.890
Disturbance	0.4815	0.025

TABLE 12

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FROZEN FILLETED FISH PRICES - (FNFP)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
Variables		
Constant	1.46557 (34.316)	1.48177 (35.576)
Fnfei	-0.03531 (-9.835)	-0.03058 (-9.343)
Farmp	1.77490 (26.664)	1.73557 (26.976)
Summary Statistics		
Root Mean-Square Error	0.150	0.913
Theil's Inequality: U_1	0.0570	0.3476
Proportions of Inequality:		
Bias	0.5271	0.052
Variance	0.0585	0.732
Covariance	0.4144	0.217
Regression	0.2031	0.933
Disturbance	0.2698	0.015

TABLE 13

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FROZEN OTHER FISH PRICES - (FNOP) (t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	0.16169 (0.521)	0.12576 (0.396)
Fnoei	-0.02598 (-1.013)	-0.022643 (-0.882)
Fnfp	0.63662 (5.122)	0.64980 (5.117)
Shift5	0.20939 (6.820)	0.20478 (6.724)
<u>Summary Statistics</u>		
Root Mean-Square Error	0.102	0.611
Theil's Inequality: U_1	0.0518	0.3118
Proportions of Inequality:		
Bias	0.3574	0.059
Variance	0.0003	0.520
Covariance	0.6423	0.421
Regression	0.0629	0.890
Disturbance	0.5798	0.051

Large positive relationships relative to their standard errors were estimated between Fnop and frozen fillet fish prices (Fnfp) and between Fnop and a dummy variable indicating a shift in the demand for other frozen processed fish products (Shift5).

Processor Sales

Own price and the price of competitive wholesale fish products (Seappi) were shown to be significant contributing factors to the level of monthly processed fish sales for both the non-risk and risk models. The inclusion of the processors' competitive price risk variable (Searsk) in the sales equations also produced a significant affect on most of the sales equations. In general, the risk model tends to underestimate the sales of processed fish.

All the signs of the estimated coefficients in the fresh whole processed fish sales (Fhws) equation were as expected and large relative to their standard errors (Table 14). Figure 9 shows the combined affect of the estimated six month and twelve month periodicities on the percent of mean change in sales of fresh whole processed fish.

The twelve month variables describe the yearly wholesale demand cycle which runs from a peak in fresh whole processed fish sales in early March of each year during the Lenten period to a low point in sales in late November of each year during the Thanksgiving holiday period which is

TABLE 14

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FRESH WHOLE FISH SALES - (FHWS)
(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	7.05306 (11.725)	6.88184 (11.691)
S6	0.31473 (6.375)	0.35000 (7.390)
C6	-0.08689 (-1.797)	-0.10958 (-2.415)
S12	0.28293 (5.421)	0.27817 (5.408)
C12	-0.12417 (-2.160)	-0.06877 (-1.203)
Fhwp	-4.24260 (-9.439)	-4.02623 (-9.229)
Seappi	1.97395 (5.699)	1.83011 (5.472)
Searsk	--	8.88291 (3.129)

TABLE 14 (Continued)

Predetermined Variables/Statistics	Without Risk	With Risk
Summary Statistics		
Root Mean-Square Error	0.688	3.585
Theil's Inequality: U_1	0.1971	1.0275
Proportions of Inequality:		
Bias	0.4355	0.051
Variance	0.0018	0.703
Covariance	0.5626	0.246
Regression	0.1244	0.928
Disturbance	0.4400	0.021

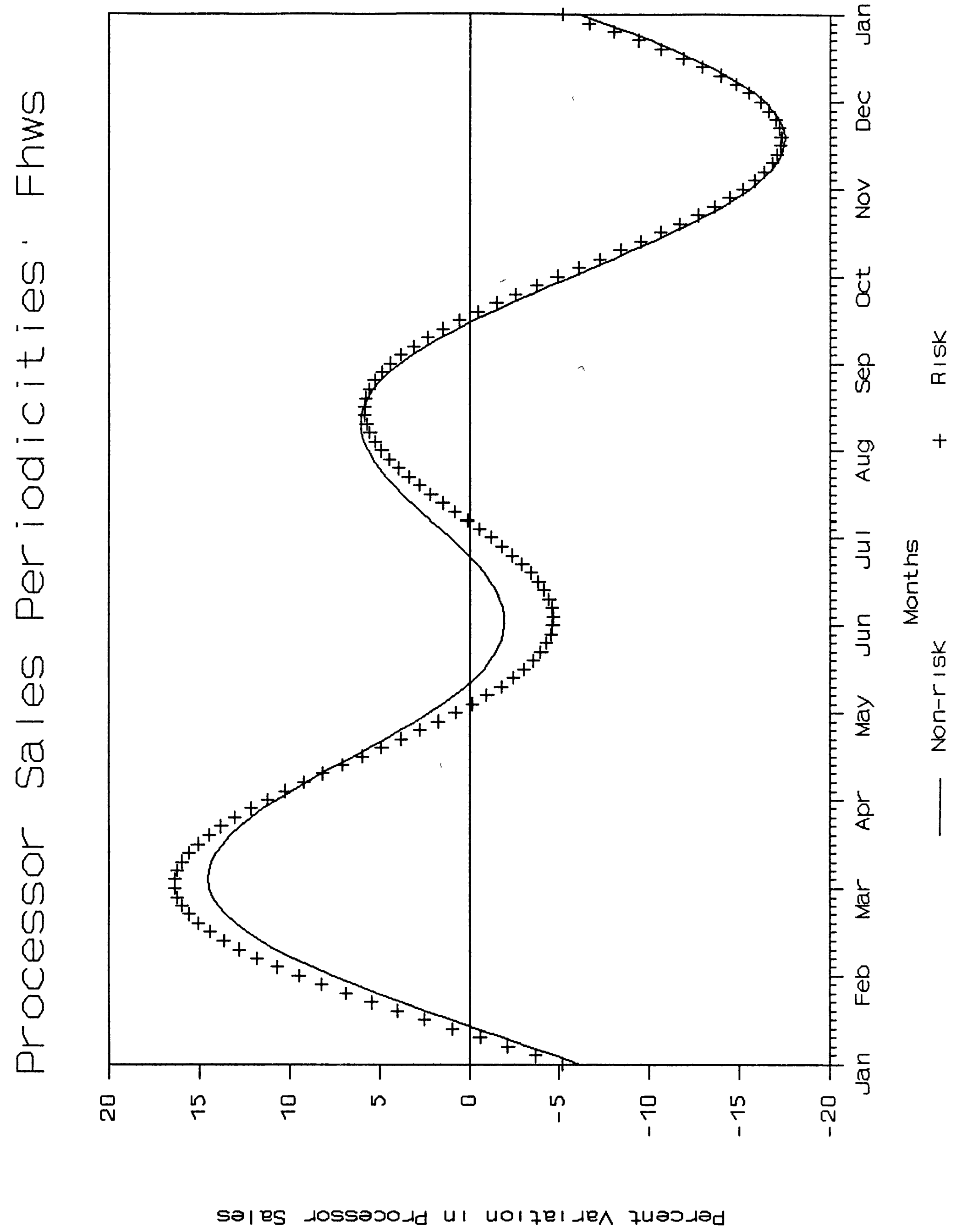


Figure 9. Processor Sales Periodicities: Fhws

traditionally a period of high poultry sales. The six month variables describe a cyclical pattern that occurs within the wholesale demand cycle. In early June fresh whole processed fish sales hit a relative local minimum while sales hit a relative local peak in mid-August. This minimum appears to be due to increased outdoor cooking and picnicking during the summer, which traditionally implies higher beef consumption, while the peak is due to increasing supplies of fish and lower prices in late summer and early fall as fish harvesting begins to increase.

The negative estimated coefficient on own-price (Fhwp) implies that as the price of fresh whole processed catfish falls relative to the prices of other consumer fish products, the sales of fresh whole processed catfish will increase. The positive estimated coefficient on the alternative goods price coefficient (Seappi) implies that as the price of other consumer fish products fall relative to the price of fresh whole processed catfish, the sales of these products will raise and the sales of fresh whole processed catfish will fall.

The inclusion of the competitive price risk variable (Searsk) in the fresh whole processed catfish sales equation produced the hypothesized positive affect on the sales of fresh whole processed fish. As the variability of other competitive consumer fish product prices increases, the sales of fresh whole processed catfish products also increases.

The estimated periodicities for the fresh filleted fish sales (Fhfs) equations (Table 15) yielded a set of coefficients that were large relative to their standard errors and displayed the same basic yearly sales pattern as was exhibited by fresh whole fish sales. As Figure 10 shows, the combined affects of the estimated six month and twelve month periodicities on the percent of mean change in the sales of fresh filleted fish yields a wholesale demand based cycle with a peak and low point during mid-March and late November, respectively. Within this twelve month cycle lies a six month cycle with relative local minimum and peak sales in mid-June and mid-August respectively.

The own-price (Fhfp) and competitive price (Seappi) variables both yield estimated signs as hypothesized and the dummy variable indicating an increase in the demand for filleted fish (Shift2) showed a significant positive relationship with respect to fresh filleted fish sales. The competitive price risk variable (Searsk) was also significant with respect to fresh filleted fish sales.

The estimated coefficients for the other fresh fish products sales equation (Fhos) attained a lesser degree of significance when compared to the estimated coefficients of the previous two sales equations discussed (Table 16). Additionally, a positive relationship was estimated between sales and own-price (Fhop), all other signs were as

TABLE 15

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FRESH FILLETED FISH SALES - (FHFS)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
Variables		
Constant	8.54980 (6.666)	8.60785 (6.975)
S6	0.16749 (3.438)	0.18657 (3.717)
C6	-0.12373 (-2.576)	-0.13798 (-2.842)
S12	0.19441 (3.701)	0.20059 (3.566)
C12	-0.13910 (-2.519)	-0.10065 (-1.687)
Fhfp	-3.20014 (-6.257)	-3.19402 (-6.553)
Seappi	0.85039 (2.285)	0.77348 (2.045)
Shift2	1.22245 (12.350)	1.23893 (12.962)
Searsk	--	5.17029 (1.792)

TABLE 15 (Continued)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Summary Statistics</u>		
Root Mean-Square Error	0.628	3.408
Theil's Inequality: U_1	0.2958	1.6049
Proportions of Inequality:		
Bias	0.4214	0.051
Variance	0.0938	0.634
Covariance	0.4848	0.316
Regression	0.0006	0.914
Disturbance	0.5780	0.036

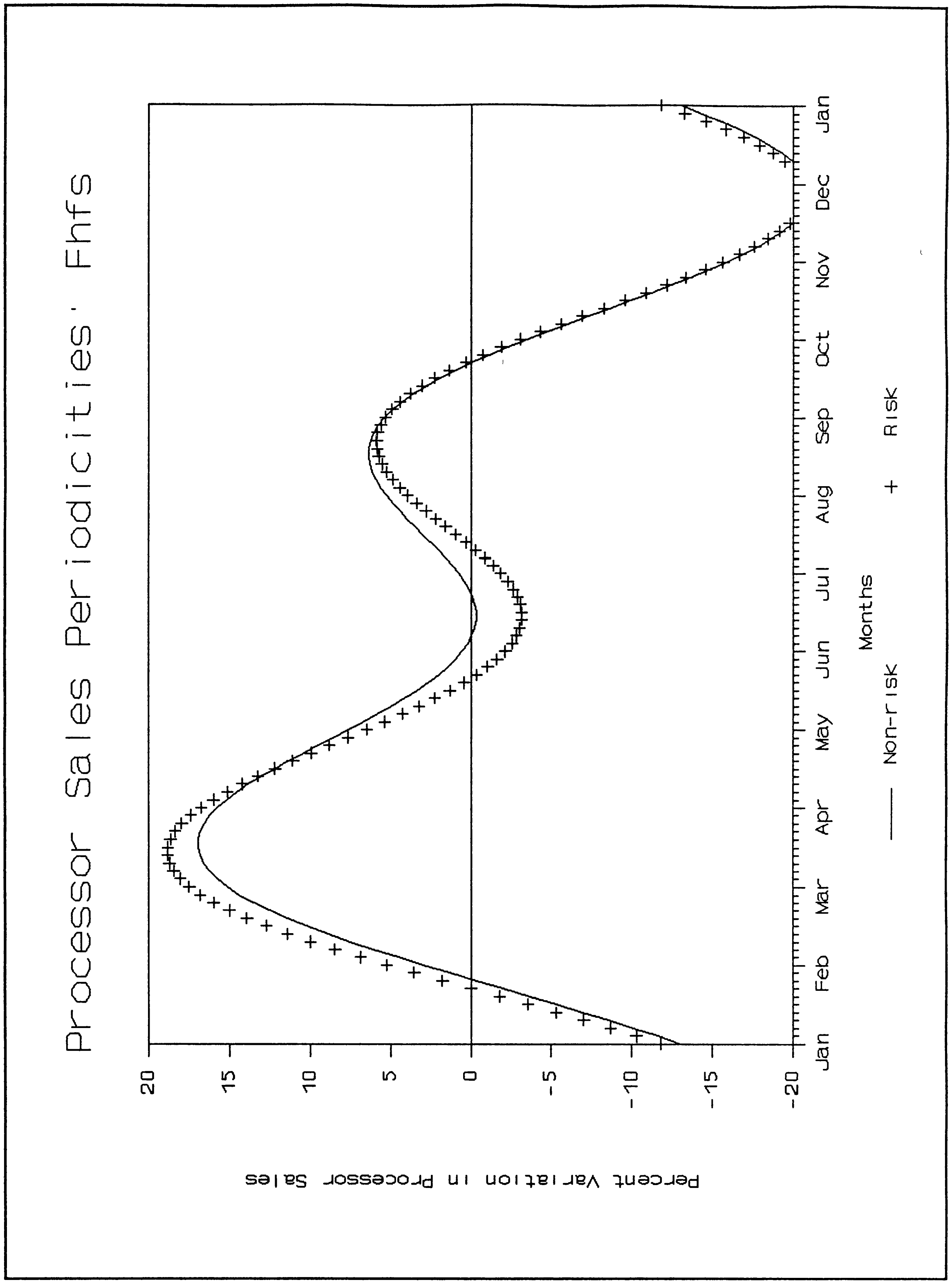


Figure 10. Processor Sales Periodicities: Fhfs

TABLE 16

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FRESH OTHER FISH SALES - (FHOS)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	0.17559 (1.255)	0.10260 (0.731)
S6	0.02115 (1.855)	0.03291 (2.851)
C6	0.00162 (0.146)	-0.00224 (-0.203)
S12	-0.00151 (-0.135)	-0.00279 (-0.234)
C12	0.02229 (1.688)	0.03736 (2.681)
Fhop	0.14920 (1.669)	0.17879 (1.932)
Seappi	0.00139 (0.017)	0.01137 (0.136)
Shift3	0.19695 (7.612)	0.19001 (7.311)
Searsk	--	1.89401 (2.606)

TABLE 16 (Continued)

Predetermined Variables/Statistics	Without Risk	With Risk
Summary Statistics		
Root Mean-Square Error	0.063	0.137
Theil's Inequality: U_1	0.1225	0.2682
Proportions of Inequality:		
Bias	0.0349	0.038
Variance	0.0902	0.063
Covariance	0.8749	0.899
Regression	0.0043	0.377
Disturbance	0.9607	0.585

expected. Despite the lack of significant estimated coefficients, the statistics of fit for the ex post simulation indicate a better fit for the equation compared to the other fresh sales equations. Bias and variance were small relative to covariance in Theil's Proportions of Inequality for both the non-risk and risk equations as were bias and regression relative to disturbance.

The combined affects of the estimated six month and twelve month periodicities on the percent of mean change in the sales of other fresh processed fish products yielded a wholesale demand based cycle with a peak and low point during early February and late May, respectively (Figure 11). Within this twelve month cycle lies a six month cycle with relative local minimum and peak sales in late August/early September and early November respectively. This cycle for other fresh processed fish products differs considerably from the estimated cycles for the two previous fresh sales equations estimated. All three equations generate cycles with global peaks during the Lenten period. However, while fresh whole and fresh fillet sales hit a global minimum in the later part of the year during the Thanksgiving period, other fresh processed product sales hit a global minimum in mid-May. Other fresh processed product sales decline somewhat during the Thanksgiving period but are generally stable relative to fresh whole and filleted fish sales. Additionally, the risk model equation for other

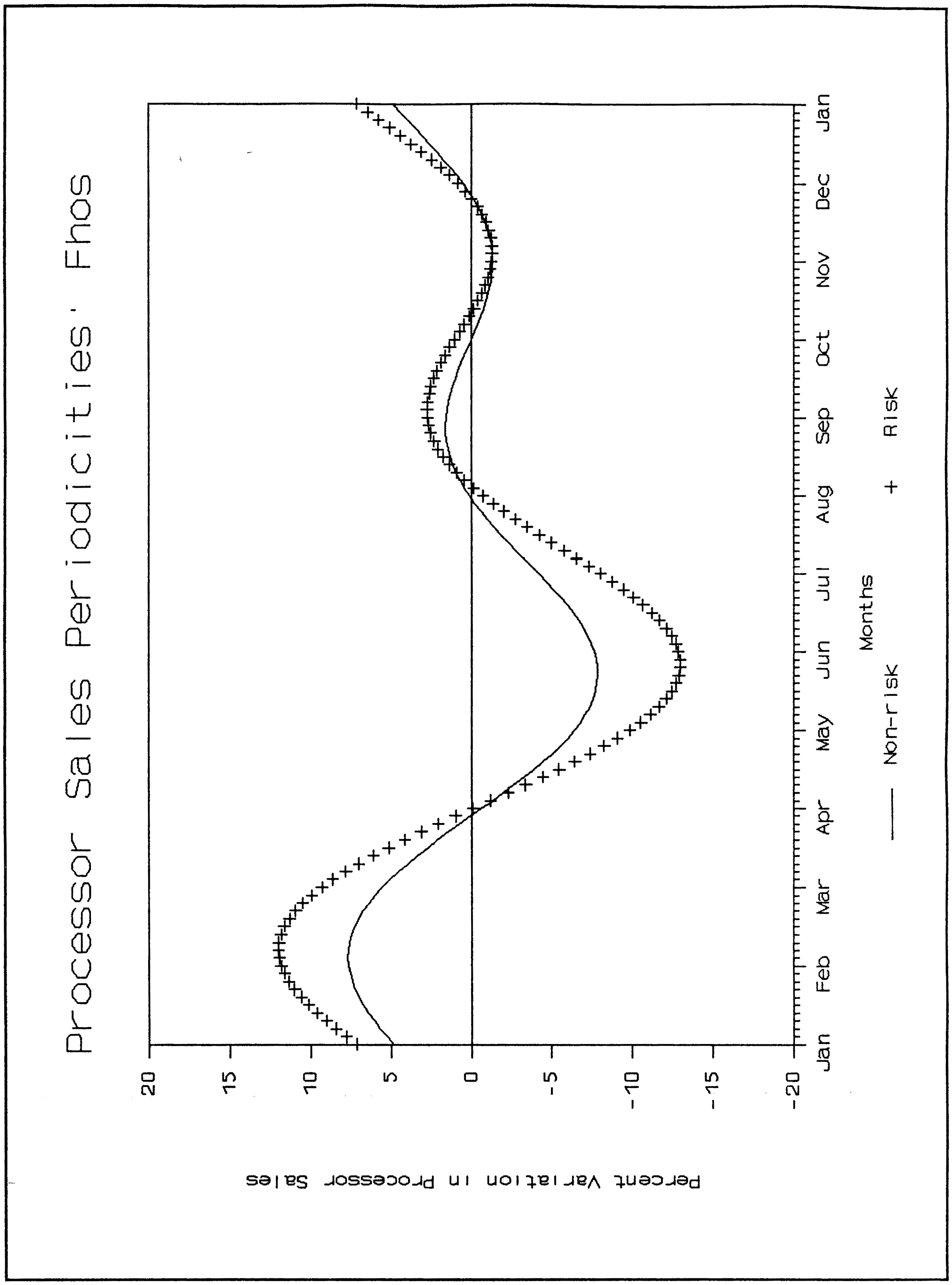


Figure 11. Processor Sales Periodicities: Fhos

fresh processed product sales shows a much higher degree of variability relative to the non-risk equation while the fresh whole and filleted fish sales cycles are basically the same with respect to variability for both the non-risk and risk models. This is particularly true for the first half of the wholesale demand cycle.

The signs of the estimated coefficients for the frozen whole processed fish sales equations (Fnws) are as hypothesized and large with respect to their standard errors with the exception of the own-price coefficients (Fnwp) which do not differ significantly from zero for either the non-risk or risk equations (Table 17). As with the other fresh processed fish products sales equation (Fhos), the statistics of fit for the ex post simulation of the frozen whole processed fish sales equation indicate a better fit for the equation compared to the other frozen sales equations. Bias and variance are small relative to covariance in Theil's Proportions of Inequality for both the non-risk and risk equations as were bias and regression relative to disturbance, particularly for the non-risk equation.

The six month and twelve month periodicity variables for the frozen whole processed fish sales equation are shown in Figure 12. Figure 12 as well as the figures of the estimated periodicities for the other frozen sales equations indicate that a different wholesale demand cycle exists for

TABLE 17

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FROZEN WHOLE FISH SALES - (FNWS)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	0.78903 (2.680)	0.74847 (2.458)
S6	0.13093 (5.367)	0.14103 (5.737)
C6	0.01107 (0.460)	0.00481 (0.202)
S12	0.06725 (2.923)	0.07219 (2.845)
C12	-0.11443 (-4.204)	-0.10251 (-3.460)
Fnwp	-0.25874 (-1.241)	-0.26956 (-1.282)
Seappi	0.75681 (4.509)	0.78772 (4.573)
Searsk	--	2.21911 (1.550)

TABLE 17 (Continued)

Predetermined Variables/Statistics	Without Risk	With Risk
Summary Statistics		
Root Mean-Square Error	0.134	0.234
Theil's Inequality: U_1	0.0898	0.1568
Proportions of Inequality:		
Bias	0.0156	0.049
Variance	0.1523	0.041
Covariance	0.8321	0.909
Regression	0.0015	0.444
Disturbance	0.9829	0.507

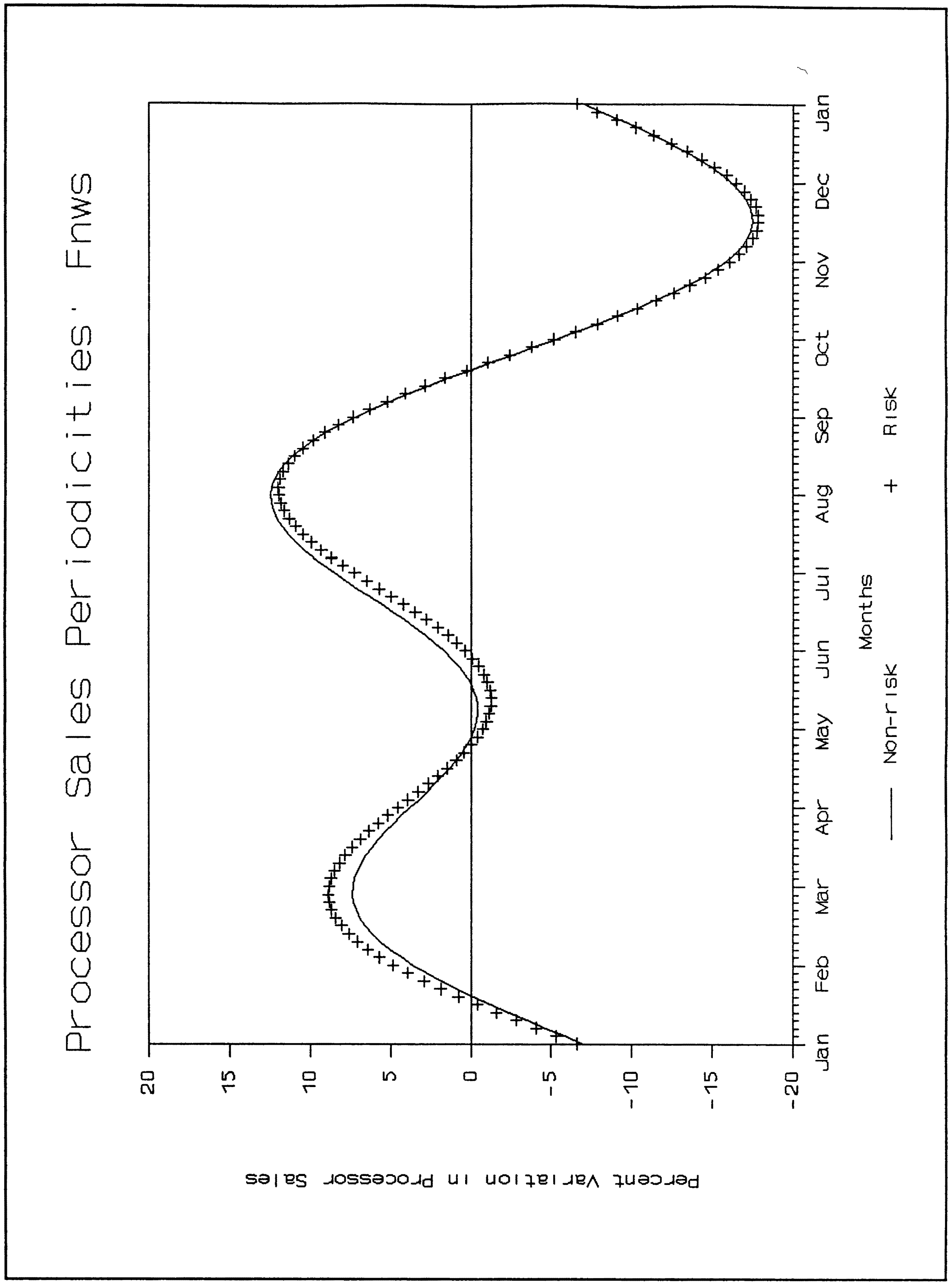


Figure 12. Processor Sales Periodicities: Fnws

frozen sales as compared to fresh sales. Fresh sales were estimated to hit global peaks and troughs during Lent and Thanksgiving respectively, with the fresh other processed product sales cycle differing somewhat. Estimated frozen sales are expected to hit global peaks and troughs during late summer and the Thanksgiving period respectively, with the frozen other processed product sales cycle differing somewhat. Specifically, the percent of mean change in frozen whole processed fish sales (Fnws) peaks in early August each year and reaches a global minimum in mid-November when poultry demand is high. A less significant cycle occurs with its peak in late February during Lent and a trough in early May. This difference in maximum sales points during the wholesale demand cycles for fresh and frozen processed fish appears to be due to the difference in nature of the two product types. It appears that the increase in fish supply from harvest that occurs in February of each year (Figure 6) goes into the production and immediate sale of fresh fish for consumption during the Lenten period, with a lessor proportion of the harvested fish going into the production and sale of frozen fish. At the end of summer during a period of lower demand relative to Lent, increases in fish supplies from harvest go into the production of storable frozen fish products. Increases in inventories cause prices to fall and sales of frozen fish to increase.

The signs of the estimated coefficients for the frozen filleted fish sales equations (Fnfs) are as hypothesized and all are statistically different than zero (Table 18). Figure 13 shows that the combined influences of the estimated six month and twelve month periodicities on the percent of mean change in the sales of frozen filleted fish yield a wholesale demand based cycle with a peak and low point during late July/early August and late November, respectively. Within this twelve month cycle lies a six month cycle with relative local peak and minimum sales in mid-March and early May respectively.

The other frozen fish products sales equations (Fnos) failed to yield a negative own-price (Fnop) relationship as did the other fresh fish products sales equations (Table 19). The coefficients estimated were large relative to their standard errors as were the estimated coefficients for the other variables of the equations with the exception of the competitive products price variable (Seappi). The statistics of fit for the ex post simulation indicate a better fit for the non-risk equation relative to the risk equation. Bias and variance are small relative to covariance in Theil's Proportions of Inequality as are bias and regression relative to disturbance.

Figure 14 presents the combined six month and twelve month periodicity variables for the other frozen fish products sales equations. Other frozen fish products sales

TABLE 18

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FROZEN FILLETED FISH SALES - (FNFS)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	7.43680 (4.266)	7.37233 (4.348)
S6	0.24689 (4.008)	0.26939 (4.356)
C6	-0.01862 (-0.309)	-0.03415 (-0.571)
S12	0.17971 (2.772)	0.18313 (2.697)
C12	-0.38550 (-5.486)	-0.34639 (-4.654)
Fnfp	-3.14349 (-4.309)	-3.09850 (-4.368)
Seappi	2.31248 (4.797)	2.25271 (4.727)
Shift2	1.24950 (9.668)	1.24614 (10.132)
Searsk	--	6.40390 (1.779)

TABLE 18 (Continued)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Summary Statistics</u>		
Root Mean-Square Error	0.557	2.920
Theil's Inequality: U_1	0.1639	0.8592
Proportions of Inequality:		
Bias	0.3767	0.048
Variance	0.1165	0.524
Covariance	0.5069	0.427
Regression	0.0089	0.885
Disturbance	0.6144	0.066

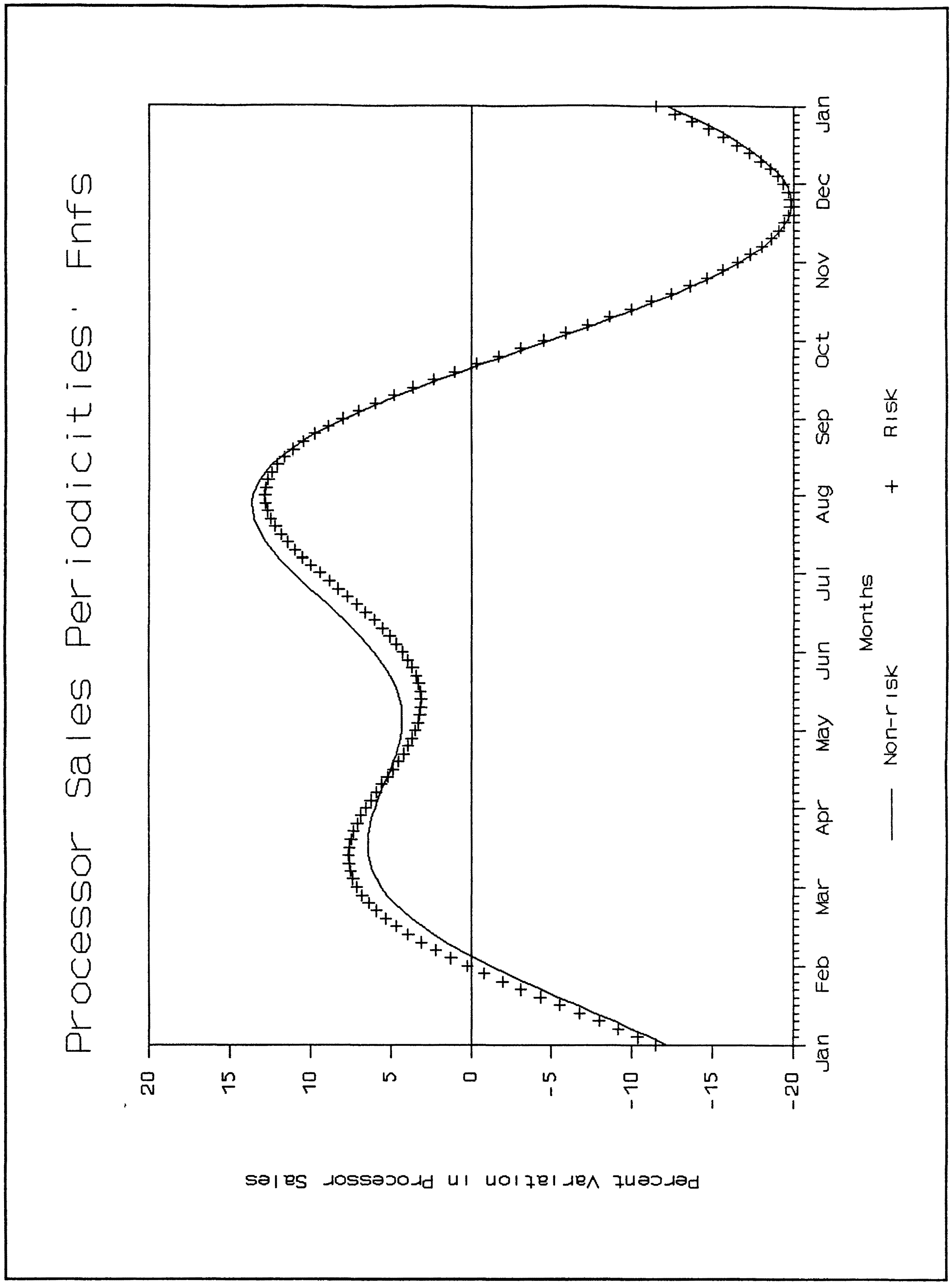


Figure 13. Processor Sales Periodicities: Fnfs

TABLE 19

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FROZEN OTHER FISH SALES - (FNOS) (t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Constant	-2.62398	-2.27164
	(-3.446)	(-3.270)
S6	0.11553	0.13586
	(2.307)	(2.833)
C6	-0.07251	-0.08543
	(-1.565)	(-1.968)
S12	-0.20436	-0.18534
	(-3.965)	(-3.639)
C12	-0.00773	0.25500
	(-0.120)	(0.416)
Fnop	2.07352	1.91756
	(3.418)	(3.625)
Seappi	0.19732	0.11337
	(0.391)	(0.235)
Shift5	0.28576	0.35425
	(2.610)	(3.451)
Searsk	--	3.94678
		(1.748)

TABLE 19 (Continued)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Summary Statistics</u>		
Root Mean-Square Error	0.280	1.187
Theil's Inequality: U_1	0.1407	0.5976
Proportions of Inequality:		
Bias	0.1987	0.057
Variance	0.0203	0.343
Covariance	0.7809	0.601
Regression	0.0134	0.798
Disturbance	0.7878	0.145

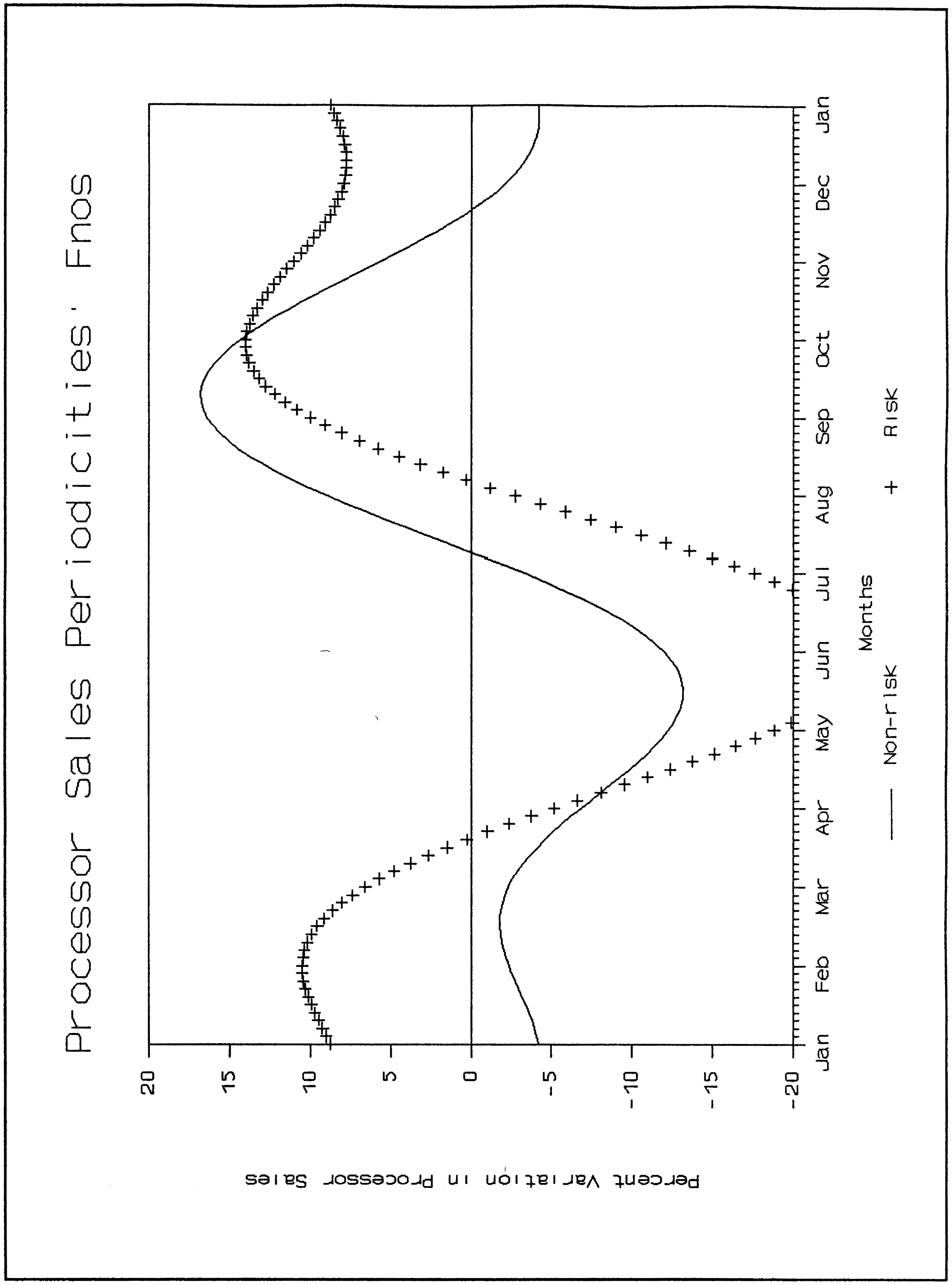


Figure 14. Processor Sales Periodicities: Fnos

show the greatest variability in percent of mean change in sales with the inclusion of the risk variables, as compared to all the other estimated sales equations. Other frozen fish product sales reach a global maximum in the fall of the year (mid-September) as do frozen whole fish and frozen filleted fish sales. They also reach a global minimum in sales in mid-May as do other fresh processed product sales.

Processor Production

The frozen whole fish and other frozen processed product production variables were assumed to be endogenous and estimable. The equations for the other four processor product variables are accounting identities. Statistics of fit for these identity equations are discussed following a discussion of the two estimated processor production equations.

Estimation of the frozen whole processed fish production equation (Profnw) yielded positive relationships between production and frozen whole processed fish sales (Fnws) and live fish harvest (Livwts) as hypothesized (Table 20). The risk model yielded higher levels of significance for the estimated coefficients however, the non-risk model appeared to fit the data better based upon Theil's Proportions of Inequality. Figure 15 presents the results of the twelve month periodicity estimated in the Profnw equation. Percent of mean change in production attains

TABLE 20

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FROZEN WHOLE FISH PRODUCTION - (PROFNW)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
Variables		
Constant	-0.04012 (-0.141)	-0.05966 (-0.229)
S12	-0.10013 (-2.944)	-0.09865 (-3.001)
C12	0.13942 (5.025)	0.14067 (4.996)
Fnws	0.87223 (2.841)	0.87032 (3.106)
Livwts	0.01073 (1.238)	0.01164 (1.427)
Summary Statistics		
Root Mean-Square Error	0.205	0.379
Theil's Inequality: U_1	0.1342	0.2477
Proportions of Inequality:		
Bias	0.0056	0.032
Variance	0.2990	0.026
Covariance	0.6955	0.943
Regression	0.0025	0.524
Disturbance	0.9919	0.444

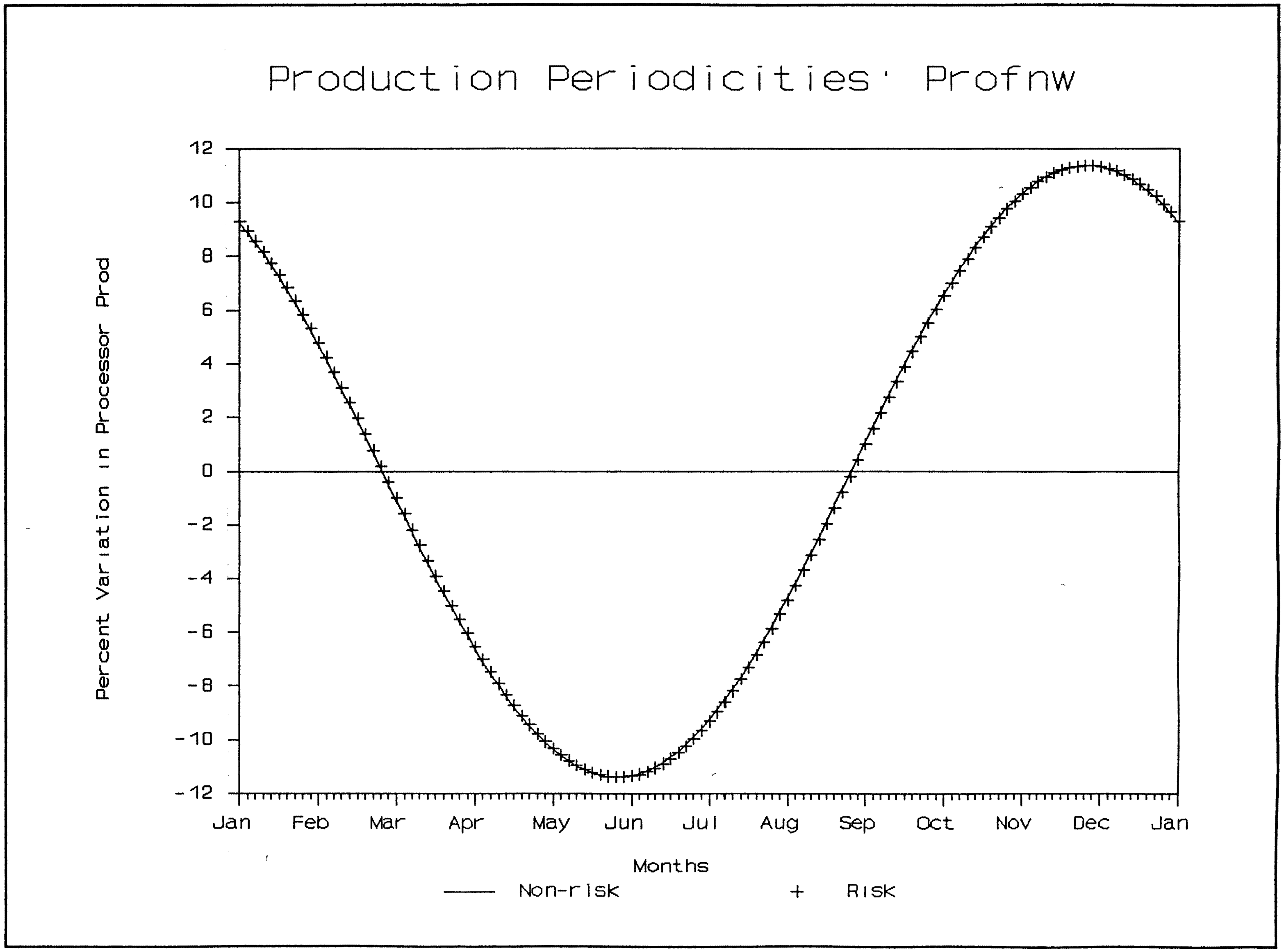


Figure 15. Production Periodicities: Profnw

a minimum in late May each year while attaining a maximum in late November.

Monthly production of other frozen processed fish products (Profno) was shown to have a significant positive relationship with the level of other processed fish product sales (Fnos) in both the non-risk and risk models (Table 21). However, based upon Theil's Inequality and the Proportions of Fit the non-risk estimated equation does appear to fit the actual data better.

The processor production identities tend to under estimate the monthly level of processor production in both the non-risk and risk models. The risk model appears to be slightly better able to predict fresh whole processed fish production (Profhw) based upon Theil's Inequality and the Proportions of Inequality (Table 22). The variance of the risk model is large relative to the non-risk model due to the model's errors in prediction during rapid input price risk increases. This large variance is offset to some extent by a relatively small bias in the risk model. The same points made concerning the fit of the fresh whole processed fish production identity can be made concerning the fresh filleted fish production identity (Profhf), Table 23.

The rapid change in input price risk that affected the predictive ability of the risk model during 1987 and 1988 had relatively little affect on the other fresh processed

TABLE 21

NON-LINEAR THREE STAGE LEAST SQUARES ESTIMATES OF NON-RISK AND RISK EQUATION COEFFICIENTS NORMALIZED VARIABLE: FROZEN OTHER FISH PRODUCTION - (PROFNO)

(t-values are in parentheses)

Predetermined Variables/Statistics	Without Risk	With Risk
<u>Variables</u>		
Fnos	1.01629 (54.881)	1.01576 (54.921)
<u>Summary Statistics</u>		
Root Mean-Square Error	0.346	1.241
Theil's Inequality: U_1	0.1702	0.6107
Proportions of Inequality:		
Bias	0.1453	0.055
Variance	0.1021	0.262
Covariance	0.7526	0.682
Regression	0.0003	0.761
Disturbance	0.8545	0.184

TABLE 22

NON-RISK AND RISK MODEL IDENTITIES STATISTICS OF FIT NORMALIZED VARIABLE: FRESH WHOLE FISH PRODUCTION - (PROFHW)

Statistics	Without Risk	With Risk
Root Mean-Square Error	0.693	3.599
Theil's Inequality: U_1	0.1986	1.0310
Proportions of Inequality:		
Bias	0.4277	0.051
Variance	0.0042	0.690
Covariance	0.5681	0.259
Regression	0.1142	0.928
Disturbance	0.4581	0.022

TABLE 23

NON-RISK AND RISK MODEL IDENTITIES STATISTICS OF FIT NORMALIZED VARIABLE: FRESH FILLETED FISH PRODUCTION - (PROFHF)

Statistics	Without Risk	With Risk
Root Mean-Square Error	0.631	3.413
Theil's Inequality: U_1	0.2969	1.6052
Proportions of Inequality:		
Bias	0.4218	0.051
Variance	0.0948	0.631
Covariance	0.4834	0.319
Regression	0.0006	0.913
Disturbance	0.5776	0.036

fish products production identity (Profho), Table 24. The inclusion of the risk variables improved the fit of the identity with respect to the Proportions of Inequality in terms of bias, variance and covariance and showed a slight decrease in fit in terms of bias, regression and disturbance.

Inclusion of the risk variables reduced the error in bias for the frozen filleted fish production identities (Profnf) in Table 25. However, as noted above, inclusion of the risk variables tends to increase the level of variance in the results from ex post simulation due to the models inability to react to the rapid change in producer input prices that occurred in 1987 and early 1988.

Processed Product Ending Inventory

The ending inventory identities in both the non-risk and risk models showed the poorest fit of all the simulated equations in terms of mean bias in ex post simulation. The non-risk model substantially over estimated ending inventories while the risk model substantially under estimated ending inventories.

Both frozen whole processed fish ending inventory identities (Fnwei) display a clear twelve month cyclical pattern (Table 26). Inventories build to their highest levels in the first two months of the year just prior to the Lenten period and then decline to their lowest levels in

TABLE 24

NON-RISK AND RISK MODEL IDENTITIES STATISTICS OF FIT NORMALIZED VARIABLE: FRESH OTHER FISH PRODUCTION - (PROFHO)

Statistics	Without Risk	With Risk
Root Mean-Square Error	0.071	0.138
Theil's Inequality: U_1	0.1385	0.2673
Proportions of Inequality:		
Bias	0.0152	0.030
Variance	0.1212	0.043
Covariance	0.8636	0.927
Regression	0.0071	0.339
Disturbance	0.9777	0.631

TABLE 25

NON-RISK AND RISK MODEL IDENTITIES STATISTICS OF FIT NORMALIZED VARIABLE: FROZEN FILLETED FISH PRODUCTION - (PROFNF)

Statistics	Without Risk	With Risk
Root Mean-Square Error	0.676	2.798
Theil's Inequality: U_1	0.1971	0.8154
Proportions of Inequality:		
Bias	0.2724	0.047
Variance	0.1389	0.483
Covariance	0.5888	0.470
Regression	0.0008	0.868
Disturbance	0.7268	0.084

TABLE 26

NON-RISK AND RISK MODEL IDENTITIES STATISTICS OF FIT NORMALIZED VARIABLE: FROZEN WHOLE FISH ENDING INVENTORY - (FNWEI)

Statistics	Without Risk	With Risk
Root Mean-Square Error	0.708	1.842
Theil's Inequality: U_1	0.4408	1.1468
Proportions of Inequality:		
Bias	0.7004	0.933
Variance	0.0117	0.000
Covariance	0.2879	0.067
Regression	0.0625	0.011
Disturbance	0.2371	0.057

July and August just prior to fall harvest.

The frozen filleted fish ending inventory identities (Fnfei) showed the least mean bias of the ending inventory identities simulated, Table 27. The non-risk identity displays fairly good fit with the actual data. Ex post simulation statistics of fit indicate that bias and variance are small relative to covariance in Theil's Proportions of Inequality as are bias and regression relative to disturbance.

The ex post simulation data series generated from the other frozen processed fish products ending inventory identities (Fnoei) appear to be linear functions over time (Table 28). However, further analysis reveals that the estimated models are in fact oscillatory and stable (the stability and dynamics of the non-risk and risk models are discussed in Chapter V) at least in the case of the non-risk model. These simulated "linear" trends then may in fact be long period cycles inherent in the simulation models.

Output Price Risk

The rapid change in input price risk (Iprisk) that occurred in mid-1988 dramatically impacted the simulation of the output price risk variable (Oprisk), Table 29. During this period actual output price risk did not exist. However, simulation generated Oprisk values ranging from 50 to 800 times the greatest level of output price risk to

TABLE 27

NON-RISK AND RISK MODEL IDENTITIES STATISTICS OF FIT NORMALIZED VARIABLE: FROZEN FILLETED FISH ENDING INVENTORY - (FNFEI)

Statistics	Without Risk	With Risk
Root Mean-Square Error	0.900	2.695
Theil's Inequality: U_1	0.3485	1.0438
Proportions of Inequality:		
Bias	0.1263	0.053
Variance	0.2652	0.428
Covariance	0.6085	0.519
Regression	0.0024	0.832
Disturbance	0.8713	0.115

TABLE 28

NON-RISK AND RISK MODEL IDENTITIES STATISTICS OF FIT NORMALIZED VARIABLE: FROZEN OTHER FISH ENDING INVENTORY - (FNOEI)

Statistics	Without Risk	With Risk
Root Mean-Square Error	0.487	0.677
Theil's Inequality: U_1	0.3066	0.4259
Proportions of Inequality:		
Bias	0.4753	0.712
Variance	0.0436	0.021
Covariance	0.4811	0.267
Regression	0.0001	0.001
Disturbance	0.5246	0.288

TABLE 29

NON-RISK AND RISK MODEL IDENTITIES STATISTICS OF FIT
NORMALIZED VARIABLE: FARM OUTPUT
PRICE RISK - (OPRISK)

Statistics	Without Risk	With Risk
Root Mean-Square Error	--	0.000
Theil's Inequality: U_1	--	4.5957
Proportions of Inequality:		
Bias	--	0.0016
Variance	--	0.6031
Covariance	--	0.3953
Regression	--	0.9627
Disturbance	--	0.0357

actually occur. This variation in the simulated data greatly reduced the fit of the Oprisk equation relative to the actual data.

CHAPTER V

SIMULATION ANALYSIS

Introduction

Dynamic economics is defined [36] as the inter-temporal analysis of an economic system. The essence of a dynamic system is the concept of lags in the adjustment of endogenous variables. Current values of endogenous variables are dependent upon past values of themselves and\or other endogenous or exogenous variables. Thus, any system which contains variables dated in more than one time period may be considered dynamic. Determination of the time path of effect for endogenous variables given the time path movements of exogenous variables provides an understanding of the general structure and stability of the economic system as well as a means for predicting the direction and magnitude of change within the system given specific external change.

The dynamic properties and sensitivity to change of the estimated non-risk and risk systems are outlined in the sections that follow. Dynamic properties are analyzed by means of the characteristic equations derived from the reduced forms of the estimated systems. Sensitivity is analyzed through the use of model multipliers and elasticities derived from the reduced forms and final forms of the estimated systems.

The Methodology section in Chapter III alluded to the non-linearities that exist in the risk model due to the structure of the output price risk variable (Oprisk). While these non-linearities did not effect the estimated results of the risk model they do affect the simulation and analysis of dynamic and sensitivity properties as outlined above. Specifically, the non-linear structure of the output price risk variable precludes the analysis of the risk model, as described above, when output price risk exists as defined. Based on the dichotomous conditional definition of risk, the risk model is expanded by the addition of the Oprisk equation when output price risk exists. This expansion results in the introduction of the output price risk non-linearity into the system which in turn has a direct affect on the level of food-size fish harvested, as outlined in the Livwts equation, and an indirect affect on the rest of the system due to interactions with Livwts. To overcome this the risk model is linearized to provide an approximate analysis of the non-linear model dynamics.

Dynamic Stability

The dynamic structure of a linear system of equations is found by an analysis of the reduced form of the system [Theil and Boot, Goldberger, Pindyck and Rubinfeld, Maddala]. Specifically, the matrix of estimated coefficients on the lagged endogenous variables of the reduced form of the system can be termed the *fundamental dynamic matrix* (FDM). The non-trivial eigenvalues (Γ_i) of the FDM provide the key to the dynamic characteristics of the system. Four possibilities exist to characterize a system's dynamic structure:

1. If the absolute value of the real component of Γ_i is less than one in magnitude for all i and all Γ_i are real, the system is converging and non-oscillatory;
2. If the absolute value of the real component of Γ_i is less than one in magnitude for all i and at least one conjugate pair of complex eigenvalues exists, the system is converging with dampened oscillation;
3. If the absolute value of the real component of Γ_i of at least one of the i eigenvalues is greater than or equal to one in magnitude and all Γ_i are real, the system is diverging and non-oscillatory; and
4. If the absolute value of the real component of Γ_i of at least one of the i eigenvalues is greater than or equal to one in magnitude and at least one conjugate pair of complex eigenvalues exists, the system is diverging and oscillatory.

Analysis of the FDM is only applicable to linear systems with first-order lags. However, higher-order lag systems can be transformed to derive a first-order system [Theil and Boot]. This transformation involves the creation of a set of endogenous variable identities to be included in the system to account for the higher lag structures. Such a transformation does not change the dynamic structure or characteristics of the system.

Oprisk is a function of the square of the current price received by producers for farm-raised fish ($Farmp(0)^2$). $Farmp(0)^2$ is a contemporaneous function of Farmp(0) and it is this relationship that creates the non-linearity in the system. To linearize the system, the relationship between Farmp(0) and $Farmp(0)^2$ is approximated using a Taylor Series equation. The linearization allows for an approximation of the dynamic stability and sensitivity analysis of the risk model structure when output price risk exists ($Oprisk > 0$).

The non-linear price relationship and Taylor Series equation are:

1.a) $f(x) = x^2$

1.b) $g(x) = -0.5625 + 1.5\ (x)$

where

$x = Farmp(0)$

At a price of 0.75¢/pound $f(x) = g(x)$ and $f'(x) = g'(x)$. The producer price of 0.75¢/pound was used in the Taylor

Series equation because of its close proximity to the current producer price.

The estimated non-trivial (non-zero) eigenvalues for the non-risk and risk models are presented in Table 30. The non-risk model and risk model (Oprisk = 0) each generated 27 eigenvalues with eight values being non-trivial. Each model contains 23 equations and an additional four endogenous lag variables were introduced to reduce the lag structure of the models to a first order degree. This total of 27 equations accounts for the number of eigenvalues derived. The risk model (Oprisk > 0) was also augmented to reduce its lag structure to a first order degree. One hundred and eight endogenous lag variables were introduced into the model to reduce the lag structure to a first order degree. This 132 equation model generated 98 non-trivial eigenvalues. The eight eigenvalues associated with the basic model are also presented in Table 30. The remaining 90 non-trivial eigenvalues did not significantly influence the dynamic structure of the model and are not considered further in the analysis.

The absolute value of the real component of each eigenvalue associated with the non-risk model is less than one in magnitude which implies that the model is converging. Two conjugate pairs of complex eigenvalues were also generated implying that the model is oscillatory.

The eight basic eigenvalues associated with the risk

TABLE 30

NON-TRIVIAL EIGENVALUES[1] DERIVED FROM FINAL-FORM EQUATION ESTIMATES OF THE NON-RISK AND RISK MODELS

	Without Risk		With Risk (Oprisk = 0)		With Risk (Oprisk > 0)	
	r	θ	r	θ	r	θ
1)	0.6385	205.25	1.0452	180.00	1.0452	180.00
2)	0.6385	154.75	0.9124	244.65	0.9124	244.65
3)	7.00E-6	180.00	0.9124	115.35	0.9124	115.35
23)	0.4934	279.67	2.00E-6	0.00	2.00E-6	0.00
24)	0.4934	80.33	0.8185	320.86	0.8185	320.86
25)	0.4657	0.00	0.8185	39.14	0.8185	39.14
26)	0.9990	0.00	0.9992	360.00	0.9992	360.00
27)	0.9992	0.00	0.9992	0.00	0.9992	0.00

---

[1] Eigenvalues are presented in polar form:

$$z = r(\cos\theta \pm i\sin\theta)$$

where

r = amplitude
θ = degrees

model are identical regardless of the state of Oprisk (Oprisk = 0 or Oprisk > 0). The absolute value of the real component of one of the values is greater than one in magnitude which implies that the model is diverging. Three conjugate pairs of complex eigenvalues were also generated implying that the model is oscillatory.

The individual elements of the FDM are random variables derived from the estimation of the structural equations of the non-risk and risk models. This implies that the eigenvalues obtained from the FDM are themselves random variables and have asymptotic standard errors associated with them. Some of the estimated eigenvalues for the non-risk and risk models, particularly the risk model, are very close to or in one case greater than one. T-tests of significance indicate that the eigenvalues are not significantly different from one, unless the estimated asymptotic standard errors are very small, implying that the models may be unstable. Given the possible instability of the models, it appears that the relevant points of interest are the implied periodicities of the systems and the relative time until divergence if instability exists in the models. These periodicities are discussed further in the following section.

Sensitivity

Changes in exogenous variables that affect the dynamic structure of a system can be categorized under two headings:

1) one-time only changes; and
2) sustained changes.

These changes are quantified in terms of *multipliers*.

Multipliers refer to the change in endogenous variable *i* given a change in exogenous variable *j*. Four types of multipliers are used to describe the effects of a specific exogenous change[1]:

1) Impact multipliers (IM) - give the contemporaneous change in an endogenous variable given a one-time or sustained change in an exogenous variable.

   $IM_\tau = B$ for $\tau = 0$.

   where

   τ = the delay following an exogenous change

   $= t - t$ for $t' > t$

2) Interim (Delay) multipliers (DM) - give the subsequent period(s) change in an endogenous variable given a one-time change in an exogenous variable.

   $DM_\tau = A^{\tau-1}(C + AB)$ for $\tau > 0$.

   $= \Sigma^n_{i=1}\Gamma^{\tau-1}_i v_i v'_i (C + AB)$ for $i = 1,2,3,\ldots,n$

   where

   n = the rank of A.

   v_i = the normalized eigenvector associated with Γ_i.

---

[1] Definition and derivation of nomenclature is outlined in Appendix A.

3) Cumulative multipliers (CM) - give the cumulative change in an endogenous variable through τ given a sustained change in an exogenous variable.

$$CM_\tau = B + \Sigma^{\tau-1}{}_{i=0}\ A^i(C + AB)$$

if the limit of $A^\tau = 0$ as $\tau \to \infty$.

4) Long-run multipliers (LM) - give the total cumulative change in an endogenous variable given a sustained change in an exogenous variable.

$$\begin{aligned} LM &= B + \Sigma^{\infty}{}_{i=0}\ A^i\ (C + AB) \\ &= B + (I + A + A^2 + A^3 + \ldots)(C + AB) \\ &= B + (I - A)^{-1}\ (C + AB) \end{aligned}$$

if the limit of $A^\tau = 0$ as $\tau \to \infty$.

The sensitivity of a system to these types of changes is a direct function of the individual eigenvalues, as indicated in the definition of the delay multipliers and implied in the definitions of the other multipliers, and their interrelationships with each other. In this section the structure of the non-risk and risk model eigenvalues are analyzed in a general sense followed by an analysis of the effects of both types of change on the individual models as a whole.

The definitions for the interim, cumulative and long-run multipliers imply that the dynamic structure of these multipliers is a function of the underlying dynamic structure of the eigenvalues associated with the model in question, as represented by the exponential structure of the eigenvalues. The importance of each ith eigenvalue in defining this structure is dependent upon the eigenvalues relative dominance with respect to the other eigenvalues of the system. Dominance within a set of eigenvalues is based upon the magnitude of the real component of the individual eigenvalues in the set. The greater the magnitude, the more dominant the individual eigenvalue. More dominant means the dynamic affect implicit in the eigenvalue will influence the dynamic structure of the system for a longer period of time, given an exogenous change.

Table 30 listed the eigenvalues for the non-risk and risk models. The real component of each eigenvalue is represented by its amplitude (r). For the non-risk model the eigenvalues designated as numbers 26 and 27 dominate the set followed by the two conjugate pairs, (1,2) and (24,25) respectively. The exponential structures for the non-risk eigenvalues are presented in Table 31. As the eigenvalues are raised to higher powers they tend toward zero thus the converging structure of the non-risk model as noted above. All the non-trivial eigenvalues approximate zero after 25 periods with the exception of the dominate values, 26 and 27. The dynamic structures of these eigenvalues converge on zero more slowly than the other non-trivial values due to their relatively large real component. In total, the sum of the dynamic effects represented by the eigenvalues, represented in column ten of Table 31, is small however, the

TABLE 31

NON-TRIVIAL EIGENVALUE POWER STRUCTURE REAL COMPONENT: NON-RISK MODEL

Power	Γ^{s}_{1}	Γ^{s}_{2}	Γ^{s}_{3}	Γ^{s}_{23}	Γ^{s}_{24}	Γ^{s}_{25}	Γ^{s}_{26}	Γ^{s}_{27}	Sum
0	1	1	1	1	1	1	1	1	27
1	-0.577	-0 577	-0 000	0 083	0 083	0 465	0.999	0 999	1 474
2	0.259	0 259	5E-11	-0 229	-0 229	0 216	0 998	0 998	2 272
3	-0 064	-0 064	-3E-16	-0 058	-0.058	0 100	0.997	0 998	1 850
4	-0 031	-0 031	2E-21	0 046	0.046	0 047	0.996	0 997	2 069
5	0 063	0 063	-2E-26	0.022	0.022	0 022	0 995	0.996	2.182
6	-0 059	-0 059	1E-31	-0 007	-0 007	0 010	0 994	0.995	1 865
7	0 043	0 043	-9E-37	-0 006	-0 006	0 005	0 993	0.994	2 065
8	-0 025	-0 025	6E-42	0 001	0 001	0 002	0 992	0 993	1 938
9	0 012	0 012	-4E-47	0 002	0 002	0 001	0 991	0 993	2 012
10	-0 003	-0 003	3E-52	0 000	0 000	0 000	0 990	0 992	1 976
11	-0 000	-0 000	-2E-57	-0 000	-0 000	0 000	0 989	0 991	1 978
12	0 002	0.002	1E-62	-0 000	-0 000	0 000	0.988	0 990	1 983
13	-0 002	-0 002	-1E-67	0 000	0 000	0 000	0 987	0 989	1 972
14	0 002	0 002	7E-73	0 000	0 000	0 000	0 986	0 988	1 978
15	-0 001	-0 001	-5E-78	-0 000	-0 000	0 000	0 985	0.988	1 971
16	0 001	0 001	4E-83	-0 000	-0 000	0 000	0.984	0 987	1 972
17	-0 000	-0 000	-3E-88	0 000	0 000	0 000	0.983	0.986	1 969
18	-0 000	-0 000	2E-93	0 000	0 000	0 000	0 982	0 985	1 967
19	0 000	0 000	-1E-98	0 000	0 000	0 000	0 981	0 984	1 966
20	-0 000	-0 000	0 000	-0 000	-0.000	0 000	0 980	0 983	1 964
21	0 000	0 000	-0 000	-0.000	-0 000	0 000	0 979	0 983	1 962
22	-0 000	-0 000	0 000	0 000	0 000	0 000	0 978	0.982	1 960
23	0 000	0 000	-0.000	0 000	0 000	0 000	0 977	0 981	1 959
24	-0 000	-0 000	0 000	-0 000	-0 000	0 000	0 976	0 980	1.957
25	-0.000	-0 000	-0 000	-0 000	-0 000	0 000	0 976	0 979	1 955

duration of affect from a change in an exogenous variable is quite long, approximately 3,000 periods (months).

The sum of the eigenvalue dynamic structures as shown in Table 31 depict the basic structure of the delay multipliers over time. The specific affects of a change in an exogenous variable on a endogenous variable will vary in magnitude and phase shift depending upon the exogenous and endogenous variables in question however, the periodicity and total length of affect will not vary across variables.

Examination of the sum of the interim dynamic affects for the non-risk model (Table 31, column 10 and Figure 16) shows that a one-time change in an exogenous variable initially causes the endogenous variables to cycle in a dampening saw-toothed pattern for approximately one year. This dampening saw-toothed pattern of movement is due to the dynamic structure of the non-dominate complex eigenvalues. A long period of asymptotic movement to zero reflecting the slow convergence properties of the dominate eigenvalues of the system follows the initial cycling pattern caused by the endogenous change. Figure 16 depicts the slow converging properties of the non-risk model as represented by the eigenvalues of the model given a one-time exogenous change.

Summing along the columns of Table 31 yields the cumulative dynamic structure of the individual non-trivial eigenvalues for the non-risk model. These summations (Table 32) represent the movement of the system, relative to the

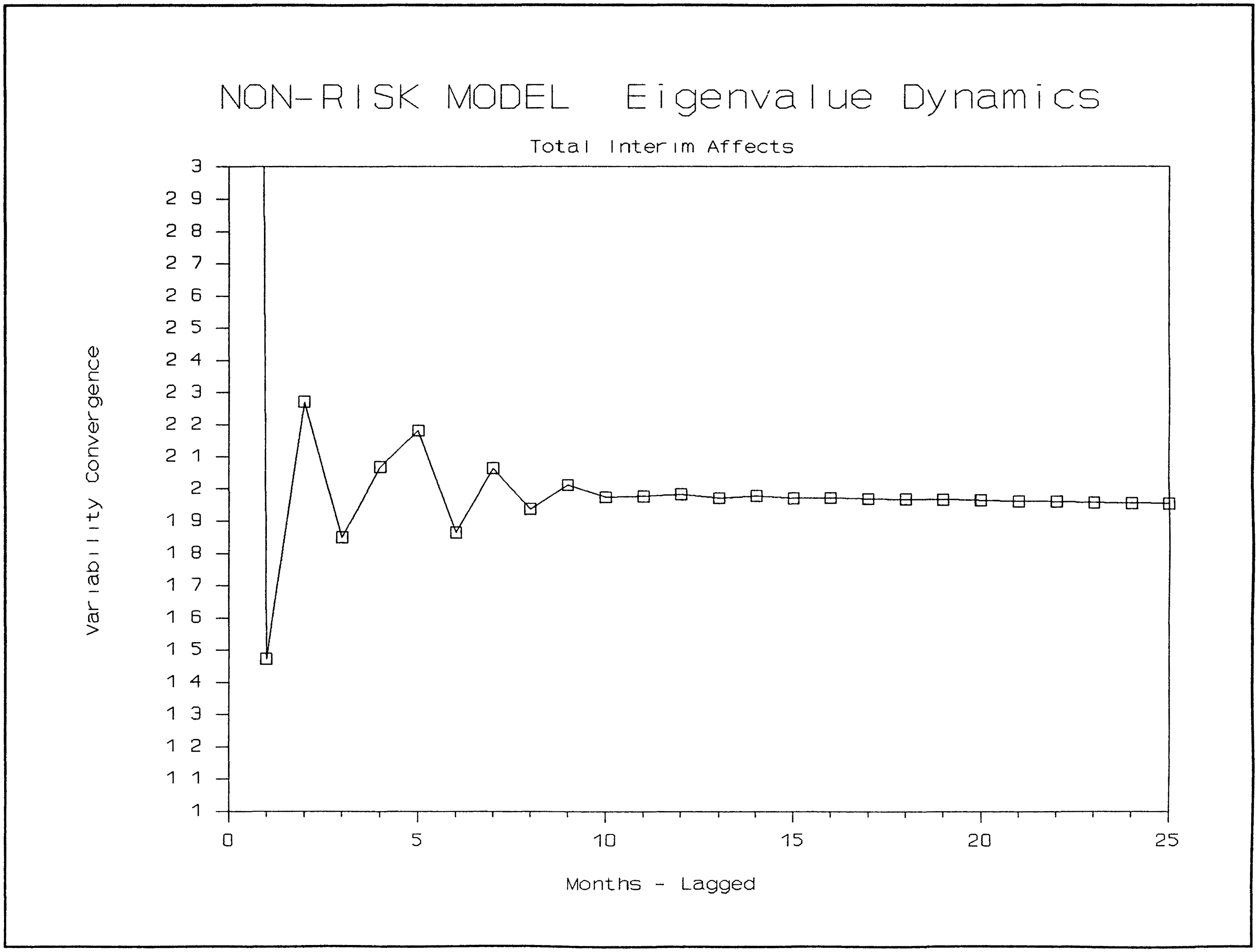


Figure 16. Non-Risk Model: Interim Affects

TABLE 32

SUMMATION OF THE NON-TRIVIAL EIGENVALUE POWER STRUCTURE REAL COMPONENT: NON-RISK MODEL

Power	r^{s}_{1}	r^{s}_{2}	r^{s}_{3}	r^{s}_{23}	r^{s}_{24}	r^{s}_{25}	r^{s}_{26}	r^{s}_{27}	Sum
0	1	1	1	1	1	1	1	1	27
1	0 423	0 423	1 000	1 083	1 083	1 465	1.999	1.999	28 474
2	0.682	0 682	1.000	0 853	0.853	1.681	2 997	2 998	30.745
3	0 618	0.618	1 000	0 795	0 795	1.781	3.994	3 995	32.595
4	0 586	0.586	1 000	0 841	0.841	1 828	4.990	4 992	34 664
5	0.649	0 649	1 000	0 863	0 863	1 849	5 985	5 988	36.846
6	0 589	0 589	1.000	0 855	0 855	1 859	6 979	6.983	38 710
7	0 632	0 632	1 000	0 849	0 849	1 864	7.972	7 977	40 776
8	0 607	0.607	1 000	0 850	0.850	1 866	8 964	8 970	42 713
9	0.619	0.619	1 000	0 851	0 851	1 867	9.956	9 963	44.726
10	0 615	0 615	1 000	0 851	0.851	1 868	10 946	10 954	46 701
11	0.614	0.614	1 000	0 851	0 851	1 868	11.935	11.945	48 679
12	0 617	0 617	1 000	0 851	0 851	1 868	12.923	12.935	50 662
13	0 614	0 614	1.000	0 851	0 851	1 868	13.910	13.925	52.634
14	0 616	0 616	1 000	0 851	0 851	1 868	14.896	14 913	54 612
15	0 615	0 615	1 000	0 851	0.851	1 868	15 882	15.901	56 583
16	0 616	0 616	1 000	0 851	0 851	1 868	16 866	16.887	58 555
17	0 616	0 616	1.000	0.851	0.851	1 868	17 849	17 873	60.524
18	0.616	0 616	1 000	0 851	0 851	1.868	18.832	18 858	62 491
19	0 616	0 616	1 000	0.851	0 851	1 868	19 813	19 843	64.457
20	0 616	0 616	1 000	0 851	0 851	1 868	20.793	20 826	66.421
21	0 616	0.616	1 000	0 851	0 851	1 868	21 773	21 809	68 383
22	0 616	0 616	1 000	0 851	0 851	1 868	22 751	22 791	70.343
23	0 616	0 616	1.000	0 851	0.851	1.868	23.729	23.772	72.301
24	0.616	0 616	1 000	0 851	0 851	1 868	24.705	24.752	74.258
25	0 616	0 616	1 000	0 851	0.851	1.868	25 681	25 731	76.213

eigenvalue in question, to a new equilibrium position given a sustained change in an exogenous variable. The combination of these individual changes are depicted in column ten of Table 32.

The dominance of eigenvalues 26 and 27 in the system is again apparent. The cyclical structure of the non-dominate eigenvalues is out-weighed by the asymptotic structure of eigenvalues 26 and 27 as the system moves towards a new equilibrium given a sustained exogenous change (Figure 17).

The asymptotic dynamic structure of eigenvalues 26 and 27 dominate the overall dynamic structure of the non-risk model, particularly over the long-run. However, during the first six months following an exogenous change the dampening oscillatory structure of the model is evident. Two conjugate pairs of complex eigenvalues (1,2 and 23,24) combine to produce this effect.

A one-time change in an exogenous variable will affect the value of each endogenous variable differently relative to the complex eigenvalues and their structures. Associated with these eigenvalues are specific variability or amplitudinal affects and phase shifts. Tables 33 and 34 present a summary of these interim affects for each exogenous and endogenous variable relative to the two conjugate complex pairs of eigenvalues.

The eigenvalue pair (1,2) dominates pair (23,24) as was noted in Table 30 by the magnitude of its real component.

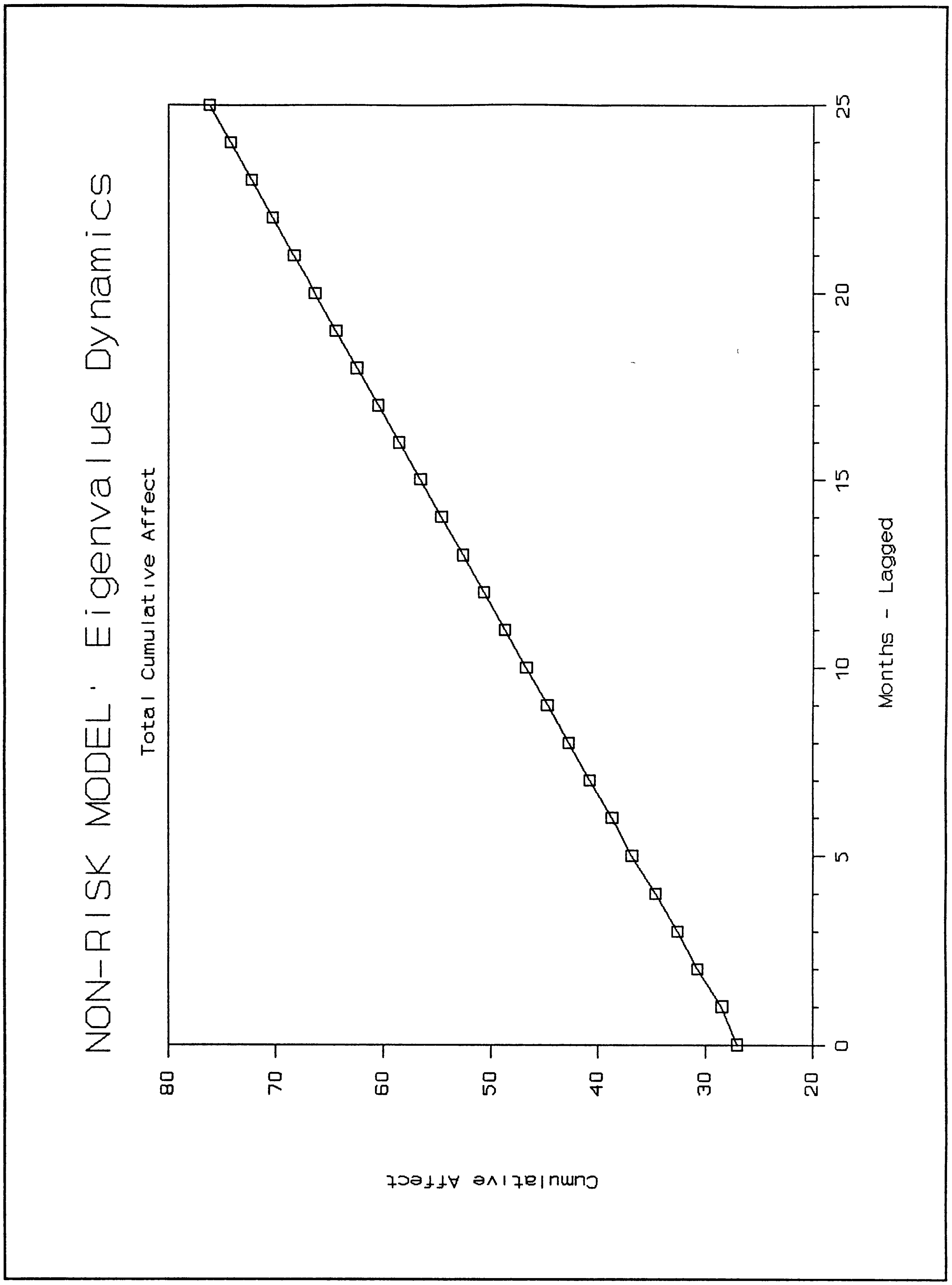


Figure 17. Non-Risk Model: Cumulative Affects

This dominance is reflected in the amplitude values of Table 33 for pair (1,2) as they compare to the amplitude values of pair (23,24) in Table 34. Generally, the associated movement in an endogenous variable given an exogenous change is greater for eigenvalue pair (1,2) relative to pair (23,24).

For both eigenvalue pairs, a change in the lagged input price variable (Feedp(-5)) causes the greatest variability in the endogenous variables followed by a change in the price of substitutes variable (Seappi) in the processing sector. Other exogenous changes have a relatively small influence on the variability of the endogenous variables. The endogenous quantity variables are also impacted more by exogenous change than are the endogenous price variables particularly, total monthly weight of food-size fish processed (Livwts) and the fresh whole, fresh filleted and frozen filleted sales (Fhws, Fhfs, Fnfs) and production (Profhw, Profhf, Profnf) variables. Additionally, while a change in the lagged input price variable affects the price paid to producers and processed product prices fairly equally, this same change has a substantially larger affect on the Livwts, Fhws, Fhfs, Fnfs, Profhw, Profhf and Profnf variables, particularly with respect to the other processing sales and production variables.

The phase difference values presented in Tables 33 and 34 measure in months the horizontal shift in the dynamic

TABLE 33

AMPLITUDES AND PHASE DIFFERENCES OF INTERIM MULTIPLIERS NON-RISK MODEL: EIGENVALUE CONJUGATE PAIR - 1 & 2

Endogenous Variables	Amplitudes											
	Predetermined Variables											
	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2	Shift3	Shift4	Shift5	Seappi
Livwts	1 642	0 218	0.077	0 007	0 471	28 289	1.788	2 244	0 167	0 008	0 532	4 698
Farmp0	0 163	0 022	0 008	0 001	0 047	2 811	0.178	0 223	0 017	0 001	0 053	0 467
Fhwp	0 258	0 034	0 012	0.001	0 074	4 446	0 281	0 353	0 026	0 001	0 084	0 738
Fhfp	0 307	0 041	0 014	0 001	0 088	5 298	0 335	0 420	0.031	0 002	0 100	0 880
Fhop	0 191	0 025	0 009	0 001	0 055	3 297	0 208	0 262	0 019	0.001	0.062	0 548
Fnwp	0 190	0 025	0 009	0 001	0 054	3 270	0.207	0.259	0 019	0 001	0 061	0 543
Fnfp	0.262	0 035	0 012	0 001	0 075	4 517	0 286	0 358	0 027	0 001	0.085	0 750
Fnop	0 167	0.022	0 008	0 001	0 048	2 874	0 182	0 228	0.017	0 001	0 054	0 477
Fhws	1 095	0 146	0 051	0 005	0.314	18 863	1 193	1 496	0.111	0.005	0 355	3 133
Fhfs	0 984	0.131	0 046	0 004	0 282	16.953	1 072	1 345	0.100	0 005	0 319	2 816
Fhos	0 029	0 004	0 001	0 000	0 008	0 492	0.031	0 039	0 003	0 000	0 009	0 082
Fnws	0 049	0 007	0 002	0 000	0 014	0 846	0 053	0 067	0.005	0 000	0 016	0 141
Fnfs	0 824	0 110	0.039	0 004	0 236	14.198	0 898	1 126	0 084	0 004	0 267	2 358
Fnos	0.346	0 046	0 016	0 002	0 099	5.960	0.377	0 473	0 035	0 002	0 112	0 990
Profhw	1 095	0 146	0 051	0 005	0 314	18.863	1 193	1 496	0.111	0.005	0 355	3 133
Profhf	0 984	0 131	0.046	0.004	0 282	16.953	1 072	1.345	0 100	0 005	0 319	2 816
Profho	0 029	0 004	0.001	0 000	0 008	0 492	0 031	0 039	0 003	0 000	0 009	0 082
Profnw	0 055	0 007	0 003	0 000	0 016	0.950	0 060	0 075	0 006	0 000	0 018	0 158
Profnf	1 178	0 157	0 055	0 005	0 338	20 302	1 284	1 610	0 120	0.006	0 382	3 372
Profno	0 352	0 047	0 017	0 002	0 101	6 057	0 383	0 480	0 036	0.002	0 114	1 006
Fnwei	0 006	0 001	0 000	0 000	0.002	0.102	0.006	0.008	0 001	0 000	0.002	0 017
Fnfei	0 778	0 104	0.037	0.003	0 223	13 413	0.848	1 064	0 079	0.004	0 252	2 228
Fnoei	0 002	0 000	0.000	0 000	0 001	0.039	0 002	0.003	0.000	0 000	0 001	0 006
Farmp1	0 256	0 034	0 012	0 001	0 073	4 403	0.278	0 349	0 026	0 001	0 083	0 731
Farmp2	0 400	0 053	0 019	0 002	0.115	6.896	0.436	0 547	0.041	0 002	0 130	1 145
Farmp3	0 627	0 083	0.029	0 003	0 180	10 801	0 683	0 857	0.064	0.003	0 203	1 794
Farmp4	0 982	0 131	0.046	0.004	0 282	16 915	1.069	1 342	0.100	0 005	0 318	2 809

TABLE 33 (Continued)

Endogenous Variables	Phase Differences* Predetermined Variables											
	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2	Shift3	Shift4	Shift5	Seappi
Livwts	0.244	-1.128	-1.129	0.202	0.247	-1.128	-1.128	0.245	0.245	-1.129	0.245	0.245
Farmp0	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fhwp	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fhfp	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fhop	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fnwp	1.207	-0.164	-0.166	1.165	1.211	-0.165	-0.165	1.209	1.209	-0.165	1.209	1.209
Fnfp	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fnop	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fhws	-0.167	1.209	1.208	-0.209	-0.163	1.208	1.208	-0.165	-0.165	1.208	-0.165	-0.165
Fhfs	-0.167	1.209	1.208	-0.209	-0.163	1.208	1.208	-0.165	-0.165	1.208	-0.165	-0.165
Fhos	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fnws	-0.166	1.210	1.208	-0.208	-0.163	1.209	1.209	-0.165	-0.165	1.209	-0.165	-0.165
Fnfs	-0.167	1.209	1.208	-0.209	-0.163	1.208	1.208	-0.165	-0.165	1.208	-0.165	-0.165
Fnos	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Profhw	-0.167	1.209	1.208	-0.209	-0.163	1.208	1.208	-0.165	-0.165	1.208	-0.165	-0.165
Profhf	-0.167	1.209	1.208	-0.209	-0.163	1.208	1.208	-0.165	-0.165	1.208	-0.165	-0.165
Profho	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Profnw	-0.052	1.324	1.322	-0.094	-0.049	1.323	1.323	-0.051	-0.051	1.323	-0.051	-0.051
Profnf	1.007	-0.364	-0.366	0.965	1.010	-0.365	-0.365	1.009	1.009	-0.365	1.009	1.008
Profno	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fnwei	0.514	-0.857	-0.859	0.472	0.517	-0.858	-0.858	0.516	0.516	-0.858	0.516	0.515
Fnfei	1.207	-0.164	-0.166	1.165	1.210	-0.165	-0.165	1.208	1.208	-0.165	1.208	1.208
Fnoei	1.325	-0.046	-0.048	1.283	1.328	-0.047	-0.047	1.326	1.326	-0.047	1.326	1.326
Farmp1	-0.359	1.017	1.015	-0.401	-0.356	1.016	1.016	-0.358	-0.358	1.016	-0.358	-0.358
Farmp2	0.822	-0.550	-0.551	0.780	0.825	-0.551	-0.551	0.823	0.823	-0.551	0.823	0.823
Farmp3	-0.745	0.631	0.630	-0.787	-0.741	0.630	0.630	-0.743	-0.743	0.630	-0.743	-0.743
Farmp4	0.436	-0.935	-0.937	0.394	0.440	-0.936	-0.936	0.438	0.438	-0.936	0.438	0.438

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* Measured in months

TABLE 34

AMPLITUDES AND PHASE DIFFERENCES OF INTERIM MULTIPLIERS NON-RISK MODEL: EIGENVALUE CONJUGATE PAIR - 23 & 24

Endogenous Variables	Amplitudes Predetermined Variables										
	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2	Shift3	Shift4	Shift5	Seappi
Livwts	0.780	0.105	0.037	0.003	0.227	13.516	0.855	1.072	0.080	0.004	0.254	2.245
Farmp0	0.021	0.003	0.001	0.000	0.006	0.370	0.023	0.029	0.002	0.000	0.007	0.061
Fhwp	0.034	0.005	0.002	0.000	0.010	0.585	0.037	0.046	0.003	0.000	0.011	0.097
Fhfp	0.040	0.005	0.002	0.000	0.012	0.697	0.044	0.055	0.004	0.000	0.013	0.116
Fhop	0.025	0.003	0.001	0.000	0.007	0.434	0.027	0.034	0.003	0.000	0.008	0.072
Fnwp	0.025	0.003	0.001	0.000	0.007	0.430	0.027	0.034	0.003	0.000	0.008	0.071
Fnfp	0.034	0.005	0.002	0.000	0.010	0.594	0.038	0.047	0.003	0.000	0.011	0.099
Fnop	0.022	0.003	0.001	0.000	0.006	0.378	0.024	0.030	0.002	0.000	0.007	0.063
Fhws	0.143	0.019	0.007	0.001	0.042	2.483	0.157	0.197	0.015	0.001	0.047	0.412
Fhfs	0.129	0.017	0.006	0.001	0.037	2.231	0.141	0.177	0.013	0.001	0.042	0.371
Fhos	0.004	0.001	0.000	0.000	0.001	0.065	0.004	0.005	0.000	0.000	0.001	0.011
Fnws	0.006	0.001	0.000	0.000	0.002	0.111	0.007	0.009	0.001	0.000	0.002	0.018
Fnfs	0.108	0.014	0.005	0.000	0.031	1.869	0.118	0.148	0.011	0.001	0.035	0.310
Fnos	0.045	0.006	0.002	0.000	0.013	0.785	0.050	0.062	0.005	0.000	0.015	0.130
Profhw	0.143	0.019	0.007	0.001	0.042	2.483	0.157	0.197	0.015	0.001	0.047	0.412
Profhf	0.129	0.017	0.006	0.001	0.037	2.231	0.141	0.177	0.013	0.001	0.042	0.371
Profho	0.004	0.001	0.000	0.000	0.001	0.065	0.004	0.005	0.000	0.000	0.001	0.011
Profnw	0.013	0.002	0.001	0.000	0.004	0.227	0.014	0.018	0.001	0.000	0.004	0.038
Profnf	0.207	0.028	0.010	0.001	0.060	3.597	0.227	0.285	0.021	0.001	0.068	0.597
Profno	0.046	0.006	0.002	0.000	0.013	0.797	0.050	0.063	0.005	0.000	0.015	0.132
Fnwei	0.004	0.000	0.000	0.000	0.001	0.064	0.004	0.005	0.000	0.000	0.001	0.011
Fnfei	0.102	0.014	0.005	0.000	0.030	1.766	0.112	0.140	0.010	0.001	0.033	0.293
Fnoei	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.001
Farmp1	0.043	0.006	0.002	0.000	0.013	0.750	0.047	0.059	0.004	0.000	0.014	0.125
Farmp2	0.088	0.012	0.004	0.000	0.025	1.520	0.096	0.121	0.009	0.000	0.029	0.252
Farmp3	0.178	0.024	0.008	0.001	0.052	3.081	0.195	0.244	0.018	0.001	0.058	0.512
Farmp4	0.360	0.048	0.017	0.002	0.105	6.245	0.395	0.495	0.037	0.002	0.117	1.037

TABLE 34 (Continued)

Endogenous	Phase Differences*											
	Predetermined Variables											
Variables	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2	Shift3	Shift4	Shift5	Seappi
Livwts	-0.397	0.918	0.910	-0.605	-0.382	0.914	0.914	-0.390	-0.390	0.914	-0.390	-0.390
Farmp0	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.613	0.612
Fhwp	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.613	0.612
Fhfp	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.613	0.612
Fhop	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.613	0.612
Fnwp	0.607	-0.687	-0.695	0.399	0.622	-0.691	-0.691	0.614	0.614	-0.691	0.614	0.614
Fnfp	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.613	0.612
Fnop	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.612	0.612
Fhws	-0.698	0.616	0.608	-0.906	-0.684	0.612	0.612	-0.692	-0.692	0.612	-0.692	-0.692
Fhfs	-0.698	0.616	0.608	-0.906	-0.684	0.612	0.612	-0.692	-0.692	0.612	-0.692	-0.692
Fhos	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.613	0.612
Fnws	-0.697	0.618	0.610	-0.905	-0.682	0.614	0.614	-0.691	-0.691	0.613	-0.690	-0.691
Fnfs	-0.698	0.616	0.608	-0.906	-0.684	0.612	0.612	-0.692	-0.692	0.612	-0.692	-0.692
Fnos	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.612	0.612
Profhw	-0.698	0.616	0.608	-0.906	-0.684	0.612	0.612	-0.692	-0.692	0.612	-0.692	-0.692
Profhf	-0.698	0.616	0.608	-0.906	-0.684	0.612	0.612	-0.692	-0.692	0.612	-0.692	-0.692
Profho	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.613	0.612
Profnw	-0.516	0.799	0.791	-0.724	-0.501	0.795	0.795	-0.509	-0.509	0.795	-0.509	-0.509
Profnf	-0.128	1.187	1.179	-0.336	-0.113	1.183	1.183	-0.122	-0.122	1.182	-0.121	-0.122
Profno	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.612	0.612
Fnwei	0.152	-1.142	-1.150	-0.056	0.167	-1.146	-1.146	0.159	0.159	-1.147	0.159	0.159
Fnfei	0.606	-0.688	-0.696	0.398	0.621	-0.692	-0.692	0.612	0.612	-0.693	0.613	0.612
Fnoei	1.126	-0.169	-0.176	0.918	1.140	-0.173	-0.173	1.132	1.132	-0.173	1.132	1.132
Farmp1	1.188	-0.106	-0.114	0.980	1.203	-0.110	-0.110	1.195	1.195	-0.111	1.195	1.194
Farmp2	-0.839	0.476	0.468	-1.047	-0.824	0.472	0.472	-0.832	-0.832	0.472	-0.832	-0.832
Farmp3	-0.256	1.058	1.051	-0.464	-0.242	1.054	1.054	-0.250	-0.250	1.054	-0.250	-0.250
Farmp4	0.326	-0.969	-0.976	0.118	0.340	-0.973	-0.973	0.332	0.332	-0.973	0.332	0.332

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* Measured in months.

structure of the interim multipliers. If the phase difference is equal to zero then the maximum affect of an exogenous change occurs during the period of change, the initial impact. A non-zero phase difference implies that the maximum impact is lagged to some later date.

While the composition of the eigenvalues gives a general indication as to the dynamic structure of a model, it is the various sets of multipliers that provide a specific understanding of the consequence of exogenous change. The impact multipliers for the non-risk model are presented in Table 35. A change in the lagged price paid by producers for feed (Feedp(-5)) creates the greatest immediate impact on the endogenous variables followed by a change in the price of substitute products in the processing sector (Seappi). Both of these results were indicated in the analysis of the eigenvalue structure.

Tables 36 and 37 outline the decreasing delay effects for a 25 month period following a one-time change in the Feedp(-5) and Seappi exogenous variables. It is evident from the delay multipliers that the effects of one-time exogenous changes have dissipated within two years of the change with exceptions for the frozen other processed fish products ending inventory (Fnoei) variables with respect to both Feedp(-5) and Seappi. For the non-risk model one-time changes in the Feedp(-5) and Seappi variables display the bulk of their impact in the initial period of change with

TABLE 35

IMPACT MULTIPLIERS
NON-RISK MODEL

Endog-enous	Predetermined Variables											
Vari-ables	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2	Shift3	Shift4	Shift5	Seappi
Livwts	14 768	2.190	-0 234	0 000	0.000	82 657	5 226	0.000	0.000	0.000	0 000	0 000
Farmp0	0.401	-0 011	-0 016	0.026	-0 015	-3.569	-0.226	0.283	0 021	-0.001	0 067	0 593
Fhwp	1 170	-0 025	-0 023	0 040	-0 029	-5.644	-0 357	0.448	0 033	-0.002	0.106	0 867
Fhfp	2 140	-0 021	-0 028	0 049	-0 039	-6.725	-0 425	0 501	0 040	-0.002	0 126	1 094
Fhop	1 267	0 000	-0.018	0 033	-0 015	-4.185	-0.265	0 332	0 242	-0.001	0 079	0 696
Fnwp	1 303	-0 011	-0 019	0 034	-0 027	-4 169	-0.264	0 329	0.024	0 059	0.078	0.691
Fnfp	2.143	-0 014	-0 026	0 046	-0 036	-5.733	-0 362	0 455	0.034	-0.002	0.108	0.952
Fnop	1 526	-0 009	-0 017	0 029	-0 023	-3.647	-0.231	0 289	0 021	-0.001	0 278	0 606
Fhws	2 090	0 422	0.010	0 113	-0 003	23 943	1 514	-1 899	-0.141	0.007	-0 449	-1 704
Fhfs	1 702	0 236	-0.035	0 037	-0 014	21 520	1 360	-0 382	-0.127	0 006	-0 404	-2 652
Fhos	0 365	0 021	-0 001	0 003	0 020	-0 624	-0 039	0 050	0.233	-0 000	0 012	0.105
Fnws	0 452	0.134	0 016	0 059	-0 108	1 079	0.068	-0.085	-0 006	-0 015	-0 020	0.578
Fnfs	0 699	0 292	0 064	0 035	-0 271	18.022	1 139	-0.180	-0 106	0 005	-0 338	-0 681
Fnos	0 540	0 096	-0 107	-0 143	-0 056	-7 561	-0 478	0 600	0 045	-0 002	0 861	1 453
Profhw	2 050	0 422	0 010	0 013	0 136	23 943	1.514	-1 899	-0.141	0 007	-0 449	-1 704
Profhf	1 702	0 236	-0 035	0 037	-0 014	21 520	1.360	-0.382	-0 127	0 006	-0 404	-2 652
Profho	0 365	0.021	-0.001	0.003	0 020	-0.624	-0 039	0.050	0.233	-0.000	0 012	0 105
Profnw	0 553	0 140	0.011	0.051	-0 094	1 828	0 116	-0 074	-0.006	-0.013	-0 018	0 504
Profnf	1 679	0 160	0.018	0 038	0 016	0.995	0 063	1.171	-0 006	0.000	-0 019	2 147
Profno	0 549	0 098	-0 109	-0 146	-0 057	-7.685	-0 486	0 610	0 045	-0.002	0 875	1 477
Fnwei	0 101	0 006	-0 005	-0 007	0.014	0.749	0 047	0 011	0.001	0.002	0 003	-0 074
Fnfei	0 980	-0 132	-0 046	0 003	0 287	-17.027	-1 076	1.351	0 100	-0 005	0 320	2 828
Fnoei	0 009	0 002	-0 002	-0 002	-0 001	-0 123	-0.008	0 010	0 001	-0 000	0 014	0 024
Farmp1	0 000	0 000	0 000	0 000	0 000	0.000	0.000	0.000	0 000	0 000	0 000	0 000
Farmp2	0 000	0 000	0 000	0 000	0 000	0.000	0 000	0.000	0 000	0 000	0 000	0 000
Farmp3	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000
Farmp4	0 000	0 000	0 000	0 000	0 000	0.000	0.000	0 000	0.000	0 000	0 000	0 000

TABLE 36

DELAY MULTIPLIERS: EXOGENOUS
VARIABLE - Feedp(-5)
NON-RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	82 657	-3 569	-5 644	-6 725	-4 185	-4.169	-5.733	-3.647	23 943
1	27 026	-3 909	-6 181	-7 365	-4 584	-4.550	-6 279	-3.972	26 223
2	1 639	1 985	3 138	3 739	2 327	2 301	3 188	2 053	-13 315
3	-6 262	-0 766	-1 211	-1 443	-0 898	-0 895	-1 231	-0 759	5 139
4	4 700	0 204	0.322	0 384	0 239	0.231	0 327	0 232	-1 366
5	-5 589	0 139	0 220	0 262	0 163	0 157	0.224	0 166	-0.934
6	4 173	-0 249	-0.393	-0 468	-0 291	-0 295	-0 399	-0 230	1 667
7	-2 119	0 227	0.358	0 427	0 266	0.258	0 364	0 256	-1 520
8	0 818	-0 149	-0 236	-0.282	-0.175	-0 179	-0.240	-0.129	1 003
9	-0 217	0 093	0 146	0 174	0 108	0.102	0.149	0 118	-0.621
10	-0 149	-0 037	-0.059	-0 071	-0 044	-0 049	-0 060	-0 014	0.251
11	0 265	0.013	0.020	0 024	0.015	0.010	0.021	0 037	-0 086
12	-0 242	0 008	0 013	0 016	0 010	0 005	0.013	0 032	-0 056
13	0 160	-0 007	-0 010	-0.012	-0.008	-0.013	-0 011	0 017	0.044
14	-0 099	0 012	0 020	0 023	0.015	0 009	0.020	0.036	-0.083
15	0 040	-0 004	-0 006	-0 007	-0 004	-0 009	-0.006	0 020	0 024
16	-0 014	0 007	0 011	0 013	0.008	0 003	0 011	0 031	-0 048
17	-0 009	0 001	0 002	0 002	0 002	-0 004	0 002	0 025	-0 009
18	0 007	0 004	0 006	0 007	0 004	-0.001	0 006	0 027	-0 025
19	-0 013	0.003	0 005	0 006	0 004	-0 001	0 005	0 027	-0 022
20	0 004	0 003	0 004	0 005	0.003	-0 002	0 004	0 026	-0 018
21	-0 008	0.004	0 006	0 007	0 004	-0 001	0 006	0 027	-0.024
22	-0 001	0 003	0.005	0 005	0 003	-0.002	0.005	0 026	-0 019
23	-0 004	0 003	0 005	0 006	0 004	-0.001	0.005	0 027	-0.022
24	-0 004	0 003	0 005	0 006	0.004	-0 002	0 005	0 027	-0.020
25	-0 003	0 003	0 005	0 006	0.004	-0.001	0 005	0 027	-0 021

TABLE 36 (Continued)

Lags in Months	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
	Endogenous Variables								
Impact	21 520	-0 624	1 079	18 022	-7 561	23 943	21 520	-0.624	1 828
1	23 569	-0.684	1 177	19.738	-8 236	26.223	23.569	-0 684	1 317
2	11 967	0 347	-0 595	-10 022	4 257	-13 315	-11 967	0.347	-0 502
3	4 619	-0 134	0 232	3 868	-1 574	5.139	4 619	-0.134	0 135
4	-1 228	0 036	-0 060	-1 028	0.482	-1 366	-1 228	0.036	-0 002
5	-0 839	0.024	-0.041	-0.703	0 345	-0.934	-0.839	0 024	-0 095
6	1 499	-0 043	0 076	1 255	-0 477	1 667	1 499	-0 043	0 111
7	-1.366	0 040	-0 067	-1 144	0 530	-1 520	-1 366	0 040	-0 081
8	0 901	-0 026	0 046	0 755	-0 267	1 003	0 901	-0 026	0 049
9	-0 558	0 016	-0 026	-0 467	0 246	-0 621	-0 558	0 016	-0 025
10	0 226	-0 007	0 013	0.189	-0 030	0 251	0.226	-0 007	0.009
11	-0 078	0 002	-0 003	-0 065	0 077	-0 086	-0 078	0 002	0 001
12	-0 051	0 001	-0 001	-0 042	0 067	-0 056	-0.051	0 001	-0 004
13	0 040	-0 001	0 003	0 033	0 035	0.044	0 040	-0 001	0 005
14	-0 075	0 002	-0 002	-0 063	0 076	-0 083	-0 075	0 002	-0 003
15	0 021	-0 001	0 002	0 018	0 042	0 024	0 021	-0 001	0 003
16	-0 043	0 001	-0 001	-0 036	0.064	-0 048	-0 043	0 001	-0 001
17	-0 008	0 000	0 001	-0 007	0.052	-0 009	-0.008	0 000	0 001
18	-0 022	0.001	0 000	-0 019	0 057	-0 025	-0 022	0 001	0 000
19	-0 020	0 001	0 000	-0 017	0.056	-0.022	-0 020	0 001	0 000
20	-0 017	0 000	0 001	-0 014	0 055	-0 018	-0 017	0 000	0 000
21	-0 021	0 001	0 000	-0 018	0 056	-0 024	-0 021	0 001	0 000
22	-0 017	0 000	0 000	-0 014	0 055	-0 019	-0 017	0 000	0 000
23	-0 020	0 001	0 000	-0 017	0 056	-0 022	-0 020	0 001	0 000
24	-0 018	0 001	0 000	-0 015	0 055	-0.020	-0 018	0 001	0 000
25	-0 019	0 001	0 000	-0 016	0.055	-0 021	-0 019	0.001	0 000

TABLE 36 (Continued)

Lags in Months	Endogenous Variables								
	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	0 995	-7 685	0 749	-17 027	-0 123	0 000	0 000	0.000	0 000
1	-23 884	-8 370	0 184	-18 648	-0 975	5.235	-4 402	5.864	-1 535
2	18 094	4 327	0 277	9 468	-0 906	-3.909	5.234	-4.402	5 864
3	-9 254	-1.600	0.180	-3.655	-0.931	1.984	-3.908	5 234	-4 402
4	3 598	0 489	0 238	0 972	-0 923	-0.766	1 984	-3 908	5 234
5	-1 010	0 350	0.184	0.664	-0.918	0.204	-0.766	1.984	-3 908
6	-0 595	-0 485	0 219	-1 186	-0 926	0 139	0 204	-0 766	1 984
7	1 122	0 539	0 204	1 081	-0 917	-0 249	0.139	0 204	-0.766
8	-1 039	-0 272	0 207	-0 713	-0 921	0 227	-0 249	0 139	0.204
9	0 687	0 250	0 208	0 441	-0 917	-0 149	0 227	-0 249	0 139
10	-0 431	-0 030	0 205	-0.179	-0 918	0 092	-0 149	0 227	-0 248
11	0 175	0 078	0 208	0 061	-0.917	-0 037	0 092	-0 149	0.227
12	-0 064	0 068	0 206	0 040	-0.915	0.013	-0 037	0 092	-0 149
13	-0 038	0 036	0 207	-0 032	-0 915	0 008	0.013	-0.037	0 092
14	0 028	0 077	0 206	0 059	-0 914	-0 007	0.008	0 013	-0 037
15	-0 058	0 042	0 207	-0 017	-0 913	0.012	-0 007	0 008	0 013
16	0 015	0.065	0 206	0 034	-0.912	-0 004	0 012	-0.007	0 008
17	-0 034	0 053	0 206	0 006	-0.911	0 007	-0 004	0 012	-0 007
18	-0 007	0.058	0.206	0 017	-0.910	0 001	0 007	-0 004	0 012
19	-0 018	0 057	0.206	0 016	-0 909	0 004	0 001	0 007	-0 004
20	-0 017	0 056	0 206	0 013	-0.908	0 003	0.004	0 001	0 007
21	-0 014	0 057	0 206	0.017	-0 907	0 003	0 003	0 004	0 001
22	-0 018	0 056	0 206	0 014	-0 906	0 004	0.003	0.003	0 004
23	-0 014	0 057	0 206	0 016	-0 906	0 003	0.004	0 003	0 003
24	-0 017	0 056	0 206	0.015	-0 905	0 003	0 003	0.004	0 003
25	-0 015	0 056	0 206	0 015	-0.904	0.003	0.003	0.003	0 004

TABLE 37

DELAY MULTIPLIERS: EXOGENOUS
VARIABLE - SEAPPI
NON-RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	0.000	0.593	0.867	1.094	0.696	0.691	0.952	0.606	-1.704
1	-4.488	0.649	1.026	1.223	0.761	0.754	1.043	0.659	-4.355
2	-0.272	-0.330	-0.521	-0.621	-0.387	-0.384	-0.530	-0.342	2.212
3	1.040	0.127	0.201	0.240	0.149	0.147	0.204	0.125	-0.853
4	-0.781	-0.034	-0.054	-0.064	-0.040	-0.040	-0.054	-0.039	0.227
5	0.928	-0.023	-0.037	-0.044	-0.027	-0.028	-0.037	-0.028	0.156
6	-0.693	0.041	0.065	0.078	0.048	0.047	0.066	0.037	-0.276
7	0.352	-0.038	-0.060	-0.071	-0.044	-0.045	-0.061	-0.043	0.253
8	-0.136	0.025	0.039	0.047	0.029	0.028	0.040	0.021	-0.166
9	0.036	-0.015	-0.024	-0.029	-0.018	-0.019	-0.025	-0.020	0.104
10	0.025	0.006	0.010	0.012	0.007	0.006	0.010	0.002	-0.041
11	-0.044	-0.002	-0.003	-0.004	-0.003	-0.003	-0.004	-0.007	0.015
12	0.040	-0.001	-0.002	-0.003	-0.002	-0.002	-0.002	-0.006	0.010
13	-0.026	0.001	0.002	0.002	0.001	0.000	0.002	-0.004	-0.007
14	0.016	-0.002	-0.003	-0.004	-0.003	-0.003	-0.003	-0.007	0.014
15	-0.007	0.001	0.001	0.001	0.001	-0.000	0.001	-0.004	-0.003
16	0.002	-0.001	-0.002	-0.002	-0.001	-0.002	-0.002	-0.006	0.008
17	0.002	-0.000	-0.000	-0.001	-0.000	-0.001	-0.000	-0.005	0.002
18	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.005	0.005
19	0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.005	0.004
20	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.005	0.004
21	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.005	0.004
22	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.005	0.004
23	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.005	0.004
24	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.005	0.004
25	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.005	0.004

TABLE 37 (Continued)

	Endogenous Variables								
Lags in Months	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-2.652	0.105	0.578	-0.681	1.453	-1.704	-2.652	0.105	0.504
1	-3.914	0.114	-0.195	-3.278	1.366	-4.355	-3.914	0.114	-0.218
2	1.988	-0.058	0.099	1.665	-0.709	2.212	1.988	-0.058	0.084
3	-0.767	0.022	-0.038	-0.642	0.260	-0.853	-0.767	0.022	-0.022
4	0.204	-0.006	0.010	0.171	-0.082	0.227	0.204	-0.006	0.001
5	0.140	-0.004	0.007	0.117	-0.059	0.156	0.140	-0.004	0.016
6	-0.248	0.007	-0.012	-0.208	0.078	-0.276	-0.248	0.007	-0.018
7	0.227	-0.007	0.012	0.190	-0.090	0.253	0.227	-0.007	0.014
8	-0.149	0.004	-0.007	-0.125	0.043	-0.166	-0.149	0.004	-0.008
9	0.093	-0.003	0.005	0.078	-0.042	0.104	0.093	-0.003	0.005
10	-0.037	0.001	-0.002	-0.031	0.003	-0.041	-0.037	0.001	-0.001
11	0.013	-0.000	0.001	0.011	-0.014	0.015	0.013	-0.000	0.000
12	0.009	-0.000	0.001	0.007	-0.013	0.010	0.009	-0.000	0.001
13	-0.006	0.000	-0.000	-0.005	-0.007	-0.007	-0.006	0.000	-0.000
14	0.013	-0.000	0.001	0.011	-0.014	0.014	0.013	-0.000	0.001
15	-0.003	0.000	0.000	-0.003	-0.008	-0.003	-0.003	0.000	-0.000
16	0.008	-0.000	0.001	0.006	-0.012	0.008	0.008	-0.000	0.001
17	0.002	-0.000	0.000	0.001	-0.010	0.002	0.002	-0.000	0.000
18	0.004	-0.000	0.000	0.003	-0.011	0.005	0.004	-0.000	0.000
19	0.004	-0.000	0.000	0.003	-0.011	0.004	0.004	-0.000	0.000
20	0.003	-0.000	0.000	0.003	-0.011	0.004	0.003	-0.000	0.000
21	0.004	-0.000	0.000	0.003	-0.011	0.004	0.004	-0.000	0.000
22	0.003	-0.000	0.000	0.003	-0.011	0.004	0.003	-0.000	0.000
23	0.004	-0.000	0.000	0.003	-0.011	0.004	0.004	-0.000	0.000
24	0.003	-0.000	0.000	0.003	-0.011	0.004	0.003	-0.000	0.000
25	0.004	-0.000	0.000	0.003	-0.011	0.004	0.004	-0.000	0.000

TABLE 37 (Continued)

Lags in Months	Endogenous Variables Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	2.147	1.477	-0.074	2.828	0.024	0.000	0.000	0.000	0.000
1	3.967	1.389	0.033	3.097	0.189	-0.869	0.731	-0.974	0.255
2	-3.005	-0.720	0.017	-1.573	0.177	0.649	-0.869	0.731	-0.974
3	1.537	0.264	0.033	0.607	0.182	-0.330	0.649	-0.869	0.731
4	-0.597	-0.083	0.023	-0.162	0.180	0.127	-0.330	0.649	-0.869
5	0.168	-0.060	0.032	-0.111	0.179	-0.034	0.127	-0.330	0.649
6	0.099	0.079	0.026	0.197	0.181	-0.023	-0.034	0.127	-0.330
7	-0.186	-0.091	0.029	-0.180	0.179	0.041	-0.023	-0.034	0.127
8	0.173	0.044	0.028	0.118	0.180	-0.038	0.041	-0.023	-0.034
9	-0.114	-0.043	0.028	-0.074	0.179	0.025	-0.038	0.041	-0.023
10	0.072	0.003	0.028	0.029	0.179	-0.015	0.025	-0.038	0.041
11	-0.029	-0.015	0.028	-0.011	0.179	0.006	-0.015	0.025	-0.038
12	0.011	-0.013	0.028	-0.007	0.179	-0.002	0.006	-0.015	0.025
13	0.007	-0.008	0.028	0.005	0.179	-0.001	-0.002	0.006	-0.015
14	-0.004	-0.014	0.028	-0.010	0.178	0.001	-0.001	-0.002	0.006
15	0.010	-0.009	0.028	0.002	0.178	-0.002	0.001	-0.001	-0.002
16	-0.002	-0.012	0.028	-0.006	0.178	0.001	-0.002	0.001	-0.001
17	0.006	-0.010	0.028	-0.001	0.178	-0.001	0.001	-0.002	0.001
18	0.002	-0.011	0.028	-0.003	0.178	-0.000	-0.001	0.001	-0.002
19	0.003	-0.011	0.028	-0.003	0.177	-0.001	-0.000	-0.001	0.001
20	0.003	-0.011	0.028	-0.003	0.177	-0.001	-0.001	-0.000	-0.001
21	0.003	-0.011	0.028	-0.003	0.177	-0.001	-0.001	-0.001	-0.000
22	0.003	-0.011	0.028	-0.003	0.177	-0.001	-0.001	-0.001	-0.001
23	0.003	-0.011	0.028	-0.003	0.177	-0.001	-0.001	-0.001	-0.001
24	0.003	-0.011	0.028	-0.003	0.177	-0.001	-0.001	-0.001	-0.001
25	0.003	-0.011	0.028	-0.003	0.176	-0.001	-0.001	-0.001	-0.001

decreasing levels of adjustment back to equilibrium thereafter. For the majority of the endogenous variables this adjustment is 95 percent complete within seven months. Exceptions exist for the processed sales variables given a change in Seappi, where eight to nine months are required for 95 percent adjustment and for the frozen other processed fish products ending inventory variable, as noted above, where over 25 months is required for adjustment.

The cumulative multipliers for the non-risk model with respect to the Feedp(-5) and Seappi exogenous variables are presented in Tables 38 and 39. Long-run multipliers for Feedp(-5) and Seappi are also included at the bottom of each table to provide a comparison as to where the system is given a sustained exogenous change after 25 months and in long-run equilibrium. Long-run multipliers with respect to all the exogenous and endogenous variables are presented in Table 40.

The major effects of a sustained exogenous change on the system generally occur rather rapidly following the change as an examination of the impact, cumulative and long-run multipliers indicates although, certain exceptions do exist particularly with respect to changes in the price of substitute products variable (Seappi) in the processing sector. The impact of a unit increase in Seappi (a one percent change in the Producer Price Index for finished consumer fish goods) on frozen wholefish and other processed

TABLE 38

CUMULATIVE MULTIPLIERS: EXOGENOUS VARIABLE - FEEDP(-5) NON-RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	82 657	-3.569	-5 644	-6.725	-4.185	-4.169	-5.733	-3.647	23 943
1	109 683	-7 478	-11 825	-14.090	-8 769	-8.719	-12.012	-7 619	50 166
2	111 322	-5 493	-8 687	-10 350	-6 441	-6 418	-8 824	-5.566	36 852
3	105.060	-6 259	-9 898	-11 794	-7 340	-7 314	-10.055	-6.325	41 991
4	109 760	-6 055	-9 576	-11 410	-7 101	-7 083	-9.727	-6 093	40 625
5	104 171	-5.916	-9 356	-11 148	-6.938	-6.925	-9 504	-5.927	39.691
6	108 344	-6 165	-9 749	-11 616	-7.229	-7.220	-9.903	-6 157	41.358
7	106 226	-5 938	-9 391	-11 189	-6 963	-6 962	-9.539	-5 901	39 838
8	107 043	-6 088	-9 627	-11 471	-7 139	-7 141	-9.779	-6 030	40 841
9	106 826	-5 995	-9 481	-11 297	-7 030	-7 038	-9 631	-5 912	40.220
10	106 677	-6 033	-9.540	-11 367	-7 074	-7 087	-9.691	-5 926	40 471
11	106 943	-6 020	-9 519	-11 343	-7 059	-7 077	-9 670	-5 889	40 385
12	106 701	-6 011	-9 506	-11 327	-7 049	-7 073	-9 657	-5.857	40 329
13	106 860	-6 018	-9.517	-11 339	-7 057	-7 086	-9.667	-5.840	40.373
14	106 762	-6 006	-9 497	-11.316	-7.042	-7.076	-9 647	-5.803	40 290
15	106 802	-6 009	-9 503	-11 323	-7 047	-7.086	-9 653	-5.783	40 314
16	106 788	-6 002	-9 491	-11 309	-7 038	-7 082	-9 642	-5 752	40 266
17	106 779	-6 001	-9 489	-11.307	-7.037	-7 086	-9 639	-5.727	40 257
18	106 786	-5 997	-9 484	-11 300	-7 032	-7 087	-9 634	-5.700	40 233
19	106 773	-5 994	-9.478	-11.294	-7 029	-7 088	-9.628	-5 673	40 211
20	106 777	-5.991	-9.474	-11 289	-7 025	-7.090	-9 624	-5 647	40.192
21	106 769	-5 987	-9 468	-11 282	-7 021	-7 091	-9 618	-5 619	40.169
22	106 768	-5 985	-9 464	-11.277	-7 018	-7 093	-9 614	-5 593	40 149
23	106 764	-5.981	-9 459	-11 270	-7 014	-7 095	-9 608	-5.566	40 127
24	106 760	-5 978	-9 454	-11 265	-7.010	-7.096	-9 603	-5 539	40 107
25	106 757	-5 975	-9 449	-11 259	-7.007	-7 098	-9 598	-5 513	40 086
Long-run	84.660	-1.876	-2.966	-3.535	-2 220	-27 483	-3 013	-0 000	12 585

TABLE 38 (Continued)

Lags in Months	Endogenous Variables Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	21 520	-0 624	1 079	18.022	-7.561	23.943	21.520	-0.624	1 828
1	45 089	-1 308	2.256	37.760	-15.797	50.166	45.089	-1.308	3.145
2	33.122	-0 961	1.661	27.738	-11 540	36.852	33.122	-0.961	2 643
3	37.741	-1 095	1 893	31 607	-13.114	41.991	37.741	-1.095	2 778
4	36 513	-1.059	1 833	30.578	-12.633	40.625	36.513	-1.059	2.776
5	35 674	-1.035	1 792	29 875	-12 288	39.691	35.674	-1 035	2 681
6	37 172	-1 078	1 868	31 130	-12.765	41 358	37 172	-1 078	2 792
7	35 806	-1 039	1 802	29 986	-12 235	39 838	35 806	-1 039	2 711
8	36 707	-1 065	1 848	30 741	-12 503	40 841	36 707	-1 065	2.760
9	36 150	-1 049	1 821	30 274	-12 257	40.220	36 150	-1 049	2 735
10	36 375	-1 055	1 834	30 463	-12 287	40.471	36.375	-1 055	2.744
11	36 298	-1 053	1 831	30 398	-12.210	40.385	36.298	-1 053	2 745
12	36 247	-1 051	1 830	30 356	-12 143	40.329	36.247	-1 051	2 741
13	36 287	-1 053	1 834	30.389	-12 108	40.373	36.287	-1.053	2 746
14	36 212	-1 050	1 831	30 326	-12 032	40 290	36 212	-1 050	2 743
15	36 234	-1 051	1 834	30 344	-11 991	40 314	36 234	-1 051	2 745
16	36 191	-1 050	1 833	30 308	-11 926	40 266	36.191	-1.050	2.745
17	36 183	-1 049	1 834	30 302	-11 875	40.257	36 183	-1 049	2.745
18	36.161	-1 049	1 834	30 283	-11 818	40 233	36.161	-1 049	2 746
19	36 141	-1 048	1 834	30 267	-11.762	40 211	36 141	-1 048	2 746
20	36 124	-1 048	1 835	30 253	-11.707	40.192	36 124	-1 048	2 746
21	36 103	-1.047	1 835	30 235	-11 651	40.169	36.103	-1 047	2 746
22	36 086	-1 047	1 836	30.220	-11 596	40.149	36 086	-1 047	2.747
23	36 066	-1 046	1 836	30.204	-11 540	40.127	36 066	-1 046	2 747
24	36 048	-1 046	1 836	30 188	-11.485	40 107	36 048	-1 046	2.747
25	36 029	-1 045	1.837	30.172	-11 429	40.086	36 029	-1 045	2 748
Long-run	11 311	-0.328	7.111	9.473	-0.000	12.585	11 311	-0 328	7 111

TABLE 38 (Continued)

Lags in Months	Endogenous Variables								
	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	0 995	-7 685	0 749	-17 027	-0 123	0 000	0 000	0 000	0 000
1	-22 889	-16 055	0.933	-35 675	-1.098	5 235	-4.402	5 864	-1 535
2	-4 795	-11 729	1 210	-26.207	-2 004	1 326	0.832	1 462	4 330
3	-14 050	-13 329	1 390	-29.861	-2 935	3.311	-3.076	6 697	-0.072
4	-10 452	-12 839	1 628	-28.890	-3 858	2 545	-1 092	2.788	5 162
5	-11 462	-12 489	1 812	-28 225	-4 776	2 748	-1 858	4.773	1 254
6	-12 057	-12.974	2 031	-29 411	-5 702	2 887	-1.654	4 007	3 238
7	-10 935	-12 435	2 235	-28 330	-6 619	2 639	-1.515	4 210	2 472
8	-11 974	-12 707	2 443	-29 043	-7 540	2 865	-1.763	4 350	2 676
9	-11 286	-12 457	2 651	-28 602	-8 457	2 716	-1 537	4 101	2.815
10	-11 717	-12.488	2 856	-28 781	-9 375	2 809	-1.686	4 328	2 566
11	-11.542	-12.410	3 065	-28 719	-10 292	2.771	-1 594	4.178	2 793
12	-11 606	-12 342	3 270	-28 679	-11 207	2 784	-1 631	4 271	2 643
13	-11 644	-12 306	3 478	-28 711	-12 122	2 792	-1 618	4 233	2 736
14	-11 616	-12 229	3 684	-28 652	-13 036	2 786	-1.610	4 246	2 698
15	-11 674	-12 187	3.891	-28 669	-13 948	2 798	-1 617	4 254	2 711
16	-11 659	-12 122	4 097	-28 635	-14 860	2 795	-1.604	4 248	2 720
17	-11 694	-12 069	4 303	-28.628	-15 771	2 802	-1 608	4 260	2 713
18	-11 701	-12 011	4 510	-28 611	-16 682	2 803	-1 601	4 257	2.725
19	-11 719	-11 954	4 716	-28 595	-17 591	2 807	-1 599	4 264	2.722
20	-11 736	-11 899	4 922	-28 582	-18.499	2 810	-1 596	4 265	2 729
21	-11 750	-11 841	5 128	-28 565	-19 406	2 813	-1 592	4 269	2 730
22	-11 768	-11 786	5 334	-28 552	-20 313	2.816	-1.590	4 272	2.734
23	-11 782	-11 729	5 540	-28 536	-21 218	2.819	-1 586	4 275	2 737
24	-11 799	-11 673	5 745	-28 521	-22 123	2 822	-1 583	4 278	2 740
25	-11 814	-11 616	5 951	-28 506	-23 027	2 825	-1 580	4 281	2 744
Long-run	9 473	-0 000	1,008 410	-8 950	-73 835	-1 876	-1 876	-1.876	-1 876

TABLE 39

CUMULATIVE MULTIPLIERS: EXOGENOUS VARIABLE - SEAPPI NON-RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	0 000	0.593	0.867	1.094	0.696	0.691	0.952	0 606	-1.704
1	-4 488	1 242	1 893	2 317	1 457	1 445	1.995	1 265	-6 059
2	-4 761	0 912	1.372	1.696	1 071	1 061	1 465	0.923	-3 847
3	-3 721	1 040	1 573	1 935	1 220	1.208	1 669	1 048	-4 700
4	-4 501	1 006	1 520	1 872	1 180	1 168	1 615	1 009	-4.473
5	-3 573	0 982	1.483	1 828	1.153	1 140	1.578	0 981	-4.317
6	-4 266	1 024	1 548	1 906	1 201	1 188	1 644	1 018	-4 594
7	-3 914	0 986	1 488	1 834	1 157	1.143	1 583	0 975	-4 341
8	-4 050	1 011	1.528	1 881	1.186	1 171	1.623	0 996	-4 507
9	-4 013	0.995	1 503	1 852	1 168	1.153	1.598	0 975	-4 403
10	-3 989	1 001	1.513	1 864	1.175	1 159	1.608	0 977	-4.444
11	-4 033	0 999	1 509	1 859	1 172	1.156	1 605	0.970	-4.429
12	-3 992	0 998	1 507	1 857	1 171	1.153	1 602	0 964	-4 420
13	-4 019	0 999	1 509	1 859	1.172	1 154	1 604	0 960	-4 427
14	-4 002	0 997	1 505	1 855	1 169	1 151	1 600	0 953	-4 412
15	-4 009	0.997	1 506	1 856	1.170	1.151	1 601	0 949	-4.416
16	-4 007	0 996	1 504	1 853	1 169	1 148	1 599	0 943	-4.407
17	-4 005	0.996	1 504	1 853	1.168	1 147	1.599	0 938	-4 405
18	-4 006	0 995	1 503	1 851	1 167	1 146	1 598	0 933	-4 401
19	-4 004	0 994	1 502	1 850	1.167	1.144	1 597	0 928	-4 397
20	-4 004	0 994	1 501	1 849	1 166	1.143	1 596	0 923	-4 393
21	-4 003	0 993	1 500	1 848	1.165	1 142	1 595	0.917	-4 389
22	-4 003	0 993	1 499	1 847	1.165	1.140	1 594	0.912	-4 385
23	-4 002	0 992	1 498	1 846	1.164	1.139	1 593	0.907	-4 381
24	-4 001	0 991	1 497	1 845	1.163	1 138	1 592	0 902	-4 377
25	-4 001	0 991	1 496	1 844	1 163	1 136	1 591	0.897	-4.373
Long-run	-0 337	0 316	0 429	0 573	0 371	3 035	0 508	-0.095	0 153

TABLE 39 (Continued)

Lags in Months	Endogenous Variables Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-2 652	0 105	0 578	-0 681	1 453	-1.704	-2 652	0.105	0 504
1	-6 566	0 219	0 383	-3.959	2 819	-6.059	-6 566	0 219	0 286
2	-4 578	0 161	0 482	-2.294	2.111	-3 847	-4 578	0.161	0 369
3	-5.345	0 183	0 444	-2 936	2 371	-4 700	-5 345	0.183	0 347
4	-5.140	0.177	0 455	-2.765	2 289	-4 473	-5.140	0.177	0.348
5	-5 001	0 173	0 462	-2.648	2 230	-4 317	-5 001	0 173	0.364
6	-5 249	0 180	0 449	-2 856	2 308	-4 594	-5 249	0 180	0 346
7	-5 022	0 174	0 461	-2 666	2 218	-4 341	-5 022	0 174	0 360
8	-5 171	0 178	0 454	-2 791	2 261	-4 507	-5 171	0 178	0 352
9	-5.078	0 175	0 459	-2 713	2.219	-4.403	-5 078	0 175	0 357
10	-5 115	0 176	0.457	-2.744	2.222	-4 444	-5.115	0.176	0.356
11	-5 102	0 176	0 458	-2 732	2 208	-4.429	-5 102	0 176	0 356
12	-5 093	0.176	0 458	-2 725	2 195	-4.420	-5 093	0 176	0 357
13	-5.099	0 176	0 458	-2 730	2 187	-4 427	-5 099	0.176	0.356
14	-5 086	0 176	0 459	-2.719	2 173	-4 412	-5.086	0 176	0.357
15	-5.089	0 176	0 459	-2 722	2 165	-4 416	-5 089	0 176	0.357
16	-5 082	0 176	0 460	-2 716	2.153	-4 407	-5 082	0 176	0 358
17	-5 080	0 175	0 460	-2 714	2 142	-4 405	-5 080	0.175	0 358
18	-5 076	0 175	0 460	-2 711	2 131	-4 401	-5 076	0 175	0 358
19	-5 072	0 175	0 461	-2.708	2 120	-4.397	-5 072	0 175	0 359
20	-5 069	0 175	0 461	-2 705	2 110	-4 393	-5 069	0 175	0 359
21	-5 065	0 175	0 461	-2 702	2 099	-4.389	-5 065	0 175	0 359
22	-5 062	0 175	0 462	-2 699	2 088	-4 385	-5 062	0 175	0 360
23	-5 058	0 175	0 462	-2.696	2.077	-4 381	-5 058	0 175	0 360
24	-5.054	0.175	0 462	-2.693	2 067	-4 377	-5 054	0 175	0 360
25	-5 051	0 175	0.463	-2 690	2 056	-4 373	-5 051	0 175	0 361
Long-run	-0 983	0 057	-0 028	0 717	0.000	0 153	-0 983	0 057	-0 028

TABLE 39 (Continued)

	Endogenous Variables								
Lags in Months	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	2 147	1 477	-0 074	2 828	0.024	0.000	0.000	0 000	0 000
1	6 114	2 866	-0 041	5 925	0.213	-0 869	0 731	-0.974	0 255
2	3 109	2.145	-0 024	4 352	0 390	-0.220	-0 138	-0 243	-0 719
3	4 647	2 409	0 008	4 959	0.572	-0.550	0.511	-1.112	0 012
4	4 050	2 327	0 032	4.797	0.752	-0.423	0.181	-0.463	-0.857
5	4 218	2 267	0 064	4.686	0.931	-0 457	0 308	-0 793	-0 208
6	4 317	2 346	0.091	4 883	1.112	-0.480	0 274	-0 666	-0 538
7	4 131	2 255	0.119	4 703	1 291	-0 439	0 251	-0 700	-0 411
8	4 304	2.298	0 148	4 821	1 471	-0 477	0 292	-0 723	-0 445
9	4 190	2 255	0 175	4 747	1.650	-0 452	0 255	-0 682	-0 468
10	4 262	2.258	0.204	4 777	1.829	-0.467	0.279	-0.719	-0 427
11	4 233	2 244	0 232	4 766	2 008	-0.461	0 264	-0 695	-0 464
12	4 244	2 231	0.260	4 759	2.186	-0 463	0.270	-0 710	-0.440
13	4 251	2 223	0 288	4 764	2 365	-0 465	0.268	-0 704	-0 455
14	4 247	2 209	0 316	4 754	2 543	-0.464	0 266	-0 706	-0 449
15	4 257	2 200	0 344	4 756	2.722	-0.466	0 267	-0 708	-0 451
16	4 255	2 188	0 372	4 750	2 900	-0 465	0.265	-0 707	-0 453
17	4 261	2 178	0 400	4 749	3 077	-0 467	0 266	-0 709	-0 452
18	4 262	2 166	0 428	4 746	3 255	-0 467	0 265	-0 708	-0 454
19	4 266	2 155	0.456	4 743	3.433	-0.468	0 264	-0 709	-0 453
20	4 269	2 144	0 483	4 740	3 610	-0 468	0 264	-0 710	-0 455
21	4 272	2 133	0 511	4 737	3 787	-0 469	0 263	-0 710	-0 455
22	4 275	2 122	0 539	4 734	3.964	-0.469	0 262	-0.711	-0 455
23	4 278	2 111	0 567	4.732	4 141	-0 470	0.262	-0 712	-0.456
24	4 281	2 101	0 594	4.729	4.317	-0.471	0 261	-0 712	-0 457
25	4 284	2 090	0 622	4 726	4 494	-0 471	0 261	-0 713	-0.457
Long-run	0 717	0 000	-106 298	1 508	16.100	0 316	0 316	0 316	0 316

TABLE 40

LONG-RUN MULTIPLIERS
NON-RISK MODEL

Endogenous	Predetermined Variables											
Variables	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2	Shift3	Shift4	Shift5	Seappi
Livwts	14 398	2 196	-0 225	-0.034	0 029	84 660	5.352	-0.182	-0.014	-0.000	-0.000	-0 337
Farmp0	0 347	-0.006	-0 009	0 032	-0 027	-1 876	-0.119	0.170	0.013	0.000	0.000	0.316
Fhwp	1 084	-0 017	-0 011	0 050	-0 048	-2 966	-0 188	0.269	0 020	0.000	0.000	0.429
Fhfp	2 037	-0 012	-0 014	0 061	-0 062	-3 535	-0.223	0 289	0.024	0 000	0 000	0 573
Fhop	1 203	0 006	-0 010	0 040	-0 029	-2 200	-0.139	0 200	0 232	0 000	0.000	0.371
Fnwp	-1 624	-0 207	0 116	0 271	-0 452	-27 483	-1 737	0 059	0 004	-0.000	0 000	3.035
Fnfp	2 056	-0 006	-0 015	0 056	-0 056	-3 013	-0.191	0 274	0 020	0 000	0 000	0 508
Fnop	1 265	-0.056	0 035	0 099	0 004	-0 000	-0.000	0 000	0 000	0.000	-0 138	-0 095
Fhws	2 456	0 388	-0 039	0 071	0 077	12 585	0.796	-1.143	-0.085	-0 000	-0 000	0 153
Fhfs	2 031	0 205	-0 079	0.000	0.058	11 311	0.715	0.298	-0.076	-0 000	-0.000	-0 983
Fhos	0 355	0 022	0 000	0.004	0 018	-0 328	-0 021	0 030	0 232	0 000	0 000	0 057
Fnws	1 209	0 184	-0 019	-0 003	0 002	7 111	0 450	-0 015	-0 001	0 000	-0 000	-0 028
Fnfs	0 975	0 267	0 028	0 004	-0 210	9 473	0 599	0 389	-0 064	-0 000	-0 000	0 717
Fnos	-0 000	0 000	-0 000	-0 000	-0 000	-0 000	-0 000	0 000	0 000	0.000	0 000	0 000
Profhw	2 416	0 388	-0 039	-0 029	0 217	12.585	0 796	-1 143	-0 085	-0 000	-0 000	0 153
Profhf	2 031	0 205	-0 079	0 000	0 058	11 311	0.715	0 298	-0 076	-0 000	-0 000	-0 983
Profho	0 355	0 022	0 000	0 004	0 018	-0 328	-0 021	0 030	0 232	0 000	0 000	0 057
Profnw	1 209	0 184	-0 019	-0 003	0 002	7 111	0 450	-0 015	-0.001	0 000	-0 000	-0 028
Profnf	0 975	0 267	0 028	0 004	-0 210	9 473	0 599	0 389	-0 064	-0 000	-0 000	0.717
Profno	-0 000	0 000	-0 000	-0 000	-0.000	-0 000	-0 000	0 000	0 000	0 000	0 000	0 000
Fnwei	114 254	8 065	-5 041	-9 187	16 390	1,008.410	63 753	5 542	0.411	2.411	0 000	-106 298
Fnfei	0.720	-0.108	-0 011	0 033	0 230	-8.950	-0.566	0 813	0 060	0 000	0 000	1 508
Fnoei	7 889	1 991	-1 707	-2 420	-1 508	-73.835	-4 668	6 705	0.498	0.000	13 363	16 100
Farmp1	0 347	-0 006	-0 009	0 032	-0 027	-1 876	-0 119	0 170	0 013	0 000	0 000	0 316
Farmp2	0 347	-0 006	-0 009	0 032	-0 027	-1 876	-0 119	0.170	0 013	0 000	0 000	0 316
Farmp3	0 347	-0 006	-0 009	0.032	-0 027	-1 876	-0 119	0.170	0 013	0 000	0 000	0 316
Farmp4	0 347	-0 006	-0 009	0.032	-0 027	-1 876	-0.119	0.170	0 013	0 000	0 000	0 316

products ending inventories (Fnwei and Fnoei) is initially a -0.0007 and 0.0002 unit change in Fnwei and Fnoei respectively. In the long-run a unit increase in Seappi causes Fnwei to decrease by 1.063 units while Fnoei increases by 0.161 units.

The initial and first period following a sustained change in the Producer Price Index for finished fish products (Seappi) show relatively large adjustments in the endogenous variables past the new long-term equilibrium levels as indicated by the long-run multipliers. Exceptions to this exist for the frozen whole fish sales, price, production and ending inventory variables. These variables do not incur the initial over adjustment given a sustained exogenous change but rather, move directly toward their new equilibrium levels. Following these initial and first period over corrections the model the adjusts slowly to its new level of equilibrium. All the endogenous variables take over 25 months to complete 95 percent of the adjustment to new equilibrium.

The impact and long-run multipliers for the non-risk model are presented as elasticities about the means of the sample data used in the estimation of the non-risk model in Tables 41 and 42. In general the impact elasticities are less than one implying a relatively fixed system initially. The long-run elasticities also are generally less than one with the exception of the frozen ending inventory

TABLE 41

IMPACT ELASTICITIES NON-RISK MODEL

Endogenous Variables	Predetermined Variables											
	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2	Shift3	Shift4	Shift5	Seappi
Livwts	0.602	0.000	0.000	0.000	0.000	0.268	0.161	0.000	0.000	0.000	0.000	0.000
Farmp0	0.573	0.000	0.000	0.003	0.000	-0.405	-0.243	0.229	0.010	-0.001	0.074	1.245
Fhwp	0.760	0.000	0.000	0.002	0.000	-0.292	-0.175	0.165	0.007	-0.001	0.053	0.829
Fhfp	0.807	0.000	0.000	0.001	0.000	-0.202	-0.121	0.107	0.005	-0.000	0.037	0.607
Fhop	0.750	0.000	0.000	0.001	0.000	-0.197	-0.118	0.111	0.046	-0.000	0.036	0.607
Fnwp	0.791	0.000	0.000	0.001	0.000	-0.202	-0.121	0.113	0.005	0.018	0.037	0.618
Fnfp	0.817	0.000	0.000	0.001	0.000	-0.174	-0.104	0.098	0.004	-0.000	0.032	0.534
Fnop	0.780	0.000	0.000	0.001	0.000	-0.148	-0.089	0.084	0.004	-0.000	0.110	0.456
Fhws	0.606	0.000	-0.000	0.002	0.000	0.552	0.331	-0.312	-0.013	0.001	-0.101	-0.727
Fhfs	0.842	0.000	0.000	0.001	0.000	0.848	0.508	-0.107	-0.020	0.001	-0.155	-1.932
Fhos	0.740	0.000	0.000	0.000	0.000	-0.101	-0.060	0.057	0.152	-0.000	0.018	0.314
Fnws	0.305	0.000	-0.000	0.003	0.000	0.058	0.035	-0.033	-0.001	-0.005	-0.011	0.574
Fnfs	0.211	0.000	-0.000	0.001	0.000	0.433	0.260	-0.031	-0.010	0.001	-0.079	-0.303
Fnos	0.279	0.000	0.001	-0.005	0.000	-0.311	-0.187	0.176	0.007	-0.001	0.345	1.107
Profhw	0.594	0.000	-0.000	0.000	0.000	0.552	0.331	-0.312	-0.013	0.001	-0.101	-0.727
Profhf	0.841	0.000	0.000	0.001	0.000	0.847	0.507	-0.107	-0.020	0.001	-0.154	-1.930
Profho	0.736	0.000	0.000	0.000	0.000	-0.100	-0.060	0.057	0.151	-0.000	0.018	0.313
Profnw	0.366	0.000	-0.000	0.002	0.000	0.096	0.058	-0.028	-0.001	-0.004	-0.009	0.492
Profnf	0.504	0.000	-0.000	0.001	0.000	0.024	0.014	0.199	-0.001	0.000	-0.004	0.949
Profno	0.280	0.000	0.001	-0.005	0.000	-0.312	-0.187	0.176	0.007	-0.001	0.346	1.110
Fnwei	0.068	0.000	0.000	-0.000	0.000	0.041	0.024	0.004	0.000	0.001	0.001	-0.074
Fnfei	0.408	0.000	0.000	0.000	0.000	-0.564	-0.338	0.318	0.013	-0.001	0.103	1.734
Fnoei	0.006	0.000	0.000	-0.000	0.000	-0.007	-0.004	0.004	0.000	-0.000	0.007	0.024

TABLE 42

LONG-RUN ELASTICITIES
NON-RISK MODEL

Endogenous	Predetermined Variables											
Variables	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2	Shift3	Shift4	Shift5	Seappi
Livwts	0.586	0.000	0.000	-0.000	0.000	0.275	0.165	-0.004	-0.000	-0.000	-0.000	-0.020
Farmp0	0.495	0.000	0.000	0.003	0.000	-0.213	-0.128	0.138	0.006	0.000	0.000	0.664
Fhwp	0.704	0.000	0.000	0.002	0.000	-0.153	-0.092	0.099	0.004	0.000	0.000	0.411
Fhfp	0.768	0.000	0.000	0.002	0.000	-0.106	-0.064	0.062	0.003	0.000	0.000	0.318
Fhop	0.713	0.000	0.000	0.002	0.000	-0.104	-0.062	0.067	0.044	0.000	0.000	0.324
Fnwp	-0.986	0.000	-0.001	0.012	0.000	-1.328	-0.796	0.020	0.001	0.000	0.000	2.713
Fnfp	0.783	0.000	0.000	0.002	0.000	-0.091	-0.055	0.059	0.002	0.000	0.000	0.285
Fnop	0.647	0.000	-0.000	0.004	0.000	-0.000	-0.000	0.000	0.000	0.000	-0.054	-0.072
Fhws	0.712	0.000	0.000	0.001	0.000	0.290	0.174	-0.187	-0.008	-0.000	-0.000	0.065
Fhfs	1.005	0.000	0.001	0.000	0.000	0.446	0.267	0.084	-0.012	-0.000	-0.000	-0.716
Fhos	0.721	0.000	-0.000	0.001	0.000	-0.053	-0.032	0.034	0.151	0.000	0.000	0.170
Fnws	0.816	0.000	0.000	-0.000	0.000	0.382	0.229	-0.006	-0.000	0.000	-0.000	-0.028
Fnfs	0.294	0.000	-0.000	0.000	0.000	0.228	0.136	0.067	-0.006	-0.000	-0.000	0.319
Fnos	-0.000	0.000	0.000	-0.000	0.000	-0.000	-0.000	0.000	0.000	0.000	0.000	0.000
Profhw	0.700	0.000	0.000	-0.001	0.000	0.290	0.174	-0.187	-0.008	-0.000	-0.000	0.065
Profhf	1.004	0.000	0.001	0.000	0.000	0.445	0.267	0.083	-0.012	-0.000	-0.000	-0.716
Profho	0.716	0.000	-0.000	0.001	0.000	-0.053	-0.032	0.034	0.150	0.000	0.000	0.169
Profnw	0.801	0.000	0.000	-0.000	0.000	0.375	0.225	-0.006	-0.000	0.000	-0.000	-0.028
Profnf	0.293	0.000	-0.000	0.000	0.000	0.226	0.136	0.066	-0.006	-0.000	-0.000	0.317
Profno	-0.000	0.000	0.000	-0.000	0.000	-0.000	-0.000	0.000	0.000	0.000	0.000	0.000
Fnwei	77.581	0.000	0.065	-0.439	0.000	54.505	32.671	2.130	0.090	0.803	0.000	-106.269
Fnfei	0.300	0.000	0.000	0.001	0.000	-0.297	-0.178	0.192	0.008	0.000	0.000	0.924
Fnoei	5.420	0.000	0.022	-0.117	0.000	-4.038	-2.420	2.607	0.110	0.000	7.102	16.286

elasticities. Frozen inventories tend to be quite responsive to change, particularly with respect to changes in Seappi.

Changes in the Producer Price Index for other processed fish products cause the greatest change in system prices and in turn may have the greatest effect on the margins between the producer price and the prices of processed products. The impact elasticity of the difference between an individual processed product price (Fhwp, Fhfp, Fhop, Fnwp, Fnfp, Fnop) and the price paid to producers for live fish (Farmp(0)) (at the means of the data series) with respect to Seappi ranges from a low of 1.524 for (Fnop - Farmp(0)) to a high of 48.111 for (Fhwp - Farmp(0)). This implies that as Seappi increases and the demand for processed catfish shifts outward, the increase in prices paid to processors is not passed on to producers ceteris paribus and the margin between producer and processor prices increases. In turn, a decrease in demand due to a fall in Seappi lowers the prices processors receive for processed fish. This decrease in price is not passed on to the producers ceteris paribus and the margin between producer and processor prices decreases.

For a change in Feedp(-5) recall that a positive coefficient was estimated for the Feedp(-5) variable in the Livwts equation of the non-risk model, opposite of that hypothesized. This leads to a negative relationship between feed prices and producer and processor prices, opposite of that hypothesized. Thus, conclusions from comparing price elasticities between the producer and processor levels would be incorrect. However, in comparing the magnitude of the price elasticities generated from a change in Seappi and those from a change in Feedp(-5) it may be assumed that changes in Seappi have a much larger affect on the price margins between the producer and processor levels of the system than do changes in Feedp(-5).

It was noted above that the eight basic eigenvalues associated with the risk model are identical regardless of the status of Oprisk. Additionally, the absolute value of the real component of one of the risk model eigenvalues is greater than one in magnitude which implies that the model is diverging. The exponential structures of the risk model eigenvalues are characterized in Table 43.

Eigenvalue 1 (Table 30) is the dominate eigenvalue of the risk model and also causes the non-stability in the system. As indicated in Table 43, the power structure of value 1 increases in a saw-tooth manner. The real component of eigenvalue 1 is greater than but near one in absolute value. This fact implies that the divergence of the exponential structure of the value will be slower relatively, compared to an eigenvalue with a larger real component. Additionally, this divergence with respect to the system is dampened, at least in the short-run, as a result of the convergent properties of the other eigenvalues. As column ten of Table 43 and Figure 18 indicate, the sum of the non-trivial eigenvalue power structures for the risk model is relatively stable over the short-run (12 to 18 months) given a one-time exogenous change. Table 44 and Figure 19 show the cumulative effect or summation of the non-trivial eigenvalue power structures and the total cumulative effect respectively for the risk model given a sustained exogenous change. The total cumulative impact of a sustained exogenous change appears to be basically the same for the non-risk and risk models as depicted in Figures 17 and 19. Two exceptions hold however, first, the saw-toothed structure of the dominate eigenvalue in the risk model is apparent in Figure 19 as compared to the smooth structure of the dominate eigenvalues in the non-risk model as shown in Figure 17. Second, while the total cumulative affect of a sustained exogenous change in the non-risk model culminates in the asymptotic movement of the system to a new equilibrium, the same change causes an exponentially increasing, diverging movement of the system in the risk model.

The divergent structure of the risk model suggests that the risk model would be inappropriate for long-term forecasting and indeed, long-term multipliers and elasticities are not available due to the structure of the risk model (see Appendix A and the definition of long-run

TABLE 43

NON-TRIVIAL EIGENVALUE POWER STRUCTURE
REAL COMPONENT: RISK MODEL

Power	Γ^{s}_{1}	Γ^{s}_{2}	Γ^{s}_{3}	Γ^{s}_{23}	Γ^{s}_{24}	Γ^{s}_{25}	Γ^{s}_{26}	Γ^{s}_{27}	Sum
0	1	1	1	1	1	1	1	1	27
1	-1 045	-0 390	-0 390	0 000	0.635	0 635	0.999	0.999	1.442
2	1.092	-0 527	-0.527	4E-12	0 136	0.136	0.998	0.998	2.307
3	-1.141	0.737	0 737	9E-18	-0.252	-0.252	0.998	0.998	1.823
4	1 193	-0 136	-0.136	2E-23	-0.411	-0 411	0.997	0.997	2.090
5	-1 247	-0.506	-0.506	4E-29	-0.353	-0.353	0.996	0.996	-0.976
6	1 304	0 510	0 510	9E-35	-0.173	-0 173	0 995	0.995	3 968
7	-1 362	0.023	0 023	2E-40	0.0171	0.017	0.994	0.994	0 708
8	1 424	-0 442	-0 442	4E-46	0.138	0 138	0.994	0 993	2.802
9	-1.488	0 326	0 326	8E-52	0 163	0 163	0 993	0.993	1.477
10	1 556	0 114	0.114	2E-57	0 115	0.115	0 992	0 992	3 998
11	-1 626	-0 360	-0 360	4E-63	0.037	0.037	0 991	0.991	-0.291
12	1 700	0 187	0 187	8E-69	-0 030	-0 030	0 991	0 991	3 994
13	-1 776	0 154	0 154	2E-74	-0 063	-0 063	0 990	0.990	0.384
14	1 857	-0 275	-0.275	3E-80	-0 059	-0.059	0 989	0 989	3.163
15	-1 940	0 087	0 087	7E-86	-0 033	-0.033	0 988	0 988	0.143
16	2 028	0 161	0 161	2E-91	-0 002	-0.002	0 987	0 987	4 321
17	-2 120	-0 198	-0 198	3E-97	0 019	0.019	0 987	0 987	-0 506
18	2 216	0 021	0.021	0.000	0.026	0 026	0.986	0 986	4 282
19	-2 316	0 149	0.149	0 000	0 020	0 020	0 985	0.985	-0.007
20	2 421	-0 134	-0 134	0 000	0 008	0 008	0 984	0.984	4 138
21	-2 530	-0 019	-0 019	0.000	-0 003	-0.003	0 984	0 984	-0 608
22	2 645	0 127	0 127	0 000	-0 009	-0 009	0.983	0 983	4 845
23	-2 764	-0 082	-0 082	0.000	-0.009	-0 009	0.982	0 982	-0.986
24	2.889	-0 040	-0 040	0 000	-0 006	-0 006	0 981	0 981	4 757
25	-3 019	0.101	0 101	0 000	-0 001	-0.001	0 980	0.980	-0.860

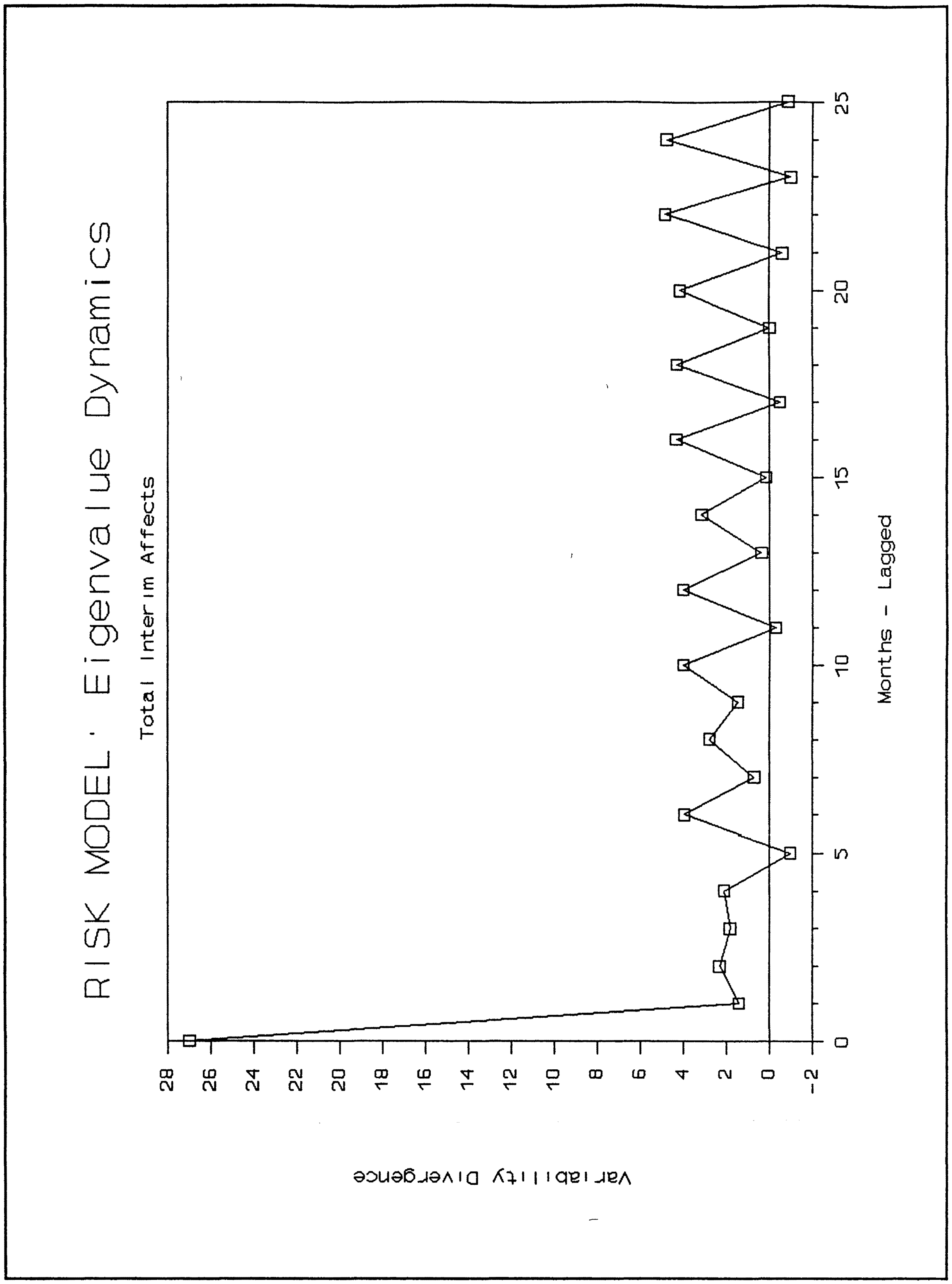

Figure 18. Risk Model: Interim Affects

TABLE 44

SUMMATION OF THE NON-TRIVIAL EIGENVALUE POWER STRUCTURE REAL COMPONENT: RISK MODEL

Power	r^{s}_{1}	r^{s}_{2}	r^{s}_{3}	r^{s}_{23}	r^{s}_{24}	r^{s}_{25}	r^{s}_{26}	r^{s}_{27}	Sum
0	1	1	1	1	1	1	1	1	27
1	-0.045	0.609	0.609	1.000	1.635	1.635	1.999	1.999	28.442
2	1.047	0.082	0.082	1.000	1.771	1.771	2.998	2.998	30.748
3	-0.095	0.819	0.819	1.000	1.518	1.518	3.995	3.995	32.571
4	1.099	0.682	0.682	1.000	1.106	1.106	4.992	4.992	34.660
5	-0.149	0.176	0.176	1.000	0.753	0.753	5.988	5.988	33.684
6	1.155	0.685	0.685	1.000	0.580	0.580	6.983	6.983	37.652
7	-0.207	0.709	0.709	1.000	0.597	0.597	7.978	7.978	38.360
8	1.217	0.266	0.266	1.000	0.735	0.735	8.972	8.972	41.161
9	-0.272	0.593	0.593	1.000	0.898	0.898	9.964	9.964	42.638
10	1.284	0.706	0.706	1.000	1.013	1.013	10.957	10.957	46.635
11	-0.342	0.346	0.346	1.000	1.050	1.050	11.948	11.948	46.345
12	1.358	0.533	0.533	1.000	1.019	1.019	12.938	12.938	50.339
13	-0.419	0.687	0.687	1.000	0.956	0.956	13.928	13.928	50.723
	1.438	0.411	0.411	1.000	0.896	0.896	14.917	14.917	53.886
	-0.503	0.498	0.498	1.000	0.862	0.862	15.905	15.905	54.029
16	1.526	0.660	0.660	1.000	0.860	0.860	16.893	16.893	58.350
17	-0.595	0.461	0.461	1.000	0.879	0.879	17.879	17.879	57.844
18	1.621	0.482	0.482	1.000	0.905	0.905	18.865	18.865	62.126
19	-0.695	0.631	0.631	1.000	0.926	0.926	19.850	19.850	62.119
20	1.726	0.497	0.497	1.000	0.934	0.934	20.835	20.835	66.257
21	-0.804	0.477	0.477	1.000	0.931	0.931	21.818	21.818	65.648
22	1.840	0.604	0.604	1.000	0.921	0.921	22.801	22.801	70.493
23	-0.924	0.521	0.521	1.000	0.911	0.911	23.783	23.783	69.507
24	1.965	0.480	0.480	1.000	0.905	0.905	24.764	24.764	74.264
25	-1.054	0.581	0.581	1.000	0.904	0.904	25.744	25.744	73.404

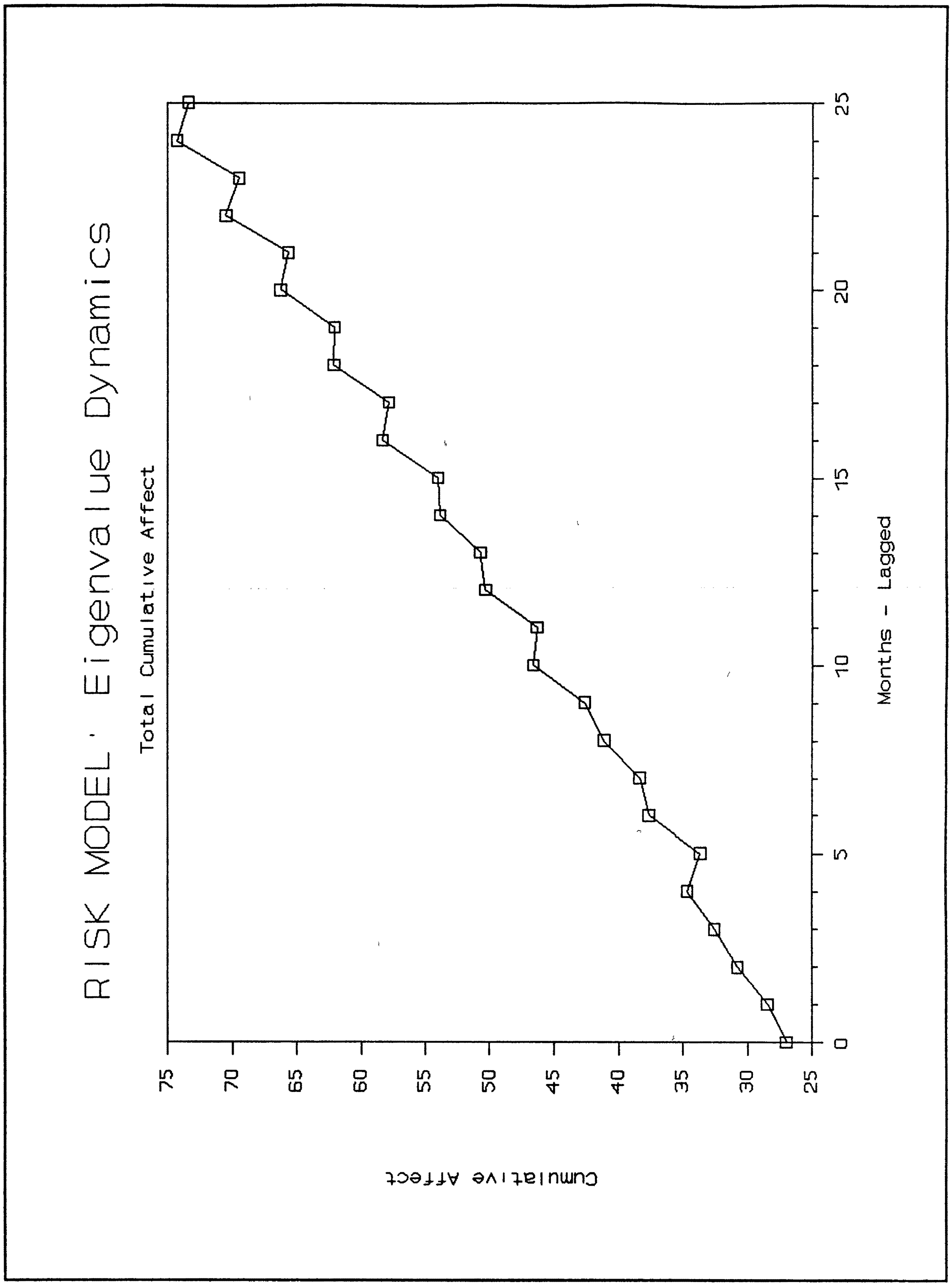

Figure 19. Risk Model: Cumulative Affects

multipliers above). However, short-run forecasts could be made. The usefulness of such forecasts will depend upon forecaster discretion and needs as to length of forecast and accuracy.

The impact multipliers and elasticities for the risk model along with delay and cumulative elasticities representing changes in the Feedp(-5), Seappi, Yrisk, and Searsk exogenous variables are presented in Tables 45 through 54 in Appendix B. Results from a change in the Iprisk variable were negligible and so not presented.

The impact multipliers indicate that the risk associated with the Producer Price Index for finished fish products (Searsk) has the greatest unit effect on the endogenous variables of the risk model with the exception of Livwts variable which is effected more initially by production risk (Yrisk) rather than processors competitive price risk. With respect to the non-risk exogenous variables, Seappi had the largest effect on the endogenous variables of the risk model.

In terms of elasticities, exogenous change in the risk model yields relatively little change in the endogenous variables of the system as represented by the impact elasticities of less than one in magnitude. The only exception is a change in Seappi in the processing sector. A change in Seappi causes an impact response of greater than one in the price received by producers for live fish

(Farmp0), fresh filleted fish sales and production (Fhfs and Profhf) and frozen filleted fish ending inventory (Fnfei).

The delay elasticities are generally less than one for the risk model with the exception of those associated with the Seappi variable. This is in the short run of course. In the long run, all elasticities increase in magnitude as the system diverges. The delay elasticities with respect to Seappi for the price received by producers for live fish (Farmp0), the fresh wholefish and filleted fish sales and production (Fhws, Fhfs and Profhw, Profhf) and the frozen filleted fish sales and production (Fnfs and Profnf) variables increase to greater than one during the 25 month lag period depicted in the delay elasticities tables.

The cumulative elasticities are again generally less than one in magnitude for the risk model. The saw-toothed dynamic structure of the system given an exogenous change tends to dampen the explosive nature of the cumulative elasticities initially even with respect to the Seappi variable.

Inspection of the delay and cumulative elasticities table indicates a basic parabolic movement in the structure of the risk model given an exogenous change. The converging properties of the non-dominate eigenvalues initially outweigh the diverging property of the dominate eigenvalue. This causes an initial decrease in the lagged effects of an exogenous change to the system following first impact. As

the non-dominate eigenvalues exponential structures go to zero, the dominate eigenvalues power structure begins to take over and the system diverges. This initial decrease in lagged effect lasts from six to eighteen depending upon the exogenous and endogenous variable in question. As mentioned above, the divergent structure of the risk model suggests that the risk model would be inappropriate for long-term forecasting. However, short-run forecasts can be made that may be of use to the forecaster depending upon use and need of accuracy.

Comparing the producer and processor price elasticities with respect to changes in the price paid by producers for feed and the Producer Price Index for other processed fish products in the risk model yields the same conclusions with respect to Feedp(-5) and Seappi as were assumed for the non-risk model. Changes in Seappi have a greater effect on system prices than do changes in Feedp(-5) and in turn have a greater effect on the margins between the producer price and the prices of processed products. The impact elasticities of difference between the processor prices for processed fish products (Fhwp, Fhfp, Fhop, Fnwp, Fnfp, Fnop) and the price paid to producers for live fish (Farmp(0)) with respect to Seappi ranges from a low of 2.223 for (Fnop - Farmp(0)) to a high of 45.761 for (Fhwp - Farmp(0)), results similar to those yielded by the non-risk model. This implies that as Seappi increases and the demand for

processed catfish shifts outward, the increase in prices paid to processors is not passed on to producers ceteris paribus and the margin between producer and processor prices increases. In turn, a decrease in demand due to a fall in Seappi lowers the prices paid to processors. This decrease in price is not passed on to the producers ceteris paribus and the margin between producer and processor prices decreases.

For a change in Feedp(-5) the impact elasticities of the differences between processor prices and Farmp(0) with respect to Feedp(-5) range from a low of 0.000 for (Fnop - Farmp(0)) to a high of 0.006 for (Fhwp - Farmp(0)). This implies that as input prices paid by the producers rise ceteris paribus, this additional cost is passed from the producer to the processor. At this point the processor passes relatively more of the cost increase on to the wholesaler and the price margin between the processor and producer widens. Conversely, if Feedp(-5) falls the producer price falls relatively less than processor prices ceteris paribus and the margin between the producer and processor prices decreases. In this case the producer passes the benefits from lower input prices on to the processor who passes them on to the wholesaler. In conclusion, as predetermined price variables increase, processor prices increase relative to producer prices and the price margins between the two sectors widens. As

predetermined price variables decrease, processor prices decrease relative to producer prices and the price margins between the two sectors narrows.

CHAPTER VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Rapid and at times imbalanced expansion describe the growth that has occurred in catfish production and marketing in the United States during the past ten years. Successes in the system have sparked increased public and private interest and in turn the need for additional information pertaining to all phases of the catfish marketing system. Published research has focused on industry description, production practices and cost budgeting. Empirical work with respect to the estimation of basic economic parameters has centered on aggregate demand estimation in a limited scope. Supply response parameters are not available. This lack of a system-wide analysis of the economic relationships within the catfish industry has provided the motivation for the research reported in this dissertation. To this end, the objectives were:

1. To determine the price and quantity interrelationships between live-fish at the producer level of the system and the six basic processed fish products that are produced and marketed at the processor level;

2. To evaluate the sources, influences and impact of the omission of yield and price risk on short-run supply at the producer level and on monthly sales volume of the six processed fish products produced by processors; and

3. To evaluate the dynamics and sensitivity of the relationships within the system to change. In particular, with respect to changes in the price paid by producers for feed, changes in the price of substitutes in the processing sector and in the level of price variability at both the farm and processing levels.

To meet these objectives, a simultaneous equations model containing sixteen behavioral and seven identity equations was hypothesized and estimated using a non-linear three stage least squares technique. The model contained equations detailing the harvesting and pricing relationships at the producer level of the catfish marketing system as well as equations representing the production, sales, ending inventory and pricing relationships that occur with respect to the six basic processed fish products that are produced and marketed at the processing level of the system. The model was expanded to incorporate the influences of various types of aggregate risk following initial estimation. Risk hypothesized to be associated with the catfish marketing system included production, input and output price risk at the producer level and substitute price risk at the processing level. The period of estimation for the model was February 1986 to June 1990.

Conclusions

With respect to the first objective, the signs of the estimated coefficients of the individual equations generally coincide with those hypothesized and a high level of significance was achieved as indicated by the relative size of the estimated coefficients with respect to their standard errors. Overall the estimated equations fit the data well. Ex post simulation indicated that the risk model generally fits the historical data better than the non-risk model however, the risk model did have problems simulating during periods of rapid change in the risk variables. This was particularly true during an increase in feed prices that occurred in 1987 and early 1988. Unrealistic values were forecasted for the endogenous variables for the entire risk model and these inaccurate forecasts resulted in poor statistics of fit for some of the hypothesized equations.

With respect to the second objective, the estimated production and output price risk coefficients at the producer level yielded signs as hypothesized and were shown to be large relative to their standard errors. The input price risk variable yielded an insignificant sign opposite of that hypothesized. One possible reason for this lack of significance may be the relative lack of input price risk, as defined, that occurred during the period of estimation.

Dynamic and sensitivity analyses of the non-risk and risk models were made to meet the third objective. Results indicate that the non-risk model is an oscillating, stable model in light of exogenous change while the risk model oscillating and unstable. While ultimately unstable, the risk model was shown to be relatively slow in its divergence, at least in the short term (six to eighteen months), due to an interaction of all the dynamic properties inherent in the model. While inappropriate for long-term forecasting, the short-run characteristics of the risk model may allow the use of the model for forecasting depending upon purpose and need of accuracy.

One time only changes in the lagged price paid by producers for feed (Feedp(-5)) and other competitive prices in the processing sector (Seappi) had the greatest impact and delayed effects on the non-risk model endogenous variables. Delay effects were relatively short in duration. For the non-risk model, a one-time change in the Seappi variable displays the bulk of its impact in the initial period of change with decreasing levels of adjustment back to equilibrium there after. For the majority of the endogenous variables this adjustment is 95 percent complete within seven months. Exceptions exist for the processed sales variables given a change in Seappi, where eight to nine months are required for 95 percent adjustment and for the frozen other processed fish products ending inventory

variable where over 25 months is required for adjustment. Major effects from a sustained exogenous change in the non-risk model are felt in the system quickly also. In general the impact elasticities of the non-risk model are less than one in magnitude. The long-run elasticities are also generally less than one in magnitude with the exception of the frozen inventory elasticities with respect to other competitive prices in the processing sector (Seappi). The initial and first period following a sustained change in the Feedp(-5) or Seappi exogenous variables show relatively large adjustments in the endogenous variables past their new long-term equilibrium levels as indicated by the long-run multipliers. Exceptions to this exist for the frozen whole fish sales, price, production and ending inventory variables. These variables do not incur the initial over adjustment given a sustained exogenous change but rather, move directly toward their new equilibrium levels. All the endogenous variables take over 25 periods to complete 95 percent of the adjustment to new equilibrium.

In comparing producer and processor price elasticities with respect to changes in the Producer Price Index for other processed fish products it is evident that as Seappi increases and the demand for processed catfish shifts outward, the increase in prices paid to processors is not passed on to producers ceteris paribus and the margin between producer and processor prices increases. In turn, a

decrease in demand due to a fall in Seappi lowers the prices processors receive for processed fish. This decrease in price is not passed on to the producers ceteris paribus and the margin between producers and processor prices decreases.

One time unit changes in the Producer Price Index for finished fish products risk variable (Searsk) created the greatest unit changes in the endogenous variables of the risk model among the risk variables. With respect to the non-risk exogenous variables, Seappi had the largest effect on the endogenous variables of the risk model.

Endogenous impact and delayed change were generally small with impact and delay elasticities of less than one in magnitude with the exception of change caused by the other competitive prices variable (Seappi).

Comparing the producer and processor price elasticities with respect to changes in the price paid by producers for feed and the Producer Price Index for other processed fish products in the risk model yields the same results as those from the non-risk model. Changes in Seappi have a greater effect on system prices than do changes in Feedp(-5) and in turn a greater effect on the margins between the producer price and the prices of processed catfish products.

Limitation to the Analysis

The recent development of the U.S. catfish marketing system into a domestic-production based industry along with

changes in consumer demands have given rise to a major limitation with respect to this analysis. The newness of the industry results in a limited amount of available data for analysis. While records of production-level output, prices and aggregate processor sales data have been maintained since the early 1970's, disaggregate processor data has only been available since 1986. Data with respect to capital invested (pond acreage), production losses (disease and predators) and processed product exports is just beginning to be collected and disseminated.

Instability exists in the young industry, particularly at the processing level. This instability is caused by changing demand exhibited by the consumers of processed catfish and a changing structure of the processing sector. The current trend in consumer demand appears to be away from fresh wholefish to frozen filleted fish and value-added products represented by the other products category of processed fish. Lack of disaggregate data with respect to consumer demand in conjunction with a limited period of available data lessens the level of significance associated with any behavioral relationships derived from the analysis.

Recommendations

This analysis of the economic relationships in the U.S. catfish marketing system should provide a benchmark for future analysis of the system. These relationships must be respecified and analyzed as the system grows and develops and the quantity and accuracy of available data increases.

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APPENDIXES

APPENDIX A

DERIVATION OF FINAL-FORM

Reduced form of a system of equations [35] -

(1) $$Y_t = AY_{t-1} + BX_t + CX_{t-1} + v_t$$

where

Y_t = an (n x 1) column vector of endogenous variables.

Y_{t-1} = an (n x 1) column vector of lagged endogenous variables.

X_t = an (m x 1) column vector of exogenous variables.

X_{t-1} = an (m x 1) column vector of lagged endogenous variables.

v_t = an (n x 1) column vector of reduced form disturbances.

A = an (n x n) coefficient matrix.

B = an (n x m) coefficient matrix.

C = an (n x m) coefficient matrix.

Successively substituting s times for the lagged value of Y in (1) yields -

(2) $$\begin{aligned} Y_t = A^{s+1} Y_{t-s-1} + BX_t + (C + AB)X_{t-1} + \\ A(C + AB)X_{t-2} + \ldots + A^{s-1}(C + AB)X_{t-s} + \\ A^{s}CX_{t-s-1} + v_t + \ldots + A^{s}v_{t-s} \end{aligned}$$

If the limit of A^s as $s \to \infty$ is a zero matrix, (2) becomes the *final-form* of the system -

(3) $$Y_t = BX_t + \Sigma^{\infty}_{\tau=1}A^{\tau-1}(C + AB)X_{t-\tau} + \Sigma^{\infty}_{\tau=0}A^{\tau}v_{t-\tau}$$

The limit of A exists if the absolute value of the real components of the eigenvalues associated with A are less than one in magnitude.

The successive coefficient matrices of (3), [B, (C +

AB), A(C + AB), A^2(C + AB),...], describe the effect of exogenous changes on the endogenous variables in the present year and in subsequent years.

APPENDIX B

RISK MODEL MULTIPLIERS AND ELASTICITIES

TABLE 45

IMPACT MULTIPLIERS
RISK MODEL

Endogenous Variables	Predetermined Variables							
	Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2
Livwts	9.574	2.478	-0.271	0.000	0.000	-2.636	9.227	0.000
Farmp0	0.657	-0.007	-0.023	0.032	0.014	0.121	-0.422	0.301
Fhwp	1.561	-0.021	-0.033	0.048	0.014	0.186	-0.651	0.464
Fhfp	2.615	-0.016	-0.040	0.058	0.013	0.222	-0.776	0.524
Fhop	1.561	0.000	-0.028	0.039	0.015	0.139	-0.485	0.345
Fnwp	1.600	-0.008	-0.027	0.042	0.003	0.138	-0.482	0.342
Fnfp	2.554	-0.010	-0.037	0.054	0.009	0.192	-0.671	0.478
Fnop	1.785	-0.007	-0.024	0.035	0.006	0.124	-0.435	0.310
Fhws	0.597	0.436	0.023	0.085	-0.125	-0.749	2.621	-1.868
Fhfs	0.255	0.238	-0.010	0.014	-0.142	-0.708	2.479	-0.435
Fhos	0.382	0.033	-0.007	0.004	0.040	0.025	-0.087	0.062
Fnws	0.317	0.143	0.012	0.061	-0.103	-0.037	0.130	-0.092
Fnfs	-0.542	0.301	0.082	0.015	-0.375	-0.594	2.078	-0.235
Fnos	1.151	0.123	-0.132	-0.117	0.037	0.239	-0.835	0.595
Profhw	0.538	0.436	0.023	0.085	-0.125	-0.749	2.621	-1.868
Profhf	0.255	0.238	-0.010	0.014	-0.142	-0.708	2.479	-0.435
Profho	0.382	0.033	-0.007	0.004	0.040	0.025	-0.087	0.062
Profnw	0.387	0.153	0.007	-0.046	0.051	-0.063	0.221	-0.080
Profnf	1.655	0.222	-0.001	0.055	0.127	-0.018	0.064	1.201
Profno	1.169	0.125	-0.134	-0.119	0.037	0.242	-0.848	0.604
Fnwei	0.070	0.010	-0.005	-0.107	0.154	-0.026	0.091	0.012
Fnfei	2.197	-0.080	-0.083	0.040	0.502	0.575	-2.014	1.435
Fnoei	0.018	0.002	-0.002	-0.002	0.001	0.004	-0.013	0.009

TABLE 45 (Continued)

Endogenous Variables	Predetermined Variables						
	Shift3	Shift4	Shift5	Seappi	Yrisk	Iprisk	Searsk
Livwts	0 000	0 000	0 000	0 000	-10.162	-126.965	0 000
Farmp0	0.022	-0 001	0 074	0 590	0.465	5 805	2 923
Fhwp	0.034	-0 002	0 114	0 851	0.717	8.958	4 221
Fhfp	0.041	-0 002	0 136	1 067	0.855	10.682	5 257
Fhop	0 244	-0 001	0 085	0 680	0 534	6.671	3 789
Fnwp	0 025	0 061	0 084	0 673	0.531	6 638	3 331
Fnfp	0 035	-0 002	0 117	0 938	0 739	9 228	4 646
Fnop	0 023	-0 001	0 281	0 609	0 480	5.992	3 016
Fhws	-0 138	0 007	-0.458	-1 594	-2 887	-36 068	-8 110
Fhfs	-0 131	0 007	-0 433	-2 635	-2 731	-34.118	-11 622
Fhos	0 234	-0 000	0 015	0 133	0 095	1 193	2 572
Fnws	-0 007	-0 016	-0 023	0 606	-0 143	-1 789	1 321
Fnfs	-0 110	0 006	-0 363	-0 653	-2 289	-28 593	-7 993
Fnos	0 044	-0 002	0 892	1 281	0 920	11 490	9 730
Profhw	-0 138	0 007	-0 458	-1 594	-2 887	-36.068	-8 110
Profhf	-0 131	0 007	-0.433	-2.635	-2 731	-34 118	-11 622
Profho	0 234	-0.000	0.015	0.133	0.095	1 193	2 572
Profnw	-0 006	-0 014	-0.020	0 528	-0 243	-3 035	1 150
Profnf	-0 003	0 000	-0 011	2 164	-0 070	-0 878	5 962
Profno	0 045	-0 002	0 906	1 301	0 934	11 672	9 883
Fnwei	0 001	0 002	0 003	-0 079	-0 100	-1 246	-0 171
Fnfei	0 106	-0 006	0.352	2.816	2 218	27.715	13.955
Fnoei	0 001	-0.000	0 014	0.020	0 015	0 181	0.153

TABLE 46

IMPACT ELASTICITIES
RISK MODEL

Endogenous Variables	Predetermined Variables Inter	S6	C6	S12	C12	Feedp(-5)	Shift1	Shift2
Livwts	0.390	0.000	0.000	0.000	0.000	-0.009	0.284	0.000
Farmp0	0.937	0.000	0.001	0.003	0.000	0.014	-0.454	0.243
Fhwp	1.014	0.000	0.000	0.002	0.000	0.010	-0.319	0.171
Fhfp	0.986	0.000	0.000	0.002	0.000	0.007	-0.221	0.112
Fhop	0.925	0.000	0.000	0.002	0.000	0.007	-0.217	0.116
Fnwp	0.972	0.000	0.000	0.002	0.000	0.007	-0.221	0.117
Fnfp	0.973	0.000	0.000	0.001	0.000	0.006	-0.193	0.103
Fnop	0.912	0.000	0.000	0.001	0.000	0.005	-0.168	0.090
Fhws	0.173	0.000	-0.000	0.002	0.000	-0.017	0.573	-0.306
Fhfs	0.126	0.000	0.000	0.001	0.000	-0.028	0.926	-0.122
Fhos	0.775	0.000	0.000	0.001	0.000	0.004	-0.133	0.071
Fnws	0.214	0.000	-0.000	0.003	0.000	-0.002	0.066	-0.035
Fnfs	-0.164	0.000	-0.000	0.000	0.000	-0.014	0.473	-0.040
Fnos	0.596	0.000	0.001	-0.004	0.000	0.010	-0.326	0.174
Profhw	0.156	0.000	-0.000	0.002	0.000	-0.017	0.573	-0.306
Profhf	0.126	0.000	0.000	0.001	0.000	-0.028	0.925	-0.122
Profho	0.770	0.000	0.000	0.001	0.000	0.004	-0.132	0.071
Profnw	0.257	0.000	-0.000	-0.002	0.000	-0.003	0.110	-0.030
Profnf	0.497	0.000	0.000	0.001	0.000	-0.000	0.014	0.204
Profno	0.597	0.000	0.001	-0.004	0.000	0.010	-0.327	0.175
Fnwei	0.048	0.000	0.000	-0.005	0.000	-0.001	0.046	0.005
Fnfei	0.915	0.000	0.001	0.001	0.000	0.019	-0.633	0.338
Fnoei	0.012	0.000	0.000	-0.000	0.000	0.000	-0.007	0.004

TABLE 46 (Continued)

Endogenous Variables	Predetermined Variables						
	Shift3	Shift4	Shift5	Seappi	Yrisk	Iprisk	Searsk
Livwts	0 000	0 000	0 000	0 000	-0 066	-0 000	0.000
Farmp0	0 010	-0 001	0 081	1 239	0.105	0 000	0 023
Fhwp	0 007	-0 001	0 057	0 814	0 074	0 000	0 015
Fhfp	0.005	-0 000	0 040	0 592	0 051	0.000	0 011
Fhop	0.046	-0.000	0.039	0 594	0 050	0.000	0.013
Fnwp	0 005	0 018	0 039	0 602	0.051	0.000	0 011
Fnfp	0.004	-0 000	0 035	0 526	0.045	0.000	0 010
Fnop	0 004	-0 000	0 111	0 458	0 039	0.000	0 009
Fhws	-0 013	0 001	-0 103	-0 680	-0 133	-0 001	-0.013
Fhfs	-0 021	0 002	-0 166	-1.920	-0 214	-0.001	-0 032
Fhos	0 152	-0 000	0.024	0.398	0 031	0 000	0 029
Fnws	-0 001	-0 005	-0 012	0 602	-0 015	-0 000	0 005
Fnfs	-0 011	0 001	-0 085	-0 290	-0 110	-0 000	-0 014
Fnos	0 007	-0 001	0 357	0 976	0 076	0 000	0 028
Profhw	-0 013	0.001	-0 103	-0.680	-0 133	-0 001	-0 013
Profhf	-0 021	0 002	-0 166	-1.918	-0 214	-0 001	-0 032
Profho	0 151	-0 000	0 024	0.395	0 031	0 000	0 029
Profnw	-0 001	-0 005	-0 010	0.515	-0 026	-0 000	0 004
Profnf	-0.000	0 000	-0 003	0 957	-0 003	-0 000	0 010
Profno	0 007	-0 001	0 358	0 978	0 076	0.000	0 028
Fnwei	0 000	0 001	0 002	-0 079	-0 011	-0 000	-0 001
Fnfei	0 014	-0 001	0 113	1 727	0 147	0 001	0.033
Fnoei	0 000	-0 000	0 007	0 020	0 002	0 000	0.001

TABLE 47

DELAY ELASTICITIES: EXOGENOUS VARIABLE - FEEDP(-5) RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	-0.009	0.014	0.010	0.007	0.007	0.007	0.006	0.005	-0.017
1	0.000	-0.008	-0.005	-0.004	-0.004	-0.004	-0.003	-0.003	0.010
2	0.000	0.004	0.003	0.002	0.002	0.002	0.002	0.002	-0.005
3	0.000	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	0.003
4	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.000	-0.002
5	0.005	-0.009	-0.006	-0.004	-0.004	-0.004	-0.004	-0.003	0.011
6	-0.003	0.009	0.007	0.005	0.004	0.005	0.004	0.003	-0.012
7	0.002	-0.008	-0.005	-0.004	-0.004	-0.004	-0.003	-0.003	0.010
8	-0.001	0.006	0.004	0.003	0.003	0.003	0.002	0.002	-0.007
9	0.000	-0.004	-0.003	-0.002	-0.002	-0.002	-0.002	-0.001	0.005
10	-0.003	0.007	0.005	0.004	0.003	0.004	0.003	0.003	-0.009
11	0.003	-0.009	-0.007	-0.005	-0.005	-0.005	-0.004	-0.004	0.012
12	-0.003	0.010	0.007	0.005	0.005	0.005	0.004	0.004	-0.012
13	0.002	-0.009	-0.006	-0.004	-0.004	-0.004	-0.004	-0.003	0.011
14	-0.001	0.007	0.005	0.003	0.003	0.003	0.003	0.003	-0.009
15	0.003	-0.008	-0.006	-0.004	-0.004	-0.004	-0.003	-0.003	0.010
16	-0.003	0.010	0.007	0.005	0.005	0.005	0.004	0.004	-0.013
17	0.004	-0.011	-0.008	-0.005	-0.005	-0.005	-0.005	-0.004	0.014
18	-0.003	0.011	0.008	0.006	0.005	0.006	0.005	0.004	-0.014
19	0.003	-0.010	-0.007	-0.005	-0.005	-0.005	-0.004	-0.004	0.013
20	-0.003	0.011	0.007	0.005	0.005	0.005	0.005	0.004	-0.013
21	0.004	-0.012	-0.008	-0.006	-0.006	-0.006	-0.005	-0.004	0.015
22	-0.004	0.013	0.009	0.006	0.006	0.006	0.006	0.005	-0.017
23	0.004	-0.014	-0.010	-0.007	-0.007	-0.007	-0.006	-0.005	0.018
24	-0.004	0.014	0.010	0.007	0.007	0.007	0.006	0.005	-0.018
25	0.004	-0.014	-0.010	-0.007	-0.007	-0.007	-0.006	-0.005	0.018

TABLE 47 (Continued)

	Endogenous Variables								
Lags in Months	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-0 028	0 004	-0.002	-0 014	0.010	-0 017	-0 028	0 004	-0.003
1	0 016	-0 002	0 001	0 008	-0.005	0.010	0.016	-0.002	0 001
2	-0 009	0 001	-0 001	-0.004	0.003	-0 005	-0 009	0 001	-0 001
3	0 005	-0.001	0 000	0 002	-0.002	0.003	0 005	-0.001	0 000
4	-0 003	0 000	-0 000	-0 001	0 001	-0 002	-0.003	0 000	-0.000
5	0 018	-0 003	0 001	0 009	-0 006	0 011	0 018	-0.003	0 002
6	-0 019	0 003	-0 001	-0 010	0.007	-0.012	-0.019	0.003	-0 002
7	0 016	-0 002	0 001	0 008	-0 005	0 010	0 016	-0.002	0.001
8	-0 011	0 002	-0 001	-0 006	0.004	-0 007	-0 011	0.002	-0 001
9	0 008	-0 001	0 001	0 004	-0 003	0 005	0.008	-0 001	0 001
10	-0 015	0 002	-0 001	-0 008	0 005	-0 009	-0 015	0 002	-0 002
11	0 019	-0 003	0 001	0 010	-0 007	0 012	0 019	-0 003	0 002
12	-0 020	0 003	-0 001	-0 010	0 007	-0 012	-0 020	0.003	-0 002
13	0 018	-0 003	0 001	0 009	-0 006	0 011	0.018	-0 003	0.001
14	-0 015	0 002	-0 001	-0 007	0 005	-0 009	-0 015	0 002	-0 001
15	0 017	-0 002	0 001	0 009	-0 006	0 010	0 017	-0 002	0 002
16	-0 021	0 003	-0 001	-0 011	0 007	-0 013	-0 021	0 003	-0 002
17	0 023	-0 003	0 002	0 012	-0 008	0 014	0 023	-0 003	0 002
18	-0 023	0 003	-0 002	-0 012	0 008	-0.014	-0.023	0.003	-0 002
19	0 021	-0 003	0 002	0 011	-0 008	0.013	0 021	-0 003	0 002
20	-0 022	0 003	-0 002	-0 011	0 008	-0 013	-0.022	0.003	-0 002
21	0 024	-0 003	0 002	0 012	-0.008	0 015	0 024	-0 003	0 002
22	-0 027	0 004	-0.002	-0 014	0.009	-0 017	-0 027	0 004	-0.002
23	0 028	-0 004	0 002	0 015	-0.010	0 018	0 028	-0 004	0 003
24	-0 028	0 004	-0.002	-0 014	0 010	-0 018	-0 028	0 004	-0 002
25	0 028	-0 004	0 002	0 014	-0.010	0 018	0 028	-0 004	0 002

TABLE 47 (Continued)

	Endogenous Variables								
Lags in Months	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	-0.000	0.010	-0.001	0.019	0 000	0.000	0 000	0 000	0 000
1	-0.014	-0 005	-0.002	-0 011	0.000	0.000	0.000	0.000	0 000
2	0 008	0 003	-0.001	0 006	0.000	0 000	0.000	0 000	0.000
3	-0 004	-0 002	-0 002	-0.003	0 000	0.000	0.000	0 000	0.000
4	0 002	0 001	-0 001	0.002	0.000	0.000	0.000	0 000	0.000
5	-0 001	-0 006	-0.001	-0.012	0.000	0.000	0.000	0 000	0.000
6	0 008	0 007	-0 001	0 013	0 000	0 000	0 000	0 000	0 000
7	-0 009	-0 006	-0 001	-0 011	0 000	0 000	0.000	0.000	0 000
8	0 008	0 004	-0 001	0 008	0 000	0 000	0.000	0.000	0 000
9	-0 006	-0 003	-0 001	-0 005	0 000	0 000	0 000	0 000	0 000
10	0 004	0 005	-0 001	0 010	0.000	0 000	0.000	0.000	0 000
11	-0 007	-0 007	-0 001	-0 013	0.000	0 000	0 000	0 000	0 000
12	0 009	0 007	-0 001	0 014	0.000	0 000	0 000	0 000	0 000
13	-0 009	-0 006	-0 001	-0 012	0 000	0.000	0 000	0 000	0 000
14	0 009	0 005	-0 001	0 010	0 000	0 000	0 000	0 000	0 000
15	-0 007	-0 006	-0 001	-0 011	0 000	0 000	0 000	0 000	0 000
16	0 008	0 007	-0 001	0 014	0 000	0 000	0 000	0 000	0 000
17	-0 010	-0 008	-0 001	-0 016	0.000	0 000	0 000	0 000	0.000
18	0 011	0 008	-0 001	0 016	0 000	0 000	0 000	0.000	0 000
19	-0 011	-0 008	-0 001	-0 015	0 000	0 000	0 000	0.000	0 000
20	0 010	0 008	-0.001	0 015	0 000	0 000	0 000	0.000	0 000
21	-0 010	-0 008	-0 001	-0 016	0.000	0 000	0 000	0 000	0 000
22	0 011	0 009	-0 001	0.018	0 000	0 000	0.000	0 000	0 000
23	-0 013	-0 010	-0.001	-0 019	-0 000	0 000	0.000	0 000	0 000
24	0.014	0 010	-0 001	0 019	0.000	0 000	0 000	0.000	0 000
25	-0 013	-0 010	-0.001	-0.019	-0 000	0 000	0.000	0 000	0 000

TABLE 48

DELAY ELASTICITIES: EXOGENOUS VARIABLE - SEAPPI RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	0 000	1 239	0 814	0.592	0 594	0.602	0.526	0.458	-0 680
1	0 000	-0 690	-0.485	-0 336	-0 329	-0 332	-0.293	-0 256	0 871
2	0 000	0 384	0 270	0 187	0 183	0 188	0.163	0 142	-0 485
3	0 000	-0 214	-0 150	-0 104	-0 102	-0 102	-0 091	-0 079	0 270
4	0 000	0 119	0 084	0 058	0.057	0 060	0 051	0 044	-0 150
5	0 451	-0 789	-0 554	-0 384	-0 376	-0.382	-0.335	-0 292	0 995
6	-0 251	0 842	0 591	0 409	0 402	0 409	0.357	0 311	-1 062
7	0 140	-0 693	-0 487	-0 337	-0 331	-0 335	-0 294	-0 256	0.874
8	-0 078	0 510	0 359	0 248	0 244	0 248	0.217	0 189	-0.644
9	0 043	-0 354	-0 249	-0 172	-0.169	-0 171	-0 150	-0.131	0.446
10	-0 287	0 657	0 461	0 319	0.313	0 320	0.279	0 243	-0 829
11	0 306	-0 856	-0 602	-0 416	-0.409	-0 414	-0 364	-0.317	1 081
12	-0 252	0 881	0 619	0 428	0 420	0 428	0 374	0 326	-1 111
13	0 186	-0 788	-0 554	-0 383	-0.376	-0 381	-0.335	-0.292	0 994
14	-0 129	0 645	0 453	0 314	0 308	0 314	0 274	0 238	-0 814
15	0.239	-0 742	-0.521	-0 361	-0.354	-0 359	-0.315	-0 275	0 936
16	-0 312	0 912	0.641	0 444	0 435	0 443	0 387	0 337	-1 151
17	0 321	-1 022	-0 718	-0 497	-0 487	-0 494	-0 434	-0 378	1 289
18	-0 287	1 028	0 722	0 500	0.491	0 499	0.436	0 380	-1 297
19	0 235	-0 949	-0 666	-0 461	-0 453	-0 459	-0 403	-0.351	1.197
20	-0 270	0 961	0 675	0 467	0 458	0 467	0 408	0 355	-1 212
21	0 332	-1 067	-0 750	-0 519	-0 509	-0 516	-0.453	-0 395	1 346
22	-0 372	1 190	0.836	0 578	0.568	0.578	0 505	0 440	-1 501
23	0 374	-1 262	-0 887	-0 613	-0.602	-0 611	-0 536	-0.467	1 592
24	-0 345	1 256	0 882	0 610	0 599	0 610	0 533	0 464	-1.584
25	0 350	-1 259	-0 885	-0 612	-0 601	-0 609	-0.535	-0.466	1 589

TABLE 48 (Continued)

	Endogenous Variables								
Lags in Months	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-1 920	0 398	0 602	-0 290	0 976	-0.680	-1.918	0 395	0 515
1	1 407	-0 202	0 100	0 719	-0 496	0.871	1.405	-0.201	0.085
2	-0 783	0 112	-0 056	-0.400	0 275	-0.485	-0.782	0.112	-0 048
3	0 436	-0.063	0 030	0 223	-0 154	0.270	0.436	-0 062	0 026
4	-0 243	0 035	-0.018	-0 124	0 085	-0.150	-0.242	0 035	-0 015
5	1 608	-0 231	0.114	0 822	-0 567	0 996	1.606	-0.229	0.183
6	-1 715	0 246	-0 122	-0 877	0 604	-1 062	-1 713	0 245	-0 152
7	1 412	-0 202	0 100	0 722	-0 498	0 874	1 410	-0.201	0.112
8	-1 040	0 149	-0 074	-0 532	0.366	-0 644	-1 039	0 148	-0 078
9	0.721	-0 103	0 051	0 369	-0 254	0 446	0 720	-0 103	0 052
10	-1 338	0 192	-0 096	-0 684	0 471	-0 829	-1.337	0.191	-0.136
11	1.745	-0 250	0 124	0 893	-0 615	1 081	1.743	-0 249	0 164
12	-1 795	0 257	-0 128	-0 918	0 632	-1 111	-1.793	0.256	-0 157
13	1 606	-0 230	0.114	0 821	-0.566	0 995	1 604	-0 229	0.133
14	-1 314	0 188	-0 094	-0.672	0 463	-0.814	-1.313	0.187	-0 105
15	1 512	-0 217	0 107	0 773	-0.533	0 937	1.511	-0 216	0.137
16	-1.859	0 267	-0 133	-0 951	0 655	-1 151	-1.857	0 265	-0 173
17	2.082	-0 299	0 148	1 065	-0 734	1 289	2.079	-0.297	0 187
18	-2 095	0 300	-0 150	-1 072	0.738	-1 298	-2.093	0 299	-0 182
19	1 933	-0 277	0 137	0 989	-0 681	1 197	1 931	-0 276	0.162
20	-1 958	0 281	-0.140	-1 001	0 689	-1 212	-1 956	0 279	-0.171
21	2 175	-0 312	0 155	1 112	-0 766	1 347	2 172	-0 310	0 195
22	-2 424	0 348	-0 173	-1.240	0.854	-1 501	-2 421	0 346	-0 218
23	2 572	-0 369	0 183	1 315	-0 906	1 593	2 569	-0 367	0 227
24	-2 559	0 367	-0 183	-1 309	0 901	-1 585	-2.556	0 365	-0 221
25	2 567	-0 368	0 183	1 312	-0 905	1 589	2 563	-0.366	0 222

TABLE 48 (Continued)

Lags in Months	Endogenous Variables Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	0 957	0 978	-0 079	1 727	0 020	0 000	0 000	0 000	0 000
1	-1 223	-0 497	-0 092	-0 962	0 010	0 000	0 000	0 000	0 000
2	0 681	0 276	-0 084	0 535	0 016	0 000	0.000	0 000	0.000
3	-0 379	-0 155	-0.088	-0 298	0.013	0 000	0 000	0 000	0 000
4	0 211	0 085	-0 086	0 166	0 014	0.000	0 000	0.000	0.000
5	-0 095	-0.568	-0 013	-1 099	0.002	0 000	0.000	0 000	0 000
6	0 766	0 605	-0 046	1 173	0.015	0 000	0 000	0 000	0 000
7	-0 824	-0 499	-0 032	-0 965	0 005	0.000	0.000	0 000	0.000
8	0 680	0 367	-0 037	0 711	0 012	0 000	0.000	0 000	0 000
9	-0 502	-0 255	-0 036	-0 493	0.007	0 000	0 000	0 000	0 000
10	0.335	0 472	-0 079	0 915	0 017	0 000	0.000	0 000	0 000
11	-0 633	-0 617	-0 036	-1 193	0.004	0 000	0 000	0 000	0.000
12	0 833	0 633	-0 068	1 227	0 017	0 000	0.000	0 000	0 000
13	-0 860	-0 567	-0 047	-1 098	0 005	0 000	0.000	0.000	0.000
14	0 771	0 464	-0 059	0 898	0.015	0 000	0 000	0 000	0 000
15	-0 624	-0 534	-0 027	-1 034	0 004	0.000	0.000	0 000	0 000
16	0 717	0 656	-0 070	1 271	0 018	0 000	0.000	0.000	0 000
17	-0 884	-0 735	-0 027	-1 423	0 002	0 000	0 000	0 000	0 000
18	0 994	0 739	-0 063	1 432	0 018	0 000	0 000	0 000	0 000
19	-1 003	-0 683	-0 036	-1 322	0.003	0 000	0.000	0.000	0 000
20	0 923	0 691	-0 070	1 338	0 018	0 000	0 000	0.000	0 000
21	-0 931	-0 768	-0 026	-1 487	0 002	0 000	0 000	0 000	0 000
22	1 034	0 856	-0 075	1 657	0 020	0 000	0 000	0 000	0 000
23	-1 155	-0 908	-0 027	-1 758	0 001	0 000	0 000	0 000	0 000
24	1 228	0 903	-0 070	1 749	0.020	0 000	0 000	0 000	0 000
25	-1 222	-0 907	-0 026	-1 755	0 001	0 000	0 000	0 000	0 000

TABLE 49

DELAY ELASTICITIES: EXOGENOUS VARIABLE - YRISK RISK MODEL

Lags in Months	Endogenous Variables								
	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	-0.066	0.105	0.074	0.051	0.050	0.051	0.045	0.039	-0.133
1	0.000	-0.059	-0.041	-0.028	-0.028	-0.028	-0.025	-0.022	0.074
2	0.000	0.033	0.023	0.016	0.016	0.016	0.014	0.012	-0.041
3	0.000	-0.018	-0.013	-0.009	-0.009	-0.009	-0.008	-0.007	0.023
4	0.000	0.010	0.007	0.005	0.005	0.005	0.004	0.004	-0.013
5	0.038	-0.067	-0.047	-0.033	-0.032	-0.032	-0.028	-0.025	0.085
6	-0.021	0.071	0.050	0.035	0.034	0.035	0.030	0.026	-0.090
7	0.012	-0.059	-0.041	-0.029	-0.028	-0.028	-0.025	-0.022	0.074
8	-0.007	0.043	0.030	0.021	0.021	0.021	0.018	0.016	-0.055
9	0.004	-0.030	-0.021	-0.015	-0.014	-0.014	-0.013	-0.011	0.038
10	-0.024	0.056	0.039	0.027	0.027	0.027	0.024	0.021	-0.070
11	0.026	-0.073	-0.051	-0.035	-0.035	-0.035	-0.031	-0.027	0.092
12	-0.021	0.075	0.053	0.036	0.036	0.036	0.032	0.028	-0.094
13	0.016	-0.067	-0.047	-0.033	-0.032	-0.032	-0.028	-0.025	0.084
14	-0.011	0.055	0.038	0.027	0.026	0.027	0.023	0.020	-0.069
15	0.020	-0.063	-0.044	-0.031	-0.030	-0.030	-0.027	-0.023	0.080
16	-0.026	0.077	0.054	0.038	0.037	0.038	0.033	0.029	-0.098
17	0.027	-0.087	-0.061	-0.042	-0.041	-0.042	-0.037	-0.032	0.109
18	-0.024	0.087	0.061	0.042	0.042	0.042	0.037	0.032	-0.110
19	0.020	-0.081	-0.057	-0.039	-0.038	-0.039	-0.034	-0.030	0.102
20	-0.023	0.082	0.057	0.040	0.039	0.040	0.035	0.030	-0.103
21	0.028	-0.091	-0.064	-0.044	-0.043	-0.044	-0.038	-0.034	0.114
22	-0.032	0.101	0.071	0.049	0.048	0.049	0.043	0.037	-0.127
23	0.032	-0.107	-0.075	-0.052	-0.051	-0.052	-0.045	-0.040	0.135
24	-0.029	0.107	0.075	0.052	0.051	0.052	0.045	0.039	-0.135
25	0.030	-0.107	-0.075	-0.052	-0.051	-0.052	-0.045	-0.040	0.135

TABLE 49 (Continued)

	Endogenous Variables								
Lags in Months	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-0.214	0.031	-0.015	-0.110	0.076	-0.133	-0.214	0.031	-0.026
1	0.119	-0.017	0.008	0.061	-0.042	0.074	0.119	-0.017	0.007
2	-0.066	0.010	-0.005	-0.034	0.023	-0.041	-0.066	0.009	-0.004
3	0.037	-0.005	0.003	0.019	-0.013	0.023	0.037	-0.005	0.002
4	-0.021	0.003	-0.002	-0.011	0.007	-0.013	-0.021	0.003	-0.001
5	0.137	-0.020	0.010	0.070	-0.048	0.085	0.136	-0.019	0.016
6	-0.146	0.021	-0.010	-0.074	0.051	-0.090	-0.145	0.021	-0.013
7	0.120	-0.017	0.008	0.061	-0.042	0.074	0.120	-0.017	0.010
8	-0.088	0.013	-0.006	-0.045	0.031	-0.055	-0.088	0.013	-0.007
9	0.061	-0.009	0.004	0.031	-0.022	0.038	0.061	-0.009	0.004
10	-0.114	0.016	-0.008	-0.058	0.040	-0.070	-0.113	0.016	-0.012
11	0.148	-0.021	0.011	0.076	-0.052	0.092	0.148	-0.021	0.014
12	-0.152	0.022	-0.011	-0.078	0.054	-0.094	-0.152	0.022	-0.013
13	0.136	-0.020	0.010	0.070	-0.048	0.084	0.136	-0.019	0.011
14	-0.112	0.016	-0.008	-0.057	0.039	-0.069	-0.111	0.016	-0.009
15	0.128	-0.018	0.009	0.066	-0.045	0.080	0.128	-0.018	0.012
16	-0.158	0.023	-0.011	-0.081	0.056	-0.098	-0.158	0.023	-0.015
17	0.177	-0.025	0.013	0.090	-0.062	0.109	0.177	-0.025	0.016
18	-0.178	0.026	-0.013	-0.091	0.063	-0.110	-0.178	0.025	-0.015
19	0.164	-0.024	0.012	0.084	-0.058	0.102	0.164	-0.023	0.014
20	-0.166	0.024	-0.012	-0.085	0.059	-0.103	-0.166	0.024	-0.015
21	0.185	-0.026	0.013	0.094	-0.065	0.114	0.184	-0.026	0.017
22	-0.206	0.030	-0.015	-0.105	0.072	-0.127	-0.206	0.029	-0.019
23	0.218	-0.031	0.016	0.112	-0.077	0.135	0.218	-0.031	0.019
24	-0.217	0.031	-0.016	-0.111	0.077	-0.135	-0.217	0.031	-0.019
25	0.218	-0.031	0.015	0.111	-0.077	0.135	0.218	-0.031	0.019

TABLE 49 (Continued)

	Endogenous Variables								
Lags in Months	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	-0.003	0 076	-0 011	0 147	0 002	0 000	0 000	0 000	0 000
1	-0 104	-0 042	-0 012	-0 082	0 001	0.000	0 000	0 000	0 000
2	0 058	0 023	-0 011	0 045	0 001	0 000	0 000	0 000	0 000
3	-0 032	-0 013	-0 012	-0 025	0 001	0 000	0.000	0 000	0 000
4	0 018	0 007	-0 011	0 014	0.001	0 000	0 000	0 000	0 000
5	-0 008	-0 048	-0 005	-0 093	0 000	0 000	0 000	0 000	0 000
6	0 065	0 051	-0 008	0 100	0 001	0 000	0 000	0 000	0 000
7	-0 070	-0 042	-0 007	-0 082	0 000	0 000	0.000	0 000	0 000
8	0 058	0 031	-0 007	0 060	0 001	0 000	0 000	0 000	0 000
9	-0 043	-0 022	-0 007	-0 042	0 000	0 000	0 000	0 000	0.000
10	0 028	0 040	-0 011	0 078	0 001	0 000	0 000	0 000	0 000
11	-0 054	-0 052	-0 007	-0 101	0 000	0 000	0 000	0 000	0 000
12	0 071	0 054	-0 010	0 104	0 001	0 000	0 000	0 000	0 000
13	-0 073	-0 048	-0 008	-0 093	0.000	0 000	0 000	0 000	0.000
14	0 065	0 039	-0 009	0 076	0 001	0 000	0 000	0 000	0 000
15	-0 053	-0 045	-0 006	-0 088	0 000	0 000	0 000	0 000	0 000
16	0 061	0 056	-0 010	0 108	0 001	0 000	0 000	0 000	0 000
17	-0 075	-0 062	-0 006	-0 121	0 000	0 000	0 000	0.000	0 000
18	0 084	0 063	-0 009	0 122	0 001	0 000	0.000	0 000	0 000
19	-0 085	-0 058	-0 007	-0 112	0.000	0.000	0 000	0 000	0 000
20	0 078	0 059	-0 010	0 114	0 001	0 000	0 000	0 000	0 000
21	-0 079	-0 065	-0 006	-0 126	0 000	0 000	0 000	0 000	0 000
22	0 088	0 073	-0 010	0 141	0 002	0 000	0 000	0 000	0 000
23	-0 098	-0 077	-0 006	-0 149	-0 000	0 000	0 000	0 000	0 000
24	0 104	0 077	-0 010	0.149	0.002	0 000	0 000	0 000	0 000
25	-0 104	-0 077	-0 006	-0 149	-0 000	0 000	0 000	0 000	0 000

TABLE 50

DELAY ELASTICITIES: EXOGENOUS VARIABLE - SEARSK RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	Farmp0	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	0 000	0 023	0 015	0 011	0 013	0.011	0.010	0.009	-0 013
1	0 000	-0 013	-0 009	-0 006	-0 006	-0 006	-0 006	-0.005	0 016
2	0 000	0 007	0 005	0 004	0 003	0 004	0 003	0.003	-0 009
3	0 000	-0 004	-0 003	-0 002	-0 002	-0.002	-0 002	-0.002	0 005
4	0 000	0 002	0 002	0 001	0 001	0 001	0.001	0 001	-0.003
5	0 009	-0 015	-0 010	-0 007	-0 007	-0 007	-0 006	-0 006	0.019
6	-0 005	0 016	0 011	0 008	0 008	0 008	0 007	0 006	-0 020
7	0 003	-0 013	-0 009	-0 006	-0.006	-0 006	-0 006	-0.005	0 016
8	-0 001	0 010	0 007	0 005	0 005	0.005	0 004	0 004	-0 012
9	0 001	-0 007	-0 005	-0 003	-0.003	-0.003	-0 003	-0 002	0.008
10	-0 005	0 012	0 009	0 006	0 006	0.006	0 005	0 005	-0 016
11	0 006	-0 016	-0 011	-0 008	-0 008	-0 008	-0 007	-0.006	0 020
12	-0 005	0 017	0 012	0 008	0.008	0 008	0.007	0 006	-0 021
13	0 004	-0 015	-0 010	-0 007	-0 007	-0 007	-0.006	-0.006	0 019
14	-0 002	0 012	0 009	0 006	0 006	0 006	0 005	0 004	-0 015
15	0 005	-0 014	-0 010	-0 007	-0 007	-0 007	-0 006	-0.005	0 018
16	-0 006	0 017	0 012	0 008	0 008	0 008	0 007	0 006	-0 022
17	0 006	-0 019	-0 014	-0 009	-0.009	-0 009	-0 008	-0.007	0 024
18	-0 005	0 019	0 014	0 009	0.009	0 009	0 008	0 007	-0 024
19	0 004	-0 018	-0 013	-0 009	-0 009	-0.009	-0.008	-0.007	0 023
20	-0 005	0 018	0 013	0 009	0 009	0 009	0.008	0 007	-0 023
21	0 006	-0 020	-0 014	-0 010	-0.010	-0 010	-0 009	-0 007	0 025
22	-0 007	0 022	0 016	0 011	0.011	0 011	0.010	0 008	-0 028
23	0 007	-0 024	-0 017	-0 012	-0 011	-0.012	-0 010	-0.009	0 030
24	-0 007	0 024	0 017	0 012	0 011	0 011	0.010	0.009	-0 030
25	0 007	-0 024	-0 017	-0 012	-0 011	-0 012	-0 010	-0.009	0 030

TABLE 50 (Continued)

	Endogenous Variables								
Lags in Months	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-0.032	0.029	0.005	-0.014	0.028	-0.013	-0.032	0.029	0.004
1	0.027	-0.004	0.002	0.014	-0.009	0.016	0.026	-0.004	0.002
2	-0.015	0.002	-0.001	-0.008	0.005	-0.009	-0.015	0.002	-0.001
3	0.008	-0.001	0.001	0.004	-0.003	0.005	0.008	-0.001	0.000
4	-0.005	0.001	-0.000	-0.002	0.002	-0.003	-0.005	0.001	-0.000
5	0.030	-0.004	0.002	0.015	-0.011	0.019	0.030	-0.004	0.003
6	-0.032	0.005	-0.002	-0.017	0.011	-0.020	-0.032	0.005	-0.003
7	0.027	-0.004	0.002	0.014	-0.009	0.016	0.027	-0.004	0.002
8	-0.020	0.003	-0.001	-0.010	0.007	-0.012	-0.020	0.003	-0.001
9	0.014	-0.002	0.001	0.007	-0.005	0.008	0.014	-0.002	0.001
10	-0.025	0.004	-0.002	-0.013	0.009	-0.016	-0.025	0.004	-0.003
11	0.033	-0.005	0.002	0.017	-0.012	0.020	0.033	-0.005	0.003
12	-0.034	0.005	-0.002	-0.017	0.012	-0.021	-0.034	0.005	-0.003
13	0.030	-0.004	0.002	0.015	-0.011	0.019	0.030	-0.004	0.003
14	-0.025	0.004	-0.002	-0.013	0.009	-0.015	-0.025	0.004	-0.002
15	0.029	-0.004	0.002	0.015	-0.010	0.018	0.028	-0.004	0.003
16	-0.035	0.005	-0.002	-0.018	0.012	-0.022	-0.035	0.005	-0.003
17	0.039	-0.006	0.003	0.020	-0.014	0.024	0.039	-0.006	0.004
18	-0.039	0.006	-0.003	-0.020	0.014	-0.024	-0.039	0.006	-0.003
19	0.036	-0.005	0.003	0.019	-0.013	0.023	0.036	-0.005	0.003
20	-0.037	0.005	-0.003	-0.019	0.013	-0.023	-0.037	0.005	-0.003
21	0.041	-0.006	0.003	0.021	-0.014	0.025	0.041	-0.006	0.004
22	-0.046	0.007	-0.003	-0.023	0.016	-0.028	-0.046	0.007	-0.004
23	0.048	-0.007	0.003	0.025	-0.017	0.030	0.048	-0.007	0.004
24	-0.048	0.007	-0.003	-0.025	0.017	-0.030	-0.048	0.007	-0.004
25	0.048	-0.007	0.003	0.025	-0.017	0.030	0.048	-0.007	0.004

TABLE 50 (Continued)

	Endogenous Variables								
Lags in Months	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	0 010	0.028	-0 001	0 033	0 001	0 000	0 000	0 000	0 000
1	-0 023	-0 009	-0 001	-0 018	0 000	0.000	0.000	0.000	0 000
2	0.013	0 005	-0 001	0 010	0 001	0.000	0.000	0.000	0 000
3	-0 007	-0 003	-0 001	-0 006	0 000	0.000	0 000	0 000	0 000
4	0 004	0.002	-0 001	0 003	0 000	0.000	0 000	0.000	0 000
5	-0 002	-0 011	0 001	-0 021	0 000	0.000	0 000	0 000	0 000
6	0 014	0 011	-0 000	0.022	0 000	0 000	0 000	0 000	0 000
7	-0 016	-0 009	0 000	-0 018	0 000	0 000	0 000	0 000	0.000
8	0 013	0 007	0 000	0 013	0 000	0 000	0.000	0.000	0.000
9	-0 009	-0 005	0 000	-0 009	0 000	0.000	0 000	0.000	0 000
10	0 006	0 009	-0 001	0 017	0 001	0 000	0.000	0.000	0 000
11	-0 012	-0 012	0 000	-0 022	0 000	0 000	0 000	0.000	0 000
12	0 016	0 012	-0 000	0 023	0.001	0 000	0 000	0 000	0 000
13	-0 016	-0 011	-0 000	-0 021	0 000	0.000	0 000	0 000	0 000
14	0 015	0 009	-0 000	0 017	0 000	0 000	0 000	0.000	0.000
15	-0 012	-0 010	0 000	-0 019	0 000	0 000	0 000	0 000	0 000
16	0 014	0 012	-0 001	0 024	0 001	0 000	0.000	0.000	0 000
17	-0 017	-0 014	0 000	-0 027	0 000	0 000	0.000	0.000	0 000
18	0 019	0 014	-0 000	0 027	0 001	0.000	0 000	0 000	0 000
19	-0 019	-0 013	0 000	-0 025	0 000	0 000	0 000	0 000	0 000
20	0 017	0 013	-0 001	0 025	0 001	0 000	0 000	0 000	0 000
21	-0 018	-0 014	0 000	-0.028	0 000	0 000	0 000	0.000	0 000
22	0 019	0 016	-0 001	0 031	0 001	0 000	0 000	0 000	0 000
23	-0 022	-0.017	0 000	-0 033	0 000	0 000	0 000	0 000	0 000
24	0 023	0 017	-0 001	0 033	0 001	0 000	0 000	0.000	0 000
25	-0 023	-0 017	0 000	-0 033	0 000	0 000	0.000	0.000	0 000

TABLE 51

CUMULATIVE ELASTICITIES: EXOGENOUS VARIABLE - FEEDP(-5) RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	-0 009	0 014	0 010	0 007	0 007	0.007	0 006	0.005	-0 017
1	-0 009	0 006	0 004	0 003	0 003	0 003	0 003	0.002	-0.008
2	-0 009	0.010	0 007	0 005	0 005	0 005	0 004	0 004	-0.013
3	-0 009	0 008	0 006	0 004	0 004	0 004	0 003	0.003	-0 010
4	-0 009	0 009	0 007	0 005	0 004	0 005	0 004	0 003	-0 012
5	-0 004	0 001	0 000	0.000	0 000	0.000	0 000	0 000	-0 001
6	-0 006	0 010	0 007	0 005	0 005	0 005	0 004	0.004	-0.012
7	-0 005	0 002	0 002	0 001	0 001	0 001	0 001	0 001	-0 003
8	-0 006	0 008	0 005	0.004	0 004	0.004	0 003	0 003	-0 010
9	-0 005	0 004	0 003	0 002	0 002	0 002	0.002	0 001	-0 005
10	-0 008	0 011	0 008	0 005	0 005	0 006	0 005	0 004	-0 014
11	-0 005	0 002	0 001	0 001	0 001	0 001	0 001	0 001	-0 002
12	-0 008	0 011	0 008	0 006	0 005	0 006	0 005	0 004	-0 014
13	-0 006	0 003	0 002	0 001	0.001	0.002	0 001	0 001	-0 003
14	-0 007	0 010	0 007	0 005	0 005	0 005	0 004	0.004	-0 012
15	-0 004	0 002	0 001	0 001	0.001	0.001	0 001	0 001	-0 002
16	-0 008	0 012	0 008	0.006	0 006	0.006	0 005	0 004	-0 015
17	-0 004	0 000	0 000	0 000	0.000	0.001	0 000	0.000	-0 001
18	-0 008	0 012	0 008	0 006	0 006	0 006	0.005	0.004	-0.015
19	-0 005	0.001	0 001	0 001	0 001	0 001	0 001	0 000	-0 002
20	-0 008	0 012	0 008	0 006	0.006	0 006	0 005	0 004	-0.015
21	-0 004	0 000	0 000	0 000	0 000	0 001	0 000	0 000	-0 000
22	-0 008	0 013	0 009	0 006	0 006	0 007	0 006	0 005	-0 017
23	-0 004	-0 001	-0 000	-0 000	-0 000	0 000	-0 000	-0 000	0.001
24	-0 008	0 013	0 009	0 006	0 006	0 007	0 006	0 005	-0 017
25	-0 004	-0 001	-0 000	-0 000	-0 000	0 000	-0 000	-0 000	0 001

TABLE 51 (Continued)

Lags in Months	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
	Endogenous Variables								
Impact	-0 028	0 004	-0 002	-0 014	0.010	-0 017	-0 028	0.004	-0 003
1	-0 012	0 002	-0 001	-0 006	0 004	-0 008	-0 012	0.002	-0 002
2	-0 021	0 003	-0 002	-0 011	0 007	-0 013	-0 021	0.003	-0 003
3	-0 016	0 002	-0 001	-0 008	0 006	-0.010	-0 016	0.002	-0 003
4	-0 019	0 003	-0.001	-0.010	0.007	-0.012	-0 019	0.003	-0.003
5	-0.001	0 000	-0 000	-0 001	0 000	-0 001	-0 001	0.000	-0 001
6	-0 020	0 003	-0 001	-0 010	0.007	-0 012	-0.020	0.003	-0 002
7	-0 004	0 001	-0 000	-0 002	0 002	-0 003	-0 004	0.001	-0.001
8	-0 016	0 002	-0 001	-0 008	0 006	-0 010	-0 016	0 002	-0 002
9	-0 008	0 001	-0 001	-0 004	0 003	-0 005	-0 008	0 001	-0 002
10	-0 023	0 003	-0 002	-0 012	0 008	-0 014	-0 023	0 003	-0.003
11	-0 003	0 000	-0 000	-0 002	0 001	-0 002	-0 003	0 000	-0 001
12	-0 023	0 003	-0 002	-0 012	0 008	-0 014	-0 023	0 003	-0 003
13	-0 006	0 001	-0 001	-0 003	0 002	-0 003	-0.006	0 001	-0 002
14	-0 020	0 003	-0 002	-0 010	0 007	-0 012	-0 020	0.003	-0.003
15	-0.003	0 000	-0 000	-0 002	0.001	-0 002	-0 003	0.000	-0 001
16	-0 024	0 003	-0 002	-0 012	0.008	-0 015	-0.024	0.003	-0 003
17	-0 001	0 000	-0 000	-0.000	0 000	-0 001	-0 001	0 000	-0 001
18	-0 024	0 003	-0.002	-0 012	0 008	-0.015	-0 024	0 003	-0 003
19	-0 003	0.000	-0 000	-0 001	0.001	-0 002	-0 003	0 000	-0.001
20	-0 024	0 003	-0 002	-0 012	0 009	-0 015	-0 024	0 003	-0 003
21	-0 000	0 000	-0 000	-0 000	0 000	-0 000	-0 000	0.000	-0 001
22	-0 027	0 004	-0 002	-0 014	0 009	-0 017	-0 027	0 004	-0 003
23	0 001	-0 000	-0 000	0 001	-0 001	0.001	0 001	-0 000	-0 001
24	-0 027	0 004	-0 002	-0 014	0 009	-0 017	-0 027	0.004	-0 003
25	0 001	-0.000	-0 000	0 001	-0 001	0.001	0 001	-0 000	-0 001

TABLE 51 (Continued)

	Endogenous Variables								
Lags in Months	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	-0 000	0 010	-0 001	0 019	0 000	0 000	0 000	0 000	0 000
1	-0 014	0 004	-0.003	0 008	0 000	0 000	0.000	0.000	0 000
2	-0 006	0 007	-0 004	0 014	0 000	0 000	0 000	0.000	0 000
3	-0 011	0 006	-0 006	0 011	0 001	0.000	0 000	0 000	0 000
4	-0 008	0 007	-0 007	0 013	0.001	0.000	0.000	0 000	0 000
5	-0 009	0 000	-0 008	0 001	0 001	0 000	0 000	0.000	0 000
6	-0 001	0 007	-0 009	0 014	0 001	0 000	0 000	0 000	0 000
7	-0 010	0 002	-0 010	0 003	0 001	0 000	0 000	0 000	0 000
8	-0 002	0 006	-0 011	0 011	0 001	0 000	0 000	0 000	0.000
9	-0 008	0.003	-0 012	0 005	0 001	0 000	0 000	0 000	0 000
10	-0 004	0 008	-0 013	0 016	0 001	0 000	0 000	0 000	0 000
11	-0 011	0 001	-0 014	0 002	0 001	0 000	0 000	0 000	0 000
12	-0 002	0 008	-0 015	0 016	0 001	0 000	0 000	0 000	0 000
13	-0 012	0 002	-0 016	0 004	0 001	0.000	0 000	0 000	0 000
14	-0 003	0 007	-0 018	0 014	0.002	0 000	0 000	0 000	0 000
15	-0 010	0 001	-0 018	0 002	0 002	0 000	0 000	0 000	0 000
16	-0 002	0 008	-0 020	0 016	0 002	0 000	0 000	0 000	0 000
17	-0 012	0 000	-0 021	0 001	0 002	0 000	0 000	0 000	0 000
18	-0 001	0 008	-0 022	0 016	0 002	0 000	0 000	0 000	0 000
19	-0 012	0 001	-0 023	0 002	0 002	0 000	0 000	0 000	0 000
20	-0 002	0 009	-0 024	0 017	0 002	0 000	0 000	0 000	0 000
21	-0 012	0 000	-0 025	0 000	0 002	0 000	0 000	0 000	0 000
22	-0 001	0 009	-0 026	0 019	0 002	0 000	0 000	0 000	0 000
23	-0 013	-0 001	-0 027	-0 001	0 002	0 000	0 000	0 000	0 000
24	0 000	0 009	-0 028	0 018	0 003	0 000	0 000	0.000	0 000
25	-0 013	-0 001	-0 029	-0.001	0 003	0 000	0 000	0 000	0 000

TABLE 52

CUMULATIVE ELASTICITIES: EXOGENOUS VARIABLE - SEAPPI RISK MODEL

Lags in Months	Endogenous Variables								
	Livwts	Farmp0	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	0 000	1 239	0 814	0 592	0 594	0 602	0 526	0 458	-0 680
1	0 000	0 549	0 329	0 257	0 264	0.270	0 233	0 203	0 191
2	0 000	0 933	0 598	0 444	0 448	0 458	0 396	0 344	-0 294
3	0 000	0 719	0 448	0 339	0 345	0 356	0 305	0 265	-0 024
4	0 000	0 838	0 532	0 397	0 402	0 415	0 356	0 309	-0 174
5	0 451	0 049	-0 023	0 014	0 026	0.034	0 021	0.017	0 821
6	0 200	0 891	0 569	0 423	0 427	0 442	0.378	0 328	-0.240
7	0 340	0 198	0 082	0 086	0 097	0 107	0.084	0 072	0 634
8	0 262	0 708	0 441	0 334	0 340	0 355	0 301	0 260	-0 010
9	0 305	0 355	0 192	0 162	0 172	0 185	0 151	0 129	0 436
10	0 018	1 012	0 654	0 482	0 485	0 505	0 429	0 372	-0 393
11	0 324	0 155	0 052	0 065	0 076	0.091	0 066	0 055	0 688
12	0 072	1 036	0 670	0 493	0 496	0 519	0.440	0.381	-0 423
13	0 258	0 248	0 117	0 110	0 120	0 138	0 105	0 089	0 571
14	0 129	0 892	0 570	0 424	0 428	0 452	0 379	0 327	-0 243
15	0 368	0 150	0.048	0 063	0 074	0 093	0 064	0.053	0 694
16	0 056	1 063	0 690	0 507	0 509	0.536	0 451	0 390	-0 457
17	0 377	0 041	-0 028	0 010	0 022	0.042	0 017	0 012	0 832
18	0 090	1 069	0 694	0 510	0 512	0 542	0 454	0 392	-0 466
19	0 325	0 121	0 028	0 049	0 060	0 083	0 051	0 041	0 731
20	0 055	1 081	0 703	0 516	0 518	0 550	0 459	0 396	-0 481
21	0 387	0 014	-0 047	-0 003	0 009	0 033	0 006	0 001	0 865
22	0 015	1 204	0 789	0 575	0 577	0.611	0 511	0 441	-0 636
23	0 389	-0 058	-0 098	-0 038	-0 025	0 001	-0 025	-0 026	0 957
24	0 044	1.198	0.784	0 572	0 574	0 610	0.508	0 438	-0 628
25	0 394	-0 062	-0 101	-0 040	-0 027	0.001	-0.026	-0 028	0 961

TABLE 52 (Continued)

Lags in Months	Endogenous Variables								
	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-1 920	0 398	0.602	-0 290	0 976	-0 680	-1 918	0 395	0 515
1	-0 513	0 196	0 702	0 429	0 480	0.191	-0 513	0 195	0 600
2	-1 296	0 308	0 645	0 029	0 755	-0 294	-1 295	0 306	0 552
3	-0 860	0 245	0 676	0 252	0 601	-0 024	-0 859	0 244	0.578
4	-1 102	0 280	0 658	0 128	0 686	-0 174	-1 101	0.279	0 563
5	0 505	0 050	0 773	0 950	0 119	0.822	0.505	0.049	0 746
6	-1 210	0 296	0 650	0 073	0 723	-0 241	-1 208	0.294	0 594
7	0 202	0 093	0 750	0 795	0 226	0 634	0 202	0 093	0 706
8	-0 838	0 242	0 676	0 263	0 592	-0 010	-0 837	0 241	0 627
9	-0 117	0.139	0.727	0 632	0 337	0.436	-0.117	0 138	0 679
10	-1 456	0 331	0 631	-0 053	0 809	-0.393	-1 454	0 329	0 543
11	0 290	0 081	0 755	0 840	0.193	0 688	0 289	0 080	0 707
12	-1 505	0 338	0 627	-0 078	0 825	-0 423	-1 503	0 336	0 550
13	0 101	0.108	0 741	0 743	0 259	0 571	0 101	0 107	0 682
14	-1 213	0 296	0 647	0 071	0 722	-0 243	-1 212	0 294	0 578
15	0 299	0 079	0 755	0 845	0 189	0 694	0 299	0 079	0 715
16	-1 560	0 346	0 622	-0 106	0 843	-0 458	-1 558	0 344	0 542
17	0 522	0 047	0 770	0 958	0 109	0 832	0 521	0 047	0 729
18	-1 574	0 348	0 620	-0 113	0 847	-0 466	-1 572	0 346	0.547
19	0 360	0 071	0.758	0 876	0 166	0 731	0 359	0 070	0 709
20	-1 598	0 351	0.618	-0 126	0 855	-0.481	-1.596	0 349	0 539
21	0.576	0 040	0 773	0 986	0 089	0 865	0 576	0 039	0 734
22	-1 848	0 387	0 599	-0 253	0 943	-0 636	-1 846	0 385	0 515
23	0 724	0 018	0 782	1 062	0 036	0 957	0.723	0.018	0 742
24	-1 835	0 385	0 600	-0 247	0 937	-0 628	-1 833	0 383	0.521
25	0 731	0 017	0 782	1 066	0 033	0 962	0 731	0 017	0 743

TABLE 52 (Continued)

Lags in Months	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
	Endogenous Variables								
Impact	0 957	0 978	-0 079	1 727	0 020	0 000	0 000	0 000	0 000
1	-0 267	0 481	-0 170	0 765	0 030	0 000	0 000	0 000	0 000
2	0 415	0.757	-0 254	1 300	0 046	0 000	0 000	0 000	0 000
3	0 036	0 602	-0 343	1 002	0 059	0 000	0.000	0 000	0.000
4	0 247	0 687	-0 429	1 168	0 073	0 000	0 000	0 000	0 000
5	0 152	0 119	-0 442	0.069	0 076	0 000	0.000	0 000	0 000
6	0 918	0 725	-0 488	1 241	0 091	0 000	0 000	0 000	0 000
7	0 095	0.226	-0 520	0 276	0 096	0 000	0 000	0 000	0 000
8	0 775	0.593	-0 557	0 987	0 108	0 000	0 000	0 000	0 000
9	0 273	0 338	-0 593	0 494	0 115	0 000	0.000	0.000	0 000
10	0 607	0 810	-0 672	1 409	0 132	0 000	0 000	0 000	0 000
11	-0 025	0 194	-0 708	0 216	0 136	0 000	0 000	0 000	0 000
12	0 807	0 827	-0 776	1 443	0 153	0 000	0 000	0 000	0 000
13	-0 052	0 260	-0 822	0 345	0 159	0 000	0 000	0 000	0 000
14	0 719	0 723	-0 882	1 243	0 174	0 000	0.000	0 000	0 000
15	0 095	0 189	-0 909	0 209	0 178	0 000	0 000	0 000	0 000
16	0 811	0 845	-0 979	1 481	0 196	0 000	0 000	0 000	0 000
17	-0 073	0 110	-1 006	0 057	0 198	0 000	0 000	0 000	0 000
18	0 921	0 849	-1 070	1 490	0 216	0 000	0 000	0 000	0 000
19	-0 082	0 166	-1 106	0 168	0 219	0.000	0 000	0.000	0 000
20	0 840	0 857	-1 176	1 507	0 237	0 000	0 000	0 000	0 000
21	-0 091	0 089	-1 201	0 020	0 239	0 000	0 000	0 000	0 000
22	0 943	0 945	-1 277	1 677	0 259	0 000	0 000	0 000	0 000
23	-0 212	0 036	-1 303	-0 081	0 259	0.000	0 000	0 000	0 000
24	1 016	0 939	-1 373	1 669	0 279	0 000	0 000	0 000	0 000
25	-0 205	0 033	-1 399	-0 086	0 280	0 000	0 000	0 000	0 000

TABLE 53

CUMULATIVE ELASTICITIES: EXOGENOUS VARIABLE - YRISK RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	FarmpO	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	-0 066	0 105	0 074	0 051	0 050	0 051	0.045	0 039	-0 133
1	-0 066	0 047	0 033	0 023	0 022	0 023	0 020	0.017	-0 059
2	-0 066	0 079	0 056	0 039	0 038	0 039	0 034	0 029	-0 100
3	-0 066	0 061	0 043	0 030	0 029	0 031	0 026	0 023	-0 077
4	-0 066	0 071	0 050	0 035	0 034	0 036	0 030	0 026	-0 090
5	-0 027	0 004	0 003	0 002	0 002	0 003	0 002	0 001	-0 005
6	-0 049	0 076	0 053	0 037	0 036	0 038	0 032	0 028	-0 095
7	-0 037	0 017	0 012	0 008	0 008	0 010	0 007	0 006	-0 021
8	-0 043	0 060	0 042	0 029	0 029	0 031	0 026	0 022	-0 076
9	-0 040	0 030	0 021	0 015	0 014	0 017	0 013	0 011	-0.038
10	-0 064	0 086	0 060	0 042	0 041	0 044	0 036	0 032	-0 108
11	-0 038	0 013	0 009	0 006	0 006	0 009	0 006	0 005	-0 017
12	-0 060	0 088	0 062	0 043	0 042	0 045	0.037	0 032	-0 111
13	-0 044	0 021	0 015	0 010	0 010	0 013	0 009	0 008	-0 026
14	-0 055	0 076	0 053	0 037	0 036	0 040	0 032	0 028	-0 096
15	-0 034	0 013	0 009	0 006	0 006	0 009	0 005	0 005	-0 016
16	-0 061	0 090	0 063	0 044	0 043	0.047	0 038	0 033	-0 114
17	-0 034	0 003	0 002	0 002	0 002	0.005	0 001	0 001	-0 004
18	-0 058	0 091	0 064	0 044	0 043	0 048	0 039	0 033	-0 115
19	-0 038	0 010	0 007	0.005	0 005	0 009	0 004	0 004	-0 013
20	-0 061	0 092	0 064	0 045	0 044	0 049	0 039	0 034	-0 116
21	-0 033	0 001	0 001	0 001	0 001	0 005	0 001	0 000	-0 002
22	-0 064	0 102	0 072	0 050	0 049	0 054	0 043	0 038	-0 129
23	-0 033	-0 005	-0 003	-0 002	-0 002	0 002	-0 002	-0 002	0 006
24	-0 062	0 102	0 071	0 049	0 049	0 054	0 043	0 037	-0 128
25	-0 032	-0 005	-0 004	-0 003	-0 003	0 002	-0 002	-0 002	0 007

TABLE 53 (Continued)

Lags in Months	Endogenous Variables Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-0 214	0 031	-0 015	-0 110	0 076	-0 133	-0 214	0 031	-0 026
1	-0 095	0 014	-0 007	-0 049	0 033	-0.059	-0 095	0 014	-0 018
2	-0 161	0 023	-0 012	-0 083	0.057	-0 100	-0 161	0 023	-0 022
3	-0 124	0 018	-0 009	-0 064	0 044	-0.077	-0 124	0.018	-0 020
4	-0 145	0 021	-0 011	-0 074	0 051	-0 090	-0 145	0 021	-0 022
5	-0 008	0 001	-0 001	-0 004	0 003	-0 005	-0 008	0 001	-0 006
6	-0 154	0 022	-0 011	-0 079	0 054	-0 095	-0 154	0 022	-0 019
7	-0 034	0 005	-0 003	-0 018	0 012	-0 021	-0.034	0 005	-0 009
8	-0 123	0 018	-0 009	-0 063	0 043	-0 076	-0 122	0 017	-0 016
9	-0 061	0 009	-0 005	-0 031	0 021	-0 038	-0 061	0 009	-0 012
10	-0 175	0 025	-0 013	-0 089	0 061	-0.108	-0 175	0 025	-0 023
11	-0 027	0 004	-0 003	-0 014	0 009	-0.017	-0 027	0 004	-0 009
12	-0 179	0 026	-0 014	-0 092	0 063	-0 111	-0 179	0 026	-0 023
13	-0 043	0 006	-0 004	-0 022	0 015	-0 027	-0 043	0 006	-0 012
14	-0 154	0 022	-0 012	-0 079	0 054	-0 096	-0.154	0 022	-0 021
15	-0 026	0 004	-0 003	-0 013	0 009	-0 016	-0 026	0 004	-0 009
16	-0 184	0 026	-0 014	-0 094	0 064	-0 114	-0 184	0 026	-0 024
17	-0 007	0 001	-0 002	-0 004	0 002	-0 004	-0 007	0 001	-0 008
18	-0 185	0 027	-0 014	-0 095	0 065	-0 115	-0 185	0 026	-0 023
19	-0 021	0 003	-0 003	-0 011	0 007	-0.013	-0 021	0 003	-0 009
20	-0 187	0 027	-0 015	-0 096	0 065	-0 116	-0 187	0 027	-0 024
21	-0 002	0 000	-0 001	-0 001	0 000	-0 002	-0 002	0 000	-0 007
22	-0 208	0 030	-0 016	-0 107	0 073	-0 129	-0 208	0 030	-0 026
23	0 010	-0 001	-0 001	0 005	-0 004	0 006	0 010	-0 001	-0 007
24	-0 207	0 030	-0 016	-0 106	0 072	-0.128	-0 207	0 030	-0 026
25	0 011	-0 002	-0 001	0 005	-0 004	0 007	0 011	-0 002	-0 007

TABLE 53 (Continued)

Lags in Months	Endogenous Variables								
	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	-0 003	0 076	-0 011	0 147	0 002	0 000	0.000	0 000	0 000
1	-0 107	0 033	-0 023	0 065	0 002	0.000	0 000	0 000	0 000
2	-0 049	0.057	-0 034	0 110	0 003	0.000	0 000	0 000	0 000
3	-0.082	0 044	-0 045	0 085	0 004	0.000	0 000	0.000	0 000
4	-0 064	0 051	-0 057	0 099	0.005	0 000	0.000	0 000	0 000
5	-0 072	0 003	-0 062	0.006	0 006	0 000	0.000	0 000	0 000
6	-0 007	0 054	-0 070	0.105	0.007	0 000	0 000	0.000	0.000
7	-0 077	0 012	-0 077	0 023	0 007	0.000	0 000	0 000	0 000
8	-0 019	0 043	-0 084	0 084	0 008	0 000	0 000	0.000	0.000
9	-0 061	0 021	-0 091	0 042	0 008	0 000	0 000	0 000	0 000
10	-0 033	0 061	-0 102	0 120	0.010	0.000	0.000	0 000	0 000
11	-0 087	0 009	-0 109	0 018	0 010	0 000	0 000	0 000	0 000
12	-0 016	0 063	-0 119	0 122	0 011	0 000	0 000	0 000	0 000
13	-0 089	0 015	-0 127	0 029	0 011	0 000	0 000	0 000	0 000
14	-0 024	0 054	-0.136	0 106	0 012	0.000	0 000	0 000	0 000
15	-0 077	0 009	-0 142	0 018	0 013	0 000	0 000	0 000	0 000
16	-0 016	0 064	-0 152	0 126	0 014	0 000	0 000	0 000	0 000
17	-0 091	0 002	-0 158	0 005	0 014	0 000	0 000	0 000	0 000
18	-0 006	0 065	-0 168	0 126	0 015	0.000	0 000	0 000	0 000
19	-0 092	0 007	-0 175	0 014	0 016	0.000	0 000	0 000	0 000
20	-0 013	0 066	-0 185	0 128	0.017	0 000	0 000	0 000	0 000
21	-0 092	0 000	-0 191	0 002	0 017	0 000	0 000	0 000	0 000
22	-0 004	0 073	-0 201	0.142	0 018	0 000	0 000	0 000	0 000
23	-0 103	-0.004	-0 207	-0 007	0 018	0 000	0 000	0 000	0 000
24	0 002	0 073	-0 217	0 142	0 020	0 000	0 000	0 000	0 000
25	-0 102	-0 004	-0 224	-0 007	0 020	0 000	0 000	0 000	0.000

TABLE 54

CUMULATIVE ELASTICITIES: EXOGENOUS VARIABLE - SEARSK RISK MODEL

	Endogenous Variables								
Lags in Months	Livwts	Farmp0	Fhwp	Fhfp	Fhop	Fnwp	Fnfp	Fnop	Fhws
Impact	0 000	0 023	0 015	0 011	0 013	0 011	0.010	0.009	-0 013
1	0 000	0 010	0 006	0 005	0.006	0 005	0 004	0 004	0 003
2	0 000	0 018	0 011	0 008	0 010	0 009	0 007	0 006	-0 006
3	0 000	0 014	0 008	0 006	0 008	0 007	0.006	0 005	-0 001
4	0 000	0 016	0 010	0 007	0 009	0 008	0.007	0.006	-0 004
5	0 009	0 001	-0 000	0 000	0 002	0 001	0 000	0.000	0 015
6	0 004	0 017	0 011	0 008	0 009	0 008	0 007	0 006	-0 005
7	0 006	0 004	0 002	0 002	0 003	0 002	0 002	0.001	0 012
8	0 005	0 013	0 008	0 006	0.008	0 007	0.006	0 005	-0 001
9	0 006	0 007	0 004	0 003	0.005	0 003	0 003	0 002	0.008
10	0 000	0 019	0 012	0 009	0 011	0.009	0 008	0 007	-0 008
11	0 006	0 003	0 001	0 001	0.003	0 001	0 001	0 001	0 013
12	0 001	0 020	0 013	0 009	0 011	0 010	0 008	0 007	-0 008
13	0.005	0.005	0.002	0.002	0.004	0.002	0 002	0 002	0 010
14	0 002	0 017	0 011	0 008	0 009	0.008	0 007	0 006	-0 005
15	0 007	0 003	0 001	0 001	0 003	0 001	0 001	0.001	0 013
16	0 001	0 020	0 013	0 009	0.011	0.010	0 008	0 007	-0 009
17	0 007	0 001	-0 001	0 000	0 002	0 000	0 000	0 000	0 015
18	0 002	0 020	0 013	0 010	0.011	0 010	0 009	0 007	-0 009
19	0 006	0 002	0 001	0 001	0 003	0.001	0 001	0.001	0 013
20	0 001	0 020	0 013	0 010	0 011	0 010	0 009	0 007	-0 009
21	0 007	0 000	-0 001	-0 000	0 002	0 000	0 000	-0 000	0 016
22	0 000	0 023	0 015	0 011	0 012	0 011	0 010	0 008	-0 012
23	0 007	-0 001	-0 002	-0 001	0 001	-0 000	-0 000	-0 001	0 018
24	0 001	0 023	0 015	0 011	0 012	0 011	0 010	0 008	-0 012
25	0 007	-0 001	-0 002	-0 001	0 001	-0 000	-0 000	-0 001	0 018

TABLE 54 (Continued)

	Endogenous Variables								
Lags in Months	Fhfs	Fhos	Fnws	Fnfs	Fnos	Profhw	Profhf	Profho	Profnw
Impact	-0 032	0 029	0 005	-0 014	0 028	-0 013	-0 032	0.029	0 004
1	-0 006	0 025	0 007	0 000	0 019	0 003	-0 006	0 025	0 006
2	-0 020	0 028	0 006	-0 008	0 024	-0 006	-0 020	0 027	0 005
3	-0 012	0 026	0 006	-0 003	0.021	-0 001	-0.012	0 026	0 005
4	-0 017	0 027	0 006	-0 006	0 023	-0 004	-0 017	0 027	0 005
5	0 014	0 023	0 008	0 010	0 012	0.015	0.014	0 023	0 009
6	-0 019	0 027	0 006	-0 007	0.023	-0 005	-0 019	0 027	0 006
7	0 008	0 023	0 008	0 007	0 014	0 012	0.008	0 023	0 008
8	-0 012	0 026	0 006	-0 003	0 021	-0 001	-0.012	0.026	0 006
9	0 002	0 024	0 007	0 004	0 016	0 008	0 002	0 024	0 007
10	-0 023	0 028	0 006	-0 009	0 025	-0 008	-0 023	0.028	0 005
11	0 009	0 023	0 008	0 008	0 013	0 013	0 009	0 023	0 008
12	-0 024	0 028	0 006	-0 010	0 025	-0 008	-0 024	0 028	0 005
13	0 006	0 024	0 008	0 006	0 015	0 010	0 006	0 024	0 007
14	-0 019	0 027	0 006	-0 007	0.023	-0 005	-0 019	0 027	0 006
15	0 010	0 023	0 008	0 008	0 013	0.013	0 010	0 023	0 008
16	-0 025	0 028	0 005	-0 010	0 026	-0 009	-0 025	0 028	0 005
17	0 014	0 023	0 008	0 010	0 012	0.015	0 014	0 022	0 008
18	-0 026	0 028	0 005	-0 010	0 026	-0 009	-0 026	0 028	0 005
19	0 011	0 023	0 008	0 008	0.013	0 013	0.011	0 023	0 008
20	-0 026	0 028	0 005	-0 010	0 026	-0 009	-0 026	0 028	0 005
21	0 015	0 022	0 008	0 011	0 011	0 016	0 015	0 022	0 008
22	-0 031	0 029	0 005	-0 013	0 027	-0.012	-0 031	0 029	0 004
23	0 018	0 022	0 009	0 012	0 010	0 018	0 018	0 022	0 009
24	-0 031	0 029	0 005	-0 013	0 027	-0 012	-0 031	0 029	0 004
25	0 018	0 022	0 009	0 012	0 010	0.018	0 018	0 022	0 009

TABLE 54 (Continued)

	Endogenous Variables								
Lags in Months	Profnf	Profno	Fnwei	Fnfei	Fnoei	Farmp1	Farmp2	Farmp3	Farmp4
Impact	0.010	0.028	-0.001	0.033	0.001	0.000	0.000	0.000	0.000
1	-0.013	0.019	-0.002	0.014	0.001	0.000	0.000	0.000	0.000
2	-0.000	0.024	-0.002	0.025	0.001	0.000	0.000	0.000	0.000
3	-0.007	0.021	-0.003	0.019	0.002	0.000	0.000	0.000	0.000
4	-0.003	0.023	-0.004	0.022	0.002	0.000	0.000	0.000	0.000
5	-0.005	0.012	-0.003	0.001	0.003	0.000	0.000	0.000	0.000
6	0.009	0.023	-0.003	0.023	0.003	0.000	0.000	0.000	0.000
7	-0.006	0.014	-0.003	0.005	0.003	0.000	0.000	0.000	0.000
8	0.007	0.021	-0.003	0.019	0.004	0.000	0.000	0.000	0.000
9	-0.003	0.016	-0.003	0.009	0.004	0.000	0.000	0.000	0.000
10	0.003	0.025	-0.004	0.027	0.005	0.000	0.000	0.000	0.000
11	-0.008	0.013	-0.003	0.004	0.005	0.000	0.000	0.000	0.000
12	0.007	0.025	-0.004	0.027	0.006	0.000	0.000	0.000	0.000
13	-0.009	0.015	-0.004	0.006	0.006	0.000	0.000	0.000	0.000
14	0.006	0.023	-0.004	0.023	0.006	0.000	0.000	0.000	0.000
15	-0.006	0.013	-0.004	0.004	0.007	0.000	0.000	0.000	0.000
16	0.007	0.026	-0.004	0.028	0.007	0.000	0.000	0.000	0.000
17	-0.009	0.012	-0.004	0.001	0.007	0.000	0.000	0.000	0.000
18	0.009	0.026	-0.005	0.028	0.008	0.000	0.000	0.000	0.000
19	-0.010	0.013	-0.004	0.003	0.008	0.000	0.000	0.000	0.000
20	0.008	0.026	-0.005	0.028	0.009	0.000	0.000	0.000	0.000
21	-0.010	0.011	-0.005	0.000	0.009	0.000	0.000	0.000	0.000
22	0.010	0.027	-0.005	0.032	0.010	0.000	0.000	0.000	0.000
23	-0.012	0.010	-0.005	-0.002	0.010	0.000	0.000	0.000	0.000
24	0.011	0.027	-0.005	0.031	0.010	0.000	0.000	0.000	0.000
25	-0.012	0.010	-0.005	-0.002	0.011	0.000	0.000	0.000	0.000

VITA

William Branch

Candidate for the Degree of

Doctor of Philosophy

Thesis: A SIMULTANEOUS EQUATIONS MODEL AND ANALYSIS OF THE U.S. CATFISH MARKETING SYSTEM

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Saranac Lake, New York, February 7, 1958.

Education: Received Bachelor of Science Degree in Accounting from the University of Wyoming in May 1982; received Master of Science Degree in Agricultural Economics from the University of Wyoming in August 1986; completed the requirements for the degree of Doctor of Philosophy at Oklahoma State University in July 1991.

Professional Experience: Staff Accountant, McKee, Marburger and Company, CPA's, June 1982 - September 1983; Graduate Teaching Assistant, Department of Agricultural Economics, University of Wyoming, August 1984 - August 1986; Graduate Research Assistant, Department of Agricultural Economics, Oklahoma State University, August 1986 - November 1988; Economic Research Analyst, Department of Agricultural Economics, Oklahoma State University, November 1988 - Present.