

EXHIBIT 3

**IN THE UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF MISSOURI
EASTERN DIVISION**

IN RE GENETICALLY MODIFIED RICE LITIGATION)))))	4:06 MD 1811 CDP ALL CASES
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DECLARATION OF WALTER N. THURMAN

Introduction

1. My name is Walter N. Thurman. I am a Professor of Agricultural and Resource Economics at North Carolina State University. I conduct research and teach courses in agricultural markets and econometrics. I have authored articles in the leading economics and agricultural economics journals and I am an Editor of the *American Journal of Agricultural Economics*. I am the author of a book on agricultural policy and its environmental consequences. My research is relevant to the current case as I have written on the structure of agricultural markets, on determinants of commodity prices, and on futures price movements. I have consulted on antitrust and damages matters and have testified at trial as an economic expert on damages. I have not testified as an expert at trial or by deposition in the past four years. My curriculum vitae is attached as Appendix A.
2. I have been asked by counsel for defendant Bayer CropScience LP to review the December 14, 2007 declaration of Professor Colin A. Carter (hereafter “Carter”) and comment on the relevance of futures price movements to the prices received by rice producers. Carter discusses changes in rough rice futures prices beginning on August 18, 2006—the day of a USDA announcement that LLRICE genetic material had been discovered in marketed U.S. rice—and suggests that the futures price decline could be the basis for a damages calculation that would be applicable to a broad set of rice producers.¹ My work is ongoing and I may update and revise my results and conclusions as I review additional data and information. A complete list of materials I have considered to date in connection with this particular assignment is included as Appendix B. Part of the work for this investigation was performed by others working under my direction.

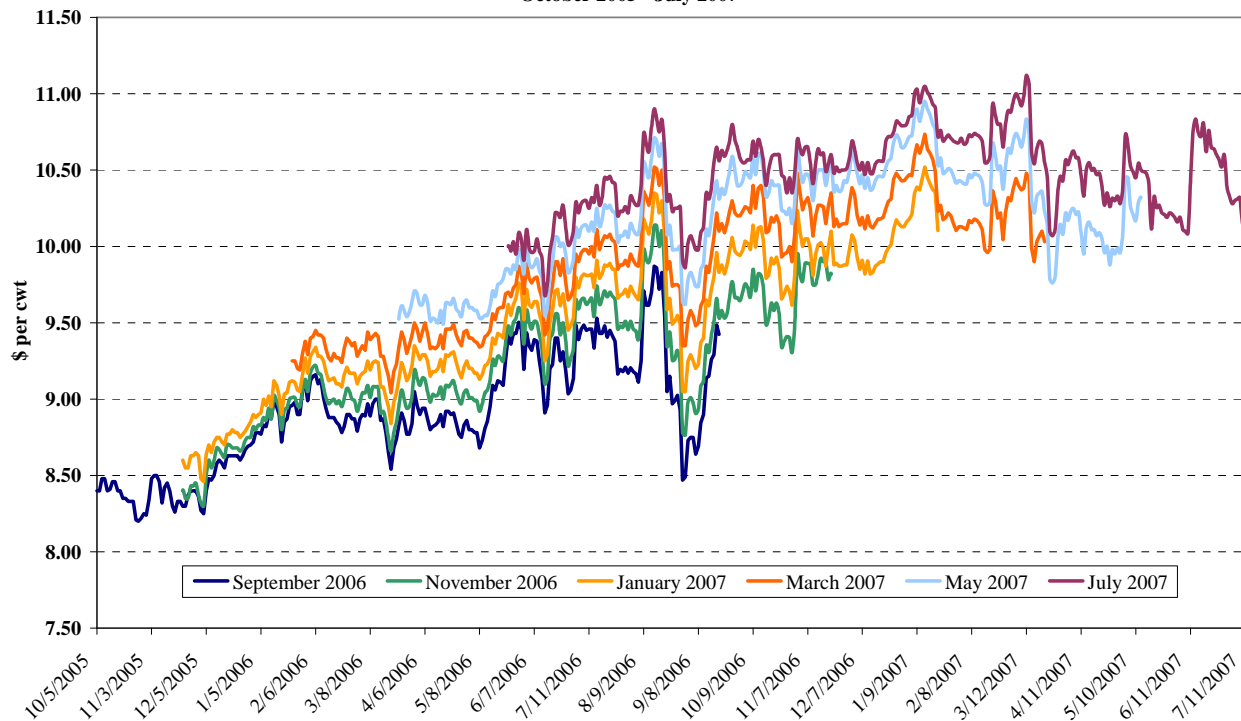
Futures Contracts

3. Futures contracts for rough rice are traded on the Chicago Board of Trade futures exchange. At any one time, contracts are traded for six future delivery months: January, March, May, July, September, and November. One can trade a futures contract either by buying (taking a long position) or by selling (taking a short position). For example, selling a November futures contract obligates the seller to deliver 2,000 hundredweight (cwt) of rough rice in November at the price of the contract prevailing on the day the contract is sold. Buying a November contract obligates the buyer to take delivery of 2,000 cwt of rough rice in November at the same price.
4. Profits can be made by entering into futures contracts. Suppose that on August 1 a trader took a short position by selling a November contract. Further suppose that the spot market price of rice in November turned out to lie below the August 1 price of the November contract. The trader would then have the right to deliver on his contract and sell rice at the price established on August 1, higher than the spot price in November. This would generate profits. On the other hand, if the November rice price turned out to lie above the August 1 futures price, the holder of the short position would incur losses

¹ I have not been asked to perform the analysis necessary to determine whether there is a reliable method for determining damages, if any, using rice futures data.

by having to sell rice at a price lower than that at which he could sell on the spot market. Thus, a trader taking a short position earns profits if prices fall and incurs losses if prices rise. The situation is reversed for a trader who buys a futures contract. By taking a long position, a trader profits if prices rise and incurs losses if prices fall.

Figure 1: Rough Rice Futures Prices for Selected Contracts
by Contract Maturity and Calendar Date
October 2005 - July 2007



Notes and Sources: Data are Chicago Board of Trade (CBOT) rough rice futures prices for contracts that mature in the labeled month.

5. Because six contracts trade at any one time, each with a different delivery date, traders can take positions with respect to the price of rice at any one of six future dates. Figure 1 displays the price history of the six contracts that existed at the beginning of August 2006. In August, the nearest delivery contract was the September 2006 contract and it traded at the lowest price. The farthest out contract at the time was the July 2007 contract and is the topmost line in Figure 1. As of August 2006, the September 2006 contract was the oldest contract traded, having been introduced in October 2005; the July 2007 contract had begun trading just two months earlier. Figure 1 illustrates the differences that market participants anticipated for future rice prices. In August, about \$1.00/cwt separated the July 2007 contract's price from the September 2006 contract's price, reflecting the market's expectation of the difference between rice prices at the two times of delivery.

Information and Futures Markets

6. There is broad empirical support in the economics literature for the proposition that commodity futures markets are informationally efficient—that they embody all publicly available information and quickly incorporate new information. The logic of this

proposition derives from the profit possibilities and incentives that futures markets provide to traders.

7. For example, traders in November futures contracts can take either long or short positions. The prospect of profit provides them with the incentive to take a long position if they believe the price of rice will rise and to take a short position if they believe the price of rice will fall. Because profits in the futures market depend on correctly predicting the direction of market movements, traders have the incentive to analyze current information to discover its implications for forecasting the future price. If new information causes market participants to reduce their forecast of future market demand for a commodity, more traders will attempt to take short positions and sell futures contracts, which will force the price of a contract down until it reflects this new understanding of future market conditions.
8. From this perspective, the November 2006 rough rice futures price at the close of trading on the LLRICE announcement day (8/18/06) reflected market participants' best estimate of what the price of rice in November would be, given what was known at the time. The closing price on 8/18 was different from the closing price on 8/17 and the change in price can be interpreted as the change in the market's prediction of the November 2006 price due to all relevant information that flowed to the market during the 24-hour period. Moving forward in time, the change in the November futures price between 8/18 and 8/24 can be interpreted as the change in the market's prediction of the November 2006 price due to all relevant information that flowed to the market during the four-trading-day period. This is the efficient markets interpretation: new information induces the market to change its expectations of future commodity prices and futures contract prices move accordingly.

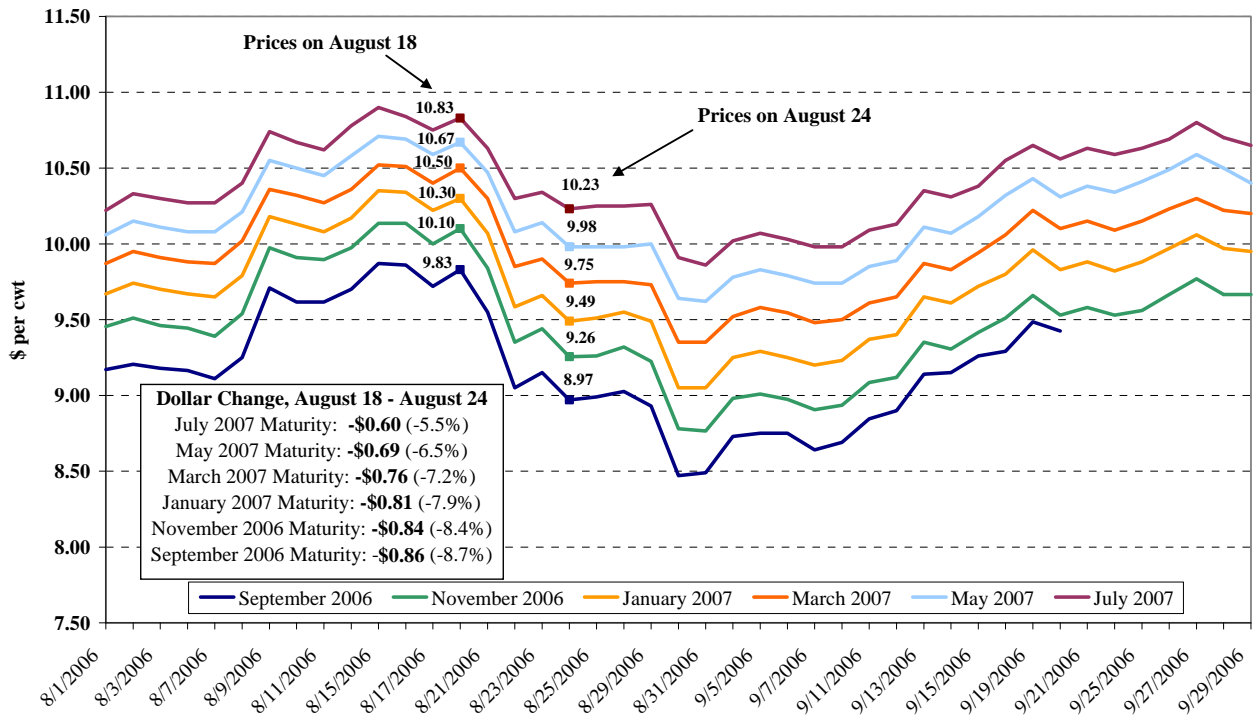
Futures Price Changes and Changes in Producer Prices

9. To equate futures price movements over a study interval (Carter focuses on the period 8/18/06-8/24/06) with changes in the prices received by producers due to the LLRICE announcement on 8/18 requires assumptions beyond the efficient markets hypothesis. They include: (i) that there is a known link between the price of a futures contract and the price received by a producer who sells rice on that day; (ii) that all the news that flowed to the market during the four-trading-day period was related to the LLRICE announcement; and (iii) that the market's assessment of the effects of the LLRICE announcement at the end of the study interval was the same as the market's assessment at the time the producer sold his rice. I will discuss each in turn.
 - (i) The link between futures contract prices and producer prices
10. Rice producers can sell their product in a variety of ways. They can forward contract, locking in a price at the time of contract (or a component of the price, such as basis). They can sell to a cooperative pool, choosing from a menu of options for determining price. They can sell on the spot, or cash, market. Further, because producers have access to futures markets, they can use futures contracts and options on futures contracts as tools to hedge against adverse price movements. To determine the connection between a

change in a futures price and the net price received by a producer would require consideration of which marketing option the particular producer had chosen and what risk hedging measures he had used.

- Beyond the issue of the marketing option chosen by a producer lies the issue of which of the several futures contracts might be relevant. In order to connect futures price changes with future spot price changes relevant to a producer, one would at least need to identify a futures contract with a delivery time close to the sales date for the individual producer.

Figure 2: Rough Rice Futures Prices by Contract Maturity and Calendar Date August 1, 2006 - September 30, 2006

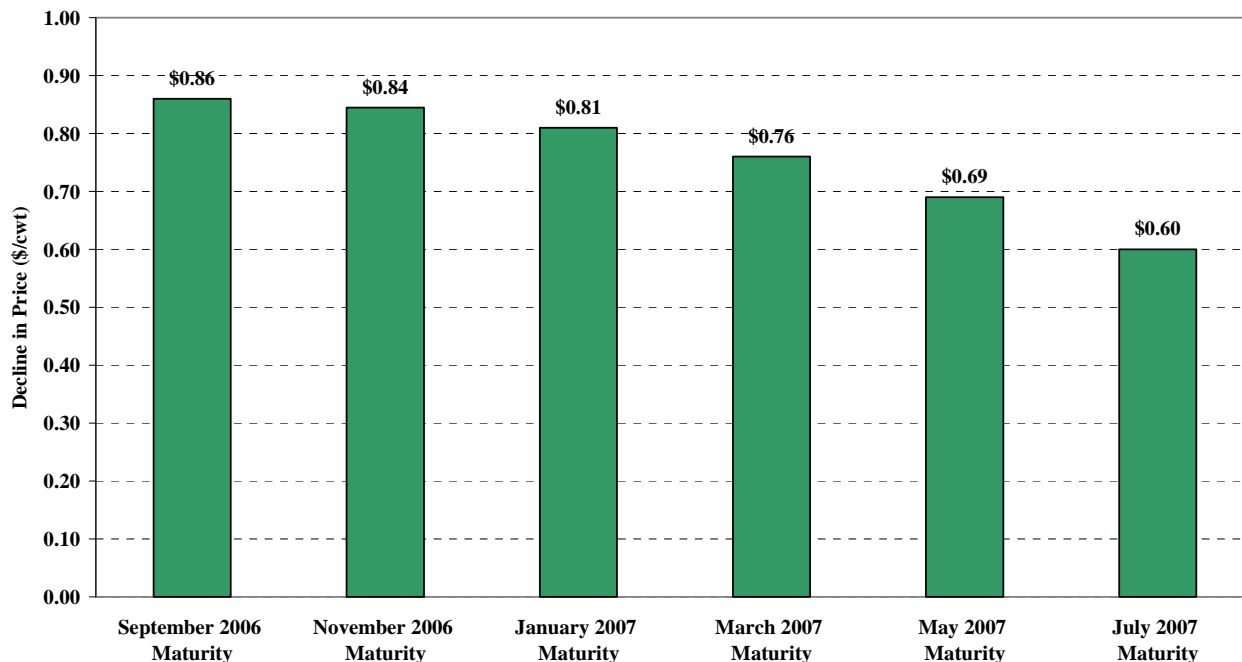


Notes and Sources: Data are Chicago Board of Trade (CBOT) rough rice futures prices for contracts that mature in the labeled month.

- In his report, Carter focuses on just the November contract. He justifies this by asserting that the contracts “fell in price by approximately the same amount following the contamination announcement.”² Figures 2 and 3 shed light on this claim. During the study interval, the six contracts previously displayed in Figure 1 provided measures of market expectations of future prices for September and November 2006, and January, March, May, and July 2007. Figure 2 shows the movements in the prices of the six rice contracts during the months of August and September. While the prices of the contracts display similar patterns, the distance between contract prices varies significantly, and in particular, over the study interval. The futures market made significantly different revisions to its expectations of future spot prices, depending on the delivery month.

² Carter declaration, footnote 23, p. 34.

Figure 3: Declines in Rough Rice Futures Prices
by Contract Maturity
August 18, 2006 - August 24, 2006



Notes and Sources: Data are calculated using Chicago Board of Trade (CBOT) rough rice futures prices for contracts that mature in the labeled month. Price declines are calculated as follows: $-(\text{Price}_{\text{Aug. 24}} - \text{Price}_{\text{Aug. 18}})$.

13. The difference in price expectation revisions across contracts can be seen clearly in Figure 3, which displays the declines in the prices of the six contracts between 8/18 and 8/24. The left bar shows that the price of the September 2006 contract fell by \$0.86/cwt. Moving to the right, Figure 3 reveals a natural pattern of response to price-depressing news: the largest decline is seen for the nearest-delivery contract. Farther out on the delivery horizon, declines in prices were smaller, consistent with the idea that with more time to adjust, the price impacts of bearish news would become more muted. In contrast to the \$0.86/cwt decline in the price of the September 2006 contract, the July 2007 contract fell by \$0.60/cwt—a 30% smaller decline in the 11-month-to-delivery contract than in the one-month-to-delivery contract.
- (ii) Was all news in the study interval related to the 8/18 announcement?
14. This is unlikely. Futures prices change nearly every day, even on days when no market-relevant news can be found in the press. For example, in the four months prior to the LLRICE announcement the average four-trading-day price change was 1.5% (averaged over all four-day intervals in the period and over all contracts that were traded throughout the four-month period). Any change in information that is relevant for assessing commodity supply and demand in the future will move futures prices.

(iii) Does the study interval include all information relevant at the time of sale?

15. The market's reaction to the LLRICE announcement began on the first trading day following the announcement. Related news several days later that the European Union had banned imports of rice that could not be demonstrated to be GMO free also influenced futures prices. Information continued to flow to the market about how other importers and U.S. rice producers would respond to the unfolding events; this later information also influenced prices. In December 2006, the Outlook Report from the Economic Research Service of the USDA indicated "[i]t is too early to gauge the full impact of the GE [genetically engineered] issue on U.S. rice exports in 2006/07 or in any future years."³
16. The market's complete assessment of the LLRICE announcement and its implications could be measured during the study interval only if information ceased to arrive at the market at the end of the interval. Because information continued to flow to the market, stopping on any day prior to the sales day of a particular producer is arbitrary.

On the Permanence of Price Changes in the Rice Market

17. Carter performs statistical tests and concludes that futures contract prices follow a random walk. A random walk is a time series that has no tendency to revert to a long-run mean; it is often referred to as a nonstationary series. For a random walk, the best forecast of all future values is the current period's value. This implies that if a random walk is displaced from its previous value, that displacement is permanent in the sense that the forecast of all future values changes by that same amount.
18. In Carter's view, the declines in futures prices following the 8/18 announcement were permanent⁴ and the sum of the price declines that occurred on 8/21, 8/22, and 8/24 (93.5 cents/cwt) represents a price discount that could persist forever.⁵ The basis for Carter's conclusion is his characterization of rice prices as following a random walk. He uses statistical methods to conclude that the data are consistent with a random walk process. But the changes in futures contract prices over the study period indicate that the market did not consider the near-term changes in rice prices to be permanent. If it had, all contracts would have fallen by the same amount—which they did not (see Figure 3).
19. Further, the data Carter analyzes are consistent with statistical models that have very different long-run implications than does the random walk. To draw inference from the random walk model is arbitrary and, further, unreasonable given its unreasonable implications.

³ Nathan Childs and Janet Livezey, "Outlook Report from the Economic Research Service: Rice Backgrounder," USDA, December 2006, p. 9.

⁴ Carter deposition, pp. 205-207.

⁵ The actual decline in the price of the November 2006 futures contract over the period 8/18 to 8/24 is 84 cents/cwt, as Carter does not include a 9 cent increase in the price that occurs on 8/23 (Carter deposition, pp. 265-267).

20. Among the implications of rice prices following a random walk is the implication that the price of rice is unbounded—as time passes, with probability one, the price of rice eventually will exceed any arbitrarily high value (say \$1,000 per hundredweight) and eventually will fall below any arbitrarily low value (say \$0.01 per hundredweight or even negative values). This implication of the random walk model is unrealistic because the price of rice is limited from falling too low by costs of production and from rising too high by consumers' abilities to switch to non-rice food alternatives should the price of rice rise high enough. While a random walk may not be ruled out by certain statistical tests, its unreasonable implications suggest that it should be rejected.
21. The real world fact that rice prices are bounded is entirely consistent with the data Carter analyzes. To demonstrate this, I apply a standard statistical model (a first-order autoregression) to Carter's bi-monthly futures price data to estimate the relationship between the current price and the price in the previous period (the lagged price). The estimated coefficient on the lagged price reveals the extent of persistence in price changes.
22. Estimating a first-order autoregression from the data used by Carter in his Table 11 yields a value of 0.936 for the key parameter that relates current and lagged price.⁶ A 95% confidence interval for the autoregressive parameter is given by the interval (0.852, 1.020). A confidence interval is a standard statistical calculation that reflects the uncertainty one should acknowledge in estimation. Notice that while the interval contains the value 1.0—which would imply a random walk—it also contains a range of values less than 1.0, for which price changes are not permanent. This type of series is often referred to as a stationary series. The lower the value of the autoregressive parameter, the less persistent are price changes.
23. Prices following a stationary first-order autoregressive model exhibit correlation between current and lagged values but, nonetheless, tend to revert to a long-run mean. Market changes are persistent, but they are not permanent as their effects dissipate over time. Using the 0.936 estimate of the autoregressive parameter derived from Carter's data, one can conclude that a one-time drop in demand that reduced price by \$0.10 in the current month would still influence the market 10 months later, but the size of its impact would be reduced to \$0.072. This provides independent corroboration of what is seen in the comparison of price changes across contracts in Figure 3: a near-30% smaller price impact 10 months farther out.
24. In addition, one cannot dismiss the possibility that the degree of persistence in the price series is much lower. According to the 95% confidence interval, the data are consistent with values of the autoregressive parameter as low as 0.852. A value of 0.852 would

⁶ Carter's Table 11 contains the results of statistical tests he uses to support his position that rice prices follow a random walk. I was provided by counsel with the underlying data file used to produce these results. The data as supplied to me were not in sequential time order, in contradiction to labeling of the data that indicated otherwise. To estimate the autoregressive parameter required reordering the data as a standard time series. The estimated equation from the correctly sequenced data is $\hat{F}_t = 0.517 + 0.936F_{t-1}$. The standard errors for the intercept and slope are 0.337 and 0.0428 respectively.

imply that the price impact ten months out would be less than half of the price impact at the time that the news arrived at the market.

25. These results show that Carter's statistical work on the permanence of price changes is not particularly informative. Moreover, if price changes are not permanent, the task of calculating the effects of the LLRICE announcement on the prices actually received by farmers, if any, becomes an individualized inquiry in which the timing of each producer's rice sales is critical.

The Implications of Efficient Markets Theory for the Permanence of Price Changes

26. Carter suggests that the efficient markets hypothesis supports the idea that rice futures prices follow a random walk.⁷ This suggestion is misleading. The efficient markets hypothesis does provide theoretical support for the argument that prices of financial assets traded in liquid markets should follow a random walk. But the argument does not apply to the spot price of rice, and it does not apply to a time series composed of the prices of different financial assets—futures contracts with different delivery dates—such as the time series analyzed in Table 11 of Carter's report.⁸
27. In the context of futures markets, the random walk implications of efficient markets theory can only appropriately be applied to the prices of a particular futures contract. Consider the November 2006 contract, which existed only for the 14 months that it traded—from September 2005 to November 2006. If the efficient markets hypothesis properly characterizes the rice futures market, then the November 2006 futures price followed a random walk. When new information arrived to the market and was incorporated into that day's price, the change was permanent in the sense that the forecast for all future dates would be revised by the same amount. Any tendency for one day's price decline, for example, to reverse itself the next day and for the November futures price to predictably revert toward a long-run mean would imply a profitable trading opportunity, the possibility of which is denied by the efficient markets hypothesis.
28. However, changes in the spot price of rice, or in a series of futures contracts that forecast the spot price on different delivery dates, can predictably revert toward a long-run mean and not be in conflict with the efficient markets hypothesis. The same arbitrage opportunities that exist for a single futures contract do not exist for spot prices (or for predictions of spot prices two months prior). The efficient markets hypothesis does not imply that either series should follow a random walk and it, therefore, has no implication for the long-run permanence of price changes in rice spot or futures markets.

⁷ See Carter declaration, p. 40.

⁸ As discussed previously in footnote 6, the data series provided to me as Carter's source for Table 11 is not a time series. I refer here to the reordered series I used to estimate the first-order autoregressive model. Carter's analysis in Table 11 appears to have been run on the improperly ordered data.

Conclusion

29. I conclude that Carter has not established that declines in rough rice futures prices immediately following 8/18/06 provide a reliable basis for determining price changes that might have been experienced by individual rice farmers as a result of the discovery of LLRICE genetic material in marketed U.S. rice. Carter's random walk characterization of rice prices is unrealistic and inconsistent with observed futures price changes and the basic notion that rice prices are bounded. The price data Carter uses for his statistical tests are consistent with a statistical model in which one-time price changes dissipate over time and prices revert to a long-run mean. His report advances no methodology that would properly account for variation in the means by which individual producers marketed their rice; and it advances no methodology that would properly connect the timing of individual producers' sales with the information that had flowed to the market at the times of their sales.

I declare under the penalties of perjury that the foregoing statements are true and correct to the best of my knowledge and belief.

March 4, 2008

Walter N. Thurman

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Appendix A

Curriculum Vita
Walter N. Thurman

February 27, 2008

Agricultural & Resource Economics
North Carolina State University
Raleigh, North Carolina 27695-8109
(919) 515-4545

Education

Ph.D., Economics, University of Chicago, 1984.
M.S., Economics, Montana State University, 1977.
B.A., Environmental Studies, Utah State University, 1976.

Experience

William Neal Reynolds Professor of Agricultural & Resource Economics,
N.C. State University, 2007 to present.
Professor of Agricultural & Resource Economics, 1994 to present.
Professor of Economics, N.C. State University, 1994 to present.
Editor of the American Journal of Agricultural Economics, 2006-present.
Associate Director of the Kinship Conservation Institute, 2005-present.
Senior Fellow of the Property and Environment Research Center, 2003 to present.
Visiting Professor, Dept. of Ag. Econ. and Econ., Montana State University, 2002.
Director of Economics Graduate Program, N.C. State University, 1996-1999
Associate Professor, N.C. State University, 1989-1994.
Visiting Lecturer, University of Waikato in Hamilton, New Zealand, 1990.
Assistant Professor, N.C. State University, 1984-1989.
Instructor, Loyola University of Chicago, 1982-1983.
Research Associate, RCF Inc., Chicago, 1981-1982.
Research Staff, Standard Oil of Indiana, 1980.

Research and Teaching Fields

Agricultural and natural resource economics, econometrics, welfare economics.

Awards and Honors

Julian Simon Fellow, Summer 2003, Property and Environment Research Center
Quality of Research Discovery Award, American Agricultural Economics Association, 1996
First recipient of the American Agricultural Economics Association Outstanding Graduate
Instructor Award (10 or more years experience), 1996
First recipient of the NCSU College of Agriculture and Life Sciences Outstanding Graduate
Instructor Award, 1994-1995.

Working Papers

“Announcement Effects and the Theory of Storage: an Empirical Study of Lumber Futures Markets,” (with Berna Karali), under review.

“Contests, Grand Prizes and the Hot Hand,” (with Todd McFall and Charles Knoeber), under review.

“Internalizing Reciprocal Benefits: The Economics of Honeybee Pollination Markets” (with Randy Rucker and Michael Burgett).

“Crowding Out Open Space: Federal Land Programs and Their Effects on Land Trust Activity” (with Dominic P. Parker).

Publications - Refereed Journal Articles

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Publications - Books and Monographs

- Thurman, Walter N., Assessing the Environmental Impact of Farm Policies, AEI Press, Washington, D.C., 1995.

Publications - Other Journal Articles

- Thurman, Walter N., "Bayesian Specification Analysis in Econometrics: Comment" American Journal of Agricultural Economics 83(2001): 1187-1189.
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Publications - Popular Press

Parker, Dominic P. and Walter N. Thurman, "The Private and Public Economics of Land Trusts," NC State Economist, July/August 2004.

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Knoeber, Charles R. and Walter N. Thurman, "Broiler Contracting: Smooths Grower Incomes, Shifts Price Change Risk, but Critics Maintain Gains Accrue Largely to Integrators," N.C. State Economist, September 1994.

Knoeber, Charles R. and Walter N. Thurman, "The Risk-Shifting Effects of Broiler Contracts," N.C. State Economist, September 1994.

Thurman, Walter N. "Reasons Debated for Consumption Pattern Changes," N.C. State Economist, April 1993.

Thurman, Walter N. "Relative Prices," N.C. State Economist, March 1990.

Thurman, Walter N. "Has Poultry Consumption Risen Because Prices Have Dropped?" Processed Poultry, January/February 1989: 32-34.

Thurman, Walter N. "Chicken Cycles," Tar Heel Economist, May 1988.

Thurman, Walter N., "Effects of the Peanut Program," Tar Heel Economist, February 1988.

Publications - Popular Press - continued

Thurman, Walter N. "Distinguishing Between Price Effects and Preference Changes," Tar Heel Economist, February 1986.

Thurman, Walter N. and James E. Standaert, "Reasons for Changes in Meat Consumption Composition," Tar Heel Economist, February, 1986.

Thurman, Walter N. "Why Has Poultry Consumption Doubled?" Breakthrough (published by the N.C. State Univ. Dept. of Poultry Science), December 1985.

Presented Papers

Parker, Dominic P. and Walter N. Thurman, "Crowding Out Open Space: Federal Land Programs and their Effects on Private Land Trust Activity," 2004 meetings of the American Agricultural Economics Association, Denver. Also presented at Montana State University, Michigan State University, and the University of Illinois in summer and fall 2004.

Thurman, Walter N. "A Classical Liberal View of Land Trusts," presented at the biennial international meeting of the Mont Pelerin Society Meetings in Salt Lake City, August 2004.

Rucker, Randal R., Walter N. Thurman, and Michael Burgett, "The Internalization of Reciprocal Benefits: An Analysis of Honeybee Pollination Markets," presented at U. of Maryland, Montana State, UC-Davis, Utah State, Washington State, and Oregon State Universities, spring and summer 2002, Clemson University and the University of Maryland, 2003.

Chvosta, Jan, Walter N. Thurman, and A. Blake Brown, "The Economic Effects of Recent Change in Federal Peanut Policy," presented at American Peanut Research and Education Society meetings in Raleigh, North Carolina, July 20, 2002.

Walter N. Thurman and A. Blake Brown, "The Economic Consequences of the Elimination of the Tobacco Program," presented at the Tobacco Workers Conference in Pinehurst, North Carolina, January 15, 2002.

Rucker, Randal R. and Walter N. Thurman, "An Empirical Analysis of Honeybee Pollination Markets," presented at the 2001 summer meetings of the American Agricultural Economics Association in Chicago, IL.

Chvosta, Jan, Randal R. Rucker, and Walter N. Thurman, "Peanut Quota Markets and Peanut Production after FAIR," presented at the 2001 summer meetings of the American Agricultural Economics Association in Chicago, IL.

Rucker, Randal R., Jonathon K. Yoder, and Walter N. Thurman, "An Economic Analysis of the Determinants of Lumber Futures Price Movements," presented at the 1999 summer meetings of the American Agricultural Economics Association in Nashville, Tennessee.

Thurman, Walter N., Tyler Fox and Tayler Bingham, "Imposing Smoothness Priors in Applied Welfare Economics: An Analysis of Environmental Regulation in the Pulp and Paper Industry," presented to the U. of Arizona Econometrics Workshop, Tucson AZ, April 23, 1999.

Thurman, Walter N. and Francis G. Scrimgeour, "Agricultural Marketing Boards: The Structure of Rent Dissipation in New Zealand," presented at the meeting of the International Agricultural Trade Research Consortium, Washington, D.C., December 15, 1996.

Muth, Mary, Randal R. Rucker, Walter N. Thurman, and Ching-Ta Chuang, "A Post Mortem of the U.S. Honey Program," presented at Kansas State University's Department of Agricultural Economics, March 22, 1996.

Muth, Mary, Randal R. Rucker, Walter N. Thurman, and Ching-Ta Chuang, "A Post Mortem of the U.S. Honey Program," presented at Tulane University's Department of Economics, February 23, 1996.

Park, Hoanjae and Walter N. Thurman, "On Interpreting Inverse Demand Systems: A Primal View of Scale Flexibilities and Income Elasticities," paper presented at the NCSU Agricultural Economics Workshop, February 13, 1996.

Muth, Mary, Walter N. Thurman, and Ching-Ta Chuang, "A Post Mortem of the U.S. Honey Program," presented paper at the 1996 meetings of the Southern Agricultural Economics Association in Greensboro, North Carolina.

Thurman, Walter N., "The Environmental Effects of Agricultural Policy," paper presented at an American Enterprise Institute conference, "Future Directions in Agricultural Policy," held in Washington, D.C. on November 3-4, 1994.

Thurman, Walter N., "Restricting the Market for Quota: An Analysis of Tobacco Production Rights with Corroboration from Congressional Testimony," presented at the Brigham Young University Department of Economics, June 21, 1994.

Borges, Robert B. and Walter N. Thurman, "Production Quotas and Random Yields: The Marginal Effects of Inframarginal Subsidies on Peanut Production," at the presented at the annual meetings of the American Agricultural Economics Association in Orlando, Florida, August 1993.

Robenstein, Rodney and Thurman, Walter N., "Health Risk and the Demand for Red Meat: Evidence from Futures Markets," presented at the annual meetings of the American Agricultural Economics Association in Orlando, Florida, August 1993.

Morales, Roberta and Thurman, Walter N., "Welfare Analysis in a Market with Multiple Distortions: The Case of Salmonella enteritidis in Eggs," presented at the annual meetings of the American Agricultural Economics Association in Orlando, Florida, August 1993.

Easley, J.E., Jr. and Walter N. Thurman, "Valuation of Commercial Harvest: Practical considerations for Fishery Management of the General Equilibrium Derived Demand and a Recent Application," presented at the International Conference on Fisheries Economics, Centre for Fisheries Economics, Norwegian School of Economics and Business Administration, Bergen, Norway, May 1993.

Thurman, Walter N. "Imposing Priors in Applied Welfare Analysis: Applications of Leamer's Information Contract Curve," seminar presented at the University of California-Davis Department of Agricultural Economics, June 7, 1993.

Thurman, Walter N. "Applied General Equilibrium Welfare Analysis," presented at the annual meetings of the American Agricultural Economics Association in Manhattan, Kansas, August 1991.

Thurman, Walter N. and Randal R. Rucker, "The Side Effects of Supply Controls," presented at the annual meetings of the American Agricultural Economics Association in Manhattan, Kansas, August 1991.

Rucker, Randal R., Walter N. Thurman, and Daniel A. Sumner, "The Economic Effects of Transferability Restrictions on Tobacco Quota," presented at the 1991 annual meetings of the American Agricultural Economics Association in Vancouver, British Columbia, August 1990.

Thurman, Walter N. "The Welfare Significance of General Equilibrium Supply and Demand Curves," The University of Waikato, Hamilton, New Zealand, September 1990 and Lincoln University, New Zealand, December 1990.

Thurman, Walter N. "On The Welfare Significance of General Equilibrium Demand and Supply Curves," UNC-Wilmington Dept. of Economics and Finance workshop, December 1989.

Thurman, Walter N. "Two Illustrations of the Welfare Significance of a General Equilibrium Demand Curve," NCSU Natural Resource Economics workshop, August 22, 1989.

Thurman, Walter N. and Michael K. Wohlgenant, "Consistent Estimation of General Equilibrium Welfare Effects," presented at the annual meetings of the American Agricultural Economics Association in Knoxville, Tennessee, August 1988.

Thurman, Walter N. "The Welfare Significance of General Equilibrium Demand Curves and their Consistent Estimation," NCSU Department of Statistics workshop, Sept. 20, 1988.

Hakeem, Salih A. and Walter N. Thurman, "Futures-based Price Forecasts When Futures Markets Don't Exist," presented at the annual meetings of the American Agricultural Economics Association in Knoxville, Tennessee, August 1988.

Thurman, Walter N. "Risk in Broiler Production," presented at the annual meeting of the Southern Agricultural Economics Association in New Orleans, February 1988.

Thurman, Walter N. "Apple Prices and Storage Technology," meeting of the Southern Agricultural Economics Association in Nashville, Tenn., February 1987.

Thurman, Walter N. "Have Meat Price and Income Elasticities Changed? Their Connection with Changes in Marketing Channels," prepared for presentation at a symposium, "The Demand for Red Meat," sponsored by The Southern Regional Research Committee (S-165) and the Board of Agriculture of the National Research Council held October 20-21, 1986 in Charleston, South Carolina.

Thurman, Walter N. "Endogeneity Testing in Supply and Demand Systems with an Application to the Demand for Poultry Meat," presented at the 1985 American Agricultural Economics Association summer meeting in Ames, Iowa.

Professional and Department Service

Editor of the American Journal of Agricultural Economics, 2006-2010.

External review panel member for the Department of Statistics, North Carolina State University, March 2004.

Invited participant in the Technical Assistant Visit (external review) of the U.S. Forest Service Southern Research Station, November 2003

Academic Review Team member for the Department of Agricultural and Resource Economics at the University of Arizona, 2001

Editorial Board member for Choices, 1998-2002

Agricultural Policy Topic Leader for Selected Papers for the annual meetings of the American Agricultural Economics Association, 2000

Member of Awards Committee for Quality of Communication for the American Agricultural Economics Association, 1999-2001

Member of Awards Committee for Quality of Teaching for the American Agricultural Economics Association, 1999-2001

Academic Consultant for the Casualty Actuarial Society and Society of Actuaries, 1994-present. Duties comprise advising the Society on the economics portion of their semi-annual examination.

Senior Associate Editor of the American Journal of Agricultural Economics, 1993-1997

Chair and member of the Awards Committee for Quality of Research Discovery for the American Agricultural Economics Association, 1993 (chair), 1992 (member)

Grant proposal reviewer for the National Science Foundation

Grant proposal reviewer for USDA National Research Initiative Grant Competition

Referee for:

American Economic Review
American Journal of Agricultural Economics
American Statistician
Australian Journal of Agricultural Economics
Canadian Journal of Agricultural Economics
Energy Journal
European Economic Review
Journal of Business and Economics Statistics
Journal of Economic Education
Journal of Environmental Economics and Management
Journal of Futures Markets
Journal of Law & Economics
Journal of Political Economy
Journal of Production Economics
Journal of Sports Economics
New Zealand Economic Papers
Oxford Economic Papers
Review of Financial Economics
Rand Journal of Economics
Review of Economics and Statistics
Scandinavian Journal of Economics
Southern Journal of Agricultural Economics
Western Journal of Agricultural Economics.

Committee work and other departmental and university service:

University Promotion and Tenure Committee, 2001-2001
Agricultural Economics Workshop Coordinator, 1999-present
ARE Marketing and Development Committee Member, 1998-present
College of Ag. and Life Sciences Research Committee, 1999-present
Departmental graduate admission committee, 1989-1993, 1996-2001, 2004-present.
College of Ag. and Life Sciences Tenure and Promotion Committee, 1999-2001
Chair, economics graduate program admissions committee, 1996-1999
College of Ag. and Life Sciences Associate Dean search committee, 1998
Economics search committee, 1991-1993, 1995-1996, 2001-2002
Served as CALS representative at ITA English Proficiency Screenings, 1995-1996.
Chair of ARE committee to evaluate 9-month appointments, 1995-1996.
College of Ag. and Life Sciences long-range planning committee, 1995.
College of Ag. and Life Sciences grad. committee, 1991-1995.
Ag. and Resource Economics search committee, 1993-1994, 2001-2002
Ad hoc econometrics search committee, 1993-1994.
Ag. and Resource Economics CSRS Review Committee, 1993.
Preliminary exam committee Winter 1987 - Winter 1989, Summer 1991, Summer 1999-
Summer 2001
Undergraduate curriculum committee 1986-87, 1987-88, 1988-89.
Economics and Business search committee 1983-84 and 1984-85.

Courses Taught at NCSU

Undergraduate:

EC 201 - Principles of Microeconomics
EC 301 - Intermediate Microeconomics
ARE 311 - Agricultural Markets
EC/ARE 336 - Introduction to Environmental Economics

Graduate:

ECG 561 - Intermediate Econometrics
ECG 701 - Microeconomic Theory I
ECG 702 - Prices, Value, and Welfare (Microeconomic Theory II)
ECG 741 - Consumption, Demand, and Market Interdependency
(Agricultural Economics Field Course)
ECG 751 - Econometric Methods

Graduate Student Advising

Ph.D. committees - graduated

(Economics unless otherwise indicated)

Committee chair or co-chair for the following students:

Borges, Robert
 Butry, David
 Chuang, Ted
 Chvosta, Jan
 Deese, William
 Ferrier, Peyton
 Frechette, Darren
 Hakeem, Salih Abdul
 Karali, Berna
 Kincaid, Joel
 Martin, Laura
 Markson, Kelly
 Martinez, Miguel
 Morales, Roberta
 Park, Hoanjae
 Roka, Fritz
 Schafer, Hartwig
 Schuhmann, Peter
 Seabolt, James
 Wadood, Syed
 Zulridah Mohd-Noor

Committee member (continued)

DaSilva, Orlando
 Davis, George
 DeJuan, Joseph
 Domdom, Aleta
 Eastwood, Brian - Statistics
 Elsheimer, Bruce - Statistics
 Evans, Barry - Statistics
 Fontes, Rosa Maria Olivera
 Frazao, Elizabeth
 Fulcher, Charles
 Ghosh, Sarbashis
 Hegde, Aaron
 Hossain
 Houg, Shiou-Yin
 Huang, Ju-Chin (Statistic co-major)
 Huang, Yue-Qiu
 Jajri, Idris
 Jian, Jiang
 Ker, Alan
 Khalil, Tarek Mohamed - Statistics
 Kianafard, Farid - Statistics
 Koppit, Justin - Statistics
 Lamb, Vivian
 Lee, Jong-Hwa
 Leegomonchai, Win
 Lin, Jen-Hsiang
 Long, Jonathan
 Maia, Luiz
 Markson, Kelly
 Marsoem, Bambang
 McKenzie, Andrew
 McDowell, Allen
 McFall, Todd
 McNew, Kevin
 Mensah, Clifford

Committee member for the following students:

Abdelmagid, Benaga
 Ahrendsen, Bruce
 Beach, Robert
 Belasco, Eric
 Boonsang, Tullaya
 Brester, Gary
 Brown, Blake
 Brown, Greg
 Brown, John William
 Chang, Ruey-er

Ph.D. committee member (continued)

Metcalf, Michael
Moerz, Armin (Civil Engineering)
Muth, Mary
Pope, Jaren
Reed, Albert John
Renkow, Mitchell Adam
Rezitis, Anthony
Roberts, Matthew C.
Schwabe, Kurt
Solakoglu, Nihat
Wells, O. Fenton
Zeng, Tao
Zhen, Chen

Masters committees - graduated

Committee chair or co-chair for the following
Masters students:

Bruns, David - ME
Christoforidis, Andreas - ME
Depro, Brooks - ME
Eom, Young Sook - ME
Erickson, Jonathan - ME
Gallogly, Erin - ME
Knisely, Joseph - ME
Robenstein, Rody (MS Ag. Econ.)
Schafer, Hartwig - ME

Committee member for the following Masters
students:

Borges, Robert B. - ME
Cotton, Steve - ME
Domdom, Aleta Catamora - ME
Duggan, Wesley - MS Ag. Econ.
Eccles, Bradley
Esys Eyvazoova
Gregory, Linda Gail (MS Ag. Econ.)
Hilmer, Christiana - MS Statistics
Homs, Ghada - ME
Kalinowski, Catherine - ME
Kincaid, Joel - ME
Metcalf, Mark - MS Statistics
Lopez, Martha - ME
Plotnikova, Maria - ME
Roy, Debiprasad - ME
Roy, Priyanka - ME
Sierra, Jose Augusto - ME
Sabel, Thomas - ME
Smith, Salma - ME
Taylor, Ellis - ME
Wulan, Tririni - MS Ag. Econ.

Ph.D. committees - current

Committee chair or co-chair for the following
Ph.D. students:

Dudley, Mitchell
Graybeal, Dale
Maranakis, Kosmas
Moore, Christopher
Perez, Keri
Scotello, Michelle

Committee member for the following Ph.D.
students:

Bauch, Simone (joint with Forestry)
Collett-Schmit, Kristen
Girante, Joana
Sung, Joo-Kyung
Zhu, Qihong
Yu, Yanru

Grants and Contracts

Title: "Economic Implications of Colony Collapse Disorder"
Description: Cooperative Agreement with USDA
PIs: Walter N. Thurman and Randal R. Rucker
Amount: \$25,000

Title: "A Fellowship Grant to Meet the National Need for Scientists Trained in Forest Products Marketing and Management"
Description: USDA/CSREES National Needs Graduate Fellowship Grant, 2005-2008
PIs: Walter N. Thurman and Raymond B. Palmquist
Amount: \$280,000

Title: "The Impact of a Tobacco Program Buyout"
Description: North Carolina Tobacco Research Commission
PIs: A. Blake Brown and Walter N. Thurman
Amount: \$29,000

Title: "A Fellowship Grant to Meet the National Need for Scientists Trained in Forest Products Marketing and Management"
Description: USDA/CSREES National Needs Graduate Fellowship Grant, 2002-2005
PIs: Walter N. Thurman and Raymond B. Palmquist
Amount: \$276,000

Title: "Externalities in Agriculture: The Economics of Pollination and Honey Markets"
Description: USDA National Research Initiative (NRI) Competitive Grant, 2001-2003
PIs: Randal R. Rucker (Montana State U.), Walter N. Thurman, and Michael Burgett (U. of Oregon Dept. of Entomology)
Amount: \$135,000

Title: "An Economic Analysis of Tobacco Markets without the Tobacco Program"
Description: North Carolina Tobacco Research Commission grant, 2001
PIs: Walter N. Thurman and A. Blake Brown
Amount: \$5,000

Title: "The Economic Effects of Restrictions on the Transfer of Marketing Quota"
Description: USDA National Research Initiative Grant, 1999-2000
PIs: Randal R. Rucker and Walter N. Thurman
Amount: \$52,000

Grants and Contracts - continued

Title: "Economic Analysis of Regulation to Control S. Enteritidis in Commercial Egg Production"
 Description: USDA National Research Initiative grant, 1996-1999
 PIs: Roberta A. Morales, Peter Cowen, Walter N. Thurman
 Amount: \$160,000

Title: "The Economics of Pathogen Control Using HAACP"
 Description: Cooperative Research Agreement with USDA, 1994-1997
 PIs: Walter N. Thurman and Jon Brandt
 Amount: \$69,000 for 1994-1995, \$174,000 total scheduled ERS contribution

Title: "The South Atlantic and Gulf Snapper-Grouper Complex: Demand Estimation for Selected Individual Species and the Composite Species Complex"
 Description: National Marine Fisheries Service project, 1994-1995
 PIs: J.E. Easley, Jr. and Walter N. Thurman
 Amount: \$110,000

Title: "Bioeconomics of Commercial/Recreational Fishery Harvest Allocation"
 Description: UNC Seagrant project, 1994-1995
 PIs: J.E. Easley, Jr. and Walter N. Thurman
 Amount: \$83,479

Title: "Risk and Contracting in the Broiler Industry"
 Description: N.C. Poultry Federation Grant, 1993
 PIs: Walter N. Thurman and Charles R. Knoeber
 Amount: \$3,000

Title: "Improved Valuation of Fisheries Harvest: Application of the General Equilibrium Derived Demand"
 Description: UNC Seagrant project, 1991-1993
 PIs: J.E. Easley, Jr. and Walter N. Thurman
 Amount: \$31,593

Title: "Economics of Salmonella enteritidis Control in a Laying Flock"
 Description: Cooperative research agreement and cooperative education agreement with USDA to fund Roberta Morales' dissertation research, 1990-1992
 PIs: Walter N. Thurman and Frank Jones (NCSU Poultry Science)
 Amount: Cooperative education agreement - Two years of RA support for Morales
 Cooperative research agreement - \$6,000

Grants and Contracts - continued

Title: "The Impacts of Supply Controls and Related Programs: Empirical Analysis and Implications"
Description: Cooperative research agreement with USDA, 1990-1991
PIs: Walter N. Thurman, Randal R. Rucker, and Daniel A. Sumner
Amount: \$15,000

Professional Consulting

Analysis Group, 2002-present. Consult on agricultural and natural resource market issues. Named an Academic Affiliate of AG in 2005. Currently bill at \$550/hour.

Research Triangle Institute, Center for Economics Research, 1993-present. Collaborate with RTI on EPA study of the pulp and paper industry as well as other projects on welfare analysis of environmental regulations.

Arthur D. Little/TIAX, 2001-2003. Collaborated on Dept. of Energy project on the market for platinum group metals and the impact of widespread adoption of fuel cell technologies.

Society of Actuaries/Casualty Actuary Society, 1996-2002. Academic consultant to the committees preparing certifying exams in economics for actuaries.

New Zealand Treasury, 1996-1997. Commissioned study titled "An Economic Analysis of Agricultural Marketing Structures in New Zealand."

Triangle Economic Research, 1995-1996. Econometric work forecasting recreational beach attendance in connection with oil spill litigation. Testified at trial as an expert witness.

Appendix B Documents Considered

Court Filings

Declaration of Colin A. Carter, December 14, 2007.

Declaration of Bruce A. Babcock, December 14, 2007.

Memorandum of Law in Support of Plaintiffs' Motion for Class Certification, December 17, 2007.

Depositions

Deposition of Colin A. Carter, February 5, 2008.

Deposition of Bruce A. Babcock, February 6, 2008.

Data

Chicago Board of Trade, open auction rough rice futures prices, 2006-2008, obtained from <http://cbotdataexchange.if5.com/Markets.aspx?symbol=RR/F.CBOT>.

Raw data files used in Declaration of Colin A. Carter, Figures 1-9, Tables 10-13; Eviews commands used to generate results in Table 11 of Carter declaration.

Arkansas rice basis data referenced in Carter Figure 5, available at <http://www.aragriculture.org/marketing/basis/ARRice.xls>.

Research Papers and Reports

Carter, Colin A. and Aaron Smith, Estimating the Market Effect of a Food Score: The Case of Genetically Modified StarLink Corn," *The Review of Economics and Statistics*, Vol. 89, No. 3, August 2007, pp. 522-533.

Chen, Gongmeng, Michael Firth, and Yu Xin, "The Response of Volume and Returns to the Information Shocks in China's Commodity Futures Markets," *The Journal of Futures Markets*, Vol. 25, No. 9, 2005, pp. 893-916.

Childs, Nathan and Janet Livezey, "Outlook Report from the Economic Research Service: Rice Backgrounder," United States Department of Agriculture, RCS-2006-01, December 2006.

Gürkan, Ali Arslan, "Commodity Price Developments since the 1970s," in *Consultation on Agricultural Commodity Price Problems*, Commodities and Trade Division, Food and Agriculture Organization of the United Nations, Rome, March 25-26, 2002, pp. 121-171.

McKenzie, Andrew M., Bingrong Jiang, Harjanto Djunaedi, Linwood A. Hoffman, and Eric J. Wailes, "Unbiasedness and Market Efficiency Tests of the U.S. Rice Futures Market," *Review of Agricultural Economics*, Vol. 24, No. 2, Fall/Winter 2002, pp. 474-493.

Rice Market News

Bennett, David, "Shipments Delayed at Border...GM Worries Slow Rice into Mexico," *Delta Farm Press*, March 23, 2007.

Gunther, Mark, "Attack of the Mutant Rice," *Fortune – CNN Money.com*, July 2, 2007.

Haarlander, Lisa, "U.S. Rice Pummeled by Harvest, Biotech Woes," *Reuters News*, August 24, 2006.

Poncer, Joe, "Strong Global Rice Demand Underscores Price Rally," *Dow Jones Newswires*, October 10, 2007.

Poncer, Joe, "Rice Futures on CBOT Climb to All-Time Record on Robust Export Demand," *Dow Jones Newswires*, December 5, 2007.

"Protection Measures for U.S. Rice," *Europolitics*, January 7, 2008.

Remarks by Agriculture Secretary Mike Johanns and Dr. Robert Brackett, Director of the FDA's Center for Food Safety and Applied Nutrition, August 18, 2006.

Riceland Cooperative, "2007 Riceland Marketing Programs: Rice, Soybeans, Wheat."

Robinson, Elton, "Strong Rice Prices Are Likely for 2008-2009," *Penton Insight Online Exclusive - Western Farm Press*, January 8, 2008.

Shumaker, Lisa, "Initial Tests Show U.S. Rice Free of GMO Trait," *Reuters News*, September 14, 2007.

Shumaker, Lisa, "U.S. Rice Sale to Switzerland Boosts Trade Hopes," *Reuters News*, January 7, 2008.

"U.S. Ex-Im Backs Mexico Rice Transaction," *Trade Finance*, July 1, 2007.

"U.S. Rice Counter-testing No Longer Needed–EU," *Reuters News*, December 20, 2007.

"U.S. Rice Ends Firm, Good Export Sales Support," *Reuters News*, January 4, 2008.

"U.S. Rice Exports to Mexico Face New Uncertainty over GMOs," *Inside U.S. Trade*, April 6, 2007.

USDA Animal and Plant and Health Inspection Service, Press Release Announcing Deregulation of Line of Genetically Engineered Rice, November 24, 2006.