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OUTSTANDING MASTER'S THESIS FOR 1983
NORTHEASTERN AGRICULTURAL ECONOMICS COUNCIL

THE EFFECT OF A CHANGE IN THE SIZE AT FIRST CAPTURE IN THE RHODE ISLAND INSHORE LOBSTER FISHERY: A BIOECONOMIC ANALYSIS

Edward J. Richardson

University of Rhode Island
Advisor: Dr. John M. Gates

ABSTRACT

At this time minimum size limit regulations are the primary tool used to manage Rhode Island's American lobster (Homarus americanus) resource. One shortcoming of this policy is its lack of foundation in bioeconomic analysis. To encourage the incorporation of bioeconomic considerations into the management strategy used on this valuable resource, a fishery simulator (Gates 1974) was modified and employed to analyze the effects of changing the size at first capture in Rhode Island's inshore lobster fishery.

A cost and earnings survey of Rhode Island's commercial lobster license holders was conducted to provide the economic data required to simulate the fishery. This survey uncovered information characterizing the exploitation of the resource. For example, the survey estimated inshore catch of 2.1 million pounds indicates that three quarters of the inshore catch may go unrecorded. The survey also revealed that full-time commercial harvesters are outnumbered by part-time personnel by a factor of seven, but still land over 90% of Rhode Island's lobster catch.

The simulation results also proved quite informative. They suggest that an increase in Rhode Island's minimum size at first capture, if promulgated alone, will not confer increased benefits to society or fishermen. In fact, if a reasonable rate of discount is employed, the analysis indicates the measure will decrease the present value of social surplus generated by Rhode Island's inshore lobster fishery. Averaging over the range of results obtained, an 0.8 mm carapace length increase will reduce annualized benefits by 7%. Alternative larger increases of 1.6 mm and 9.5 mm (3.5 inch minimum) are estimated to bring about 10% and 38% reductions in the annualized value of social surplus that the inshore fishery can be expected to generate. These results are due in part to the substantial short run decreases in catch that the increased minimum sizes generate, and in part because it is assumed that the increased minimum size will govern Rhode Island's landings only.

The immediate short run decreases in benefits that accompany the minimum size increases were found to fall primarily on the harvesters of the resource. Averaging over the discount rates employed, 87% of the short run reductions in social surplus subtracted from producer revenues. All results assume that stock recruitment is independent of stock size, that stock reproductive security is not at issue, and that lobster prices are determined in a regional market for live lobsters.

Additional simulations were performed to compare the social surplus in the open access fishery with that which might be obtained should access to the fishery be restricted. Also, social surpluses were obtained for the fishery under the assumption that an increased size at first capture results in increased recruitment. These simulations point to the general result that increased harvest selectivity will maximize the sustainable fleet size while concurrently reducing the annual social surplus generated by the fishery.

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FORECASTING MAINE POTATO PRICES

Paul Fackler

University of Maine at Orono
Advisor: Dr. Alan Kezis

ABSTRACT

Forecasting models were developed for annual and monthly average price of Maine potatoes, using Crop Reporting Board data. Several approaches to the forecasting problem were explored, as were a number of statistical aids to model development and evaluation. Attention was focused on providing timely forecasts as data became available.

Specifically, three models were developed. The first provided forecasts of the season average price. Attention here was placed on the selection of a subset of influential variables from a set of potentially important ones, as well as the detection of outliers and colinearities. These problems were especially significant given the small number of observations in the annual price series. Production data for five regions were deemed most influential.

The other two models were developed to provide forecasts of the monthly average price from November through May. A modified ARIMA (0,1,0)(2,1,0) model was estimated and used to provide forecasts based on the price data series alone. An alternate model, using production levels from four regions, current stocks levels and a monthly trend variable (and, implicitly, lagged price), was also developed.

Both monthly models provided current forecasts for each month remaining in the marketing season which were updated as new information became available. The second model, which incorporated more information, was deemed to provide somewhat more accurate forecasts, at all forecast distances, than the simpler ARIMA model, when compared over the 1977-1981 period.

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INTERTEMPORAL BASIS BEHAVIOUR ON THE CHICAGO WHEAT FUTURES MARKET

Terrence C. Sheales

Cornell University
Advisor: Dr. William Tomek

ABSTRACT

The study consists of an economic analysis of the behaviour of the Chicago wheat basis during the two decades from 1960 to 1980. First, there is a descriptive analysis of changes to the basis between the 1960's and 1970's. Second, an econometric model which can be used to explain observed and possible future movements in the basis is estimated.

The econometric model provides for the direct estimation of both intra- and inter-seasonal movements of the basis. In developing this model a single-equation "quasi reduced-form" model incorporating the theoretically important factors determining the supply and demand for storage and the resulting price from month to month is specified.

Model estimation involves the incorporation of a lagged dependent variable and a set of seasonal dummy variables to account for the cyclical behaviour of the basis. The Generalized Least Squares regression results reveal that the basis lagged one period and the level of Chicago wheat stocks are the main factors explaining the current basis. A negative coefficient on national commercial stocks may be an indication that the variable is a proxy for hard wheat stocks. Changes in these stocks result in opposite movements in the demand for soft wheat (Chicago) stocks and hence the Chicago (soft wheat) basis.

While the estimated model "explains" a relatively high proportion of overall basis variation, it is not entirely satisfactory in predicting the direction of change in the basis. It also exhibits some downward bias when used to make forward predictions of the magnitude of the basis.

Many of the modelling problems encountered during the analysis probably stem from incorporating intra- and inter-seasonal basis movements into the one model. A more productive approach to an analysis of this type would be to concentrate on estimating and predicting only one type of basis movement rather than both.

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FARM PLANNING MODELS INCLUDING THE USE OF SEWAGE SLUDGE ON PENNSYLVANIA DAIRY FARMS

Dona C. Zimmerman

The Pennsylvania State University
Advisor: Donald J. Epp

ABSTRACT

A five year linear programming farm planning model was constructed to include the use of sewage sludge as a primary crop nutrient source. The five year planning period permitted the inclusion of nitrogen decay rates reflecting the residual amounts of nitrogen from sludge and manure which are mineralized over time. Net farm incomes were maximized and compared for a medium sized dairy farm representative of those found in Pennsylvania. Twenty-two scenarios depicting various operating conditions were examined. Some of the variations included the purchase of sludge at different prices, the use of free nine percent nitrogen or 4.2 percent nitrogen sludge, spring and fall application of sludge and manure, the use of free sludge when heifer corral manure was sold, and sludge use under various nitrogen application restrictions. Variables of interest in the optimal programs were than compared and discussed.

Under the conditions assumed for the analyses, net revenues were higher when sludge was used than when it was not. However, only a small percentage difference between the highest and the lowest net revenues resulted over the five year period, given a variety of operating circumstances. The combination of nine percent nitrogen sludge, manure, and fertilizer yielded the highest net revenue when sludge was free and applied either annually in the spring or semi-annually in the spring and fall. Further, when sludge was purchased at $10.00/dry ton and $20.00/dry ton for spring and fall application, the combination of nine percent nitrogen sludge and manure again resulted in the highest net revenue.

The nitrogen application restrictions were at their upper limits when sludge use was included in the optimal solution, but were not binding when sludge was not used. More sludge was applied when the nitrogen application restrictions were relaxed, resulting in higher net income. The reduced costs associated with the non-negativity constraint on sludge indicated that it would often be more costly to use more than the optimal amount of sludge, than less than the optimal amount, because less manure would be used and more fertilizer would have to be purchased to maintain nitrogen application limits and meet crop nutrient requirements.

The calculation of net present values for the two sludge contents considered provided value estimates which were in accord with the linear programming solutions. Although the programming results are situation-specific, the model's structure and coefficients may be modified to accommodate different farm activities and restrictions.