Price Competition Between Imported Wheat

Varieties in the Japanese Market

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ABSTRACT

The study uses a Transcendental logarithmic (TL) function to estimate Japanese import demand for varieties of wheat. It concludes that their Food Agency fills annual quotes without regard for the prices of competing varieties. However, price differentials have a small but measurable effect upon the monthly scheduling of import purchases.

INTRODUCTION

This paper presents the results of an estimation of the demand for internationally traded classes of wheat in the Japanese port Market (Hokkaido). Unlike the majority of previous studies dealing with the international wheat trade, this paper attempts to identify and measure the degree of importers' preference for one particular class of wheat over another class, in relation to the import prices of alternative sources of supply. The individual wheat classes considered are soft red winter, hard red winter, white, and durum, supplied by Australia, Canada, and the U.S.. Given the distinctive protein and milling characteristics of individual wheat classes, it is felt that a researcher loses a great deal of information regarding trade competition and demand preference by not differentiating between the various wheat classes traded. Indeed, in commercial contract sales, 'wheat' is never traded as aggregate quantity, but rather is specified by price, quality class and grade. This indicates that importers demand specific classes of wheat , to suit particular consumer tastes and milling requirements, and, presumably, will fill their needs from lowest cost suppliers. While this might be strictly true of a wheat importing county like Indonesia, it is not strictly true of Japan, where the government Food Agency directs Japanese importers to meet its import policy objectives.

SCOPE OF STUDY AND INSTITUTIONAL SETTING

This study is confined to Japan, the world's second largest wheat importer after the U.S.S.R.,covering the period April 1979 to May 1981. Monthly importation of wheat is controlled by the Japanese Food Agency, which sets targets for the quality classes and quantities of wheat demanded by millers and consumers. It is assumed that these targets correspond to monthly national requirements,without stocks. The actual importation is made by private traders under contractual arrangements,who are the only ones with government permission to import. Domestic wheat does not compete with imported wheat at the port market,but rather at the millers' market, so it does not enter this study. One would expect that the registered importers would fill these targets from the lowest cost suppliers. Furthermore, one might envision that a two-tiered cost-minimization objective could be postulated for this import market: whereby the Food Agency strives to minimize the cost of its wheat import activity while private traders attempt to minimize costs (or maximize profits by purchasing from the lowest priced foreign supplies. However, the Food Agency administers the import wheat market in a manner that severely restricts the degree to which cost minimization takes place there. There is no facile manner in which to characterize the Japanese wheat import objective,except as 'the minimization of import cost only in cases when it is not difficult to secure stable supplies of the particular varieties of wheat in demand by Japanese millers.' In the absence of a statistically significant alternative to cost minimization, this study relies upon a restrictable version of this maintained hypothesis to model the behavior of the Japanese importers as it is coordinated by the target-setting of the Food Agency. Tests are devised to ascertain whether Japanese import behavior deviates significantly enough from cost minimization to reject this hypothesis.

JAPANESE IMPORT POLICY AND COUNTY DISTRIBUTION OF IMPORTS

These features of the Japanese wheat trade arrangements interfere with the strict cost minimization postulate. Japan covers about 87 percent of its wheat consumption requirements through imports. Because of such heavy dependence on foreign supplies, Japan is sensitive to disruption in trade flows caused by volatility in international wheat markets. Concern over a stable food supply and the substantial dependence upon the U.S. has produced a Japanese trade policy of diversification. At present, Japan primarily relies on three countries-- the U.S.,Canada, and Australia, for its wheat import requirements. In order to insure its wheat import needs, Japan concludes bilateral trade agreements with the Canadians and Australians, setting out annual target amounts of wheat to be purchased (plus or minus 10 percent). These agreements contain no purchase price provisions,indicating that the prices at which wheat is purchased is of secondary consideration. Supply stability is paramount. In recent years, the U.S. supplied approximately 57 percent of Japan's wheat imports, Canada 25 percent, and Australia the remaining 18 percent. Rather than search for the most competitive source, Japan spreads the additional requirements stemming from the growth of its population almost equally among its three major suppliers. Thus, the trade shares between the three exporters remain practically constant from year to year.

Two considerations affect the Japanese decision to import wheat from the U.S.,notwithstanding that its prices are higher than those offerred by competing countries: 1) U.S. capacity to act as a residual supplier for wheat varieties that Japan cannot obtain elsewhere, and 2) a desire to deflect concern over the large trade imbalance between the two countries, to which Japan is sensitive.

Consequently, wheat importation is a matter of national importance and has merited careful and centralized supervision. The Japanese government, through its Food Agency, controls the domestic marketing, pricing, and importation of wheat. Based upon annual demand-supply estimates, the government decides on the quantity of each variety of wheat which is to be imported. Then, it designates its preferred country of origin. At the time when wheat imports are to be made, the Food Agency posts the required quantities (usually on a monthly or weekly basis) by variety or class, grades, country of origin, and the purchase price target range.(1)

Registered importers then submit sales bids to the Food Agency which, in turn, selects the seller whose offering price falls within the target purchase range and is among the lowest tender prices (2).

(1) The target price is set at a level including the total c+f price,interest,shortages,harbor charges, and importer's commission.

(2) A detailed description of wheat import procedure is given in Kalmbach,P.M. et.al. The Japanese Food and Feed Grain Economy. Ohio Agr. Res. and Dev. Center, Res.Bull. 1126, Wooster,Ohio, June 1981, pp.48-51.

The Food Agency's ability to change imports from a particular country prevents exporting countries from price collusion. Hence, the price competition that occurs to fill Japanese requirements is between the rival trading firms in the same country, e.g. Cargill and Continental, for the same variety of wheat, rather than between rival exporting countries for similar varieties.

Because of millers' adherence to strict wheat varietal proportions in flour mixes, the Japanese do not consider many wheat varieties to be interchangeable for milling, even though U.S. dns 14% is similar to Canadian CW 13.5% and U.S. hrs 13% to Australian PH 13/14%. That is, Canadian and Australian wheat varieties do not compete with American wheat varieties when a supply can be had at some price, nor do American wheat varieties compete with other American wheat varieties. Consequently, price differentials between wheats of similar variety and quality offered by a competitor country will normally not sway purchases toward the lower priced supplier. Japanese tolerance for the magnitude of price differentials between similar varieties from different countries is unusual. There is no set rule of how great the difference must be before the Food Agency will allow importers to switch from one supply source to another (3). Some ~~inter~~ intra-year monthly price competition does occur. However, switches from one variety to another or from one country to another are temporary. They last for only a month at a time and do not affect the total import levels of wheat varieties for that year. Monthly import shortfalls are usually matched by

(3) The record shows that Japanese imports of U.S. wheats have varied from the quantities set by the annual bilateral agreements by only 5-6 percent per year.

compensatory import purchases in subsequent months. A persistence of wide price disparities would prompt the Food Agency to enlarge the import quota from alternative suppliers of similar varieties in subsequent bilateral agreements.

All wheat imported by Japanese traders is sold to the Food Agency at previously agreed prices. The Food Agency, in turn resells the wheat to the millers at prices determined by the standard grade and class of the wheat, while taking into account the cost of price in order to set a competitive end-use price. The (c+f) price paid for imported wheat by registered traders therefore represents the only non-administered price. In general, the Food Agency makes a profit on the resale of imported wheat and incurs losses on the resale of high priced domestically produced wheat. Domestic and foreign wheat are resold at the same price to the millers. In recent years, the Food Agency has realized net profits on its wheat program, but in the early 1970's, the net cost of the joint import and domestic wheat resale program was 140 Trillion Yen annually. Considering that this expense occurred immediately prior to the years of this study, FY 1979/80-1980/81, it is likely that Japan continued to practice some form of import expenditure minimization. It seems fair to assume that such a principle operates in the data.

Import wheat competition in the Japanese wheat import market continues to occur at three levels: 1) as competition among exporters of specific wheat varieties within the same exporting country, 2) as competition among Japanese traders in bidding for monthly import targets, and 3) as intra-year monthly competition among wheat varieties. After examining the theoretical model used in this study, it will be demonstrated by using several varieties of imported wheat, that the Japanese Food Agency fills bilaterally arranged annual quotas without much regard for the prices of competing varieties. However, there is intra-year competition. For, price differentials between competing varieties grouped within the same quality class have a small but measurable effect upon the monthly scheduling of import purchases.

THE MODEL

A transcendental logarithmic (TL) function, a local approximation to the indirect cost function, is used to estimate the conformity of Japanese wheat importers with postulated cost minimization objectives. Additivity and Separability restrictions are imposed to test for the presence of discriminating demand preferences on the part of the Food Agency, by grouping similar wheat varieties to meet quality class targets. The TL multi-product (input) and multi-target (output) model regresses expenditure shares of wheat classes upon import varietal prices ($p_{ij}\ \forall i\ \forall j$) and aggregate quality class targets ($X_i\ \forall i$). This is a departure from the typical TL local estimation of a Cost function, which is specified only in varietal prices and total aggregate quantity. The indirect cost function estimated in this study is specified in varietal prices and class targets, since these targets must be met, it is postulated, through the importation of individual import varieties. Thus, there are three classes and seven imported wheats --'import varieties'-- involved in the wheat market for food use at the Japanese port (Cf. Table 1).

The specification of an indirect cost or 'expenditure' function has a clear economic interpretation in the Japanese port market, and this makes it more appropriate than a cost function specified only in varietal prices and total wheat imports. First, regarding the aggregation of shipments of import varieties in the same class into the aggregate tonnage targets for that class, the (X_i), the model posits that the quantities imported of particular import varieties (x_{ij}) affect total expenditure on wheat only in the sense that they help to meet the Japanese importers' demand target for that class of wheat, of which each variety is only one of several competing varieties. This is a feature of the model even though it is not an explicit feature of the market being studied. In this case, one tests for a rejection of the maintained hypothesis in the same manner as when one does not expect market behavior to violate the assumptions of the model, but rather to conform to them. The testing procedure is the same in both cases. The existence of quotas-- filled for each imported wheat variety taken separately -- also will be considered as an "alternative" to the cost minimization hypothesis, with poor results. (Quota-filling is not strictly an alternative to cost minimization, since this postulate could be constrained through the use of appropriate restrictions to meet the Food Agency's varietal quality preferences. Results from the cost minimization hypothesis modelled in this paper will show that Japan does alter the monthly scheduling of varietal imports according to monthly price changes rather than to meeting yearly quotas in rigid installments.)

This model assumes that Japanese traders, in line with Food Agency directives, regard wheat imports from different exporting countries as distinct varieties which are distinguishable by differences in quality and price, that they group them according to quality, and then, and only then, select import varieties according to price. If importers buy wheat varieties to fill varietal targets, instead of class targets, without regard to the prices of wheat varieties in the same quality classes, then we expect to reject the maintained hypothesis of cost minimization. A standard cost function, by not positing the existence of class targets, would inappropriately represent this procedure by minimizing total cost over all varieties regardless of their similarities and differences. Instead the class target expenditure minimization function used in this study minimizes the separate costs of meeting each target through the purchase of import varieties in a particular quality class. In the expenditure function, varieties of

of comparable quality, regardless of country of origin, are grouped into classes and are imported to fill the demand target for that class. Since class targets must be filled, these targets must be included in the specification, meaning that the function required for this market is better called the expenditure function rather than the 'cost' function.

Under the conjecture of cost minimization within wheat classes, the total quantity demanded of one class, the target, affects all of the variety expenditure shares, but the individual quantities of varieties of the same class, the (xij) which together fill that target, do not. Therefore, the (xij) do not appear in the expenditure function. To meet a target for a certain quantity and class of wheat, importers will pay more for that variety than they will for varieties which meet their target for another class of wheat. So, under the hypothesis of expenditure minimization for Japan, relative price is important only within classes. Of the varieties competing to fill the demand target for hard wheat, for example, importers may choose the least expensive variety among them, even if this price is higher than the price of a soft wheat variety which competes only with the other soft wheat and does not compete among the hards. This aggregation of varieties (xij ∀j) into Quota (Xi) is further investigated using Separability.

THE INDIRECT COST TRANSLOG MODEL AND ITS ENVELOPE PHENOMENA

It can be demonstrated that the expenditure function displays the same envelope phenomena as the cost function, since the former is indentical in specification to the indirect cost function which establishes the second order conditions of the comparative statics of the cost function. The target levels specified in the expenditure function are equivalent to the output level constraints under which direct cost is minimized in the comparative statics problem. Therefore, at the cost minimizing tangency, the expenditure (indirect cost) function meets the cost function, and the same envelope phenomena apply. This is essential in deriving target and variety expenditure shares from the TL expenditure function, as well as Slutsky and Allen-Uzawa substitution elasticities.

COEFFICIENTS AND THEIR INTERPRETATIONS

The unrestricted from of the TL function can test whether these hypotheses hold in the Japanese port market.

$$(1)\ \ln D = A_0 + \sum_i A_i \ln X_i + \sum_i \sum_j B_{ij} + \frac{1}{2}\sum_i \sum_l D_{il} \ln X_i \ln X_l + \frac{1}{2}\sum_i \sum_j \sum_l \sum_h G_{ijlh} \ln p_{ij} \ln p_{lh} + \frac{1}{2}\sum_l \sum_i \sum_j R_{lij} \ln X_l \ln p_{ij}$$

Here is an identification of the variables. (lnD) represents the natural logarithmic transformation of the total dollar expenditure upon all food wheat import varieties in a given month. The (Xi ∀i) represents the (i)th class of wheat imported, which is the total tonnage imported of all import varieties in that class { (xij ∀j) ∀i }. The (pij ∀i ∀j) represents the import commercial and freight (c+f) price of the (j)th variety of class (i). All variables are logarithmically transformed in the model, so coefficients are in elasticity form.

This study uses the theoretical property of Additivity to posit that wheat import varieties from different classes compete to fill class targets. If Japan does not recognize the substitutibility of similar wheat varieties, then we would expect to reject this restriction. The model also uses the property of Separability to posit that the prices of wheat varieties within a particular class affect importers' decisions to import those varieties to fill the class target. Since class targets are larger than the shipment of any one wheat variety, several varieties must be imported to meet a target, and in unequal quantities. If Separability is not rejected, this outcome would add another dimension to the word "competition" in the Japanese market.

The estimable share equations obtained through partial differentiation of the expenditure function with respect to the varietal prices and targets, are of two forms. The first are the target expenditure shares, (Si ∀i), which represent the portion of total expenditure (D) spent upon the total imports of a particular class, summed over all import varieties in that class.

$$(2)\ \frac{\partial \ln D}{\partial \ln X_i} = S_i = \frac{\sum_j p_{ij} x_{ij}}{D} = A_i + \frac{1}{2}\sum_l D_{il} \ln X_l + \frac{1}{2}\sum_l \sum_h R_{i,lh} \ln p_{lh} \quad \forall i$$

Here is an identification of the coefficients, which are also found in the expenditure function (Si): These are the target shares and are the derivatives of total expenditure on all classes with respect to each class (Xi). Each one is equal to the share of total wheat expenditure spent to import the total quantity of all wheat varieties in its own class (i). This is an envelope phenomena, and is not intuitive. (Ai): :These are the target intercepts. This intercept term in each (Si) equation appears in the expenditure function as the first partial coefficient for each (Xi) taken alone.

$$(3)\quad \frac{\partial^2 \ln D}{\partial \ln X_i \, \partial \ln X_l} = \frac{\partial (S_i)}{\partial \ln X_l} = D_{il} \quad \forall i \; \forall l$$

These are the cross-target coefficients. As one appears in the target share equation (Si), this is the impact of a change in the imported quantity (Xl) upon the expenditure share for target (Xi).

$$(4)\quad \frac{\partial^2 \ln D}{\partial \ln X_i \, \partial \ln p_{lh}} = \frac{\partial (S_i)}{\partial \ln p_{lh}} = R_{i,lh} \quad \forall i \; \forall l \; \forall h$$

These are the target-price coefficients. In a target share equation, this is the impact that a change in (plh) has upon (Si), the expenditure share for the target (Xi). Notice that these variables are not necessarily in the same class. Additivity is equivalent to making the restriction

$$(5)\quad R_{i,lh} = 0 \quad \forall i \neq l \; \forall h$$

The second set of estimable share equations are obtained from the expenditure function through partial differentiation with respect to the varietal prices. The variety share equations take the form

$$(6)\quad \frac{\partial \ln D}{\partial \ln p_{ij}} = K_{ij} = B_{ij} + \frac{1}{2}\sum_{l}\sum_{h} G_{ijlh} \ln p_{lh} + \frac{1}{2}\sum_{l} R_{ij,l} \ln X_l \quad \forall i \; \forall l$$

Here is an explanation of the economic effects measured by their coefficients, which are also found in the expenditure function.

(Kij) are the variety shares. By an envelope phenomena, the derivative of the log of total cost on food wheat with respect to the log of variety price (pij) is equal to the share of total dollar expenditure spent in a given month upon imports of a particular variety (j) of a particular class (i). (Bij) is the variety intercept. In a variety share equation, this entity, which is a direct price coefficient in the total expenditure function, appears as the intercept term, since the single price variable associated with it has been removed through partial differentiation.

$$(7)\quad \frac{\partial^2 \ln D}{\partial \ln p_{ij}\, \partial \ln p_{lh}} = \frac{\partial (K_{ij})}{\partial \ln p_{lh}} = G_{ijlh} \quad \forall i \; \forall j \; \forall l \; \forall h$$

These are the cross-price coefficients. In the variety share equations, this is the cross-class effect which a change in variety price (plh) has upon (Kij), not necessarily in the same class. When (i=l), this measures an effect among varieties within the same class. When (i≠l), this measures the impact of price changes across classes upon an unlike import variety. Separability is equivalent to the restriction

$$(8)\quad G_{ijlh} = 0 \quad \forall i \neq l \; \forall j \; \forall h$$

Separability does not restrict the target share equations, but does require that the expenditure share of an import variety is influenced only by wheat prices of varieties within that class, and not by prices of varieties in other classes.

Next, $$(9)\quad \frac{\partial^2 \ln D}{\partial \ln p_{ij}\, \partial \ln X_l} = \frac{\partial K_{ij}}{\partial \ln X_l} = R_{ij,l} \quad \forall i \; \forall j \; \forall l$$

These are the price-target coefficients, similar but not necessarily equal to the target-price coefficients found in the target share equations. They are equal only if the expenditure function is invariant to the order of taking second partials; that is, if symmetry holds. Among the variety share euqations, this measures the effect that a change in the magnitude of the class target (Xl) has upon (Kij), the expenditure share for variety (xij). There is one coefficient for each class.

This definition satisfies the economic interpretation of Additivity for the Japanese port market. Pertaining to it, the statement "varieties are additive within classes" means this: The size of each class target is influenced only by the quantities imported of wheat varieties in its class. Import varieties compete with each other to fill the demanded tonnage requirements for its class and do not compete with wheat varieties of other classes as those class targets are being filled. Among the expenditure shares for class targets, this means that varietal prices do not interact with the targets of other classes, and do not influence the level that the Food Agency sets for those targets. Among the expenditure shares for class targets, this means that varietal prices do not interact with the targets of other classes. Among the expenditure shares for varieties, class targets do not interact with varietal prices from other classes. Class targets affect the expenditure shares of varieties only of their own class.

RESULTS

Tables two through seven present selected estimates from the restricted and unrestricted cost minimization models. The significance levels for these estimates establish two broad conclusions: First, the Food Agency fills class targets, and does so without much regard for the prices of similar varieties. The class target variables have significant coefficients and the restricted and unrestricted models do not violate the assumptions of expenditure minimization. Furthermore, this study cannot confirm the existence of separate quotas for each variety,since the models used as alternatives to the cost minimization models were either insignificant or non-sensical. Secondly, the results for the cost minimization models confirm that even though class targets are filled through the importation of wheat varieties without much regard for the prices of competing varieties within classes,nonetheless, price differentials have a small but measurable effect upon monthly scheduling of import purchases.

Regarding the existence of class targets whose levels change independently of varietal price changes, Table (2) displays estimates for the expenditure share of all hard wheat (S1). This share equation shows the small but measurable impact of other targets upon this class expenditure share. Table (5) displays results from the F-ratio tests used to confirm the validity of imposing Additive and Separable restrictions upon cost minimization models. Additivity is not rejected for the expenditure share for all hard wheat, confirming that wheat varieties are grouped into classes. Table 5 also shows that , in general, the cost minimization models accept the validity of Additive and/or Separable restrictions placed upon the class and variety expenditure shares, making it more likely that the maintained hypothesis of cost minimization is not rejected. Finally, an attempt to establish the validity of an alternative hypothesis to cost minimization -- the filling of separate quotas for each wheat variety without respect to own- or cross- price effects -- was not significant. Table (6) illustrates that a quota-filling model was not significant at any level, so as not to establish the existence of varietal quotas. Such quotas were regressed for each wheat variety, and table (6) displays the best of the dismal results, which still failed to achieve significance.

Regarding the impact of price differentials within and across classes, table (3) illustrates that both own-variety and cross-class prices affect the expenditure share of Canadian CW 13.5% wheat. Similarly, results displayed in table (4) confirm that the price of CW 13.5% affects the expenditure share of U.S. dns 14% more than its own price does. Both effects are established with statistical significance of 99.5%. Finally, Table (7) displays estimates of the elasticities of substitution for these two wheat varieties. These elasticities confirm that CW 13.5% and dns 14% are monthly substitutes.

The statistical properties which support these broad conclusions will now be presented in more detail.

COLLINEARITY

The validity of statistical results depend upon the inherent properties of the data being used. The greatest threat to significance for a cost minimization model is the potential for collinearity in the large set of prices used to specify it. The F-ratio results displayed in table (5) confirm that collinearity does not significantly compromise the results for this study.

The presence of collinearity in the import prices would yield coefficient estimates with diffuse sampling distributions. Resultantly poor estimates of the coefficients would increase the probability of finding that the residuals are not well behaved. This did not happen in this study. The fact that many of the restricted models pass the F-ratio test is demonstration that potential collinearity among imported wheat prices is not pronounced enough to disrupt the testing procedure.

In theory, Additivity and Separability restrictions should help us to narrow the distributions of the estimated coefficients. By imposing relations between the estimated coefficients, we should be able to reduce the impact of the collinearity between the prices, and thereby gain more precise coefficients estimates. Restrictions reduce sampling variance, yielding better estimates for the model as a whole.Restrictions will make the residuals more random. The behavior of the residuals resulting from the restrictions can be used with more confidence to accept or reject the model without being unduly influenced by collinearity. In the case of this study, Additivity was not rejected for the hard wheat class share (S1). Also, Additivity, Separability, and Additivity and Separability together were not rejected for CW 13.5%. In the case of dns 14%, only Separability and the presence of Additivity and Separability together were rejected The presence of Additivity and Separability together is extremely restrictive. It is remarkable not to reject it in the case of the CW 13.5% wheat variety. All in all, table (7) illustrates that the potential collinearity between wheat prices in these models did not interfere with the procedure used to test for the significance of Additivity and/or Separability restrictions.

It must be stated that the Autoregressive (AUTO) versions of these restricted and unrestricted models were frequently more significant than the Ordinary Least Squares (OLS) versions. Whenever the estimates from a restricted model are displayed in tables 2-4, the estimates from the more significant of these two estimators are the ones presented. Autoregressive model estimates are more trustworthy than OLS ones when tests for autoregressive error structure confirms its presence. In such cases ,OLS estimates are not appropriate. Its t-ratios are not the real standard errors of the model, and one needs to calculate them using the autoregressive model's sigma-squared omega matrix. This study tested for autoregressivity first, and then for Additivity or Separability, out of personal choice, since testing could have been done in the reverse order. These tests are not truly independent of each other.

THE EXISTENCE OF CLASS TARGETS: THE CASE OF HARD WHEAT (S1)

While the TL model confirms the expenditure minimization hypothesis for the Japanese market, the nature of the Food Agency's demand preferences remains unclear and is not strictly defined by quality class distinctions. The estimates for the Hard wheat target share equation, (S1), illustrate this. Table (2) presents the statistical significance of the share equations estimated ,while tables (3)-(4) presents the coefficients for two selected wheat varieties in the hard class: Canadian CW 13.5% (K13) and U.S. dns 14% (K14). Table (5) presents F-ratio test results for these expenditure shares.

Table (5) shows that we can accept the OLS Additivity model results displayed in Table (2), which illustrate the small but measurable impact of other class targets upon the hard wheat share. Under Additivity restrictions, the null hypothesis is (Ho: $R(i,1) \neq 0$). The F-ratio test for the (S1) Additivity model shows that we cannot reject the null hypothesis. Therefore, targets influence expenditure shares for (S1), and indeed for the varietal shares (K13) and (K14) as well. In the case of expenditure shares for entire classes, an Additivity restriction signifies that the only price changes allowed to explain changes in class share (Si) belong to varieties in that class (P(iJ) ∀ J). In the case of the (S1) share, Additivity improves the own-class influence of one of the own-class prices upon the class share: the price for Canadian CW 13.5% becomes significant when the Additivity restriction is imposed, whereas it was insignificant in the unrestricted model.

Here are the conclusions supported by coefficient estimates for the (S1) share. First, the influences of the other classes upon the hard wheat share of total wheat expenditure are larger and more significant than those of most of the prices of the import varieties in the hard class (U.S. HW 13%, CW 13.5% and dns 14%). The correct signs and small standard errors for many of the cross-target and target- price coefficient estimates confirm the absence of strong intra-class price influence in the face of strong inter-class influence from prices and targets of other classes. This is true for both the unrestricted and Additive estimates. Consider first the cross-target coefficents, the first four estimates in either column in table (2). These answer the query of whether variations in other targets affect the variation displayed by the hard wheat share. The answer here is 'yes.' These estimates are small but significant at the 99.5% confidence level, and are of the signs expected for targets which compete against each other for shares of total expenditure. This is especially true for the target for soft wheat. Its coefficients in both unrestricted and Additive models approach the magnitudes of the own-target variables: 17% of an expenditure share also expressed as a percent, as opposed to 21% of a percent share for the own-target variable (unrestricted estimates). The intercept terms in these regressions represent the direct impact of the hard wheat class target upon total expenditure. In both the unrestricted and restricted cases, the three hard wheats taken together as a class have a large effect upon total expenditure: a 1% change in the hard wheat target changes total expenditure by .63% in the same direction. (In TL form, which uses logs of prices, targets, and of total expenditure, an estimated coefficient of (.01) represents a (.01%) impact for a (1%) change in the level of the cost share, say from 35% of total share to 36%.)

The remaining estimates in the columns represent values for the price-target coefficients. These show the influence of price changes within and across classes upon the expediture share for all hard wheats. In both the unrestricted and Additive cases, these price-target coefficients are small and insignificant for the most part. This supports the notion that the Food Agency sets the size of the import targets for classes without reference to the prices of wheat varieties in its class. The exceptions to the rule are for CW 13.5% and U.S. white wheat. The share of hard wheat is sensitive to these varieties' price changes in small magnitudes which are significant at the 97.5% and 99.5% levels respectively. The coefficient for white wheat appears in the unrestricted model, while that for CW 13.5% becomes significant under the Additivity restriction. We expect the (S1) share to decrease slightly as the prices of these wheat varieties rise. Therefore, based upon these estimates, it is possible for the coefficients of prices of wheat in other classes to be as large and significant as those for own-class prices.

These results for Hard wheat confirm that expenditure minimization is at work in the Japanese port market, for the F, chi-square, and adjusted R-square values are all high for both the unrestricted and Additive models. This level of significance supports the notion that the Food Agency does distinguish between entire classes-- the cross-target coefficients are significant -- however,price competition does not occur exclusively within classes, and it does occur between classes in a less than straightforward manner. The evidience for this conclusion is that the cross-price effects are as significant as the own-class ones, and are of similar magnitudes. If one were to judge that the statistical performance of these models was not acceptable, the appropriate corrective would be to redefine the restrictions ,grouping variety prices differently, rather than to redefine the class targets. These strong regression statistics suggest that Food Agency demand involves some type of grouping of wheat varieties into classes to meet import targets. Only further regression can determine whether Separability restrictions should be defined by class or by some other criteria such as end-use.

THE GROUPING OF WHEAT VARIETIES INTO QUALITY CLASSES

The coefficient estimates for (K14), the varietal expenditure share for U.S. dark Northern Spring (dns 14%) indicates that Expenditure minimization is at work in setting (K14), and that the demand preferences of the Food Agency cut across quality class designations. For, the small but significant values of the price-target coefficients found in table (4) over all unrestricted and retricted models indicate that (K14) is slightly responsive to changes in the target size of its own class and of other classes. This result is not as true for (K13), the expenditure share for Canadian CW 13.5% wheat, which seems to be influenced by variations in the target for soft wheat. In the cases of both shares, the results are accepted at the 99.5% confidence level.

In theory, the presence of Additive restrictions means that the only import target variable allowed to explain changes in (KiJ) is its own-class target,(Xi). The relevant question to ask is whether there is an improvement in the own-target variable (RiJ,1) as Additivity is imposed. The answer is 'no' for both CW 13.5% and dns 14%, since the coefficient for the Hard wheat target is insignificant in the Additivity models in tables (3) and (4). Consequently, since table (6) shows that the restriction of additivity is not rejected, one can conclude that the estimates from this model can be trusted so that class targets other than the own-target,affect demand for CW 13.5% and for dns 14%,too. For instance , the unrestricted (AUTO) model results depicted in table (2) show that (K13) is adversely affected by rises in the target for soft wheats. The same column for (K14) in table (4) shows that the dns 14% share is affected by soft and semi-hard wheats in the same way, and by the hard target in a positive way, all at a 99.5% significance level.

Regarding Separability, such restrictions mean that the only price effects permitted by the model to explain changes in (KiJ) belong to the same class of wheat. Table (6) shows that Separability is not rejected for the CW 13.5% wheat, but is rejected for dns 14%. The relevant question to ask here is whether there is an improvement in the own-class price coefficients (GiJih) as Separability is imposed. The answer in the case of (K13) is 'no.' The own-price coefficient loses all significance from its level in the unrestricted model (99.5%) , the same holds for the coefficient representing the price of HW 13%, and the confidence level for cross-price dns 14% variable falls from 99.5% to 97.5%. In the unrestricted (AUTO) model for (K13), estimates of (GiJlh) show that (K13) is affected by price changes outside of its own class, particularly the price of U.S. white wheat. The same phenomenon occurs in the unrestricted (AUTO) model for dns 14%. In the share equation for CW 13.5%, the coefficient for the price of U.S. white wheat has the sign of a competitor (negative.) This is borne out by a small but positive elasticity of substitution between the two wheats, as displayed in table (7). The existence of these cross-class price effects leads one to prefer the unrestricted model estimates to those of the Separable model. The shares of both CW 13.5% and dns 14% are influenced by prices across classes. There is an important distinction between these two wheats, however. The own-price coefficient in the CW 13.5% share equation is significant-- its imports are tied to its import price -- while , in contrast, the imports of dns 14% seem to be tied more with changes in the price of CW 13.5% than to the changes in its own price. As seen in the unrestricted (AUTO) column of table (4), both own- and cross-price coefficients are significant at the 99.5% level but are of greatly different magnitudes.

These small but significant coefficients lead one to conclude that change in target sizes and varietal prices do not greatly influence the expenditure shares for either CW 13.5% or dns 14%. Both are affected by changes across their class in the price of U.S. soft wheat. Perhaps they complement each other in a flour recipe of Japanese millers. Imports of CW 13.5% seem tied to its own price and not to the price of dns 14%.The same holds for its substitute,dns 14%, whose imports seem tied more to the price of its rival than to its own. The Food Agency seems to be sensitive to the price of the Canadian wheat but not to the other's price. The small magnitudes of these coefficients can be established with statistical significance, evincing some sort of substitution and end-use complementation from month to month. Such substitution seems to hold within classes while complementation holds across classes.

ESTIMATES OF THE ELASTICITIES OF SUBSTITUTION

Estimates of the elasticities of substitution between wheat varieties for the (k13) and (K14) shares are found in table (7). Strictly speaking, TL model coefficient estimates are alleged to have little economic meaning of their own, other than their signs. Consequently, they are best evaluated by the values which they imply for the elasticities of substitution (ESijlh). By conventional wisdom, these elasticities are positive for substitutes and negative for "complements." The values contained for both the unrestricted and Additive models for these two varieties suggest that the Food Agency regards dsn 14% as a substitute for CW 13.5%, at a value of ES(1314) = 14.934, while, in constrast, they regard CW 13.5% as a 'complement' for dns 14%, at a value of ES1413 = (-5.017) in the unrestricted model. (Symmetry does not hold). If it is true that the Japanese are more apt to substitute dns 14% for CW 13.5% than they are to substitute CW 13.5 for dns 14%, this result might explain why the Canadian wheat's expenditure share estimates are more sensitive to its own price than to cross-prices, and also why estimates in the dns 14% share equation are more sensitive to CW 13.5%'s price than to its own. Everything appears to depend upon the price of CW 13.5%.

Stated more formally, the evidence of the elasticities of substitution suggests that dnw 14% and CW 135% can be substituted to meet the same demand for Hard wheat. The Dark Northern Spring wheat is purchased without regard to its own price, but its expenditure share can increase significantly as the price of the Canadian wheat changes. One can further surmise that the Food Agency purchases the Canadian wheat out of a preference for its quality characteristics, but that the Japanese are sensitive to its price, which on the average is higher than that of dns 14%. Consequently, the Food Agency is willing to decrease the Canadian wheat's share in favor of that of Dark Norther Spring's when the price of the Canadian wheat fluctuates significantly.

It is also important to note that the own-variety elasticities of substitution for both CW 13.5% and dns 14% wheat have negative signs, making then "complements" for themselves. One also notices the insensitivity of elasticity estimates in the (K13) equation to the restrictions under which they are estimated. This is not true for elasticities of substitution for dns 14%.

Finally, it is important to note that the estimates in table (7) come from OLS models and may give biased results in light of the superiority of autoregressive estimates for some of the restricted models. Consequently, in this discussion we have been concerned with the signs of these elasticities rather than with their magnitudes.

TESTING FOR QUOTA-FILLING: AN ALTERNATIVE MODEL

So far,Each unrestricted and restricted model described in this paper has had expenditure minimization as an underlying maintained hypothesis. Two things would prevent the Food Agency from practicing expenditure maximization: the existence of bilateral agreements which set the quantity of wheat to be imported in a given season, and the existence of Food Agency targets for specific varieties of wheat.

There are several institutional reasons why Japan may not consider it advantageous to practice expenditure minimization. For instance, to meet bilateral agreements with exporting countries, Japan may have to scramble to import large quantities of wheat varieties for which less expensive alternatives exist in any given month. If Japan is required by agreement to import quantities of a certain size by year's end, then the Food Agency may not be responsive to changes in own-price or to competing prices. Changes in import quantities from a particular country month by month may be better explained in terms of deviations that they represent from the import schedule required to meet a bilateral agreement by year's end, rather than by price changes.

Such a postulate is incompatible with a maintained hypothesis of expenditure minimization. For, the deviations from the import schedule imposed by a trade agreement would relate change in month to month quantities, and the causes of such deviations would not be detected and analyzed by a cost minimization model. To test for the existence of separate import quotas for each wheat variety, one would have to include another explanatory variable to represent the influence of import schedules which have been bilaterally agreed upon, and it would be quite different from the price and class target variables: the annual varietal import quota, the portion of the import quota remaining to be imported by year's end, the percentage of the quota imported so far for that particular variety of wheat, or the magnitude of the portions of the quota which would have to be imported during each of the remaining months in the year so that the Food Agency could meet the terms of the agreement.

To test for the existence of separate varietal import quotas-- either imposed by rigid bilateral agreements or by Food Agency decree to the registered importers -- a model was tested as an alternative to the expenditure minimization models. Its specification is:

Ex(ij) = f{ dPih, dij(t) }

where Ex is the monthly imported quantity
in metric tons.

where dPih are deflated variety prices,
not in log form

and where dij(t) represents the percentage of the quota filled to date

The length of term for the quota variable was, first, one year, and then, two years. Some of the insignificant results from this model are reported in table (6). Models containing remainder variables and installment variables were even less successful.

The underlying assumption of this specifation is incompatible with the idea of expenditure minimization. Consequently, it is important to run this quota-filling model in conjunction with the expenditure minimization models, since the detection of operative quotas would rule out the chance that the Food Agency sets class targets and imports varieties to fill them. By positing the existence of Food Agency targets for each class of wheat, where each class is inclusive of several similar varieties and exclusive of others, one assumes that the Food Agency aggregates the demands which millers express to the Food Agency for particular classes of wheat. However, if in fact these millers express preferences for particular varieties of wheat to the Food Agency, then the class targets would not exist. The expenditure minimization models presented so far assume that one can define class targets by aggregating the demands of millers for wheats of the same class, regardless of whether the millers express preference for particular varieties or for general wheat classes. If millers' demand is variety-specific, then the Food Agency does not have the choice to minimize class expenditures between similar varieties, and it does not issue bids from importers who try to substitute quantities of one variety for another, even at lower price. There is really no way to test which of these procedures is operative, and the Japanese are not telling. One can merely test the significance of the class target variables that one aggregates from quantity data on the purchase of wheat varieties, and run alternative quota-filling models to ascertain whether to trust the results from expenditure minimization models.

The results from all of the quota-filling models are too poor to lead one to reject the results from the expenditure minimization models.Table (6A) presents the regression statistics from an equation in which the quota variable had a significant t-ratio, However, the F-test for the non-intercept coefficients does not reject the null hypothesis that such coefficients are equal to zero. Likewise, table (6B) presents the regression statistics of another quota-filling model for Australian ASW wheat. Not only was the quota variable insignificant, though its sign was correct, but the signs on the prices of competing wheats were incorrect and suggested that imports of ASW rise as the price of its companion falls. Such results--insignificant of quota variables and incorrect signs for price variables -- are typical of the models used to test for the existence of varietal quotas for the seven wheat varieties which Japan imports.

VALIDATION OF THE EXPENDITURE MINIMIZATION HYPOTHESIS

These tables present results which constitute a qualified acceptance of expenditure minimization hypothesis as a maintained hypothesis. It has been helpful in determining the magnitudes and signs of the impacts of class targets and varietal prices uon class and varietal expenditure shares. The expenditure minimization hypothesis could have been rejected by poor performance of the model, but poor performance could be due instead to the inapplicability of other maintained hypotheses as well, such as Additivity or Separability. It seems unlikely that the unrestricted and restricted models presented in this paper would perform as well as they did if the assumption underlying them all was false: expenditure minimization.

Table 1. The Japanese Import Market for Wheat by Classes Used for Food
Monthly averages for Fiscal Years[1] 1979/80 - 1980/81

Variables		Definition of Variables	Average Monthly Shipments ---Metric tons---	Average monthly deflated price ---Dollars/m. ton---	Average Monthly Expenditure Share ---Per Cent---
Hard Wheat quota filled by Food Agency purchases	X^1	Hard Winter (HW)	284,930 ± 80,004		73.0
	x11	hw 11.5%[3] (U.S.)			
	p11			193.00 ± 12.52[5]	10.3
Import Products in Class 1 C xij) and their import (c+f)[2] prices p (1j)	x12	hw 13% (U.S.)			
	p12			201.93 ± 79.53	8.9
	x13	cw 13.5% (Can.)			
	p13			221.58 ± 13.14	35.0
	x14	dns 14% (U.S.)			
	p14	(dark northern Spring)		208.12 ± 15.72	18.8
Durum wheat quota	X2	Durom	3,095 ± 2,855		1.1
import product in class 2 (xij) and its (c+f) price	x21	durom (U.S.)			
	p21			239.91 ±98.70	1.1
White wheat quota	X3	White	98,056 ± 37,268		25.9
import products in class 3 (x3j) and their (c+f) prices	x31	white (U.S.)			
	p31			178.23 ± 11.98	20.5
	x32	ASW (Aust.)			
	p32	(Australian Standard White)		188.79 ± 78.90	5.4

Average Monthly Expenditure on Wheat for Food Call products in all Classes)[4]	$67,322,159. ± 16,129,042
Total Value of Imported Wheat for FY 79/80 - 80/81	$1,615,731,816.

N.B. In the regressions presented in this paper, the hard class (X_1) in this table has been split into two classes, a hard class(X_1) comprised of the varieties (x_{12}, x_{13}, x_{14}) listed above, and a semi-hard class(X_4), comprised of (x_{11}) alone.

1) April to March Japanese Fiscal Year
2) Commercial and freight price
3) Protein content
4) Adjusted for wholesale inflation
5) Plus or minus standard deviation times the mean

Table 2: Coefficient Estimates under Different Restrictions are placed upon the Cost Minimization Model

The Model Estimated:	Unrestricted Auto		Additivity OLS	
Coefficients in the Class Share Equation for (S_1): Hard Wheats				
Hard wheat target	.21794		.21786	
(se) (t)	(.98193E-02)	(22.195)	(.87234E-02)	(24.974)
Durum wheat target	-.65324E-02		-.32221E-02	
(se) (t)	(.48266E-01)	(-1.3534)	(.39471E-03)	(-8.1633)
Soft wheat target	-.17105		-.16970	
(se) (t)	(.89039E-02)	(-19.210)	(.75627E-02)	(-22.439)
Semi-hard wheat target	-.38766E-01		-.35875E-01	
(se) (t)	(.42323E-02)	(-9.1595)	(-.35875E-01)	(-10.764)
U.S. hw 13% price	.62489E-02		.65591E-02	
(se) (t)	(.23268E-02)	(2.6856)	(.19062E-02)	(3.4409)
Can. cw 13.5% price	.35868E-01		-.67229E-01	
(se) (t)	(.93960E-01)	(.38174)	(.33261E-01)	(-2.0212)
U.S. dns 14% price	.76908E-03		.97746E-01	
(se) (t)	(.21157E-02)	(.36351)	(.18744E-02)	(.52148)
U.S. durum price	.57628E-02		-----------	
(se) (t)	(.72500E-02)	(.79488)		
U.S. white price	-.18299E-01		-----------	
(se) (t)	(.53764E-01)	(-3.4035)		
Aust. ASW price	-.20859E-03		-----------	
(se) (t)	(.10469E-02)	(.19924)		
U.S. hw 11.5% price	-.77015E-01		-----------	
(se) (t)	(.83743E-01)	(-.91965)		
Intercept	.62152		.63240	
(se) (t)	(.20532)	(3.0271)	(.18935)	(3.3399)
d.f. / ssr	12	.82717	16	.95428E-01
R^2 / adjusted R^2	.9901	.9810	.9887	.9837
F-test / Critical value (v_1, v_2)	108.914	2.72 (11,12)	199.364	2.66 (7,16)
D.W. / X^2(d.f.)	1.8529	19.7946(1)	1.6184	5.8119(2)
rho / asym. t	n.a.	n.a.	n.a.	n.a.

Table 3: Coefficient Estimates under Different Restriction

The Model Estimated:	Unrestricted Auto		~~Additivity~~ Unrestricted OLS*		Additivity AUTO		Separability OLS		Additivity and Separability OLS	
Coefficients in the Varietal Share Equation for (K_{13}): Can. CW 13.5%										
Hard wheat target	-.96307E-02		.63069E-01		-.21615E-01		.45189E-01		-.24633E-03	
(se) (t)	(.26556E-01)	(-.36266)	(.59636E-01)	(1.0576)	(.27427E-01)	(-.78808)	(.62042E-01)	(.72835)	(.52020E-01)	(-.47354E-0
Durum wheat target	.25746E-01		.37502E-01		-----------		-.23248E-02		-----------	
(se) (t)	(.12330E-01)	(2.0881)	(.29314E-01)	(1.2794)			(.28072E-02)	(-.82816)		
Soft wheat target	-.70818E-01		-.10694		-----------		-.77853E-01		-----------	
(se) (t)	(.24162E-01)	(-2.9309)	(.54077E-01)	(-1.9776)			(.53787E-01)	(-1.4474)		
Semi-hard wheat target	.19342E-01		.58335E-02		-----------		-.14037E-01		-----------	
(se) (t)	(.12339E-01)	(1.5676)	(.225704E-01)	(.22695)			(.23704E-01)	(-.59219)		
U.S. hw 13% price	.17798E-01		-.52172E-02		.11898E-01		-.23708E-02		-.86715E-02	
(se) (t)	(.75155E-02)	(2.3682)	(.14131E-01)	(-.36919)	(.79848E-02)	(1.4901)	(.13557E-01)	(-.17487)	(.11473E-01)	(-.74928)
Can. cw 13.5% price	-1.0495		-.77511		-.93507		-.28706		-.26376	
(se) (t)	(.38727)	(-2.7101)	(.57066)	(-1.3583)	(.43402)	(-2.1544)	(.23656)	(-1.2135)	(.23604)	(-1.1175)
U. S. dns 14% price	-.35613E-01		-.18735E-01		-.37583E-01		-.27306E-01		-.22492E-01	
(se) (t)	(.66626E-02)	(-5.3452)	(.12849E-01)	(-1.4581)	(.79897E-02)	(-4.7039)	(.13331E-01)	(-2.0483)	(.12850E-01)	(-1.7504)
U.S. durum price	-.45363E-01		-.64996E-01		-.11184E-01		-----------		-----------	
(se) (t)	(.20407E-01)	(-2.2229)	(.44032E-01)	(-1.4761)	(.62832E-02)	(-1.7800)				
U.S. white price	1.4964		.77704		1.6389		-----------		-----------	
(se) (t)	(.28237)	(5.2994)	(.32653)	(2.3797)	(.34034)	(4.8155)				
Aust. ASW price	.81527E-03		.99130E-02		-.32242E-02		-----------		-----------	
(se) (t)	(.30181E-02)	(.27012)	(.63584E-02)	(1.5590)	(.33992E-02)	(-.94853)				
U.S. hw 11.5% price	-.63396		-.33321		-.76094		-----------		-----------	
(se) (t)	(.38891)	(-1.6301)	(.50860)	(-.65514)	(.43492)	(-1.7496)				
Intercept	2.4209		2.7627		1.3470		2.5526		1.9367	
(se) (t)	(.86342)	(2.8038)	(1.2470)	(2.2155)	(.97683)	(1.3790)	(1.3467)	(1.8955)	(1.2905)	(1.5007)
d.f. / ssr	n.a.	.56966	12	.58396	15	.63052	16	.77965	19	.82737
R^2 / adjusted R^2	.7678	.5549	.7059	.4362	.6534	.4686	.5389	.3372	.4134	.2899
F-test / Critical value (v_1,v_2)	n.a.	2.72 (11,12)	2.618	2.72 (11,16)	n.a.	(8.15)	2.672	2.66 (7,16)	3.348	2.90 (4,19)
D.W. / X^2(d.f.)	1.7030	8.3535(1)	1.8944	13.5671(1)	1.9621	9.6705(1)	1.8164	6.0809(2)	1.4967	2,5373(3)
rho / asym. t	.90775	10.601	n.a.	n.a.	.86968	8.6312	n.a.	n.a.	n.a.	n.a.

*NOTE: These unrestricted OLS estimates are untrustworthy, since autoregressivity is significant in most of these share equations. However, the OLS results are included for reference to the separability restricted share for (K_{13}), where OLS estimates are more significant than autoregressive ones.

Table 4 : Coefficient Estimates under Different Restrictions

The Model Estimated:	Unrestricted Auto		~~Additivity~~ Unrestricted OLS*		Additivity AUTO		Separability OLS		Additivity and Separability OLS	
Coefficients in the Varietal Share Equation for (K_{14}): U.S. dns 14%										
Hard wheat target	.81449E-01		.45972E-01		-.24371E-01		.59443E-01		-.72792E-02	
(se) (t)	(.19215E-01)	(4.2389)	(.38649E-01)	(1.1895)	(.25067E-01)	(-.97223)	(.29563E-01)	(2.0107)	(.38579E-01)	(.18868)
Durum wheat target	-.22691E-02		-.11675E-01		-----------		.20960E-02		-----------	
(se) (t)	(.88026E-02)	(-.25777)	(.18997E-01)	(-.61454)			(.22925E-02)	(.91425)		
Soft wheat target	-.87232E-01		-.53828E-01		-----------		-.75896E-01		-----------	
(se) (t)	(.17311E-01)	(-5.0390)	(.35046E-01)	(-1.5359)			(.25920E-01)	(-2.9280)		
Semi-hard wheat target	-.34127E-01		-.26950E-01		-----------		-.2654E-01		-----------	
(se) (t)	(.89078E-02)	(-3.8311)	(.16658E-01)	(-1.6178)			(.11663E-01)	(-2.2759)		
U.S. hw 13% price	-.75081E-02		.24365E-02		.13799E-01		-.12313E-02		.11066E-02	
(se) (t)	(.53888E-02)	(-1.3933)	(.91582E-02)	(.26604)	(.54650E-02)	(2.525)	(.77046E-02)	(-.15981)	(.85830E-02)	(.12893)
Can. cw 13.5% price	.91484		.92618		.68237		.30579		.28690	
(se) (t)	(.26983)	(3.3904)	(.36983)	(2.5043)	(.20378)	(3.3486)	(.13988)	(2.1861)	(.17505)	(1.6389)
U.S. dns 14% price	.28202E-01		.15409E-01		.12982E-01		.26628E-01		.26511E-01	
(se) (t)	(.46771E-02)	(6.0298)	(.83273E-02)	(1.8504)	(.62688E-02)	(2.0709)	(.65749E-02)	(4.0499)	(.95297E-02)	(2.7819)
U.S. durum price	.14462E-01		.27365E-01		.64204E-02		-----------		-----------	
(se) (t)	(.14204E-01)	(1.0181)	(.28536E-01)	(.95896)	(.20476E-02)	(3.1355)				
U.S. white price	-1.0034		-.74944		-.81021		-----------		-----------	
(se) (t)	(.19546)	(-5.1334)	(.21161)	(-3.5415)	(.11546)	(-7.0173)				
Aust. ASW price	-.10281E-02		-.73881E-02		-.11509E-01		-----------		-----------	
(se) (t)	(.21664E-02)	(-.47456)	(-.41207E-02)	(-1.7929)	(.3220E-02)	(-3.5742)				
U.S. hw 11.5% price	.30498		.21187		.53082		-----------		-----------	
(se) (t)	(.26754)	(1.1400)	(.32961)	(.64278)	(.17628)	(3.0112)				
Intercept	-.93466		-1.8004		-1.9035		-1.1845		-1.5918	
(se) (t)	(.61119)	(-1.5293)	(.80813)	(-2.2279)	(.48350)	(-3.9368)	(.83484)	(-1.4189)	(.95707)	(-1.6632)
d.f. / sse	12	.40460	12	.37043	15	.41181	16	.58395	19	.65958
R^2 / adjusted R^2	.8703	.7514	.8539	.7200	8464	.7645	.7345	.6226	.6185	.5381
F-test / Critical value (v_1, v_2)	n.a.	2.72 (11,12)	6.376	2.72 (11,12)	n.a.	2.64 (8,15)	n.a.	2.66 (7,16)	7.699	2.90 (4,19)
D.W. / X^2(d.f.)	1.7947	11.4502(1)	1.9408	11.9423(1)	2.1279	3.7302(1)	1.6411	14.9335(2)	1.9196	5.1816(3)
rho / asym. t	.79288	6.374	n.a.	n.a.	.59586	-3.63482	.46068	2.54276	n.a.	n.a.

*NOTE: These unrestricted OLS estimates are untrustworthy, since autoregressivity was significant in these share equations. However, the OLS results are included for reference to the additive and separabile model for (K_{14}), since its OLS estimates are more significant than the autoregressive ones in this one case.

Table 5: F-ratio tests for Additivity and Separability Restrictions placed upon a Cost-minimization model when collinearity may be present: Results for expenditure share equations for the Class of all hard wheats, and for the wheat varieties Candian CW 13.5% and U.S. dns 14%.

Restriction Imposed:	Additivity Among Import Class Targets		Separability Among Varietal Prices		Additivity and Separability both	
	F-ratio w.r.t. unrestricted model	Critical (5%) level (v_1, v_2)	F-ratio	Critical (5%) level (v_1, v_2)	F-ratio	Critical (5%) level (v_1, v_2)
Expenditure Shares tested:						
All hard wheats (S_1)	(.0426)* OLS model	3.01 (4,16)	not applicable		not applicable	
Can. CW 13.5% (K_{13})	(.39398)* AUTO model	2.60 $(3,\infty)$	(1.702)* OLS model	3.01 (4,16)	(1.7044)* OLS model	2.55 (7,19)
U.S. dns 14% (K_{14})	(1.473)* AUTO model	2.60 $(3,\infty)$	6.14588 AUTO model	(2.37) $(4,\infty)$	2.76 OLS model	2.55 (7,19)

Note: Starred F-ratios -- (.0426)* -- haye passed the (5%) F-ratio test: Do not reject the null hypothesis H_o: (RBO).

To derive the F-ratios, autoregressivity was tested before additivity or separability. Consequently, s.s.e. and d.f. from restricted autoregressive (AUTO) models are compared against s.s.e., m.s.e., and d.f. from unrestricted autoregressive models. Likewise, error valves from restricted OLS models are evaluated with regard to those from unrestricted OLS models for those expenditure shares.

Table 6: Insignificance of quota and own-price variables in explaining fluctuations in soft wheat imports for Japan when Expenditure Minimization is not assumed.

Table 6A: Insignificance of Quota Variable

Dependent variable: Monthly quantity imported of American white wheat, (x_{31}).

Independent variables:	Estimated Coefficients	Standard Error	t-ratio 20 d.f.
Deflated price of U.S. white	-140.56	398.11	-.35308
Deflated price of Aust. ASW	12.411	64.933	.19114
% of bilateral quota filled for U.S. white	-37911.	17144.	-2.2113
Intercept	.12292E+06	76099	1.6152

Regression Statistics:

R^2: .2068 — adjusted R^2: .0878 — SSR: .37458E+08

F-test (v_1,v_2) 1.78(3,20) — critical (5%) level: 3.10 — Do not reject null hypotheses (H_o: $\hat{B}=0$)

D.W. 1.9814 — X^2(d.f.) 5.6483 (4)

Table 6B: Insignificance of Own-Price Variable

Dependent variable: Monthly quantity imported of Australian ASW, (x_{32}).

Independent Variables:	Estimated Coefficients	Standard Error	t-ratio 8 d.f.
Deflated price of U.S. white	-363.74	162.65	-2.2363
Deflated price of Aust. ASW	98.307	29.239	3.3622
% of bilateral quota filled for ASW	2693.2	9202.8	.29265
Intercept	67731.	30574.	2.2153

Regression Statistics:

R^2 : .7246 — adjusted R^2: .6213 — SSR: 62999.

F-test (v_1,v_2) 7.016(3,8) — critical (5%) level: 4.07 — Reject null hypothesis (H_o: $\hat{B}=0$)

D.W. 2.4638 — X^2(d.f.) 7.7048 (4)

Table 7: Elasticities of Substitution calculated from coefficients estimated under different restrictions. (OLS model)

	Unrestricted	Additivity	Separability	Additivity and Separability
Elasticity of Substitution between CW 13.5% and:				
U.S. hw 13%	-8.6761	-8.6761	-8.6761	-8.6761
Can. CW 13.5%	-1.8234	-1.8234	-1.8234	-1.8234
U.S. dns 14%	14.934	14.934	14.934	14.934
U.S. durum	.63551	.63551	-------	-------
U.S. white	.035159	.035159	-------	-------
Aust. ASW	3.3660	3.3660	-------	-------
U.S. hw 11.5%	2.3980	2.3980	-------	-------
Elasticity of Substitution between U.S. dns 14% and:				
U.S. hw 13%	-2558.5	-3299.5	-946.92	-869.98
Can. CW 13.5%	-5.017	-4.3271	-7.7692	-6.2232
U.S. dns 14%	-932.74	-271.18	-271.18	-271.18
U.S. durum	244.16	203.89	-------	-------
U.S. white	138.77	801.45	-------	-------
Aust. ASW	-698.83	-33.089	-------	-------
U.S. hw 11.5%	-30.782	-43.763	-------	-------

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