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Supply Management: Analyzing the Values of Tradeable Output Quotas

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Abstract: This paper is concerned with the analysis of some economic impacts of supply-management quota schemes based on evidence from some of the Canadian quota programmes. Reasons underlying the wide acceptance of these programmes and the use of cost-increasing methods of quota administration are briefly explored. Some evidence from Canadian quota programmes is presented to illustrate the economic effects of restrictive quota transfer policies. An econometric analysis of economic factors affecting the supply of and demand for transferable output quotas is presented. The results of a single-equation model of the derived demand for quotas are compared to the results of a simultaneous equation model of demand and supply for quotas. Econometric analysis of quota price and transaction data provides useful insights into the behaviour of the market for quotas.

Introduction

This paper is concerned with the analysis of some effects of a particular form of government-authorized intervention in the marketing of agricultural commodities, specifically programmes of supply management involving quota-specified constraints on output levels of individual producers. These programmes are well entrenched in Canada for dairy and poultry products; they are also applied in Australia for similar products and have more recently been introduced for milk in some countries of northern Europe and in the EC. Such programmes are allied with maintenance of price and income levels for farmers at levels higher than would be achieved without intervention.

Supply managing quota programmes have a number of problems and disadvantages. They involve increased levels of consumer expenditures; the increased farm asset values that occur with these programmes lead to increased costs of entry for young producers and higher levels of capital costs for the industry; the programmes can involve appreciable social costs, depending on the ways in which they are administered. Nonetheless, supply control has been given increasing emphasis in the debate on agricultural policy reforms, being seen by many governments as a politically acceptable short-term solution to surplus problems (OECD, 1987, p. 21). A number of people have studied the Canadian supply management programmes (e.g., Forbes, Hughes, and Warley, 1982). Evidence from the relatively long-established Canadian programmes may be useful in evaluating potential merits and problems in wider use of supply-management quota programmes. Appropriate approaches to empirical analysis of quota values also requires exploration. In addressing these issues, this paper gives an analysis of some of the factors affecting the values of quotas, applying evidence from some Canadian supply management programmes. A preliminary econometric analysis of some Canadian quota value and transaction data for Ontario fluid milk is also presented.

Factors Affecting Quota Values

Quota programmes have been a politically favoured method of providing income support to producers of domestically oriented farm products in Canada. The price-inelastic domestic demand schedules for such products as fluid milk and poultry products have enabled producer total revenue to be increased appreciably by supply limitation. The limitation of imports used to support the national supply-management programmes is justified under Article 11 of GATT, to which Canada is a signatory. The programmes have been perceived by some groups of producers as means of achieving "fair" prices and incomes justified on cost-related pricing formulas. Further, the considerable income transfers from consumers to producers are achieved without explicit government expenditures. All these factors have contributed to the popularity of supply management programmes among many producers and to widespread political support for these programmes.

One characteristic feature of programmes that maintain agricultural prices and incomes above competitive levels is the tendency for the benefits of the programmes to become capitalized into the value of farm assets; this feature can be expected as long as the rights of use of quotas lead to net returns greater than alternative uses of producer resources. Specifically, the anticipated stream of net benefits from the use of quota rights becomes capitalized into the present value of these rights. When quotas are attached to inputs such as land or cows, the capital values of these assets inflate, reflecting the benefits of gaining access to the programme through use of these assets. When supply management programmes are administered in the form of negotiable output quotas, the values attached to these assets provide a measure of the capitalized value of the stream of rents associated with use of the quotas.

Social costs of quota programmes can be increased appreciably by their application as input quotas (rather than as output quotas) and by limitations on transferability of quotas among producers. Restrictions on quota transfers may obscure quota values (as when these are reflected in the capital values of farmland or livestock). They also reduce the net benefits of quota use to producers, for example, by increasing the transaction costs of transfers, preventing the achievement of economies of scale, and preventing locational adjustments that would otherwise occur. Producer cost levels rise as restraints on quota transfers and the use of input quotas prevent producers from using the least-cost combinations of resources and limit their use of the most efficient scale of plant and the lowest cost location (Veeman, 1982 and 1987). Thus, some advocate that existing quota programmes be applied through transferable output quotas with minimal restrictions on transferability. Nonetheless, all supply-management quota programmes in Canada restrict quota transfers to some degree.

The extent of restrictions on quota transfers tends to vary by province and commodity. In some instances, this has changed over time. In the Prairie Provinces, broiler chicken, egg, and turkey quotas are not transferred by negotiated sales but are essentially transferred with land and buildings. Although changes have occurred over time, negotiated sale transfer of quota rights is now applied in most other provinces, but limitations on these transfers are widespread. These limitations include restrictions on relocation of production between specified areas, restrictions on the entitlement of those involved in transfers to share in subsequent allocations of expanded quota rights, limitations of the quantity of transferred quotas (e.g., restriction to "whole farm" transfers) and restrictions on the length of time quota purchasers must hold quotas before resale. Renting quotas is often not allowed. Restrictions on allowable quota prices are applied in some provinces in an effort to reduce these values. Restrictions exist on the maximum size of quotas that may be held by individuals in all provinces. No provision exists for negotiated transfer of quotas between provinces, although under the national supply-management programmes a very limited opportunity exists for administrative reallocation of quotas from province to province (Veeman, 1988).

These quota transfer restrictions persist for two apparent reasons, despite their deleterious effects on social costs of the programmes. First, they are used to effect desired structural changes or to limit structural changes considered undesirable by quota programme administrators and supervisors. Thus, quota policies are used to maintain "family" farms, limit purchases by nonfarmers, and limit the extent of vertical integration. Second, transfer limitations are applied to reduce the visibility and level of quota values, to limit adverse publicity on the income transfers to producers under these programmes and to reduce adverse public reaction to the programmes.

Examination of differences among provinces in quota policy for eggs and related features of this sector illustrates the implications of quota policy to producer benefits and social costs of the programmes. Some of these features are summarized in Table 1. Quota allocation and transfer policies, in particular, appear to be major factors underlying both the considerable differences in relative profitability of egg production (as indicated by the reported or imputed quota values) and the wide variation in average size of production units in different provinces outlined in Table 1. Quota values tend to be highest in those provinces with fewer quota transfer restrictions. Contrary to the belief of some producers

Table 1—Quota Transferability and Average Size of Egg Production Units, by Canadian Province

Province	Negotiated Quota Transfer	Maximum Quota Level (1983)	Quota Value Per Layer (\$)	Average Size of Producing Unit ¹	No. of Producers
B.C.	Yes	20,000	² 31	14,937	163
Alta.	No ²	⁴ 23,000	⁵ 2-5	6,426	234
Sask.	No ³	30,000	⁵ 2-5	8,248	85
Man.	No ³	20,000	⁵ 2-5	9,606	242
Ont.	Yes ⁶	30,000	⁷ 10	9,501	784
Qué.	Yes ⁸	50,000	⁹ 18	18,991	170
N.B.	Yes	25,000	na	16,771	25
N.S.	Yes	50,000	na	19,828	43
P.E.I.	No	15,000	na ¹⁰	4,461	32
Nfld.	No ³	25,000	na	12,272	36

¹Average number of laying hens per regulated producer, 1986. For Canada as a whole, this was 10,748 (CEMA, 1987).

²Based on \$2,400/case for 1983 (Dawson, 1983).

³Quota is attached to land and buildings; asset transfer and board reallocation are required.

⁴1.5 percent of provincial entitlement.

⁵Officially, these values are zero; unofficial estimates typically range from \$2 to \$5 per layer.

⁶Since 1980.

⁷Administered price for board purchases.

⁸Since 1973.

⁹1983 (Dawson, 1983).

¹⁰Officially zero.

Sources: Arcus (1981); Barichello and Cunningham-Dunlop (1987); CEMA (1987); Dawson (1983); and annual reports of various boards.

and marketing board administrators, this is not due to negotiability of quotas alone. Rather, as was noted previously, it is due primarily to the lower levels of costs that accompany negotiability of quotas when quota transfers are less restricted. This is reflected, for example, in the relatively larger scales of production associated with fewer limitations on transfer (see Table 1). However, even in provinces with fewer restrictions on egg quota transfers, average plant size is considerably less than the 30,000 layers believed to be required for a technically efficient scale of plant, ignoring pecuniary effects (Dawson and Associates, 1983). Other sources of social costs include distortions in resource allocation (such as those arising from input rather than output quotas, or when poultry boards continue to specify such input requirements as floor space allocations or production cycle times) and increased costs from prevention of locational adjustments. In addition, producer costs are increased when restrictions on quota transfers result in underuse of existing productive capacity. Administrative costs, including costs of monitoring and enforcing quota and levy regulations, as well as costs associated with rent seeking by producers, boards, and other bodies, add to the social costs of these programmes. Added risk and uncertainty arising from the possibility of programme changes also appear to contribute to the social costs of these programmes.

Empirical Analysis of Quota Values

Despite the limitations in quota value data implied by the preceding discussion, monitoring and analyzing the levels of available quota value data may provide useful information on the economic effects of supply-management programmes. Quota value data are relatively scanty for most of the regulated commodities. However, some reliable time-series data on quota values are available from organized quota exchanges, specifically for Ontario milk quotas. One purpose of analyzing quota value data is to explore the reasons underlying the tendency for milk quota values to increase over time. In addition, such analyses may shed light on the underlying economic behaviour and characteristics of market behaviour in a regulated industry.

The capital asset pricing model has commonly been used in analyzing the economic effects of quotas in Canada; e.g., in imputing annual net benefits to producers from quota use. This paper follows an alternative analytical procedure involving an econometric analysis of quota price and transaction data. In this preliminary analysis, quotas are treated as an input required for the production of fluid milk. The derived demand for quotas is estimated using the monthly data on quota prices and transactions for Ontario milk and other variables from March 1980 to December 1985.

Following standard microeconomic theory, the derived demand for quotas in time t , QD_t , the monthly volume of quota purchases, is hypothesized to be a function of the price of quotas, P_t ; PM_t , the administered and thus exogenously determined price of fluid milk; the price of the major input, feed, PF_t ; monthly dummy variables M_i , $i = 2, \dots, 12$; and the error term ud_t ; giving Model 1 as:

$$(1) \quad QD_t = D_0 - D_1P_t + D_2PM_t - D_3PF_t + \sum_{i=2}^{12} \alpha_i M_i + ud_t$$

Model 1 is estimated using OLS. The price variables are deflated and all variables except M_i are expressed in logarithmic form.

Model 2 consists of the previously specified demand function of Model 1 to which is added a supply function for quota transactions and an equilibrium condition, as outlined below:

$$(2) \quad P_t = S_0 + S_1QS_t + S_2P_{t-1} + S_3INT_t + \sum_{i=2}^{12} \beta_i M_i + us_t, \text{ and}$$

$$(3) \quad QD_t = QS_t,$$

where INT_t denotes chartered bank prime interest rate at time t , and the other variables are as previously defined.

The specification of single-equation demand models, such as Model 1, could be justified on the basis that quotas are a nonproduced factor, administratively fixed in total quantity, and thus not appropriately represented by a supply schedule. However, this argument can be challenged on the grounds that although the total stock of quotas is fixed in quantity, producer willingness to sell quotas will be affected by economic variables and constitutes the supply schedule. Specification of Model 2 thus allows assessment of the appropriateness of a single-equation approach as compared to the simultaneous equation approach of the model. The hypothesized dependent variables for the supply function (which is expressed in price-dependent form) include both quota transactions and quota prices in the previous period, since it is hypothesized that adjustment to equilibrium is not instantaneous but occurs over time. Inclusion of the interest rate variable relates to the opportunity cost of a producer's decision to retain rather than sell a quota. All price variables, including INT_t , are deflated and are expressed in logarithmic form. The system of

Table 2—Results of Econometric Analysis of Ontario Fluid Milk Quota Values and Transactions, Demand Equation, Model 1*

<i>Dependent Variable: QD</i>	
Independent Variables	Estimated Coefficients
<i>P</i>	0.42 (2.378)
<i>PM</i>	4.96 (3.179)
<i>PF</i>	-0.18 (0.667)
Constant term	13.25 (9.532)
R^2 (adjusted)	0.50
<i>D.W.</i> statistic	2.105

*Due to space constraints, the coefficients and *t*-statistics for M_i are not reported here, but application of an *F*-test to test $H_0: \beta_i = 0, i = 2, \dots, 12$, gives an *F*-statistic that exceeds the critical value of *F* at the 99-percent level of significance, suggesting that inclusion of the seasonality variables is warranted.

Note: *t*-statistics are in parentheses.

equations involved in Model 2 is overidentified and estimated using 3SLS. The resulting estimates for both models are given in Tables 2 and 3.

Examination of the results of the single-equation model of quota demand of Model 1 indicates that the milk price variable has the appropriate positive sign and is significant. Feed price also has the expected negative sign but is not significantly different from zero. The coefficient on the quota price variable is positive and is significant at the 5-percent level. This sign is not consistent with expectations but can be explained by outward shifts in the demand for quotas over time that may have outweighed any price-associated movement along the demand curve for quotas.² Results for the monthly dummy variables included to test for seasonality in quota demand are not reported in Table 2, but a test of the absence of seasonal patterns leads to rejection of the null hypothesis and thus implies that seasonal patterns of quota demand are evident. Demand for quotas in June and July, at the end of the dairy year, is typically lower than in other months.

The inclusion of the supply equation of Model 2 led to a decrease in standard errors of the estimated coefficients, supporting the use of the simultaneous equation approach reported in Table 3.³ The demand estimates in Table 3 are similar in sign to those of Model 1 but the magnitudes of these estimates, and the associated elasticities, are slightly larger than those from the single-equation demand model. The price of milk, a major factor in the profitability of milk production, appears to have a major influence on the demand for quotas. The results in Table 3 imply that a 1-percent increase in milk price is associated with a 5.4-percent increase in the demand for quotas. An increase of 1 percent in the price

Table 3—Results of Econometric Analysis of Ontario Fluid Milk Quota Values and Transactions, Demand-Supply System, Model 2*

<i>Demand,</i> Dependent Variable: <i>QD</i>		<i>Supply,</i> Dependent Variable: <i>P</i>	
Independent Variables	Estimated Coefficients	Independent Variables	Estimated Coefficients
<i>P</i>	0.57 (3.141)	<i>QS</i>	0.012 (0.239)
<i>PM</i>	5.377 (3.737)	<i>INT</i>	-0.19 (-4.256)
<i>PF</i>	-0.04 (-0.178)	<i>P_{t-1}</i>	0.79 (14.964)
Constant term	13.45 (10.627)	Constant term	-0.45 (-0.969)
<i>R</i> ² (adjusted)	0.60	<i>R</i> ² (adjusted)	0.97
<i>D.W.</i> statistic	2.095	<i>D.W.</i> statistic	1.471

*Due to space constraints, the coefficients and *t*-statistics for M_i are not reported here, but application of an *F*-test to test $H_0: \beta_i = 0, i = 2, \dots, 12$, gives an *F*-statistic that exceeds the critical value of *F* at the 99-percent level of significance, suggesting that inclusion of the seasonality variables is warranted.

Note: *t*-statistics are in parentheses.

of quotas has been associated with 0.57-percent increase in quota demand. Interest rates and the previous level of quota prices are both highly significant explanatory variables in the supply equation. The results suggest that a 1-percent increase in real interest rates decreases quota prices by 0.19 percent on average.

Overall, econometric analysis of quota value and transaction data from markets for transferable quotas may provide helpful insights into the functioning of these programmes. A priority for continuing work in the study described here is to further explore the relationships among the administered prices for milk, the demand for quotas, and quota values. Both econometric models and extensions of the capital-asset-pricing model may be useful in this context.

Summary and Conclusions

The relatively long-established Canadian supply management programmes may provide some lessons for such programmes in other regions. Despite the preference of some producers and their associations for quota policies that obscure quota values, a quota policy that emphasizes output quotas that can be freely traded with limited restrictions on negotiability is conducive to higher levels of producer returns, lower levels of social costs,

and more visible programme implications than when more restrictive quota transfer policies are applied.

Econometric estimates were derived for a hypothesized single-equation demand function and for a simultaneous equation system of hypothesized supply and demand functions for Ontario fluid milk quotas. The results suggest that outward shifts in the demand for quotas have been related to increasing levels of fluid milk prices, and these higher prices have been associated with appreciation of the real value of fluid milk quotas. The major influence on the demand for quotas appears to arise from changes in the level of the administered prices for fluid milk. Statistical support exists for use of the simultaneous equation approach to the analysis of quota values. Major supply-side influences on quota prices appear to be the real interest rate (which is negatively associated with quota prices) and previous quota prices. A pattern of seasonality is evident in the demand for quotas. The results suggest that any administrative action to moderate quota value increases should focus on the levels of fluid milk prices rather than on limiting transferability of fluid milk quotas. Econometric analyses may provide useful means of analyzing the economic implications of negotiable output quotas.

Notes

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²Subsequent substitution of measures of anticipated rather than current quota prices (modelled, for example, as $P_t - P_{t-1}$ or as deviations of current prices from three-year moving averages) yields coefficients with the expected negative sign.

³Subsequent application of Wu-Hausman endogeneity tests suggests that both QD and P are endogenous, supporting the simultaneous equation approach.

References

- Arcus, P.L. (1981) *Broilers and Eggs*, Technical Report No. E/13, Economic Council of Canada and Institute for Research on Public Policy, Ottawa, Ont., Canada.
- Barichello, R.R., and Cunningham-Dunlop, C. (1987) *Quota Allocation and Transfer Schemes in Canada*, Working Paper No. 8, Policy Branch, Agriculture Canada, Ottawa, Ont., Canada.
- CEMA (Canadian Egg Marketing Agency) (1987) *14th Annual Report*, Ottawa, Ont., Canada.
- Dawson, D., and Associates (1983) *Management of Quota in Alberta, Parts I, II, and III*, Consultants' Report to the Agricultural Marketing Council, Alberta, Canada.
- Forbes, J.D., Hughes, R.D., and Warley, T.K. (1982) *Economic Intervention and Regulation in Canadian Agriculture*, Economic Council of Canada, Ottawa, Ont., Canada.
- OECD (Organization for Economic Cooperation and Development) (1987) *National Policies and Agricultural Trade*, Paris, France.
- Veeman, M.M. (1982) "Social Costs of Supply-Restricting Marketing Boards," *Canadian Journal of Agricultural Economics*, Vol. 30, pp. 21-36.
- Veeman, M.M. (1987) "Marketing Boards: Canadian Experience," *American Journal of Agricultural Economics*, Vol. 69, No. 4, pp. 992-1000.
- Veeman, M.M. "Supply Management Systems: Impact on Interprovincial Trade," paper presented at the Symposium on Farm Policy for a Freer Trade World, Canadian Agricultural Economics and Farm Management Society, Département d'Économie Rurale, Université Laval, Sainte-Foy, Qué., Canada, 4-6 May 1988.

DISCUSSION OPENING—Praveen M. Dixit (Economic Research Service, US Department of Agriculture)

Supply controls are being introduced as short-term solutions in various proposals being made for the Uruguay Round of the GATT, and a thorough analysis of their effects on the market place is sorely needed.

Veeman's paper is especially informative when it discusses the problems, advantages, and disadvantages of the Canadian supply management system. She rightly points out that producer groups often see this as a means of obtaining "fair" prices and incomes justified on cost-related pricing formulas, and social costs of quota programmes are increased by limitations on transferability of quotas. While agreeing with her argument that gains from transferability are related to the economies of scale that can be achieved, I find her evidence rather inconclusive—weak supportive evidence within the purview of the chosen market. The sample size is rather small and based largely on observations made over one year. Also, how were the quota values calculated? Finally, I believe that the type of quota transfer system has an important bearing on the outcome. Her conclusions about the benefits of transferability depending on size of operation, therefore, may be a bit strong given the narrow purview of the chosen market.

I have more problems accepting the validity of the part of her analysis that examines forces that influence the derived demand for quotas. Her results indicate that the own-price effects on demand are perverse and significant, which she argues "can be explained by outward shifts in the demand for quotas over time that may have outweighed any price-associated movement along the demand curve for quotas." While this may be true, an econometric problem still exists with either a misspecified demand function, a poor proxy for the own-price variable, or an inappropriate estimation system. Curiously, even the price of industrial milk is not included in the demand equation. Moreover, where she tries to remedy the estimation problem by using 3SLS, the issue of demand specification still exists. The structural coefficient still has the wrong sign. Also, decreases in standard errors of the estimated coefficients do not necessarily indicate more reasonable fits but rather an estimation property when moving from OLS to 3SLS. The choice of instruments hence needs to be questioned.

Despite some of these problems, this paper, along with some of Veeman's earlier work on supply management, could be great use to both economists and policy makers alike. The Uruguay Round is expected to focus a great deal on supply management, its implications for aggregate measures of support (producer subsidy equivalents), and its effects on international agricultural trade. Veeman's work on supply management and quota rents provides a good start for Canada; it also paves the way for others to do similar work.

[No general discussion of this paper was reported.]