# Working Papers Series

Working Paper WP87/8

July 1987

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MILK QUOTAS IN ONTARIO

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## Introduction

Supply management is a distinctive and controversial feature of Canadian agriculture. The economic implications of this regulatory tool have been the object of several studies, most of which are reviewed in Forbes, Hughes, and Warley (1982), and Schmitz (1983). The general conclusion is that supply management, in addition to involving a considerable income transfer from consumers and taxpayers to the producers of the regulated commodity, entails some efficiency losses because the market clears at a point where the marginal benefit to consumers, as indicated by market price, differs from the marginal cost of production. Loosely speaking, the size of this loss can be shown to depend on the extent of the departure from marginal cost pricing, on some elasticities of demand and supply, and on the level of world price (Diewert, 1984). Unfortunately, the first of these factors is especially difficult to assess under supply management.

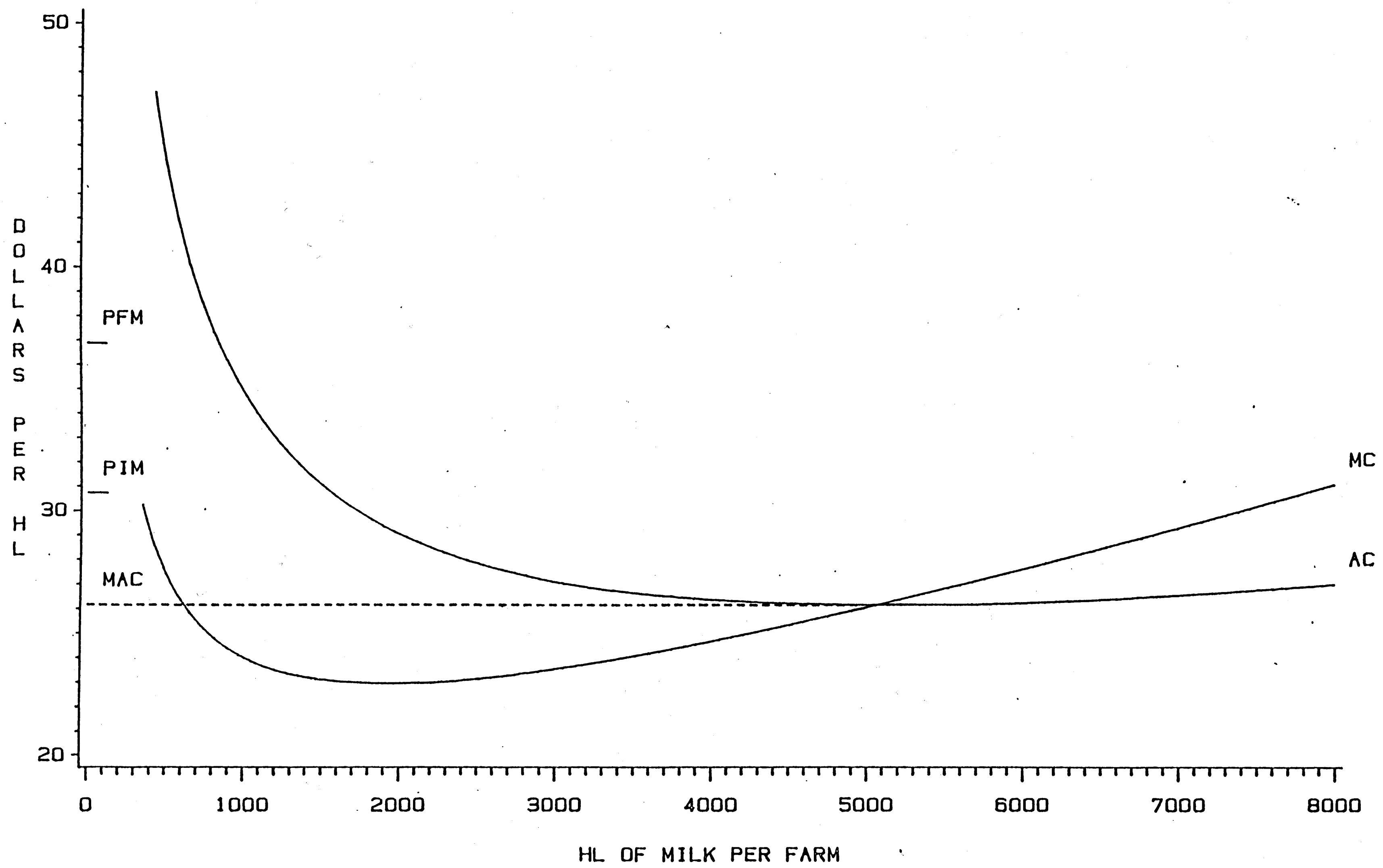
Unlike more transparent government programs, such as direct price support and/or tariff protection, the extent of departure from marginal cost pricing is not directly observable when this is due to supply restrictions. To date, the spread between prices paid to producers and marginal costs of production has been inferred from observed values of quota rights. This procedure is logically sound. Given that quotas confer a right to produce (at privileged prices) that extends into the future, they can be viewed as an asset and their value will equal some discounted form of present and future returns, these returns being the difference between price and marginal cost. Since the asset value of quotas is generally known, in principle it is possible to recover from it the size of the departure from marginal cost pricing by using an appropriate discount rate. The problem, of course, is what discount rate should be used. Notionally, this discount rate should account for elements such as the risky nature of the asset (especially the possibility that this "right" might be abolished by governmental decision, as emphasized by Lermer and Stanbury (1985)), expected capital gains, expected nominal interest rates, and planning horizons. All these factors are difficult to quantify, and indeed discount rates as different as 0.14 (Veeman, 1982) and 0.317 (Barichello, 1984) have been advocated as relevant.

To shed some light on the size of this important parameter, this paper presents some empirical results on the estimation of rates of return for milk quotas in Ontario. The analysis utilizes recent econometric evidence concerning the cost structure of Ontario dairy farms, and rates of return are estimated for three types of milk quota traded in the period 1980-1986.

## The Cost Structure of Ontario Dairy Farms

Utilizing a large body of farm level data collected by the Ontario Dairy Farm Accounting Project over the period 1978-1983, Moschini (1987) estimates econometrically a cost function for Ontario dairy farms.[1/] Given the predominantly cross-section nature of the sample, the resulting estimates can be interpreted as depicting the long-run cost structure of the representative farm in the Ontario dairy industry. The essence of the results is summarized in Figure 1, which reports the estimated average cost (AC) and marginal cost (MC) curves of milk, evaluated at the median of the exogenous variables, together with the average price of fluid milk (PFM) and industrial milk (PIM) for the same period.[2/] It

FIGURE 1 – COST STRUCTURE AND MILK PRICES IN ONTARIO (1978–83)



is apparent that milk production is characterized by increasing returns to scale for a wide range of farm size, as AC reaches a minimum only at about 5000 Hl/year of milk produced (note, however, that the size at which returns to scale are not significantly different from one is approximately 3700 Hl).

An interesting question concerns what the shadow price of quota should be given the cost and price structure depicted in Figure 1. It is well known that, given profit maximization, the shadow price of quota is given by the difference between the milk price and the marginal cost of production. Profit maximization conditions will be satisfied in the long run at the optimal scale of production, while constrained profit maximization conditions can be satisfied in the short run also at sub-optimal scales of production. The estimated cost structure is not informative of what happens in the short-run, while in the long-run the shadow price of quota is given by the difference between milk price and marginal cost (and average cost) at the optimal long-run scale of production, that is where AC achieves a minimum. This shadow price of quota is also sustainable, since it is consistent with all the other inputs being rewarded at the marginal contribution to production, something which is not possible for short-run sub-optimal production scales.

In Figure 1, the minimum value of average costs (MAC) is $26.1/Hl, while the average industrial milk price for the estimation period is $30.7/Hl, and the average fluid milk price is $36.9/Hl. At this point, the departure from marginal cost pricing is given by quantity (PFM - MAC) for fluid milk, and by quantity (PIM - MAC) for industrial milk. Over the estimation period, the departure from marginal cost pricing for industrial milk has been stable in relative terms and equal to about 15%

of the industrial milk price. In what follows we shall assume that this relative spread has remained constant over the period 1980-1986, for which we wish to analyze quota values and rates of return. The spread between fluid milk prices and marginal costs implied by this assumption will depend on the observed difference between the two milk prices.

Implicit Rates of Return for Milk Quotas

Although milk quotas have been transferable for a long time, it is only with the establishment of the quota exchange in March, 1980, that quota transfers have become truly transparent. With the current system, three types of quotas can be exchanged each month through an auction system run by the Ontario Milk Marketing Board (OMMB): quota for fluid milk (Group 1 Pool quota), quota for industrial milk that has not yet been filled in the current dairy year (unused market sharing quota (MSQ)), and quota for industrial milk that has already been filled in the current dairy year (used MSQ). Unused and used MSQ are expressed in litres per year, and thus a unit of MSQ gives the right to market a litre of industrial milk per dairy year (August 1 to July 31). Fluid milk quotas are expressed in litres per day, and thus they have to be filled daily, allowing a producer to market a maximum of 365 litres per year per unit of quota. Note, however, that only a fraction of this milk will be paid at the fluid milk price, this fraction being determined by the payout percentage. Milk in excess of this payout percentage is paid at the industrial milk price and has to be covered by MSQ, except for a small portion, proportional to the quantity of milk paid as fluid (through the exclusion factor), which is excluded from the federal subsidy and in-quota levy of industrial milk, and does not necessitate

MSQ (OMMB, 1985).

To evaluate the rates of return of purchased milk quotas, quotas can be viewed as capital assets that can provide a stream of annual returns (the shadow price of quota). Let R be the annual return, and assume that this return is expected to grow at an annual rate g. The present value of this stream of benefits is given by:

$$(1) \qquad V_o = \sum_{t=1}^{T} R(1+g)^t/(1+r)^t$$

where T is the expected life of the asset, and r is the nominal rate of return (including a risk premium).[3/] For T sufficiently large, a good approximation to (1) is given by the capitalization formula:

$$(2) \qquad V_o = R(1+r)/(r-g)$$

This specification can be utilized as such for unused MSQ. For used MSQ the stream of returns will only begin in the next period. Consequently, an appropriate capitalization formula for used MSQ is

$$(3) \qquad V_o = R/(r-g)$$

A similar problem arises in the case of fluid milk quotas. As mentioned earlier, fluid milk quotas are defined in litre/day, and therefore the annual return to a unit of fluid milk quota will have occurred fully only one year after the purchase of the quota. Thus, the capitalization formula (3) is used also for fluid milk quotas.

To compute r from the above capitalization formulae, we need to know the annual return R and the rate of growth g of R. For industrial milk, we assume that the annual return $R^i$ is:

(4) $R^i = 0.15P^i$

where 0.15 is the relative shadow price of quota estimated over the period 1978-1983 as illustrated in the previous section. For fluid milk quotas the annual return $R^f$ is defined as:

(5) $R^f = 365[0.71\ (0.15P^i + P^f - P^i)]$

where 365 is the number of days in a year, and 0.71 is the average payout percentage over the period considered.[4/]

The last parameter to be determined is the rate of growth g of the annual returns $R^i$ and $R^f$. From definition (4) it is clear that the rate of growth of $R^i$ is the same as the rate of growth of $P^i$, while the rate of growth of $R^f$ is a linear combination of the rate of growth of $P^i$ and $P^f$. Over the last 10 years the net price of fluid milk has grown at an average rate of 6%, and the net price of industrial milk has grown at 7% per year, while in the last six years the price of industrial milk has grown by 3% per year, while the price of fluid milk has grown by 4.5% per year. Thus, we conservatively estimate the expected rate of growth of both $R^i$ and $R^f$ at 3%, and set g = 0.03 for all three types of quota. Given the above, and the observed quota values on the Ontario milk quota exchange, rates of return were computed for each month of the period 1980-1986.[5/] The results are reported in Table 1 as averages per dairy year, together with average milk prices and quota values for the same period.

It is apparent that, during the period considered, quota values have increased substantially. Fluid milk quota values have increased from 98.3 to 281.9 $/litre/day, while unused MSQ have increased from 0.344 to

Table 1 - Milk Prices, Quota Values, and Estimated Rates of Return for Milk Quotas in Ontario

| Dairy Year | Milk Prices | | Quota Values | | | Rates of Return | | | Prime Rate |
|---|---|---|---|---|---|---|---|---|---|
| | Fluid (a) | Industrial (b) | Fluid (c) | MSQ (d) Unused | MSQ (d) Used | Fluid | Unused MSQ | Used MSQ | |
| 80-81 | 38.3 | 31.3 | 98.3 | 0.344 | 0.277 | 0.341 | 0.201 | 0.211 | 0.169 |
| 81-82 | 41.6 | 34.2 | 105.1 | 0.356 | 0.270 | 0.340 | 0.225 | 0.246 | 0.182 |
| 82-83 | 43.4 | 35.0 | 181.6 | 0.731 | 0.473 | 0.235 | 0.126 | 0.153 | 0.124 |
| 83-84 | 45.5 | 36.6 | 221.3 | 0.857 | 0.581 | 0.200 | 0.107 | 0.130 | 0.115 |
| 84-85 | 48.7 | 37.7 | 249.0 | 0.928 | 0.656 | 0.206 | 0.102 | 0.120 | 0.115 |
| 85-86 | 49.7 | 38.0 | 281.9 | 0.969 | 0.701 | 0.190 | 0.098 | 0.117 | 0.107 |

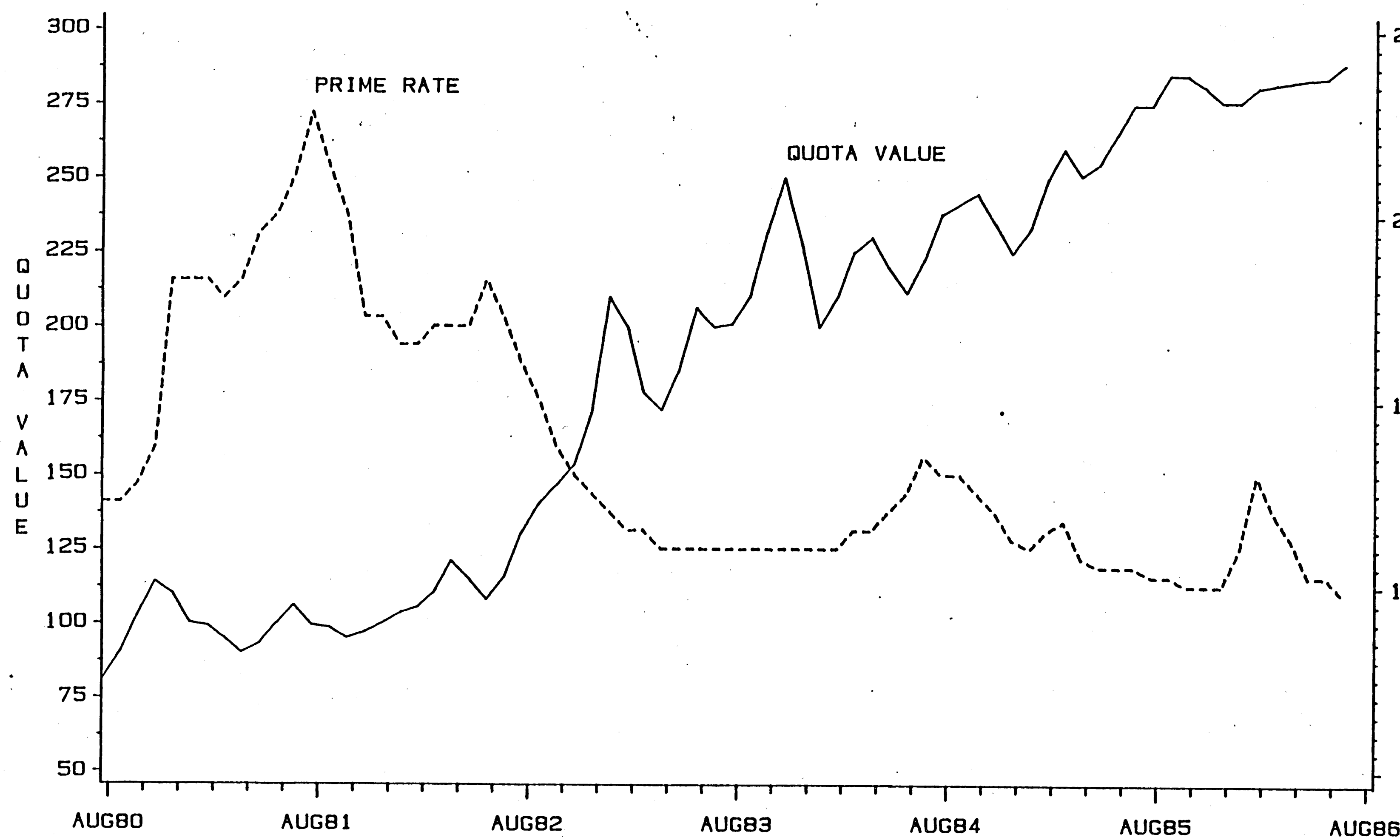
Note: (a) Class 1 milk price ($/Hl) net of transportation cost and OMMB fees;
(b) Class 3-6 blend price ($/Hl) net of transportation cost, OMMB fees, in-quota levy, and federal subsidy;
(c) $/litre/day ;
(d) $/litre/year.

Source: Milk prices and quota values are from OMMB, Dairy Statistical Handbook, and the prime rate from CANSIM.

0.969 $/litre/year, and used MSQ have increased from 0.277 to 0.701. To account fully for this dramatic increase in quota values one has to postulate a decline in the relevant discount rate, and in fact the computed rates of return for the three types of quota show a consistent decline in the last four years. For fluid milk quota the estimated rate of return declines from 34.1 percent in 1980-81 to 19 percent in 1985-86, while a high of 22.5 percent in 1981-82 for unused MSQ compares to a low of 9.8 percent in 1985-86, and for used MSQ the rate of return declines from 24.6 percent in 1981-82 to 11.7 percent in 1985-86. It is interesting to note that the movement of the computed rates of return follows the movement of the interest rate in the economy, as the prime lending rate reported in Table 1 indicates. Thus, an important explanation for the considerable increase in milk quota values observed in the last few years has its roots outside the dairy industry, and depends on the large decline experienced by the interest rate in the Canadian economy. This is best illustrated in Figure 2, which depicts the movement of fluid milk quota values and prime lending rates over the six dairy years considered above.

Rates of return for unused MSQ slightly below those of used MSQ can be partly explained by the fact that unused MSQ can be used by producers to avoid the large over-quota penalty towards the end of the dairy year. The troublesome problem in the results is the large difference between the rates of return of fluid and industrial milk quota values, the former being consistently above the latter. A possible factor is that Ontario dairy farmers cannot hold more than 75 percent of their total quota as fluid milk quota. However, given that less than half of the total quota available in Ontario is in terms of fluid milk quotas,

# FIGURE 2 – FLUID MILK QUOTA VALUE AND INTEREST RATE
AUGUST 1980 TO JULY 1986



this constraint cannot be binding for all producers, thereby leaving open the possibility of bidding up the price of fluid milk quota.

A more general conclusion, therefore, is that the risk premium associated with fluid milk quotas is much higher than that associated with industrial milk quotas. This is consistent with the observation that, as monopoly rent increases, it is likely to become more difficult to defend politically. Since this risk premium is a social cost associated with the income transfer through supply management (Lermer and Stanbury, 1985), these empirical findings have some interesting policy implications. They suggest that, if the cost to consumers of supply management policies is to be limited, then this objective can be pursued with greater economic efficiency by cutting the fluid milk price rather than the industrial milk price.

## Conclusions

This paper has presented some estimates of the rates of return for milk quotas in Ontario. It has been shown that these rates follow rather closely the movements of the interest rate in the economy. Thus, the dramatic increase in milk quota values witnessed in the last few years can be partly explained by the sharp decline in the interest rate of the Canadian economy. The analysis also shows that the rates of return of fluid and industrial milk quotas are very different. This underscores the difficulty of arriving at an estimate of the departure from marginal cost pricing using the indirect method of assuming a discount rate, since the choice of an appropriate discount rate is not straightforward. Finally, given the implied higher risk premium of fluid milk quotas, the analysis suggests that the fluid milk price should be the instrument through which efficient limitation of welfare loss due to supply management may be achieved.

# FOOTNOTES

1/ A Hybrid-Translog approximation is estimated for a cost function C(y,w,z), where y is a vector of three outputs (milk, livestock, and crops and other products), w is a vector of four input prices (labour, feed, intermediate inputs, and capital services), and z is a vector of eighteen dummy variables describing a set of twelve farm-specific structural characteristics. This cost function was estimated using a sample of 612 farm level observations (approximately 100 farms for each of the six years 1978 to 1983) collected by the Ontario Dairy Farm Accounting Project.

2/ The fluid milk price is the average of monthly class 1 prices, net of transportation cost and OMMB fees, while the industrial milk price is the average of monthly blend prices (classes 3-6) net of transportation costs, OMMB fees, in-quota levy, and federal subsidy. All these statistics are reported in OMMB (1986, 1987).

3/ Note that we are assuming that the present value is evaluated at the time the first return occurs. This is justified by the fact that quotas purchased at the quota exchange can be paid with deductions from the milk cheque of the month following the purchase, which is when the new quota can be filled.

4/ Definition (5) ignores a residual return to a unit of fluid milk quota which accrues because a small fraction of milk, determined by the exclusion factor, can be delivered at the industrial milk price (but without federal subsidy) without requiring MSQ coverage.

5/ Used MSQ is not traded in the months of August and September, and thus only 10 monthly observations per year are available.

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