QUOTA PRICES AS INDICATORS OF COMPARATIVE ADVANTAGE IN SUPPLY MANAGED INDUSTRIES

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1.0 Introduction

Production and marketing of milk, eggs and poultry in Canada are regulated under a policy framework that sets farm level prices with a formula and allocates farm level production levels and raw milk distributions to processors through a quota system. Changes in domestic market demand conditions are accommodated through adjustments in the amount of quota available. Under the Canadian Farm Products Agencies Act (2012), the allocation of additional quota (also called over-base quota) to accommodate increased product demand is required to reflect conditions of comparative advantage in primary production across Canada. This requirement, however, has not been met in practice. This has led to legal disputes, for example, when the Province of Saskatchewan demanded reevaluation of the provincial egg quota allocations on the basis of comparative advantage. The Farm products Council of Canada (2010) anticipates more disputes of this type.

Under a policy regime in which prices are set by formulas and are not determined through the interaction of supply and demand, the measurement of comparative advantage faces significant informational hurdles. The problem under supply management is that, since prices are set through a formula, output and potentially input prices are not reliable indicators of the marginal value of product and perhaps inputs and hence of comparative advantage.

Previous literature has proposed four approaches to identifying comparative advantage in the Canadian egg industry: (1) the multiple indicator approach proposed by Doyon (2007); (2) the Relative Output Advantage (ROA) index approach proposed by Katz et al (2008) and Bruneau and Schmitz (2009), (3) the Direct Resource Cost (DRC) index approach proposed by Larue and Gervais (2008) and (4) the quota price approach proposed by Meilke (2009). These approaches are based on using different economic data and arithmetic procedures to construct indicators of comparative advantage. Table 1 lists all the indicators used in the four approaches, explains briefly what each one means and provides a general outline of how these indicators are calculated.

Doyon (2007) suggested a number of indicators of comparative advantage, including farm cash receipts, farm size, inflation rates, partial productivity measures, input prices, enterprise budget data, and transportation costs. Meilke (2009) has criticized Doyon's proposed indicators on the basis that they are either theoretically inconsistent or empirically biased and suggests that production quota prices should be considered as the primary indicators of comparative advantage. Larue and Gervais (2008), while pointing out that quota prices are worth considering, express reservations as to whether they measure competitive advantage rather than comparative advantage. They characterize competitive advantage as an industry-level concept and comparative advantage as an economy-level concept.

Meilke (2009) suggests provincial quota prices are a more direct indicator of comparative advantage than the indicators proposed by Doyon (2007), Katz et al (2008) and Larue and Gervais (2008). Meilke's justification for this view is based on the idea that quota prices "show the present value of the discounted stream of benefits (valued at opportunity costs) producers expect to receive from buying production quota" (Meilke, 2009, p. 18). While not disagreeing with Meilke, our view is that there is additional theoretical support for using quota prices, albeit quota prices adjusted for distortions in quota markets, as the measure of comparative advantage to guide allocation of additional quota among provinces. This theoretical support is derived from Hayek's (1945, 2002) insights into the knowledge transformation functions of market exchanges and competition.

Table 1. Summary of the previously proposed indicators of comparative advantage for the Canadian egg industry		
Author and approach	Indicator	Indicator description
(1) Doyon (2007) Multiple indicator approach	Agricultural diversification	Distribution of provincial cash receipts for cattle and calves, eggs, cash crops, fruits and vegetables, hogs, dairy and hens and chickens
	Inflation rates	Overall Consumer Price Index (CPI)
	Average size of egg farm	Output in dozens of eggs per farm per year
	Availability and prices of major inputs	Feed cost per dozen eggs, farmland prices, and manufacturing wages
	Costs of production	
	Average unit cost of production	Prices of inputs weighted by the quantities of the respective inputs required to produce a unit of output
	Hen to population ratio	Number of hens per person
	Ratio of industrial to total egg sales	Total value of industrial egg sales divided by the total value of all egg sales
	Single factor productivity	
	Rate of lay	Number of eggs per hen produced per unit of time
	Percentage change in the rate of lay	Percentage change in the number of eggs per hen produced per unit of time
(2) Katz et al (2008) Revealed Output Advantage (ROA) index approach	ROA index	Share of agriculture in the value of output for the goods sectors in a province divided by the share of agriculture in the value of output for the goods sectors for all other provinces
(3) Larue and Gervais (2008) Domestic Resource Cost (DRC) index approach	DRC index	Provincial average cost of immobile inputs per unit of output of a supply-managed commodity divided by the provincial revenues added by an additional unit of output of that commodity
(4) Meilke (2009) Quota prices approach	Production quota prices	Provincial price of an additional unit of production quota

2.0 Allocating New Quota Using Quota Prices[1]

There are important institutional aspects of quota markets that need to be taken into account if we are to use actual historical quota prices as meaningful measures of comparative advantage. In addition to differences in underlying production possibilities and preferences, quota prices may reflect differences in the policies set by provincial supply management marketing boards. In the dairy industry, the quantity of the provincial fluid milk quota is under the jurisdiction of provincial marketing boards while the industrial milk quota is under the national jurisdiction. The provincial boards have some control over provincial quota prices indirectly by controlling the provincial milk prices and the quantity of provincial fluid milk quota. In addition, both provincial and national milk supply management authorities price discriminate between raw milk classes based on the end use of the milk. Depending on the utilization ratios of different milk classes, this can result in different milk prices received by farmers in different provinces. For example, according the Canadian Dairy Information Centre (CDIC) (2012a), average gross farm gate prices in the 2010-2011 dairy year ranged between $73.48 per hectolitre in Quebec and an average of $78.46 per hectolitre in the Atlantic Provinces. If quota buyers and sellers in different provinces face different farm gate prices for their output, some differences in quota prices might arise. As such quota price differences are a result of interplay between the supply management policy and the underlying production possibilities and preferences, calculations of comparative advantage based on quota prices should account for these policy effects.

Provincial marketing boards also have imposed restrictions on quota exchanges. Katz et al (2008), quoting Rosaasen et al (1995), argue that poultry quota prices in Saskatchewan and Manitoba may be lower than they would otherwise have been because quota could historically only be bought and sold together with other assets, not as a separate asset. This, no longer seems to be the case for poultry quota in these two provinces. However, to the extent to which exchange of quota was linked to exchange of other assets in the past, this would have had an impact on observed quota prices in the relevant jurisdictions. Although there are no ties of milk quota exchange to other assets in the dairy industry, it has its own restrictive policies. In 2009, the milk marketing boards in Ontario and Quebec imposed milk quota price ceilings of $25,000 per kg of butterfat per day (Cairns and Meilke 2012).

In Rajsic and Fox (2012) we discuss how quota prices can be modified to account for different blended milk prices in each province and how we handled the provincial quota price ceilings in our empirical analysis.

3.0 Calculating Provincial Over-base Quota Shares

In Rajsic and Fox (2012) we present two prototype methods of translating provincial quota prices, adjusted for differences in farm gate milk prices and quota price ceilings, into shares of new national yearly over-base quota: the (1) Quota Price Ratio (QPR) method and the (2) Quota Price Difference Ratio (QPDR) method.[2] The first method uses the ratios of adjusted provincial quota prices while the second method uses the ratios of interprovincial price differences as the allocation criterion. These two methods are by no means exhaustive. Their main purpose is to serve as illustrations of how quota prices could be used to allocate over-base quota. Both methods preserve the original ranking of provinces set by the adjusted provincial quota prices. This leaves space to the political authorities for choosing the preferred method based on other criteria they may find relevant.

[1] Rajsic and Fox (2012) contains a detailed discussion of the rationale for this approach.
[2] The details of the alternative allocation mechanisms are provided in Rajsic and Fox (2012).

3.1 Calculated Provincial Quota Shares

Table 2 summarizes the calculated over-base quota shares for the 2010-2011 dairy year for Canadian provinces, excluding Newfoundland[3], under the QPR method and the QPDR method. The Table also lists the actual provincial shares in the national quota increase for 2009-2010 and 2010-2011 calculated using the total provincial yearly quota data reported by Agriculture and Agri-Food Canada (AAFC) (2011, 2012). In addition, the Table shows provincial shares based on the ROA index suggested by Katz et al (2008).

The first row in Table 2 shows provincial milk prices for the dairy year 2010-2011. We calculated the milk prices for British Columbia, Alberta, Saskatchewan, Ontario, Quebec, New Brunswick and Nova Scotia as the sum of milk component prices (protein, butterfat, and other solids), reported either by the provincial marketing boards or the provincial ministries of agriculture, weighted by the content of each component in a standard hectolitre of milk. The farmer component prices for Manitoba and Prince Edward Island were not publicly available, so we used the milk component prices paid by processors for different milk classes reported by the CDIC (2012a) weighted by the utilization shares for the respective milk classes. The second row lists the (simple) average of the monthly quota prices reported by the CDIC (2012b) for the dairy year 2010-2011 for all provinces except for the provinces with quota price ceilings, Ontario and Quebec. For these two provinces, we used a linear projection of the quota prices (converted to 2011 dollars) for dairy years 2003-2004 through 2007-2008 reported by the CDIC (2012b). The third row shows the adjustment factor, P_{m_i}/P_{m_l}, where P_{m_i} is the provincial milk price net of marketing board levies, and P_l is the lowest net price across all provinces. The lowest net milk price was in Ontario—$66.72 per standard hectolitre. Manitoba and British Columbia had the highest prices—$73.52 and $72.76 per standard hectolitre, respectively. Thus, these are the provinces with the highest adjustment factor among all provinces, 1.10 and 1.09, respectively. The adjusted quota prices, V_i, shown in the fourth row of Table 2, were calculated by dividing the quota prices in the first row with the respective adjustment factors, P_{m_i}/P_{m_l}, for each province. Saskatchewan had the lowest adjusted quota price, $25,250 per kg of butterfat per day, while Alberta and British Columbia had the highest adjusted quota prices, $35,452 and $35,588 per kg of butterfat per day, respectively. Ontario was next with a price of $33,015 per kg of butterfat per day, followed by Quebec, Manitoba, Nova Scotia, New Brunswick, and Prince Edward Island, with prices ranging between $27,538 and $25,890 per kg of butterfat per day. The difference between the adjusted quota price in each province, V_i, and the lowest adjusted quota price, across all provinces, V_l, is in the fifth row of Table 2.

The adjusted quota prices determine each province's quota share in the total national over-base quota allocation. Compared to the QPR method, the QPDR method puts more weight on the provinces with high adjusted quota prices. For example, under the QPR method, the shares of the total national over-base quota going to the provinces with the highest adjusted quota prices, British Columbia and Alberta are around 13%. Under the QPDR method, the respective shares are almost 30%. On the other hand, the provinces with the lowest adjusted quota prices, Saskatchewan and Prince Edward Island, receive slightly under 10% of the national over-base quota allocation under the QPR method. But, under the QPDR method, these two provinces receive only 1.80% and 0%, respectively.

The actual shares of the national quota increase for the dairy year 2009-2010 received by provinces stand in sharp contrast with the ones calculated using the QPDR method. Quebec received almost 60% of the national quota increase. Ontario received about 31%, while none of the remaining provinces received more than 4% of this additional quota. In contrast, Ontario and Quebec together

[3] The data for Newfoundland were not reported in the CDIC data set.

Table 2. Provincial over-base quota allocations for 2010-2011 calculated using the Quota Price Ratio Method, the Quota Price Difference Ratio Method, the Revealed Output Advantage Index, and the actual 2009-2010 and 2010-2011 allocation

	BC	AB	SK	MB	ON[a]	QC[a]	NB	NS	PE
2010-2011 Quota Price Adjusted for Quota Price Ceilings ($/kg butterfat/day)[b]	39,063	36,713	26,653	29,491	33,015	27,711	27,399	27,317	27,375
2010-2011 Net Milk Price (P_{m_i}) ($/hl)[c]	73.52	68.83	70.43	72.76	66.72	67.14	70.29	67.53	70.55
Milk Price Adjustment Factor (P_{m_i}/P_{m_l})	1.10	1.03	1.06	1.09	1.00	1.01	1.05	1.01	1.06
Quota Price Adjusted for Quota Price Ceilings and Milk Price Variations (V_i) ($/kg butterfat/day)	35,452	35,588	25,250	27,044	33,015	27,538	26,009	26,992	25,890
$V_i - V_l$ ($/kg butterfat/day)	10,202	10,338	0	1,794	7,765	2,288	759	1,742	640
	Provincial Quota Share (% of national over-base allocation)								
Quota Price Ratio (QPR) Method	13.49	13.54	9.61	10.29	12.56	10.48	9.90	10.27	9.85
Quota Price Difference Ratio (QPDR) Method	28.71	29.10	0.00	5.05	21.86	6.44	2.14	4.90	1.80
2009-2010 Actual Allocation	2.37	1.58	0.00	0.00	31.09	59.47	2.11	2.11	3.42
2010-2011 Actual Allocation	11.11	29.22	0.00	0.00	25.11	29.11	1.33	1.78	1.00
Revealed Output Advantage (ROA) Index Method	3.32	6.46	29.01	17.92	3.44	6.12	4.68	3.75	24.27

Sources: Agriculture and Agri-Food Canada (AAFC) (2011, 2012), Bank of Canada (2012), Canadian Dairy Information Centre (CDIC) (2012a, 2012b), British Columbia Milk Marketing Board (2011), Alberta Milk (2011a), Saskatchewan Milk Marketing Board (2011), Dairy Farmers of Ontario (2012), Fédération des producteurs de lait du Québec (2010), Dairy Farmers of New Brunswick (2011) and Dairy Farmers of Nova Scotia (2011); Katz et al (2008).

[a]For Ontario and Quebec, linear projections of the 2003-2004 to 2007-2008 (real, 2011 dollars) quota prices were used. We used the average Canadian 2001 – 2011 quarterly CPI increase (2.1%) reported by the Bank of Canada as the discount factor for converting the nominal into real prices.

[b]The quota prices for the dairy year 2010-2011 is the (simple) average of the monthly prices reported by the CDIC.

[c]The net milk prices in provinces other than Manitoba and Prince Edward Island were calculated using farmer component prices as reported in April 2011. The milk prices for Manitoba and prince Edward Island were calculated using the CDIC reported prices paid by processors for different milk classes and components weighted by the utilization shares for the respective milk classes.

would have received only about 28% of the national over-base quota under the QPDR method. However, the shares of new quota received by British Columbia and Alberta for the dairy year 2010-2011 were 11.11% and 29.22%, respectively. Ontario and Quebec received 25.11% and 29.11% of the new quota, respectively. The Atlantic Provinces' shares were in the range of 1% to 2%, while Manitoba and Saskatchewan did not receive any additional quota. These numbers indicate that the actual quota increase across provinces for 2010-2011 resemble, to some extent, the shares derived using our QPDR method for that year.

The shares calculated using the ROA index method of allocating over-base quota suggested by Katz et al (2008) are shown in the last row. This method puts most emphasis on the provinces with relatively high shares of agriculture in the value of output for the goods sectors. For example, Saskatchewan would receive 30.5% of the national over-base quota under this allocation method. Prince Edward Island would end up with 20.5% and Manitoba would get 19.9% of the national quota increase, while Alberta and British Columbia would receive about 9.5% and 4.6%, respectively. This indicates that the ROA index does not match either of the two potential allocation methods we proposed. Moreover, the ROA index method does not corresponded with the actual allocation of new quota for 2010-2011.

4.0 Conclusions

The objective of this paper was to review and evaluate proposed indicators of comparative advantage for industries regulated under supply management. We conclude that, superficial impressions to the contrary, several leading proposed methods for measuring comparative advantage in these industries represent proxy approaches for average cost of production. We further argue that cost of production, whether measured directly or by proxy, is an unreliable indicator of comparative advantage when output prices are set by an administrative formula and production is allocated among firms through production quotas. We defend Meilke's proposal that quota prices are a more reliable indicator of comparative advantage under this type of policy regime, subject to some important adjustments to historical quota prices required by the policy-imposed constraints on the operations of quota exchanges.

In addition to defending Meilke's proposal for using quota prices as indicators of comparative advantage in supply managed industries, we provide a more fully articulated theoretical foundation for this proposal, using an agent-based general equilibrium model of quota exchange. This model shows: (1) how quota exchange facilitates the implementation of changes in individual comparative advantage in supply managed industries; and (2) that quota prices reveal otherwise unobservable underlying valuations and production possibilities of quota buyers and sellers. As such, quota prices are the only direct measures of comparative advantage in supply managed industries.

We demonstrate the practical application of quota prices as indicators of comparative advantage by using two prototype methods for calculating provincial shares of additional quota based on the 2010-2011 quota prices. We account for the effect of provincial farm gate output pricing policies on quota prices by using well established economic theory and extrapolate the most recent quota prices in Ontario and Quebec to account for the quota price ceilings in these provinces.

The potential practical challenges with using quota prices as indicators of comparative advantage stem from the effect of differences in provincial output and quota pricing policies on provincial quota prices. By removing elements of information on comparative advantage contained in quota prices, restrictions on quota exchange are implicitly in conflict with the legal requirement of using comparative advantage as a guide for allocating new quota. Putting more emphasis on quota prices in provincial quota allocation may mitigate these challenges and provide stronger incentives to provincial marketing boards for loosening restrictions on quota exchange. This suggests that using quota prices as indicators of

provincial comparative advantage in supply managed industries has the theoretical basis and the practical potential of meeting the requirements of the Canadian Farm Products Agencies Act.

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