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# Price Discovery Mechanisms and Alternatives for Canadian Agriculture
# Part III: Applying Pricing Mechanisms

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## 1.0 Introduction

Parts I and II of this project provide a survey of candidate pricing mechanisms for agricultural and food products. In Part I, pricing mechanisms currently used in agriculture were surveyed. In Part II, pricing mechanisms from the economics, business, and accounting literature were reviewed. The purpose of this paper is to take the significant insights from Parts I and II and suggest an application to a specific agricultural context, and make general observations as to how it might work. In other words, in this paper we demonstrate how previously observed pricing mechanisms would work in applied in a specific context. It is intended to generate discussion and criticism that can lead to the actual implementation of a viable pricing mechanism that real world observations and the literature tell us can work.

## 1.1 Objectives

The general objective of this paper is to demonstrate the use of an innovative pricing mechanism observed from the literature in a context relevant to Canadian agriculture. The specific objectives are:

- To select relevant pricing mechanisms from Parts I and II, and to select candidate applications
- To describe the operation of the pricing mechanism in application
- To describe the application in taxonomy developed in Part I.

## 1.2 Organization and Approach

To apply the findings on pricing mechanisms, a form of case-study approach is employed. However, it is not the typical case-study because we are essentially creating one where it does not exist. Here the marketing context and challenges in a specific farm product are described, and then the operation of a particular pricing mechanism is determined. The details of the pricing mechanism's operation are then interpreted within the taxonomy developed in Part I of the project.

This report is organized as follows. In Section 2, the major themes from Parts I and II are developed to determine the specific type of pricing mechanism is to be applied. An application (farm product) that could benefit from an alternative price mechanism is also selected in Section 2. In Section 3, detailed descriptions of the context for the farm product and the pricing mechanism are presented, and the application of the pricing mechanism to the product is developed. Section 4 relates the application to the taxonomy of pricing mechanisms and makes observations on it use.

## 2.0 Candidate Pricing Mechanisms

The major observations from the review of pricing mechanisms in agriculture and food made in Part I were the following:

- The further away from the retail stage, the simpler the pricing mechanism
- The more specialized and aligned the supply chain, the more creative and open the pricing mechanism.
- There is a distinct difference between pricing mechanisms in North America and Europe

The last point is particularly significant. On page 55 of the Part I report, the following comment was made on North American vs. European pricing mechanisms:

> *Even among the higher value-added cases in North America surveyed, there were very few that involved direct revelation of retail value as part of a pricing formula or negotiation. This may be due in part to the fact that more specialized agri-food supply chains exist in Europe than in North America. However, the comparison between selected European and North American pricing mechanisms leaves the impression that the European mechanisms studied are more about transferring value in the supply chain, and North American mechanisms are more about compensating for the additional production costs of the specialty product relative to the commodity.*

Aligned supply chains are generally set up with the intent to distribute value and convey incentives through pricing, rather than merely to compensate costs. If examples exist Europe that effectively distribute value better than those in use in North America, it is natural to investigate them.

Significant findings were made in Part II that relate to compensation of costs relative to distributing value in the supply chain through pricing. In the commentary on transfer pricing, the following was observed:

- Cost-based transfer prices tend to be preferred when transfers are mandated, the product is relatively unique so that related external cash markets do not exist, and when inducing incentives for specialized investment and effort are not particularly important in generating value from the supply chain.
- Negotiated transfer prices tend to be preferred when transfers are not mandated (suppliers and purchasers freely choose to exchange), a cash market for the commodity version of the product exists, and motivating specialized investment and effort is important in generating value from the supply chain.
- Negotiated transfer prices generate the most information because of the periodic bargaining that occurs between supply chain buyers and sellers; the information exchange is two-way between buyers and sellers. The specific information used to establish price in negotiated transfer prices is not established in advance, so new information can have an impact.
- Cost-based transfer prices generate the least amount of information, and the information is only passed from supplier to purchaser (and not vice-versa). All that matters in a cost-based transfer price are the prices and quantities of inputs, any additional information is irrelevant.

The analogy drawn in Part II is that negotiated transfer prices are representative of the European examples like Label Rouge or Soviba, and that cost-based transfer prices are representative of contracts for specialty grains in Canada and the US.

The transfer pricing literature appears to offer broad agreement on the notion that negotiated transfer prices are typically superior to cost-based transfer prices for specialty products. Since the survey of actual mechanisms found relatively few of these in use in Canada or the US, this application will be of a negotiated transfer price.

### 2.1 Candidate Farm Products

A number of farm product types could serve as the application for a negotiated transfer price. As noted above, negotiated transfer prices find best use when:

- The product is a specialty product (not a commodity)
- A cash market for the commodity version of the product exists
- Motivating specialized investment and effort is important in generating value from the supply chain

The hog sector in Canada fits the above criteria quite closely. A number of specialty pork products have emerged which depend on specific attributes of the hogs used to manufacture them. For example, a brand of pork products has emerged in which the hogs used in the program are not fed any animal by-products; other brands are derived from genetic attributes such as black pork, or differentiated on the basis of handling systems (e.g. certified salmonella-free). In any of these examples, the hogs are raised to produce a specialty product. At the same time, a cash commodity market exists for undifferentiated hogs. This commodity market could be accessed for the specialty hogs, but no additional payment would be received for the specialty attributes. Finally, in any of the above examples it is clear that some degree of additional effort or investment is needed to supply the specialty hog. Thus, the application in Section 3 will develop a negotiated transfer pricing scheme for a specialty hog-pork supply chain.

## 3.0 A Negotiated Transfer Pricing Scheme in Hogs

The general approach to designing a pricing mechanism (as with a mechanical device) is to start with the end in mind by considering what it is supposed to achieve. Thus, in considering negotiated transfer prices for hogs, we start with the objectives that it should attain. For example, incentive pricing mechanisms (described in Part II) have as their purpose to induce a specific level and type of effort or investment when it cannot be directly observed.

For a specialty pork product, the obvious objectives in a pricing mechanism are the following:

- To induce producer and processor participation in the specialty supply chain.
- To induce producer incentives/compliance with the specialty provisions of the supply chain
- To allow mutual benefit and growth for producer and processor

In meeting these objectives, the environment in which the price mechanism will be implemented imposes constraints on its practical implementation:

- The producer returns from the specialty product supply chain must be at least as high as that in commodity product channels
- Given that the producer has agreed to supply the specialty product, he must have the incentive to comply with or exceed quality standards

Given these objectives and constraints on the operation of the pricing mechanism, we can interpret its operation in a specialty hog market.

### 3.1 Devising the Negotiated Transfer Price

In the Label Rouge and Soviba examples cited in Part I, the transfer pricing scheme worked in the following way. At specified periods, selected members of the supply chain meet to negotiate transfer prices to allocate the revenue raised from product sales at retail. The key criteria in this process are:

- Production costs of supply chain members
- Level of revenue transferred back from retail
- Production costs in processing operations

Thus, assuming the specialty product truly commands a premium in the retail market, the typical progress of the negotiation should lead to compensation that covers production costs, and distributes the premium received from retail among supply chain stages.

This is similar to the price mechanisms proposed by Hart and by Holmstrom and Tirole in Part II. Their scheme is based on the value of specialized products within the supply chain relative to their alternative value in commodity markets, and on the cost advantage to purchasers of purchasing within the supply relative to commodity products. The scheme functions in the following way. The transfer price is equal to the commodity price plus a negotiated premium derived from earnings within the supply chain relative to its opportunity cost in the commodity market.

- Within the supply chain, the transfer price $p^*$ is paid by processors and received by

producers, hog production costs are $c^*$, and the processor earns net revenue[1] $r^*$. For a quantity of farm product $q$, the total supply chain earnings are $r^*q - p^*q + p^*q - c^*q = r^*q - c^*q$

- If commodity markets are accessed in lieu of the supply chain, the price received by producers and paid by processors is $\tilde{p}$, the hog production costs are $\tilde{c}$, and the processor earns net revenue $\tilde{r}$. Then, for a quantity of farm product $q$, the combined earnings of producer and processor are $\tilde{r}q - \tilde{p}q + \tilde{p}q - \tilde{c}q =$ are $\tilde{r}q - \tilde{c}q$
- The total premium generated by the supply chain relative to commodity product is thus $(r^*q - c^*q) - (\tilde{r}q - \tilde{c}q)$; the distribution of this premium is negotiated
- The implication of this negotiation[2] is that the transfer price in the supply chain $p^*$ is equal to $\tilde{p} + ½ [(r^*q - c^*q) - (\tilde{r}q - \tilde{c}q)]/q$, so the premium in the specialized supply chain relative to the commodity market is effectively split evenly between purchaser and seller through the transfer price.

This price mechanism has a number of logical (and desirable) characteristics:

- When the commodity hog price increases, the hog transfer price does as well
- When the production cost of the specialty hog increases, the transfer price of the specialty hog does as well
- When the net revenue earned from the specialty pork product increases, the transfer price of the specialty hog does as well
- When the production cost of the commodity hog increases, the transfer price of the specialty hog decreases
- When the net revenue earned from the commodity pork increases, the transfer price of the specialty product decreases

The first three characteristics are intuitive. The last two characteristics are less obvious; in both cases, the increase in the profitability in the commodity version of the farm product reduces the *relative* advantage to participating in the supply chain, so the premium available from the specialty supply chain decreases, and so does the transfer price. Because the commodity product is a substitute for the specialty good, it is likely that there will be a high correlation between sales and revenues for the specialty product and that for commodity version.

### 3.2 Applying the Mechanism for Hogs

Based on the foregoing, this pricing mechanism could work in hogs in the following way:

- A specific accounting period (week, month, or quarter) is identified over which to track hog production costs and product net revenues. These could be subject to audit.
- Throughout the period, hogs are purchased within the supply chain at a reference commodity price, subject to whatever grading grid premiums and discounts may apply.
- At the end of accounting period, the premium to be paid in addition to the commodity price is negotiated between producers and purchasers. The information relevant to the negotiation

[1] Net revenue in this context means revenue less non-hog procurement costs

[2] The specific relationship between supply chain earnings, opportunity costs in the commodity market, and transfer prices is derived by Hart, Oliver. *Firms, Contracts, and Financial Structure*. New York: Oxford University Press. 1995. In technical terms, it represents the Nash equilibrium bargaining solution

includes:

- The sales of pork products manufactured from the specialty hogs within the supply chain
- Non-hog procurement costs in manufacturing the specialty pork product
- The total costs of producing specialty hogs in the supply chain
- The sales that would have occurred had an equivalent volume of commodity hogs been processed
- Non-hog procurement costs in manufacturing commodity pork products; given that investments have been made and costs allocated to produce the specialty pork product
- The total costs of producing commodity hogs, given that investments have been made and costs allocated to produce the specialty hog

The specific outcome of a negotiation is typically difficult to anticipate in advance. However, in this mechanism, the nature of the negotiated outcome can be anticipated. Because the total premium obtained from the supply chain is retrospective (it is a known lump sum), the negotiated settlement will be an equal split. Thus, if the producers negotiate as a group with a processor, so there are effectively two parties to the negotiation, the premium added to commodity price will typically be one-half the total premium from selling through the supply chain relative to the commodity market. The negotiated transfer price p* will typically be $p^* = \tilde{p} + \frac{1}{2}[(r^*q - c^*q) - (\tilde{r}q - \tilde{c}q)]/q$, with the commodity price $\tilde{p}$ paid as an initial payment at the time of purchase, with the premium $\frac{1}{2}[(r^*q - c^*q) - (\tilde{r}q - \tilde{c}q)]/q$ paid after the negotiation.

## 4.0 Interpreting the Proposed Hog Pricing Mechanism

The characteristics of the proposed pricing mechanism are placed in context by using the pricing mechanism taxonomy applied in Part I. This is presented in Table 4.1 below. The proposed pricing mechanism has a clear base price in the form of the reference commodity price. Provisions to value volume, timing, and frequency could be built-in in addition to the basic mechanism described above, but this is not necessary. The pricing grid values quality deviations from a benchmark. In this mechanism the base (commodity) price is essentially the price of a substitute product. The proposed mechanism generates information on revenues and costs in addition to prices, and this information is shared among producers and processors, along with any other parties to the supply chain. The commodity price provides a minimum price; however it is not an absolute floor. The transfer price will decrease with the commodity, regardless of how low it goes. It is possible that this could be modified by attaching a price volatility dampening component to the mechanism (for example, using a risk-sharing "ledger").

**Table 4.1 Taxonomy of Proposed Mechanism**

| | **Proposed Mechanism** |
|---|---|
| Base Price | Commodity Benchmark Price |
| Volume | Can be specified |
| Frequency & Timing | Can be specified |
| Location | Can be specified |
| Quality | Pricing Grid |
| Price of Substitutes | Commodity price |
| Multiple levels-pricing | All levels of supply chain |
| Non-price information | Specialty and commodity cost and revenue |
| Market levels receiving information | Producer, Processor |
| Price Risk | Commodity price minimum |
| Volume/Quality Risk | No |
| Relationship risk | No |
| Market Access Risk | Commitment to buy |

## 5.0 Conclusion

The pricing mechanism proposed here and applied to a hog marketing context presents the same advantages claimed in the transfer pricing literature, and appears to be similar to that used in the European value-added supply chains. Negotiation generates more information than other mechanisms would, and the information flows is both directions. This price mechanism leaves participants at least as well of as they would be in accessing the commodity market, and should result in higher valued food products with higher prices for the specialty farm product. Improvements resulting from decreased production costs and technological improvements, or increased demand for food products are shared. From Table 4.1, it is also evident that this mechanism has different properties in the taxonomy then any of the hog price mechanisms surveyed in Part I. Thus, this mechanism appears to offer many advantages over those we observed in North America in Part I of the project.

At the same time, it is prudent to be cautious when interpreting a new pricing mechanism. The following issues come immediately to mind:

- How is it "fair" to split the supply chain gains evenly if one segment of the supply chain makes a greater contribution than another (in terms of investment or effort) in generating value over the commodity market?

This pricing mechanism deals with the total value added relative to the commodity market, with less regard to which party is responsible for adding most of the value. The negotiation structure is such that each party is rewarded in a proportion ½ to value added[3]. For example, if the premium earned over the commodity market were due solely to investment on behalf of the producer, only half of this would be returned in the form of a premium transfer price. However, the reported production cost for specialty hogs will include the additional investment (which by itself increases the transfer price). Presumably, if this level of premium did not at least fully cover the producer's cost, the producer would not make the investment. Moreover, if the additional costs of production for the specialty hog weren't at least matched by an increase in net revenue, the supply chain could not deliver any premium over the commodity market and it would not be viable.

- Don't producers have an incentive to overstate cost, and processors have an incentive to understate net revenue in this mechanism?

As shown above, increases in specialty hog production costs increase the transfer price, and reductions in specialty pork revenue will decrease it. There are at least two factors that should control this. First, the costs and revenues relative to commodity product should be highly correlated, and the ways in which they differ should be well understood. Because it is a negotiation process, stated costs and revenues are likely to be highly scrutinized. Second, the fact that this process is repeated diminishes the incentive for either of the parties to extort gains from the other. In repeated negotiations, bargaining in bad faith is usually rewarded with bargaining in bad faith. If both parties recognize this, it is unlikely that either will be tempted to

[3] If there are more than 2 parties in the supply chain (say $n$), then the split of the gains will be $1/n$

bargain in bad faith.

The specific answers to these and other questions need to be dealt with given a more specific application. As such, this application should be interpreted as a work in progress. However, what emerges is that negotiated transfer prices of this kind are about managing relationships, sharing the returns form joint effort in creating value-added, and creating the right incentives. The clear incentive for both parties is to maximize the returns from the specialty product supply chain; this is evident from an increasing transfer price premium on the producer side and from increased net revenue on the processor side. Thus, it introduces the potential for a colourful new approach to an industry that has traditionally focused on volume and base price.