MARKETING OF RAPESEED IN CANADA UNDER REGULATION

G.G. Storey, D.T. Kowal, K.A. Rosaasen
University of Saskatchewan, Saskatoon, Canada, S7N 0W0

In Canada rapeseed is marketed under an open market exchange system with a cash and futures market. Prairie rapeseed production serves a domestic crushing industry primarily located in Western Canada and an international market centred largely in Japan. For the ten year period 1980/81 to 1989/90 the market allocation for rapeseed was 35.6 percent domestic crushing (and seed) and 58.1 percent exports. Japan had 83.0 percent of the Canadian rapeseed export market and Vancouver was the dominant export port.

The marketing system in Western Canada for grains and oilseeds can be characterized as a dual structure of open and regulated markets which operate side by side and share the grain handling and transportation infrastructure. Rapeseed, rye, flaxseed, oats and domestic feed grains are marketed through the open market exchange system. The Canadian Wheat Board (C.W.B.) is responsible for marketing all wheat and barley for the export market, for domestic food, and industrial use.

The performance of the Canadian rapeseed market has been a concern to farmers, industry, and academic researchers. A vote was conducted to determine if rapeseed should be placed under the C.W.B. in 1974. Crushers, elevator companies, and others have complained about car allocation policy, quota policy, transportation policy and volatile crushing margins.

The basis between the Vancouver cash and futures market is variable, and at times the cash price is at a $20.00/tonne discount or more to the near month futures. Similarly, the street price is often at a very wide basis relative to the Vancouver futures price. These anomalies from the received theory of futures markets suggest that this area requires analysis.

The grain producing region lies in the heartland of Western Canada; a great distance from open ports. The Great Lakes are closed to navigation for approximately four months due to winter freeze up. In addition, railway and grain car capacity limitations required regulation over car allocation, terminal utilization and farmer deliveries.

One of the conditions for effective performance of cash and futures markets is that there be unrestricted movement of commodities to the delivery location as specified in the futures contract. In the case of rapeseed this has primarily meant terminal elevators at Vancouver.[1] The Western Canadian grain transportation, handling, and storage system can be described as highly regulated.

To what extent these and other regulations and restrictions on grain movement have affected the performance of the rapeseed market is the subject and purpose of this paper. The focus is on the cash and futures price relationships at Vancouver, referred to as the Vancouver basis. In addition, the paper examines the street price

[1]Inland terminals have been used as alternative delivery points.

basis, specifically, the relation of the Vancouver futures price to the local elevator bid price or street price on the prairies.

THEORETICAL CONSIDERATIONS

The normal or theoretical relationship between the price of the physical commodity, the cash price, and the futures price is best represented by the "supply curve of storage" first introduced by Working (1949). It established the theory that intertemporal price relationships are determined by the costs of carrying inventory. The supply of storage, in combination with the demand for inventory, establishes the basis level.

The demand for a commodity can be written as a function of the consumption of that commodity throughout a certain time period t. (Blank, S.C., Carter, and Schmeising, p.74)

$$P_t = f_t(C_t) \tag{1.0}$$

where: $\frac{\partial f}{\partial C_t} = C_t' < 0$

P_t = price in period t
C_t = consumption in period t.

Consumption can also be written as the amount of stocks available at the beginning of the period less the ending stocks in the same time period. Thus:

$$P_t = f(S_{t-1} + X_t - S_t) \tag{2.0}$$

where: S_{t-1} = stocks at end of period t-1
X_t = production during period t.

From these relationships, the demand for storage between two periods can be expressed by equation 3.0.

$$P_{t+1} - P_t = f_{t+1}(S_t + X_{t+1} - S_{t+1}) - f_t(S_{t-1} + X_t - S_t) \tag{3.0}$$

Differentiating equation 3.0 with respect to S_t provides the following:

$$\frac{\delta(P_{t+1} - P_t)}{\delta S_t} = \frac{\delta f_{t+1}}{\delta C_{t+1}} \frac{\delta C_{t+1}}{\delta S_t} - \frac{\delta f_t}{\delta C_t} \frac{\delta C_t}{\delta S_t} < 0$$

The supply of storage results because firms carry stocks from one period to another. If arbitrage is effective (and feasible) the net marginal cost of storage will equal the basis at equilibrium. The net cost of storage is made up of several component costs (Cootner, Brennan) including: the direct costs of storage and financing (physical storage costs), the indirect costs of inventory holding (capital risk premium), and the indirect benefits of inventory (convenience yield and income risk premium). The direct costs of storage consist of the marginal costs of storage space, the interest costs, and insurance. The indirect cost of inventory is the threat it can pose to the capital position of the merchant owner. The merchant is assumed to be risk averse and is thus willing to pay a premium to avoid the risk to the capital position of

the company for an additional unit of inventory carried.[2] The convenience yield refers to the benefits available to an inventory holder particularly when stocks are low. The benefit is the ability to maintain customer (buyer) relations through the ability to provide inventory. More importantly is the possibility of the occurrence of cash premiums resulting from a squeeze on short futures holders or merchants with cash delivery commitments. It is assumed that firms are averse to income instability that is felt to occur during low inventory periods. This distinguishes between price risk and income risk.

The net costs of storage (n_t) can be expressed in equation 4.0.

$$n_t(S_t) = m_t(S_t) + r_t(S_t) - y_t(S_t) - i_t(S_t) \quad (4.0)$$

where:
n_t = total net costs of storage,
m_t = direct costs of storage,
r_t = capital risk aversion,
y_t = convenience yield,
i_t = income risk aversion.

Differentiating the net cost of storage provides the supply of storage as shown in equation (5.0).

$$n_t(S_t) = m_t'(S_t) + r_t'(S_t) - y_t'(S_t) - i_t'(S_t) \quad (5.0)$$

It explains that the net marginal cost of storage (n_t') equals the marginal expenditure on physical storage requirements, plus marginal capital risk aversion, minus the marginal convenience yield and minus the marginal income risk aversion.[3]

The supply curve of storage with alternative demand for inventory conditions is shown in Figure 1.0. It shows that the price of storage is the difference between the price expected in the future period, P_{t+1} (the futures market price, P_F) and the current period price, P_t (the price of the physical commodity, P_c). The figure shows that the price of storage can be negative as explained when the marginal convenience yield and/or income risk premiums exceed the marginal net costs of storage and capital risk. This is shown as demand conditions D_1. It is also known as the inverted market situation where the cash price exceeds the futures price. At demand D_2 the situation is that of a normal market. Unlike the inverted market, arbitrage, if allowed to work effectively, is expected to maintain equilibrium between the basis (P_F - P_c) and the marginal costs of storage. At demand situation D_3 storage space becomes limited forcing up carrying costs. As well, for some firms, excessive inventories start to become an added capital risk.

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[2]If one wonders about the importance of this cost, recall the bankruptcy of Cooke's of Memphis, Tennessee when they found themselves on the wrong side of the soybean market in the corner perpetrated by the Hunt family.

[3]See Blank, S.C., A. Carter, and B.H. Schmeising for a more complete presentation of the theoretical principles and illustrations.

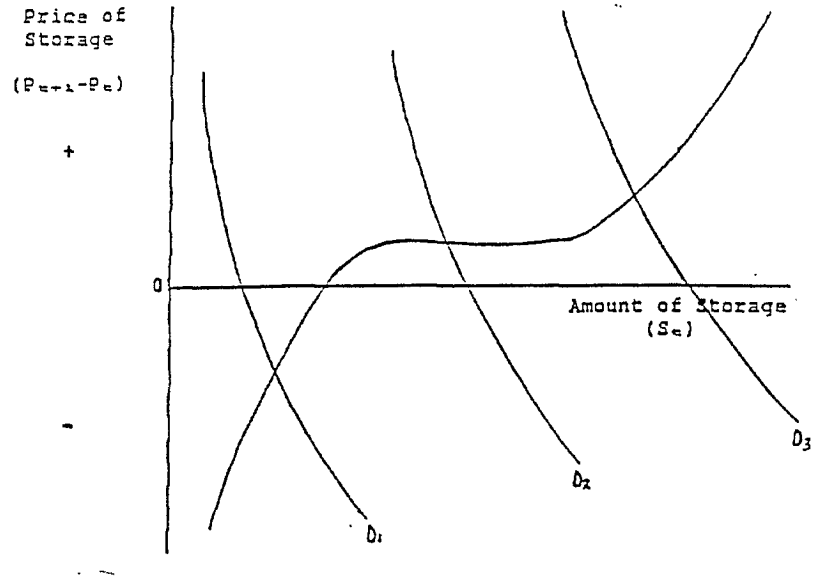


Figure 1.0: The Supply Curve of Storage

Source: (Blank, S.C., C. Carter, and B. Schmeising, 1991, p. 76).

INDUSTRY REGULATIONS

Space does not permit a detailed description of the rapeseed industry in Canada and the marketing system under which it must function. The focus is on the regulations that are felt to have affected industry performance.

In a study of the rapeseed market, Storey and Martin claimed there were two reasons for the downward bias (inverted market) that occurred in the 1963 to 1973 period of their study. First was the market situation of a small volume of speculation relative to hedging requirements. Second was the problems that elevator companies had in getting rapeseed into deliverable position at Vancouver because of regulations which caused exporters to pay high premiums for physical grain, bidding up the cash price relative to futures.

The allocation of grain cars to producers directly rather than to elevator companies has been an historic problem. Producer cars are the right of a producer to load his own car without utilizing the services of an elevator and their allocation has traditionally been handled by the Canadian Grain Commission. Allocation of the scarce rail car capacity between the C.W.B. grains and the non-Board grains was also necessary. The methods by which grain cars have been allocated and the quota based grain delivery system are important restrictions on the movement of grain to delivery position. Until 1979, the C.W.B. had the main responsibility for the allocation of grain cars. In 1969 it introduced the Block Shipping System which divided the prairie region into rail line blocks for the purpose of controlling producer grain deliveries to primary

elevators and the forwarding of grain to terminals. A six-week planning approach was adopted by which grain was to be moved to terminal position based on export demand in relation to required stocks. Although seemingly equitable and efficient in terms of making effective use of limited rail and storage capacity, it created problems for effective hedging. It restricted elevator companies from shipping grain to delivery position to meet sales commitments based on futures contract hedges.

At times various members of the rapeseed industry accused the C.W.B. of favouring Board grains relative to non-Board grains in the allocation of rail cars. In 1979 an independent authority, the Grain Transportation Agency, was established by the federal government to be responsible for grain car allocation. In December of 1980 grain car allocation, which had been a "sales based" system, was changed to a "receipt based" system. When this system encountered problems and criticism, the system reverted back to allocation based on sales.

A problem with the sales based approach was that elevator companies were not allowed to receive more rail cars until a sale of rapeseed was completed. Producers who shipped producer cars were allowed to deliver their rapeseed against a futures delivery contract. An elevator company was unable to deliver against a futures contract since if the rapeseed was not sold, their allotment of rail cars would be reduced. Aggressive elevator companies seeking an increase in market share could offer rapeseed at a discount to the futures price to achieve sales. Soon, as buyers became aware of the regulations, discounts on the cash market became the norm. The elevator companies were required to purchase a portion of their physical rapeseed for export from the shippers of producer cars using the futures market. This created further upward pressure on the futures market relative to the cash market as regulations effectively curtailed arbitrage. Speculators were unable to buy cash rapeseed and hold it for delivery on the futures contract as elevator companies would only sell to end users in order to maintain their rail car allocation.

The Canadian Grain Commission has sought to preserve the right of producers to use producer cars and has given them high priority. By 1983/84 seven percent of all car allocations were going to producers. This reached 10 percent in 1985/86. Since much of the producer car allocations were for the shipment of rapeseed to Vancouver, this resulted in periodic buildups of uncommitted rapeseed in storage at Vancouver terminals. Elevator companies, as exporters, were often forced to pay high premiums to gain access to this rapeseed. As a result, in February 1, 1989, the C.G.C. implemented a "ship to sales" policy which also forced producers to have a confirmed export sale in Vancouver before receiving a producer car. This led to the creation of the Cash Call market at the Winnipeg Commodity Exchange for the allocation of cars to producers.

Another factor that has affected the market has been the "waiving the right to recall grain". Briefly, the situation arose where producers would often deliver rapeseed (and other non-Board grains) to a primary elevator, place the grain on a storage ticket, and wait for a better price. Since the producer had the right to recall his grain off the storage ticket, it technically prevented the primary elevator company from shipping the grain. Since producers seldom recalled their grain, the elevator companies introduced a form where producers waived their right to recall the grain. As a result grain was forwarded unpriced. For open market grains like rapeseed, the grain would not be short hedged by the company. However, when the company sold the grain they were

now forced because of their risk situation to take long positions in futures. Whereas Martin and Storey discovered risk premiums to the long speculator, Keeler (1987) discovered an upward bias in the market for the period 1978 to 1985, that is risk premiums to the short speculator.

ANALYSIS AND RESULTS

The analysis of the performance of the rapeseed market focused on the relationship between the futures and cash prices; that is, the basis. The premise was that if the market was operating correctly, the basis would tend to equal the costs of carrying (storing) the commodity. It follows that the hypothesis to be tested was that there was no difference between the basis and carrying charges.

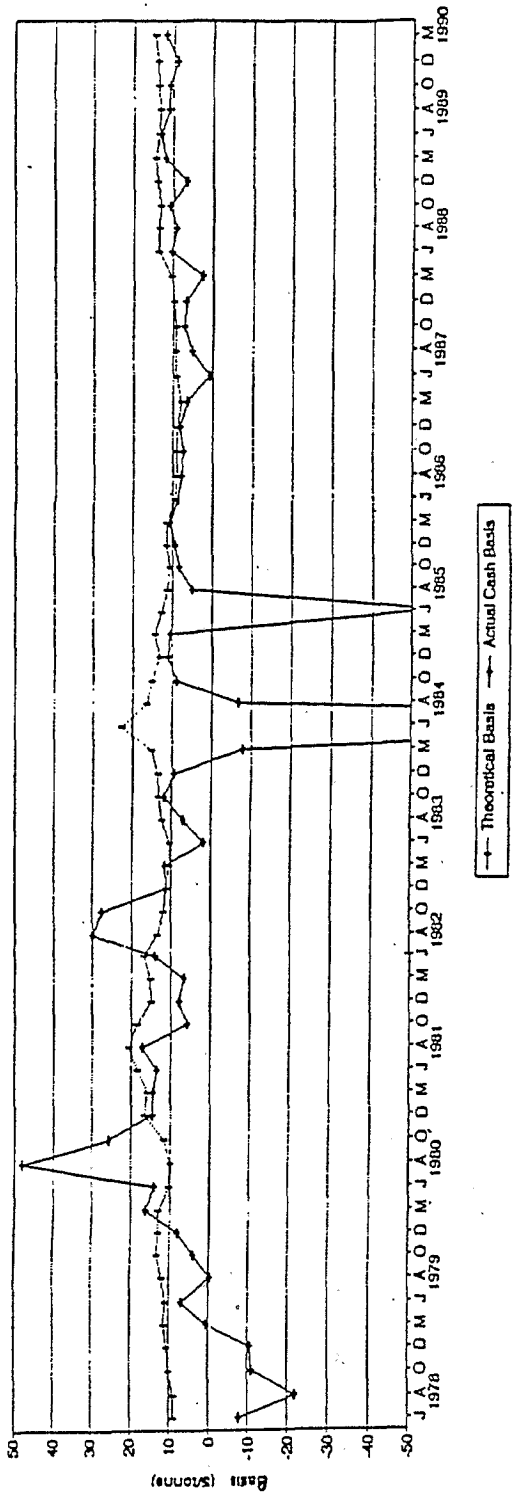
Analysis was carried out for the period June, 1978 to March, 1990. Problems in obtaining earlier cash price data precluded a more lengthy analysis. A three month basis was established for each of the five existing delivery contract months resulting in 60 observations. Prices were monthly averages. Two actual basis were calculated using historical price series, the basis at Vancouver (i.e. the Vancouver cash basis), and the street-price basis.

A first step in the analysis was to estimate the carrying charges for each of the three month prices and compare the estimated basis with the actual basis. Carrying charge calculations included terminal storage charges and opportunity cost on the value of the canola held in storage. The latter consisted of taking the interest charges on the cash price of the commodity. Insurance costs were not included.

The comparison of the estimated with the actual basis is shown in Figure 2.0. It shows that the actual basis was less than the estimated basis for much of the period under study. Only in 1980 and 1982 did the actual basis exceed the estimated basis. For certain periods the market was inverted, that is, there existed a negative basis occurring in 1978, 1984 and 1985. In June, 1984, the inversion was $196.00/tonne and $56.63/tonne in June of 1985. This represents a period of low supplies and a squeeze as there was a premium on the cash rapeseed near the end of a crop year before the new harvest arrived. Arbitrage was impossible since the premium value was low and the supplies were not available until harvest. Price increases to ration available supplies and the user shifts to substitutes if possible.

The study tested two models for the Vancouver cash and street price basis using OLS regression. The first model was specified with the carrying charge variables as well as a trend variable to estimate the basis. The results corresponded closely to what was determined in the actual versus estimated basis comparison; that is, very little of the variation in the actual basis could be explained by the carrying charge variables. The corrected coefficients of determination were .061 and .035 for the Vancouver cash basis and street basis respectively. None of the coefficients were significant and some had incorrect signs.

The study then estimated a second model incorporating variables that were felt would affect the basis. These models and OLS regression results are shown in equations 6.0 for the Vancouver cash basis (Vancouver futures minus Vancouver cash rapeseed) and equation 7.0 for the street price basis.



Source: (Estimated by Author)

Figure 2.0: Estimated and Actual Vancouver Cash Basis, 1978-1990.

(i) For the cash price basis:

$$\text{Basis}_{cash} = -33.65 + 0.69P_cInt + 0.25Vanstk - 0.06\ Export$$

t-ratios	(-2.68)	(1.14)	(2.62)	(-1.16)
S.E.	(12.56)	(0.59)	(0.09)	(0.05)

$$+ 0.04Pristk + 0.14Transit + 9.65\ DumAug + 0.02Trend$$

	(1.96)	(1.72)	(2.28)	(0.31)
	(0.02)	(0.08)	(4.23)	(0.05) (6.0)

Durbin Watson = 1.828

R^2 = .311 RBAR^2 = 0.217

(ii) For the Street price basis:

$$\text{Basis}_{street} = -28.35 + 2.51P_sInt + 0.30Vanstk - 0.07Export$$

t-ratios	(-1.98)	(3.32)	(2.89)	(-1.21)
S.E.	(14.30)	(0.75)	(0.10)	(0.05)

$$+ 0.09\ Pristk + 0.07Trans + 14.15DumAug - 0.12Trend$$

	(4.11)	(0.77)	(3.02)	(-0.21)
	(0.02)	(0.09)	(4.70)	(0.06) (7.0)

Durbin Watson = 1.788

R^2 = 0.503 RBAR^2 = 0.434

where:

P_cInt = cash price * Bank of Canada monthly interest rates. (three months).

P_sInt = street price * Bank of Canada monthly interest rates. (three months).

Vanstk = rapeseed stock levels at Vancouver (000 tonnes).

Export = exports of rapeseed originating from Vancouver. (000 tonnes).

Pristk = rapeseed stock level in the primary elevator system. (000 tonnes).

Trans = amount of rapeseed on route to Vancouver by railway. (000 tonnes).

DumAug = dummy variable taking into account the change in a crop year.

Trend = a variable to take into account any trends which are present in the data.

The above models were estimated after removing the June, 1984 observation. In an earlier model a dummy variable (DUM84) was added instead of removing the observation, but this resulted in an $RBAR^2$ of .843 in the Vancouver Cash Basis and .726 in the street basis. It was currently felt to be biasing the results. The removal of the June observation did not alter the coefficients or t-values on the other variables.

All variables had the correct signs as specified. Both Vancouver stocks and stocks in prairie positions were significant at the .05 level. Both variables had positive signs indicating correctly that higher stock levels give rise to a larger basis; which would correspond with higher carrying costs.

A dummy variable was introduced to take account of the change in conditions and prices between crop years. An estimated correlation matrix for the five months suggested that August was the first month in which new crop information had the greatest impact on price.[4] The variable was significant at the .05 level.

The Durbin Watson statistic indicated that there was no serial correlation present in the residuals. The coefficient of determination (R^2) of 21.7 percent indicated that only a small percentage of Vancouver cash basis variation was explained by the specified variables. This suggested that there are factors other than the carrying charge variables which affected the basis. This was especially important since the carrying charge variables were found to be significant. This was consistent with what was discussed in comparing the estimated with the actual basis.

For the street price basis the $\bar{R}^2$ was higher at 43.4 percent, still leaving a high percentage of the variation to be explained.

Was the unexplained variation in the basis due to government regulations, that in different ways affected the ability of the market to effectively arbitrage? No specific variable exists that would represent government regulation. An attempt was made to incorporate dummy variables to represent major changes in regulations. A dummy variable was added to represent a change from a sales based allocation procedure for rail car allocation (post February, 1982) from when the receipt based approach was used. Also, a dummy variable was used to differentiate when the 90 day limit on pricing canola (post August, 1983). These dummies were regressed against the residuals of the estimated and actual basis comparisons. Neither variable was significant.

CONCLUSIONS

Although the study could not identify empirically that government regulations have adversely affected the rapeseed basis, the analysis and results clearly suggest that the market behaviour cannot be readily explained with the usual application of theory

[4]Cash prices in August were compared to a November futures which is a new crop delivery month. This, combined with a low ending stock for the current crop year, could generate high cash or street prices in August relative to the November futures.

to the basis. The analysis did demonstrate that the basis was highly variable, meaning a high basis risk for hedgers. Second, the difference between estimated carrying charges and actual basis were large. Third, OLS regression estimates, where most of the conceptualized carrying charge and other variables were either significant or close to significant, could account for only a small percentage variation in the basis. One may, therefore, suspect that the various regulations that have been in place have adversely affected the performance of the open market system for rapeseed or that firm behaviour does not conform to the norm of perfect competition which was assumed. This does not however suggest that regulations are not necessary. Other grains also use the grain handling and transportation system. In order to achieve efficiency of the transportation and handling system, a fully competitive, unplanned system may not be appropriate. This is a much broader issue and beyond the scope of this paper. Further work is required to understand the regulatory changes and the nature of price behaviour in the Canadian rapeseed market.

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