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Third Country Effects of Price Discrimination: The Case of the Canadian Wheat Board *

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Abstract

This study considers whether the major concern with the behaviour of exporting state trading enterprises (STEs) should be the practice of price discrimination. Using a differentiated products world wheat model, the impacts of Canadian price discrimination on the welfare of competing exporters are considered. The results show that competing exporters could be better or worse off as result of price discrimination, but the impacts were small. Over a range of possible elasticities US producers were generally better off if North American arbitrage is assumed. Other wheat exporting regions could see their producer's welfare change between 2 and -0.5%. Given these small impacts, the study suggests that explicit disciplines on discriminatory pricing exporting STEs may not be appropriate.

Keywords: Price discrimination, state trading enterprises, and trade negotiations

JEL Classification: Q17, F13

Introduction

The negotiations on the practices of exporting state trading enterprise (STE) at the World Trade Organization (WTO) have been contentious, with allegations of hidden subsidies and abuse of market power. Canada and Australia, who have major exporting STEs, have countered criticisms by claiming that the allegations against their marketing boards are vague and unfounded and accuse the critics of not being able to properly identify what the hidden subsidies actually are. Major issues in this debate include the lack of proper definitions about what STEs actually are, what the actual trade distortion is, and what type of behaviour is leading to the distortion Josling (1997).

This paper attempts to address the question of how STE practices might affect the welfare of competing exporters. While there have been concerns raised about exporting STEs using indirect subsidies (Goodloe, 2004), these subsidies can be made transparent, notified and disciplined by the WTO.¹ So attention has shifted to concerns about the exercise of market power (Abbott and Young, 2004). Again the problem is that there is no explicit definition of what the exercise of market power involves beyond the idea that prices are not set competitively.

As early as 1966, McCalla modelled international wheat markets as a duopoly game with the pricing leadership by the Canadian Wheat Board (CWB). Monopoly pricing involves reducing output in order to extract higher prices from the market. This is hardly the case with international grains markets where the concern is that too much product is being sold at prices that are too low.

Another way that market power can be exercised is through third degree price discrimination where inelastic markets are taxed through higher prices and elastic

markets receive an indirect subsidy through lower prices. The exercise of market power normally involves output determination by a monopolist's decision rule, while this output is allocated among markets by equating marginal revenue. Schmalensee (1981) established that it is possible for price discrimination to increase social welfare if it leads to an increase in output. In the context of producer marketing boards, the practice of discriminatory pricing is normally combined with price pooling. Whereas monopolistic third degree price discrimination required marginal cost to be equal to marginal revenues across markets, pooling allows marginal revenue to be less than marginal cost inducing extra output by the discriminating exporter (Alston and Gray, 2000). So the welfare effects of this practice are less certain, especially for competing exporters. Sumner and Boltuck (2004) argue that third degree price discrimination is not necessarily harmful to competing exporters if it raises average prices in export markets.

Price discrimination is not prohibited by the WTO. Interpretative notes to GATT Article XVII:1 allow a state trading enterprise to charge different prices for its sale of a product in different markets provided the practice is done for commercial reasons² and to meet the market conditions in the export market. Price discrimination is generally considered an acceptable practice that, in some cases, may be desirable (Philps, 1981 and Varian, 1992).

The objective of this paper is to measure the impact of Canadian price discrimination on the welfare of competing exporters. While prior studies have examined Canadian price discrimination, the analysis has focused on the impacts in Canada. As well this study examines the impacts on third parties. A model is constructed with three competing exporter regions and a sufficient number of importers to accommodate price

discrimination. It is constructed on the assumption that wheat from each exporter region is a differentiated product. Price discrimination is introduced into the model and the impacts are judged against a competitive baseline. An attempt is made to define the boundary of parameters where competing exporters will be better off as opposed to worse off. This information will be useful in the debate over acceptable STE behaviour.

The International Wheat Market

Each year the world grows approximately 580 million metric tonnes of wheat. Most of this grain is consumed in the region that grows it, but roughly 110 million tonnes are traded internationally with Canada exporting roughly 16 million tonnes (IGC 2004). The five major exporting regions include the USA as the largest exporter, and the European Union (EU), Canada, Australia as the second, third, and fourth largest exporters depending on the year considered. The fifth largest wheat exporter is normally Argentina. Large importers include Japan, Indonesia, North Africa, Philippines, Mexico and Korea. China is the world's largest wheat producer, and while historically it was the largest importer, over the last decade it has only been a sporadic importer (IGC 2004).

In general wheat demand tends to be inelastic across importers, but individual traders face greater demand elasticities in a particular market because of the competition that they face from other traders in that market. Anecdotal evidence suggests that Japanese demand for wheat is very inelastic as one of the Japanese Food Agency's main objectives is security of supply. As a consequence, wheat is sourced from the US, Australia and Canada in roughly fixed proportions to maintain a consistent and constant source of supply so Japanese import demand is not sensitive to price changes. In contrast Iran looks for wheat from the cheapest source, is sensitive to price changes, and is willing

to accept a wide range of wheat qualities. U.S. and Canadian domestic millers are somewhere in between. Gibson, Faminow, and Jeffry (1991) showed that American mills were often located in regions with a large local supply of softer wheat that was supplemented with imported hard wheat to make flour suitable for leavened bread.

Wheat is a heterogeneous group of commodities that includes hard and soft varieties of different colours and differing characteristics including protein content. If wheat is highly differentiated, or highly segmented, the potential to exercise market power is increased.

Price Discrimination and Wheat Trade

In order for third degree price discrimination to happen, three conditions are necessary: the discriminator must have some degree of monopoly power in the foreign market (either from a lack of competitors or because the product is sufficiently differentiated); the markets must be segmented to prevent arbitrage; and markets must have different demand elasticities (Phlips 1983).

Evidence of international price discrimination is limited. A few researchers have had access to actual contract prices from state trading exporters. The major price dispersion based study of the CWB by Kraft, Furtan and Tyrchniewicz (1996) showed a \$23 average premium above U.S. market prices was extracted from inelastic buyers, but they made no attempt to model the mechanisms of the CWB price discrimination. Furthermore, no one has had similar access to those contracts to verify the calculation.

Some price dispersion is always expected in the market for a commodity (Stigler 1961). There is no reason that the dispersion should necessarily imply that explicit price discrimination is being practiced. The differences in prices between different markets

can be a result of cost differences in satisfying demand in different markets. Price differences can also be a result of other countries' policies. The policies can be those of the importing country (e.g. Japanese Food Agency) or the policies of a competing exporter (e.g. US Export Enhancement Program)³

One practical question needs to be asked. How does the CWB prevent competition from competing exporters who could also arbitrage the markets. Product differentiation limits the potential for arbitrage. Lavoie (2005) found evidence that the CWB can price discriminate due to product differentiation between Canadian and American wheat and that market impediments like export subsidies, levies and transportation costs facilitate market segmentation for the CWB. The one market that the CWB has significant control over is the Canadian market. Alston and Gray (2000) suggest that in terms of the effect on third country exporters, discriminating between home markets and exports could pose a greater burden than a targeted export subsidy. However, because of NAFTA the US has access to the Canadian market and the CWB claims that it determines the Canadian price of milling wheat as the Minneapolis nearby futures price for Dark Northern Spring (DNS) wheat adjusted for exchange rates and transportation costs. To the extent that Canadian and other countries' wheat are not perfect substitutes, the CWB can exercise some market power and price discriminate.

International grain markets do have characteristics that make price discrimination more likely. Large overhead costs associated with information and marketing have to be recovered (Caves and Pugel 1982) and differential pricing facilitates this recovery. In the presence of increasing returns to scale, price discrimination can have beneficial effects as the multiple pricing allows more output to be sold than if a single price was charged.

Although price discrimination is frequently mentioned in studies of international grains markets, explicit models or measures of price discrimination are not that frequent. Alston and Gray (2000) use differential price data among Canadian wheat markets as a first step to develop a simulation model of third degree international price discrimination. First they use the quantities and prices (derived from the observed premiums) from the Kraft, Furtan and Tyrchniewicz study to determine the intercepts and slope parameters that would have allowed the CWB to equate marginal revenues across markets. The resulting elasticities of demand ranged from -1.95 for the commercial high-premium markets to -20 (assumed) for low-premium markets affected by U.S. export subsidies.⁴ The derived parameters were then used to construct a simulation model that compared the transfer efficiency of price discrimination versus a targeted export subsidy. Schmitz et al. (1997) used a similar approach to model price discrimination in international barley markets.

Simulation Model

In order to investigate how price discrimination, by the CWB, affects third country exporters this study uses an eight region empirical model of world wheat production, consumption and trade. Unlike the approach used in Alston and Gray (2000) this study does not start by assuming that price discrimination already exists, obtaining price differentials, and then determining the parameters of the model based on these price differences and a monopolist's profit maximizing rule. Rather this study begins with a competitive model. For each type of wheat, price differences between countries only reflect differences in transportation costs.

Anecdotal evidence suggests that because world grain markets are highly concentrated with five firms accounting for over sixty percent of the trade (Scoppola 1995) that the major traders may not act competitively. However, the degree of market power has not been definitively measured. Opinions in the literature are mixed. Some commentators view international grains markets as fundamentally competitive (Caves and Pugel 1982 and Carter and Smith 2001) while others argue for the existence of market power (Kolstad and Burris 1986). The problem is that statistical estimates of market power are scarce and apply to specific markets (see for example Thursby and Thursby 1990). The choice of strategic variable is important to the analysis and significantly affects the outcome with price based strategies being closer to competitive behaviour than those outcomes that involve quantity as the strategic variable. However, price data -no less what the appropriate strategic variable is- are scarce so modeling non-competitive behaviour in the baseline would be a complicated task. An added complication is that the structure of international wheat markets has changed significantly since most of the empirical studies of imperfect competition were done. Employing a competitive baseline to calibrate the model does not result in a greater loss of generality than calibrating the baseline to the wrong type of strategic behaviour. Therefore, a competitive baseline, and competitive reactions by other exporters, is assumed in the calibration of the model.

The model is calibrated with linear supply and demand functions to the actual 2001-2002 wheat trade flows so that the model exactly reproduces the base data. Wheat is differentiated by country of origin so there are market clearing conditions and market

clearing prices for each exporter's type of wheat. Markets clear such that the supply of each exporting country's wheat has to equal the sum of demands across all destinations.

Price discrimination is introduced into this study by assuming that the CWB maximizes revenue from the sale of a crop by equating marginal revenues across all markets. Canadian grain farmers respond to the average (pooled) price from selling the crop to all markets. With this approach it is necessary to assume parameters for demand and supply elasticities rather than letting the results of the model determine the relative sizes of demand elasticities across markets. The model in this study also explicitly models the markets for competing exporters which other similar studies do not do.

There are three exporting regions – Canada, the US and an exporter aggregate (which is an aggregate of the EU, Australia, and Argentina) – which produce and consume wheat; and five importing regions – the Philippines, Japan, Mexico, Iran and the rest of the world. For computational expedience the importers are assumed not to produce or export wheat. The base data on prices, trade flows, consumption and production was obtained from the International Grains Council *World Grain Statistics* for the year 2001/02. The prices used for each wheat type are based on IGC average export price quotations (FOB) and are quoted in US dollars. The price of Canadian wheat is the average St. Lawrence price (No. 1 CWRS 13.5%).⁵ The US price is the average no. 2 Hard Red Winter Ordinary at the Pacific North West (PNW) ports. The aggregate exporter price is a weighted average of export prices and tonnages shipped for Argentina, Australia and the EU as quoted in the IGC (2004). All transportation costs are IGC freight rates for heavy grain selected routes for each exporter to the destination in question (or a nearby country).

Demand Specification

Wheat of different classes and characteristics – with the exception of durum wheat – is aggregated into one type which is only differentiated on the basis of country of origin and by no other attribute. This is an application of the Armington assumption that goods are differentiated purely because of their origin of production. Each country has a separate demand equation for wheat that is produced in each of the three exporting regions. Wheat from one region is a less than perfect substitute for wheat from the other exporting regions. Armington assumptions are used to define a matrix of own and cross price elasticities to calibrate each country's demand functions for the three types of wheat. The individual own and cross price demand elasticities are found as follows:

$$\eta_{ijj} = (-1)[(1 - S_{ij})\sigma_i + S_{ij}(\eta_j)]$$

$$\eta_{ijh} = S_{ih}(\sigma_i - \eta_i)$$

Where η_{ijj} is the price elasticity in country i for country j 's wheat with respect to a change in country j 's price. η_{ijh} is the price elasticity in country i for country j 's wheat with respect to a change in country h 's price. σ_i is the elasticity of substitution between different wheat in market i , S_{ih} is the value share of exporter h 's wheat in market i , and η_i is the overall demand elasticity for wheat from all sources in market i .

The Armington approach is empirically appealing because it accommodates product differentiation while only requiring a minimal number of parameters: market shares, elasticities of substitution, and overall demand elasticities. The market shares are determined from observed values and the substitution and overall demand elasticities are based on previous studies.

The most variation in reported parameters occurs for elasticities of substitution. The estimates range from 0.75 (for Japan by Alston et. al. 1990) to 27 (for Mexico by Ahmadi-Esfahani 1989). Most of the estimates of substitution elasticities are dated, being over 10 years old, with the exception of some recent estimates for US wheat (Marsh 2005, and Mulik and Koo 2006). Applications of the Armington model to wheat markets have typically applied substitution elasticities around 3 (Grennes, Johnson and Thursby 1978). Haley (1995) developed a world wheat simulation model which employed substitution elasticities that varied between 1 and 4 with lower elasticities for more developed countries and higher elasticities for the least developed countries. Haley's allocation of elasticities across markets was based on a wheat import decision survey by Mercier (1993). This study applies similar substitution elasticities to those employed by Haley. An elasticity of substitution of 2 is employed for the US which is consistent with an average of Marsh's elasticities across wheat classes. The Japanese elasticity of substitution was set at 1. Elasticities of substitution for the Philippines, Mexico, and for the Rest of the World were set at 4. Iran is viewed as a market of last resort. An embargo prevents the US from exporting to this market but Canadian and wheat from the other aggregate exporter are viewed as highly substitutable. This study assumes an elasticity of substitution in this market of 20 with an overall elasticity of -20.

Some of the elasticities of substitution used in this study are smaller than the estimates used in prior studies (Alston, Gray and Sumner (1994) $\sigma = 10$ for milling wheat and Alston et al. (1997) $\sigma = 20$ for durum wheat). While the elasticities are lower in the base case, a sensitivity analysis was run to find the frontier on which third country effects

can switch from negative to positive and the range of simulations covers these more elastic scenarios.

The overall demand elasticity η_i for milling wheat is regarded as highly inelastic. For Japan the elasticity of demand is assumed to be -0.1 (Haley 1995). Elasticities of -0.3 are set for the US, Mexico, and the Philippines to be roughly consistent with Haley (1995). Canadian wheat demand is assumed to be supplied by Canada only. The own price elasticity of demand in Canada is assumed to be -0.7. The Rest of the World is assumed to have an overall demand elasticity of -1. Table 1 shows the own and cross price elasticities that result after the Armington formula has been applied.

Supply Specification

Supply functions are required to determine the production of Canadian wheat, US wheat and wheat from the aggregate other exporters (Australia, Argentina, and the EU). Linear supply equations are calibrated from supply elasticities that were used in prior studies and the base prices and quantities for 2001-02⁶. The supply in each region is assumed to be only be a function of the own price in that region. The Canadian supply elasticity is assumed to 0.6 (Meilke and Weersink, 1990); the US supply elasticity is assumed to be 0.7 (Haley 1995) and the elasticity of supply in the other aggregate exporting region is assumed to be 0.5.

Model Mechanics, Closures and Market Clearing

The calibration method converts elasticities to linear function coefficients by multiplying each elasticity by the ratio of the dependent variable to independent variable in question. Intercepts are determined by subtracting the sum of the product of the relevant coefficient and the independent variables from the dependent variable. The

model is exactly calibrated to prices and quantities for the crop year 2001/02. The base model assumes competitive behaviour in each the three markets for wheat (Canadian, American and the other aggregate exporter). For each of these markets, the price in the home country is used to solve a market clearing condition that equates supply to the summed demands for each of the relevant destinations. Prices in the destination markets are linked to the home country price through transportation costs.

Price discrimination is introduced by assuming that the CWB equates marginal revenue across all markets. Marginal revenues are obtained from the linear price (own price) dependant demand functions after assuming revenue maximization. The producer price in Canada is the pooled price which is equal to the sum of revenues from all destinations of Canadian wheat sales divided by the sum of the quantities sold to all destinations. Canadian wheat supply is a function of this pooled price. Conditions equating the supply of wheat to shipments to all destinations and for equating marginal revenues across all markets for Canadian wheat are added as constraints to Microsoft Excel Solver along with constraints that equate the supplies and demands for each of the other two types of wheat. The choice variables are Canadian sales to all destinations, Canadian supply and prices of US and other wheat. The three markets are linked by cross price elasticities in the demand functions for all the destinations for each type of wheat. The Solver option is then used to solve the entire model in Microsoft Excel.

Impacts of Price Discrimination

Columns two and three of Table 2 recreate the base case that the model is calibrated to with a single FOB price for each wheat type. The fourth and fifth columns introduce the first scenario where price discrimination is combined with price pooling.

The CWB equates marginal revenues across all markets, the farm price is determined by the pooled price from sales to all markets, and Canadian wheat supply responds to this pooled price. The second scenario, in columns six and seven, also considers price discrimination with pooling but the price of Canadian wheat sold in Canada or the US are held equal and the price and that price is not allowed to be more than \$15 above the price of US wheat in the U.S. This is consistent with the CWB practice of setting the Canadian price of milling wheat off the DNS price at Minneapolis.

The third scenario, in columns 8 and 9, considers the pure price discrimination scenario where marginal cost is equated to marginal revenue across all markets. Supply is set according to the marginal cost price that equates to marginal revenue. The third scenario is not considered a feasible alternative because the CWB does not have the ability to control production, but this scenario is included to help isolate the supply inducing effect of using pooling with price discrimination.

All the price discrimination scenarios result in higher prices in the most inelastic markets and a lower price in Iran the most elastic market. In all, but the pure price discrimination scenario, Canadian production increases. Price pooling results in a 8% increase in Canadian production and significant increases in prices for Canadian wheat in Japan and Canada, minor increase in the U.S. and the Philippines and price reductions in the more elastic ROW and Iran. The impact on US wheat prices is small with a \$0.20/tonne reduction and the price decline for the other exporter is only \$0.30/tonne. The increase in the price of Canadian wheat in Canada is overstated in the second scenario. NAFTA and the practice of the CWB to tie Canadian wheat prices to the

Minneapolis DNS prices would not allow a hundred dollar price differential between the Canadian price for Canadian wheat and the American price for U.S. wheat.

In the second scenario, in order to impose the arbitrage constraint, we impose constraints on the model holding the prices for Canadian wheat sold in Canada and the U.S. at \$15 above the U.S. price for U.S. wheat. In order to price discriminate, while satisfying the arbitrage conditions for the North American market, the CWB must reallocate grain between markets. As a result, prices are higher in all off-shore markets, but the pooled price is lower than the first scenario because of lower North American prices.

The third scenario, the pure monopolist's case of third degree price discrimination, has the CWB shorting the supply of Canadian wheat and increasing all prices in all markets relative to the first scenario. The difference between this case and the first case can be thought of as the incremental impact of pooling on supply. Canadian wheat production is 25% higher with pooling than with pure price discrimination and both US and the other exporter's wheat prices are 1% lower. It must be kept in perspective, that pooling requires price discrimination in order to get higher averaged prices. So it is not possible to completely parse the effects of the two instruments.

Table 3 presents the welfare effects of the three scenarios with changes relative to the base case. Proportionately, to the initial welfare levels, the impacts on Canadian welfare are much larger than for other regions. There are significant losses in Canadian consumer surplus in the first and third scenarios with unconstrained price discrimination because Canadian prices rise significantly. Under the third scenario it is assumed that output is determined by the marginal cost price, but in terms of the welfare measurement

the assumption is that the CWB provides producers with lump sum revenue transfers equal to the difference between the pooled price and revenues at marginal cost. Canadian producer surplus is highest under this scenario. Canadian producer surplus is significantly lower when the arbitrage constraints are applied to the North American wheat market.

Consumer welfare changes in the US are relatively small in percentage terms (less than 5%). Changes in consumer welfare shift from positive to negative, between scenarios with small changes in US prices and also because the demand curve shifts as a result of changes in the US price of Canadian wheat. US producers are better off when the CWB practices lead to higher prices for Canadian Wheat in the U.S. This occurs under pure price discrimination with monopolistic output determination and with pooling under arbitrage.

Finally, Table 3 shows the welfare impacts on producers for the other exporting regions. The reallocation of Canadian sales from inelastic to elastic markets causes the price of wheat for the other exporter to increase in scenarios two and three. This leads to a minor increase in producer surplus in this region. The first scenario, with price discrimination and pooling, results in a loss in producer surplus of less than one half of a percent.

Sensitivity Analysis

Table 3 shows a wide range of welfare impacts depending on the scenario considered. The focus of this study is on the effects of price discrimination on third country exporters or more generally does it distort trade. Unlike economists' broader focus on the societal welfare, trade policy practitioners only consider the wellbeing of

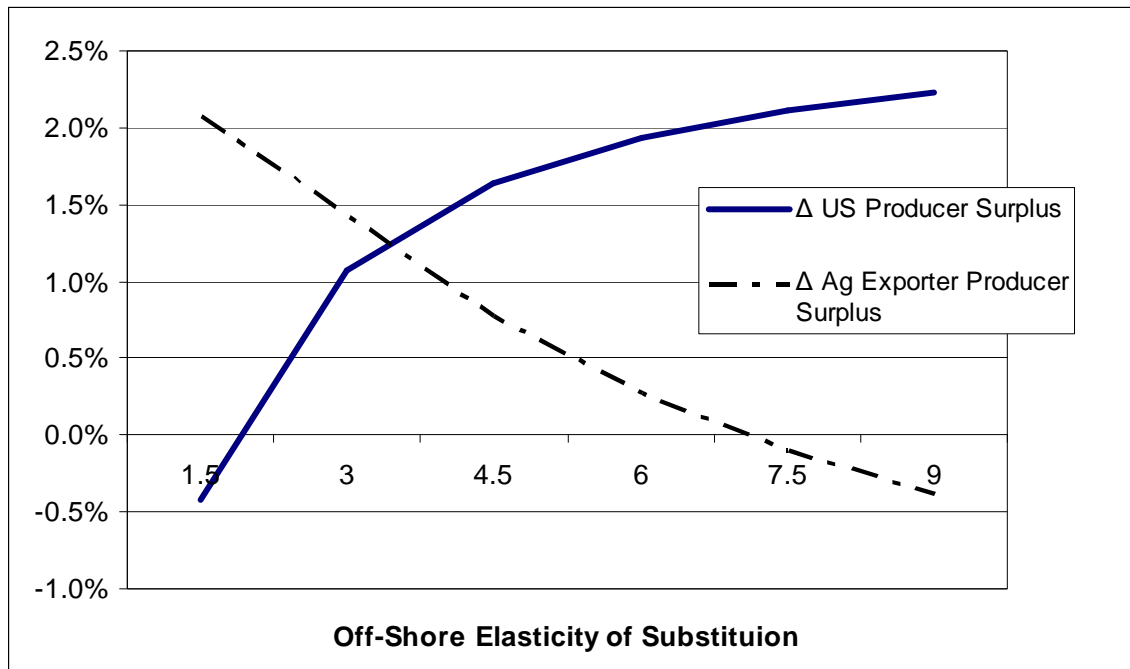
competing traders. So the remaining analysis focuses on the producer surplus of the two other exporters. Several decisions have to be made with respect to the sensitivity analysis.

First, a choice has to be made as to which of the three scenarios to conduct a sensitivity analysis on. The pure price discrimination scenario with a monopolist's output decision rule is not appropriate because the CWB does not control production decisions. The pure price pooling case is also not a particularly good basis to conduct the sensitivity analysis because the difference between Canadian and US wheat prices in North America becomes too large. The second scenario with price discrimination combined with pooling, and rules limiting the dispersion of North American prices, is the most consistent with perceived practice.

Second, the review of the literature above, suggested a wide range of Armington elasticities of substitution. The choice of elasticities of substitution affects the distribution of sales among markets so the impacts on producer surplus are sensitive to the choice of this parameter. Since arbitrage is imposed on North American prices the results are not sensitive to the choice of elasticity of substitution for the US or Canada. So the focus of the sensitivity analysis should be on off-shore markets and in particular for the more elastic markets. The Japanese elasticity of substitution is not varied because this market is assumed to be very unresponsive to price changes. The elasticities of substitution in the remaining markets were adjusted proportionately. The following sensitivity analysis considers how the elasticity of substitution affects the outcomes and the welfare of competing exporters.

Figure 1 describes the impact of CWB price discrimination on US and the aggregate of other exporters' producer welfare at differing levels of the elasticity of substitution for non-Japanese off-shore markets. The vertical axis measures the percentage change in producer surplus relative to the competitive baseline with no price discrimination. Elasticities of substitution are shown on the horizontal axis.

Figure 1: Changes in Other Exporter Producer Surplus with CWB Discrimination



As the elasticity of substitution increases everywhere except Japan and North America, the ability of the CWB to extract premiums from those markets goes down. The average price to Canadian producers goes down and lowers total Canadian production. Because the U.S. has a bigger stake in North America and Japan, with less Canadian supply, the U.S. price goes up. The aggregate exporter gains some sales in Japan but not enough to compensate for the lower average price effects especially in the rest of world.

The US welfare change ranges from high of 2.2% to a low of -0.4%, depending on the assumed elasticities. Clearly more elastic off-shore markets make the US producers better off if Canada is price discriminating. However they can be worse off if the US markets are more elastic than the rest of the world. Moreover, if price discrimination is not disciplined by the arbitrage constraints (not shown), the conditions for US producers to be better off are more stringent in terms of the size of elasticity required in the ROW. The producer welfare for the aggregate exporter can be lower with Canadian price discrimination, but overall the effects are small ranging from -0.4% to 2.1%. So the injury for all exporters is small and probably would not be sufficient to be considered material in a countervailing duty case.

Figure 1 also provides an indication of the demarcation between negative and positive third party producer welfare effects. With a U.S. substitution elasticity of 2, US producer welfare becomes negative when off-shore substitution elasticities are less than 1.75. Off-shore elasticities must increase to 7.1 for producer welfare to become negative for the other aggregate exporter.

It is likely that a model imposing some form of imperfect competition would also have minor impacts. These impacts would now be split between oligopoly rents and producer surplus. The type of impact would depend on the strategic reactions assumed for the model. The signs of the effects should be the same. Furthermore, although the magnitudes could change the overall effects should be small.

Conclusions

Finding the appropriate disciplines for exporting STEs has been one of the more contentious issues at the Doha Development Agenda WTO negotiations. A big problem

has been to define what actually should be disciplined. This paper proposed that price discrimination was at the root of the complaints against STE behaviour. If price discrimination makes competing exporters substantially worse off, then their complaints are legitimate and appropriate disciplines are in order. However, given the aggressive nature of international grain markets, the complaints may simply be a manifestation of fierce competitive behaviour and WTO disciplines would put countries with exporting STEs at a competitive disadvantage.

Price discrimination does not necessarily put competing exporters at a disadvantage. Sales to inelastic markets are reduced in favour of sales to more elastic markets and the competing exporters can benefit if they can capture a sufficient share of the inelastic markets to benefit from higher prices. The reallocation of sales, the change in prices, and the degree of substitution among competing exporters are empirical questions that this study addressed.

When the US market is more elastic, the CWB is more likely to redirect sales to that market which puts some downward pressure on US producer revenues. However, as the off-shore markets become more elastic more sales are directed to these markets and this creates opportunities for US traders. The range of studied impacts included both positive and negative outcomes but the size of the impacts, in either direction, were relatively small.

The other significant exporter, a composite of Australia, Argentina and the EU, competes less directly with Canadian wheat. A significant amount of their sales are to elastic markets so more negative effects can be expected for the other exporters. Most of the potential impacts were positive, but very small at less than 2%.

Given this study's results, it would be difficult to write a set of disciplines into Article XVII of the GATT with respect to price discrimination and to define acceptable behaviour. Since competitors can better or worse off, new STE rules could not be flexible enough to only discipline negative outcomes. Furthermore since the impacts appear to be small, over a reasonable range of elasticities, the need for disciplines is debatable. Although we treated international grain markets as perfectly competitive there is evidence to suggest that grain traders may not act competitively. Under certain conditions price discrimination can have pro-competitive effects (Scherer and Ross 1990). These potential efficiency gains also add to the doubt of the efficacy of new disciplines. Defining appropriate rules would be as ethereal as defining normal commercial practices.

Table 1 Own and Cross Price Demand Elasticities across Markets

	Canadian Wheat			USA Wheat			Other Wheat		
	η_{iic} Canada	η_{ijc} USA	η_{ikc} Ag Exporter	η_{iiu} USA	η_{iju} Canada	η_{iku} Ag Exporter	η_{iio} Ag Exporter	η_{ijo} Canada	η_{iko} USA
Japan	-0.77	0.44	0.22	-0.56	0.23	0.22	-0.78	0.23	0.44
Canada	-0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
USA	-4.79	4.49	0.00	-0.51	0.21	0.00	0.00	0.00	0.00
Philippines	-6.91	6.36	0.25	-3.64	3.09	0.25	-10.72	3.41	7.01
Mexico	-7.00	6.70	0.00	-3.30	3.00	0.00	-10.00	3.00	6.70
ROW	-8.74	3.10	4.64	-6.90	1.26	4.64	-5.36	1.26	3.10
Iran	-20.00	0.00	0.00	-20.00	0.00	0.00	-20.00	0.00	0.00

Table 2: Market Impacts of Price Discrimination by the CWB

	Base Case		Price Discrimination		Price Discrimination		Price Discrimination		
	Quantities (‘000 mt)	Prices (\$US/mt)	Pooling		Pooling/N.A. Arbitrage		ΣMR = MC		
			Quantities (‘000 mt)	Prices (\$US/mt)	Quantities (‘000 mt)	Prices (\$US/mt)	Quantities (‘000 mt)	Prices (\$US/mt)	
Canadian Market									
Demand									
Japan	1,260	149.0	783	243.1	727	255.6	728	255.7	
Canada	6,697	149.0	4,225	234.6	6,639	151.0	3,886	246.3	
USA	1,342	149.0	1,224	155.3	1,326	151.0	1,025	167.8	
Philippines	738	149.0	907	139.3	708	151.7	712	151.8	
Mexico	882	149.0	955	144.5	767	157.0	771	157.1	
ROW	7,248	149.0	8,374	141.6	6,612	154.0	6,635	154.0	
Iran	1,015	149.0	4,316	122.7	2,836	134.5	2,845	134.4	
Supply	19,182	149.0	20,784	163.6	19,615	153.8	16,601	180.1*	
US Market									
Demand									
Japan	2,995	139.0	3,321	138.8	3,353	140.3	3,350	140.6	
USA	30,573	139.0	30,686	138.8	30,502	140.3	30,734	140.6	
Philippines	1,438	139.0	1,361	138.8	1,448	140.3	1,445	140.6	
Mexico	2,086	139.0	2,025	138.8	2,177	140.3	2,171	140.6	
ROW	19,020	139.0	18,698	138.8	19,030	140.3	18,932	140.6	
Supply	56,112	139.0	56,090	138.8	56,511	140.3	56,634	140.6	
Other Aggregate Exporter									
Demand									
Japan	1,223	135.3	1,603	135.0	1,725	136.3	1,744	136.3	
Philippines	89	135.3	77	135.0	89	136.3	90	136.3	
ROW	33,396	135.3	32,905	135.0	33,473	136.3	33,500	136.3	
Iran	3,465	135.3	3,595	135.0	3,035	136.3	2,999	136.3	
Supply	38,173	135.3	38,180	135.0	38,323	136.3	38,333	136.3	

*This price is not marginal cost (which is \$112) but the pooled price if the CWB made a lump sum transfer back to producers

Table 3: Welfare Effects of Price Discrimination by the CWB

* Producer surplus is measured at pooled prices not at the marginal cost price

	Pooling	Pooling/N.A. Pooling	ΣMR = MC
Canadian Market			
• Change In Consumer Surplus	-512	-15	-564
• Change In Producer Surplus	290	93	456*
• Change In Total Surplus	-222	78	-108
US Market			
• Change In Consumer Surplus			
US Wheat	85	-54	122
Canadian wheat	-16	-2	-39
• Change In Producer Surplus	-11	73	94
• Change In Total Surplus	58	17	177
Other Aggregate Exporter			
• Change In Producer Surplus	-11	36	40

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Endnotes

¹ The Framework agreement introduced disciplines for financing arrangements for exporting STEs that would address many of the concerns about indirect financial support.

² Commercial considerations have never been defined at the WTO.

³ Wilson and Dahl (2004) argue that it is easier for the CWB to practice price discrimination when EEP is in place.

⁴ The demand elasticities that they observed were more elastic than in all other commercial markets; a observation that conflicts with typical empirical estimates that show North American wheat demand to be more inelastic than for developing country markets.

⁵ This price is a posted price and is not necessarily a transaction price. In the absence of actual transaction prices this is the best proxy for a Canadian price.

⁶ 2001/02 was an average year in terms of crop production for most exporters.