Bargaining for European Union Farm Policy Reform through U.S. Pesticide Restrictions

Lizbeth Martin, Philip L. Paarlberg, and John G. Lee

Future trade negotiations will incorporate environmental concerns. This study presents a framework to evaluate whether the United States would be willing to adopt a pesticide restriction in exchange for European Union liberalization of producer support. It outlines the conditions that must be met if a bargain is to occur. Partial equilibrium commodity models test whether the conditions for a bargaining solution are satisfied. The research results indicate that a potential bargain is possible for stricter U.S. environmental regulations in coarse grains if there is a sufficiently large positive EU externality. Conditions in the oilseed market preclude a bargain.

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Liberalizing agricultural trade and treating domestic environmental problems in the United States and the European Union (EU), may be key considerations in the next round of the World Trade Organization (WTO) negotiations. As concern over the environment increases, countries are finding fault with each other's environmental practices. Some in the European Union believe that it is unfair to compete with U.S. farmers who do not have equally tight chemical use restrictions. Strict EU environmental regulations are used to justify continued price supports for farmers (Williamson). In the next WTO round, the European Union will be pressed to further reduce domestic supports. After the previous negotiations, a "Peace Clause" insulated the reformed EU market support programs from being challenged in the WTO (IATRC). Second, the European Union will face the costs of incorporating eastern European countries. Finally, the United States should be in a strong negotiating position because the 1996 farm bill fully decouples U.S. payments where present EU payments are only partially decoupled.

This paper investigates whether the United States and European Union would be willing to bargain over a further liberalization of EU price supports in return for pesticide use restrictions on U.S. coarse grain and oilseed production. The prevailing view is that such a bargain would not be attractive to the United States. That prevailing view is the hypothesis tested in this paper. The paper begins by briefly developing the rationale why such a bargain might be feasible. It then presents a conceptual model that determines the conditions for a successful bargain. The final section uses partial equilibrium models for coarse grains and oilseeds to test whether those conditions are satisfied for the market conditions projected for the year 2005. The empirical results show that the prevailing view is correct for oilseeds as the conditions for a bargain are not satisfied. In the case of coarse grains, the conditions for a successful bargain could be satisfied if the benefits to the EU from a U.S. pesticide restriction are large enough.

Background

The Common Agricultural Policy (CAP) reform of 1992 lowered price support for grains while compensating producers with a system of direct payments. In addition, the reform partially united environmental, agricultural, and income policies by moving some costs from price support to direct payments (Scheele). Agro-environmental policy in the European Union allows member countries flexibility in program implementation. For example, Atrazine use is banned by some EU members or

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used only under certain conditions in others (Scheierling). From the European farmer's point of view the restrictive pesticide policy reduces the competitiveness of European agriculture and justifies continued producer support.

In the United States, agricultural policy evolved to a system of fully decoupled farm payments. Environmental policy in the United States has been less aggressive despite concern over the environmental consequences of pesticide and chemical use in agriculture. Several studies detail the contribution of agriculture to the contamination of water supplies (Harrington, Holtkamp and Johnson; Nielsen and Lee; Curtis and Profeta; CARD). Policy makers acknowledge that agricultural chemicals impose costs on the environment and human health, and there have been proposals to ban certain chemicals, like Atrazine (Runge). Nevertheless, the United States has not implemented extensive taxes/bans on agricultural pesticide use like European Union members.

There are a variety of possible incentives for the United States and European Union to consider a bargain where the EU further reduces farm support while the United States reduces pesticide use. The potential welfare gain for the United States stems from a number of areas. The United States would have a cleaner environment. Producer groups argue that tighter environmental restrictions would be costly and view these regulations as a threat. If the European Union liberalizes its domestic support policies, U.S. farmers would receive higher world prices to offset either higher input costs or a loss in yields resulting from the reduction in chemicals.

Groups in the European Union could also experience benefits. Further reforming of the CAP would lower the cost of agricultural support programs and would make accession of new members easier. Also there would be a rise in the world price. Finally, there would be a corresponding increase in environmental quality in both the United States and the European Union as pollution from pesticides is reduced. That would occur in the United States directly from the restriction of pesticide use and in the European Union from less intensive use of chemicals as the domestic producer price falls due to reform.

Conceptual Model

There have been several bargaining models which utilize trade or environmental policy instruments but few studies combine trade and environmental policy tools in a bargaining game (Ballenger, Krissoff and Beattie). This model is based on Gallagher's model depicting EU grain policy as a result of a "bargaining" process. The conditions under which a bargain between U.S. pesticide policy and EU producer support could evolve are illustrated in figure 1. The United States and European Union bargain over two instruments set by policy makers: the level of U.S. pesticide restriction (R_{US}) and the per ton difference between the internal EU price and the world price (t_{EU}). The beginning situation reflects the current case with a positive EU support policy, $t^0_{EU} > 0$, and no U.S. pesticide restriction, $R^0_{US} = 0$. The initial welfare level for the United States is U^0_{US} and the initial EU welfare level is U^0_{EU}.

Policies in each country are assumed to be set by a policy maker maximizing the weighted sum of producer, consumer, and taxpayer welfare (Sarris and Freebairn; Rausser and Freebairn; Paarlberg and Abbott). The weights reflect the marginal value the policy maker places on the welfare of each interest group. The decision variable for the U.S. policy maker is the restriction on U.S. pesticide use (R_{US}) while the decision variable for the EU policy maker is the gap between the EU internal price and the world price (t_{EU}). When setting these policies each policy maker must account for the rival's policy as well as for the impacts of both policies on the world price. An additional feature of the welfare functions is the presence of an externality. That is, the EU policy maker is affected by the U.S. pesticide restriction. The U.S. policy maker is not directly affected by the EU support. Rather, the impact of that enters via its impact on the world price. The U.S. policy maker is assumed to be affected by the U.S. pesticide restriction.

Iso-welfare contours give the combinations of t_{EU} and R_{US} where welfare of the policy maker in each country is constant. These are found by changing the level of EU farm support and finding the level of U.S. pesticide restriction such that the welfare of each policy maker is constant allowing for the effects of both policies on the world price.

For a bargain to be reached the iso-welfare contours must exhibit a number of properties. Each region's contour must be negatively sloped. For the United States to hold welfare constant, its pesticide restriction (R_{US}) must increase as the EU policy is liberalized. For the European Union to hold welfare constant, a lower support policy (t_{EU}) must be offered in return for a more restrictive U.S. pesticide policy.

The slope of the U.S. iso-welfare contour is labeled the marginal rate of substitution between the policies (MRS_{US}). For the United States this indicates the willingness to increase its pesticide restriction in return for a decrease in EU producer

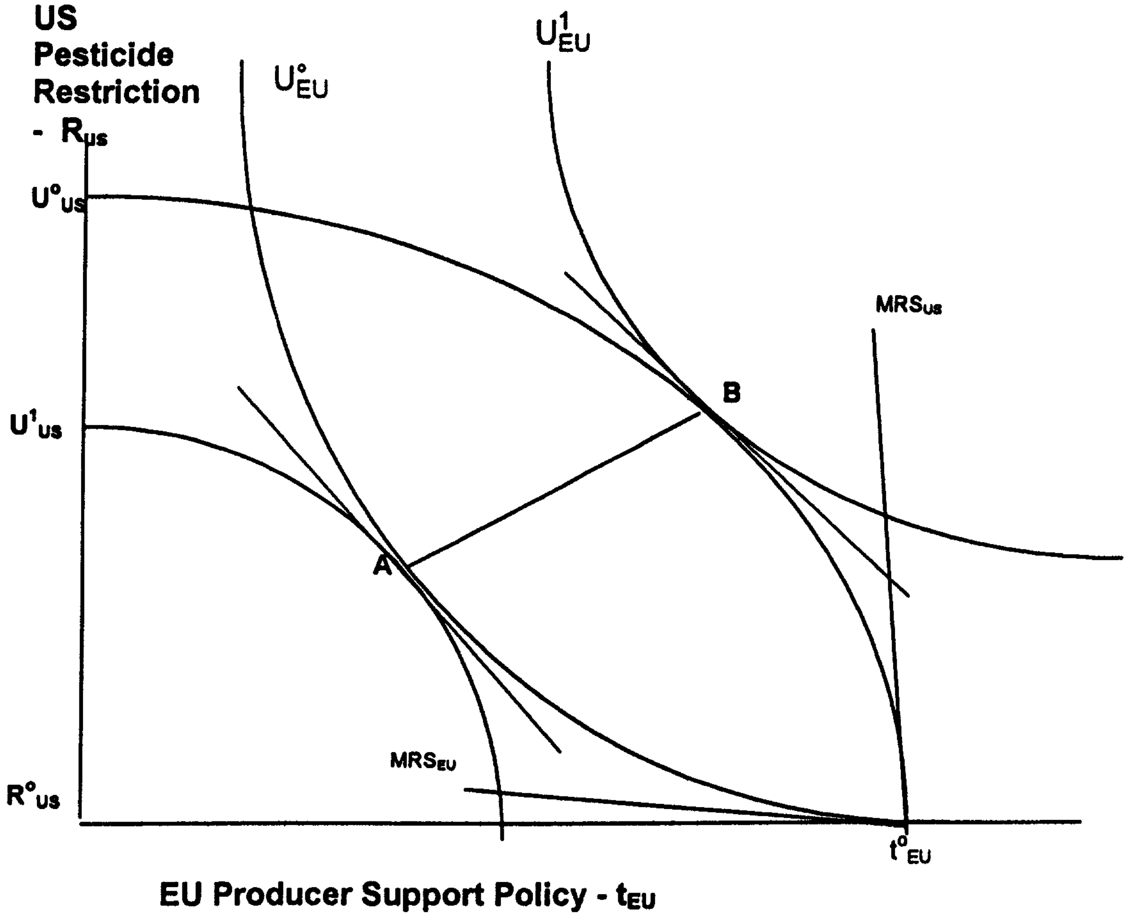

Figure 1. A Bargaining Model for the United States and the European Union

support. This willingness must fall as t_{EU} decreases, so the iso-welfare contours for the United States are quasi-concave. That is, the more liberal EU policy becomes, the less willing the United States is to offer an increase in its pesticide restriction. The minimum acceptable amount of pesticide restriction the European Union must have to agree to reduce farm support is given by the slope of EU iso-welfare contour (MRS_{EU}). As t_{EU} falls, the European Union must require larger increases in U.S. pesticide restrictions to maintain constant welfare. Thus, the EU iso-welfare contour must be quasi-convex.

For a bargain to be reached, the U.S. iso-welfare contours must be indexed toward the origin because as the European Union liberalizes its policy the welfare of the United States rises if a tighter pesticide restriction is not implemented. Thus, U^1_{US} in figure 1 corresponds to a higher level of welfare for the United States than U^0_{US}. For the European Union, increases in EU support generate higher EU welfare so higher EU iso-welfare contours, like U^1_{EU}, must be further from the origin.

At the initial equilibrium in figure 1 (t^0_{EU}, R^0_{US}), the $MRS_{US} > MRS_{EU}$ so a bargain is possible. The willingness of the United States to restrict pesticide use exceeds that which the EU must have to lower producer support. Negotiations continue until the increase in R_{US} the U.S. is willing to offer equals the increase in pesticide restrictions (R_{US}) that the EU requires. This is where the iso-welfare contours of the two countries are tangent. The set of tangencies in figure 1, represented by the line segment AB, is the possible solution set because the marginal rates of substitution between regions are equal. Point A represents the best outcome for the United States as the EU policy cut is larger and the U.S. pesticide restriction is lower. Point B is the European Union's preferred outcome as there is less of a reduction in EU support and a larger U.S. pesticide restriction. Any point on AB is a potential outcome. The tangency condition shows why the assumptions on shape of the iso-welfare contours are critical. If the U.S. iso-welfare contour were not quasi-concave, there would be multiple tangent points, like point A, along the quasi-convex EU contour.

This is how a bargain could evolve between the United States and the European Union. While the conceptual model illustrates the potential for a bargain, it also suggests that a number of conditions must be fulfilled. These conditions include the proper slope of the iso-welfare contours, their concavity, their indexing and the condition that $MRS_{US} > MRS_{EU}$. Whether such conditions are met is an empirical issue.

Empirical Model and Results

Commodity Model

Implementation of the bargaining process described in figure 1 relies on single commodity, partial equilibrium models for coarse grains and oilseeds. Each model represents a long-run average equilibrium with supply able to adjust to price changes and stocks incorporated into the demand and supply functions. The advantage of this model is its simplicity, which facilitates obtaining the iso-welfare contours. The models divide the world into three regions: the United States—subscript "$_{US}$," European Union—subscript "$_{EU}$," and the rest of the world—denoted by subscript "$_W$"—which includes other exporters. Each model assumes a single, homogeneous commodity. Both the United States and the European Union are treated as exporters in the coarse grains model, while in the oilseeds model the European Union is a net importer.

For both the United States and the European Union, demand and supply relations are specified. Supply of the commodity in the United States (S_{US}) is a function of the U.S. price (P_{US}), the effective use of pesticides ($K_{US} - R_{US}$), prices of other goods, and prices of other inputs. Because the prices of other goods and inputs are held constant in this partial equilibrium model, they are omitted from the presentation:

$$(1) \qquad S_{US} = S_{US}(P_{US}, K_{US} - R_{US}),$$

where K_{US} is the unrestricted quantity of pesticide used.

The inclusion of the difference between unrestricted pesticide use and the mandated reduction allows the U.S. supply function to capture the inward shift of supply due to the pesticide restriction and matches the decision variable in figure 1.

The demand function is found by maximizing U.S. utility including an externality due to pesticide use subject to a national income constraint. Thus, demand for the commodity in the United States, D_{US}, is a function of the own price, the effective use of pesticides ($K_{US} - R_{US}$), income, and prices of other goods. One contribution of this demand formulation is the inclusion of the ($K_{US} - R_{US}$) component. This term acts as an intercept shifter variable for U.S. demand and represents a choice variable for the policy maker. For positive levels of restrictions ($R_{US} > 0$), total pesticide use declines ($K_{US} - R_{US} < K_{US}$) and $D_{US}/R_{US} > 0$. In this case, utility includes an externality associated with agricultural pesticides. U.S. consumers receive positive benefits from the pesticide restriction. This formulation can be used to capture differences in the willingness to pay for goods produced with and without restrictions on pesticides. In addition, the demand shifter is needed in the model to calculate how U.S. consumer surplus will change for different levels of U.S. pesticide restrictions. The U.S. demand is:

$$(2) \qquad D_{US} = D_{US}(P_{US}, K_{US} - R_{US}).$$

Exports by the United States (X_{US}) are the difference between U.S. supply and U.S. demand:

$$(3) \qquad X_{US} = S_{US} - D_{US}.$$

The U.S. price (P_{US}) is linked to the world price (P_W) by a policy intervention in the United States (t_{US}):

$$(4) \qquad P_{US} = P_W + t_{US}.$$

Supply of the commodity in the European Union (S_{EU}) is a positive function of the internal EU price (P_{EU}), prices of other goods, and inputs in the European Union. As in the United States the prices of other goods and inputs are not shown to keep the presentation cleaner:

$$(5) \qquad S_{EU} = S_{EU}(P_{EU}).$$

Demand in the European Union (D_{EU}) also comes from a utility function which includes an externality associated with U.S. pesticide use and hence depends on the internal price, income, prices of other goods and the U.S. effective use of pesticides:

$$(6) \qquad D_{EU} = D_{EU}(P_{EU}, K_{US} - R_{US}).$$

The European Union receives a positive benefit when there is a U.S. pesticide restriction. The reasoning behind including the U.S. pesticide restriction in the EU demand equation is that the grain is homogeneous in that its characteristics are the same. Once in the marketing system U.S. and EU grain cannot be differentiated. But the process under which it is produced affects the EU consumers' utility as the EU dislikes the environmentally unfriendly U.S. production practices. This is similar to the dolphin-tuna issue where the General Agreement on Tariffs and Trade (GATT) ruled that Mexican tuna is the same as U.S. tuna despite the dolphin unfriendly methods Mexico uses to catch the tuna. The disutility the United States experienced over the production process did not justify a trade intervention in the dolphin-tuna case because the products are identical.

Exports by the European Union are the difference between EU supply and EU demand:

(7) $$X_{EU} = S_{EU} - D_{EU}.$$

The European price (P_{EU}) is linked to the world price by the policy (t_{EU}) in this model:

(8) $$P_{EU} = P_W + t_{EU}.$$

This specification assumes that in the long run, the European Union sets a mark-up on world price rather than a strict price support. Because EU grain policy consists of direct payments, paid set-asides, green payments, intervention purchases, and trade policies, this price linkage specification overly simplifies actual policy.

The Rest of the World is described by an excess demand function. Imports (M_W) are determined by the Rest of the World's price (P_W), the price of other goods and the income in the rest of the world:

(9) $$M_W = M_W(P_W)$$

Finally, global equilibrium requires world supply to equal world demand:

(10) $$M_W = X_{EU} + X_{US}.$$

The next step is to formulate the policy problem faced by the U.S. policy maker. It is critical to distinguish between the optimal trade policy that produces the maximum gains from trade for a large exporter from the effects of an environmental policy like pesticide restrictions (Krutilla). The policy maker is assumed to maximize a welfare function consisting of the weighted sum of producer, consumer and taxpayer welfare. The welfare of producers and consumers is measured by producer surplus and consumer surplus, respectively. Producer surplus is evaluated using the internal U.S. price which is the world price plus any intervention in the U.S. supply function which includes the level of the pesticide restriction (R_{US}). Consumer surplus also is evaluated using the domestic U.S. price and, as shown by equation (2), includes the pesticide externality. Taxpayer welfare is measured by the negative of budget costs. The costs are found by multiplying the policy by U.S. exports of the commodity.

The welfare measures of producers, consumers, and taxpayers are weighted in the policy maker's welfare function to reflect their marginal value to the policy maker. The coefficient ϕ^P_{US} is the marginal value the policy maker places on the welfare of producers relative to consumers. The coefficient ϕ^G_{US} is the marginal value the policy maker places on program costs relative to consumers (Paarlberg). The welfare function for the U.S. policy maker is:

(11)
$$W_{US} = \phi^P{}_{US}\int_0^P S_{US}(P_W + t_{US}, K_{US} - R_{US})dP_W + \int_P^0 D_{US}(P_W + t_{US}, K_{US} - R_{US})dP_W - \phi^G{}_{US} t_{US} X_{US}$$

The U.S. iso-welfare contour is found using expression (11) and the global market clearing conditions. That is, the global market clearing identity is used to determine the world price as a function of the policies and the U.S. pesticide restriction. This expression is then inserted into the U.S. welfare function. With the initial observed outcome of no U.S. pesticide restriction, no U.S. price intervention, and the observed EU price support, the initial level of U.S. welfare is U^0_{US}. By varying EU policy, t_{EU}, the level of the U.S. pesticide restriction (R_{US}) can be found such that U.S. welfare remains constant to give the U.S. iso-welfare contour. Additional U.S. iso-welfare contours can be found by setting U_{US} at different values and repeating the process.

The EU iso-welfare contour is found in a similar manner. The EU policy maker's objective function is structured like that for the United States, with the U.S. pesticide restriction entering the EU policy maker's objective:

(12)
$$W_{EU} = \phi^P{}_{EU}\int_O^P S_{EU}(P_W + t_{EU})dP_W + \int_P^O D_{EU}(P_W + t_{EU}, K_{US} - R_{US})dP_W - \phi^G{}_{EU} t_{EU} X_{EU}.$$

The locus of points (t_{EU}, R_{US}) which maintain a constant EU welfare form the EU iso-welfare contour. As in the U.S. case, the expression determining the world price is inserted into expression (12) and the EU policy maker's welfare for the initial conditions is determined, U^0_{EU}. Subsequently, R_{US} is varied and a t_{EU} is found such that U^0_{EU} is constant to determine the contour.

Data

Two empirical models are developed to test the characteristics of the iso-welfare contours to determine if a bargain between the two parties is possible in the year 2005. To estimate the model, data for production, consumption and trade for the United States, European Union, and the Rest of the World are taken from baseline data for 2005 developed by the Economic Research Service of the U.S. Department of Agriculture. The supply and demand elasticities are constructed from the regional elasticities reported in Sullivan, Wainio and Roningen (table 1). The elasticity values are used to construct linear demand and supply functions calibrated to the 2005 baseline data.[1] The use of linear demand and supply functions is restrictive, but gives a quadratic welfare function and prevents the iso-welfare contours from producing multiple tangent points.

The procedure used to approximate the impact of cutting pesticide use on U.S. output is estimated based on yield reductions reported in previous studies. The Knutson et al.; Olson, Langley and Heady; Osteen and Kuchler; GRC Economics studies' results suggest, on average, that a 30% supply reduction in coarse grains and oilseeds results from a total ban on pesticide use. The estimate of the total pesticides used by coarse grains and oilseeds in the United States comes from *Agricultural Resources Inputs Situation and Outlook* (USDA/ERS).

The world prices for coarse grains and oilseeds for 2005 are also from the baseline projections. The future EU price intervention level comes from *The Agricultural Outlook 1997–2001* (OECD) which projects the degree of EU intervention for the year 2001. This level is assumed maintained through the year 2005. The intervention level in the European Union consists of an export subsidy, compensation payments and set-aside payments. The estimated total intervention in the European Union is 34% for producers of coarse grains and 53% for oilseed producers. In the United States, farm price support is assumed to be zero because the 1996 farm bill decouples present producer support and reduces producer payments to zero by 2001. The pattern set by that legislation is assumed to continue.

[1] The trade elasticities in this model are long-run elasticities and are elastic. The excess demand elasticity facing the United States is –5.0. These elasticities affect the results because they affect the ability of each player to affect the world price. If the EU policy liberalization did not raise the world price there would be no benefit to the United States. If the U.S. pesticide restriction does not raise the world price the gain to the EU is reduced.

The welfare function includes explicit weights for producer and consumer welfare and government treasury gains similar to previous studies (Sarris and Freebairn; Paarlberg; Paarlberg and Abbott; Alston, Carter and Smith). The weights represent the political environment facing producers, consumers, and taxpayers for coarse grains and oilseeds markets. The U.S. weights are found by solving the first order conditions obtained from the United States maximizing its social welfare assuming the observed policy and market outcomes are optimal in each commodity model (Sarris and Freebairn; Paarlberg and Abbott). For the European Union and the United States, the producer weight in the coarse grains market is 1.3 assuming the consumer and government weights equal 1. The reason why the weight for the United States exceeds 1 when there is no intervention is that optimal policy for a large country like the United States is an export tax. In the oilseeds market, the marginal value U.S. (EU) policy makers placed on producers relative to government cost is calculated at 1.4 (1.5).

Coarse Grains Results

The results verify three characteristics of the U.S. and EU iso-welfare contours in the coarse grains market. First, there is a negative relationship between the EU support (t_{EU}) and the U.S. pesticide restriction (R_{US}) for both the U.S. and EU iso-welfare contours (table 2). When the EU producer support falls from 34% to 25%, the U.S. pesticide restriction necessary to maintain U.S. welfare at the initial level rises from 0 to 7% of pesticide use. The U.S. (EU) iso-welfare contours are negatively sloped. The shape of the iso-welfare contours can be inferred by evaluating the slopes at various points along the contour. As the European Union liberalizes domestic price support, the slope of the U.S. iso-welfare contour becomes flatter and the EU iso-welfare contour becomes steeper. This indicates concavity (convexity) in the U.S. (EU) iso-welfare contours making them suitable for a bargaining solution.

While the iso-welfare contours for the United States and European Union have the slope and concavity necessary for a bargain, it must also be the case that the iso-welfare contours further (closer) from (toward) the origin indicate lower levels of U.S. (EU) welfare. Initially t_{EU} = 34%, and the base U.S. (EU) welfare when there is a zero U.S. pesticide restriction is $92,516.6 ($34,491) million. When the U.S. welfare is cut to $92,000 million, then the U.S. pesticide restriction rises to 10.25 thousand tons or a 13.6% reduction. Thus,

Table 1. Elasticities Used in the Empirical Models for Coarse Grains and Oilseeds

	Coarse Grains[1]		Oilseeds[2]	
Region	Demand	Supply	Demand[3]	Supply
United States	–0.235	0.491	–0.383	0.593
EU-15	–0.382	0.566	–0.452	0.719
Other Exporters[4]	–0.279	0.358	–0.557	0.075
Importers[5]	–0.222	0.279	–0.578	0.166

[1]Total coarse grains derived as a weighted average of corn and other coarse grains.
[2]Total oilseeds derived as a weighted average of soybeans and other oilseeds.
[3]Demand elasticity for oilseeds derived from meal demand elasticities.
[4]Trade weighted average of exporting country elasticities.
[5]Trade weighted average of importing country elasticities.
Source: Sullivan, Wainio, and Roningen.

for a given EU protection (t_{EU}) greater U.S. pesticide restrictions (R_{US}) are associated with lower U.S. welfare. The U.S. iso-welfare contours are indexed toward the origin. When the EU welfare is decreased to $34,000 million, then the EU support decreases from t_{EU} = 34% to 16%. Thus, for a given R_{US}, lower levels t_{EU} are associated with lower EU welfare.

Another requirement for a bargain is that the willingness of the United States to offer a pesticide restriction in exchange for reduced EU support as measured by the slope of the U.S. iso-welfare contour be greater than the restriction the EU requires to reduce support. As table 2 reveals, the slope of the U.S. iso-welfare curve is less than the slope of the EU iso-welfare curve at each level of EU producer support. This means that for each level of EU producer support, the pesticide restriction which the United States is willing to impose is less than the minimum amount required by the European Union and the condition for a bargain is violated.

The marginal rate of substitution values in table 2 are obtained from a model where the welfare function does not recognize any external benefits which the European Union and United States receive from the United States imposing the pesticide restriction. If the external values that the European Union and the United States place on having the United States restrict its use of pesticides on coarse grains are considered, then a bargain may exist because the relationship between the slopes of the iso-welfare contours may become reversed. To indicate the external benefits to the European Union and United States required to satisfy the slope condition for bargaining, the differences in the two slopes in table 2 can be used to value the externality terms included in welfare functions from the demand equations. This difference represents a measure of the externality that must exist in the EU or U.S. welfare functions for a bargain to begin (BNB). To simplify the results, it is assumed that the U.S. externality from a pesticide restriction is zero. This assumption reflects the observation that the United States has not unilaterally restricted use as would be expected if there is an externality in the U.S. policy maker's welfare. The expression for the EU marginal rate of substitution includes the EU externality since the criticism of U.S. pesticide use being investigated originates in Europe. This critical value is found by setting the $MRS_{US} = MRS_{EU}$.

Table 2. Combination of T_{EU} and R_{US} to Form the U.S. and EU Iso-Welfare Contour Coarse Grains[1]

		Slope	
T_{EU}[2]	R_{US}[3]	U.S. Case	EU Case
25%	7%	–.4355	–2.3505
16%	12%	–.4253	–2.4113
8%	18%	–.4166	–2.4616
4%	20%	–.4105	–2.4950
0%	23%	–.4066	–2.5186

[1]W = Sum of Producer and Consumer Surplus and Government Revenue. Producer Weight in both the U.S. and EU = 1.3.
[2]Initially –34%.
[3]Initial value 75.6 × 1,000 tons.

Table 3 reports the minimum benefits necessary for a bargain (BNB) in the European Union which indicates the magnitude of the externality required for a potential bargain to begin.[2] For a pesticide restriction of 7%, the EU's value from having this U.S. pesticide restriction must exceed $78.2 million. This may appear to be a large number, but is only $.21 per person. If the European Union values the benefits from having the United States accept stronger environmental restrictions more than $.21

[2] Benefits from the U.S. pesticide reduction are measured in monetary terms and are not linked to actual pollutant levels. The benefits shown are the minimum dollar level required to satisfy the bargaining condition. Actual benefits may differ and would require application of non-market valuation techniques.

Table 3. T_{EU}, R_{US} and BNB levels required by U.S. and EU Coarse Grains

			Externality in the EU-BNB	
T_{EU}[1]	R_{US}[2] US Case	R_{US}[3] EU Case	Million $	$/per Person in EU
34%	0	0	64.9	.171
25%	7%	36%	78.2	.206
16%	12%	73%	86.3	.227
8%	18%	112.4%	93.9	.247

[1]Initial EU Producer Support of −34%.
[2]Initial value 75.6 × 1,000 tons.
[3]Initial value 75.6 × 1,000 tons.

per person, then all the conditions for a bargain are minimally satisfied. The European Union places a sufficiently high value on the U.S. pesticide restriction that it is willing to cut its protection enough to make the restriction worthwhile to the United States. If the European Union values a 7% U.S. pesticide restriction less than $.21 per person, then no bargain is possible. As t_{EU} is further liberalized, the size of the BNB get larger, but at a declining rate. This is because the pesticide restriction that the United States is willing to offer and that which the European Union must have grows further apart as t_{EU} is liberalized.

A sensitivity analysis was performed on the pesticide elasticity for the United States (initially .3) due to the uncertainty surrounding this elasticity. A range of .1 to .4 was tested for the pesticide elasticity. For a given EU producer support level, lowering the pesticide elasticity increases the maximum pesticide restriction (R_{US}) offered by the United States and increases the minimum pesticide restriction accepted by the European Union. The externality benefits necessary to start bargaining decrease as the pesticide elasticity is reduced. As the pesticide restriction becomes less of a constraint on United States production of coarse grains, the benefits the European Union must have are smaller.

Sensitivity analysis is also performed on the producer weight for the United States and indicates that the U.S. producer weight has a significant effect on the shape of the iso-welfare contour. If the U.S. producer weight of 1.3, which indicates a producer biased policy, is replaced by a neutral value of 1.0, as the European Union liberalizes the slope of the U.S. iso-welfare contour increases indicating the U.S. iso-welfare contour is convex not concave. This violates one of the conditions required for a bargain.

Oilseeds Results

The oilseeds market creates a different scenario because the European Union is a net importer. This change has an impact on the characteristics of the European Union's iso-welfare curve, but not on the U.S. iso-welfare contour.

There is no longer a negative relationship between t_{EU} and R_{US} for the European Union (table 4). The U.S. pesticide restriction causes the commodity price to increase which decreases the welfare of the European Union. The European Union does not receive positive benefits from seeing the United States place a pesticide restriction on oilseeds. A bargain over pesticide restrictions in the United States in return for liberalizing producer support in the European Union is infeasible in the oilseeds market.[3]

Summary and Conclusions

This paper assesses whether the conditions exist for a bargain where the domestic producer support

[3] In this case, if the U.S. adopted a pesticide restriction without considering the external benefits, the U.S. would need to compensate the EU by allowing higher support for oilseeds in Europe. A bargain might be found if the externality in the EU is large enough to overwhelm the loss in utility from the higher world oilseed price.

Table 4. Combination of T_{EU} and R_{US} to Form the U.S. and EU Iso-Welfare Contour Oilseeds[1]

		Slope	
T_{EU}[2]	R_{US}[3]	U.S. Case	EU Case
50%	.6%	−.013659	.6641
47%	1.2%	−.013638	.6656
43%	1.7%	−.013617	.6670
40%	2.3%	−.013597	.6685
37%	2.9%	−.013577	.6699
33%	3.4%	−.013556	.6713
0%	9%	−.013449	.6793

[1]W = Sum of Producer and Consumer Surplus and Government Revenue, Producer Weight in both the U.S. = 1.45 and EU = 1.5.
[2]Initially −53%.
[3]Initial value 24.14 × 1,000 tons.

level in the European Union is reduced in return for a pesticide restriction on coarse grains and oilseeds in the United States. There are incentives for both regions to negotiate such a bargain. Both regions export coarse grains and the two policies would increase the world price for that commodity. For the European Union, the reduction in the EU support and the increase in the world price decrease EU outlays for agricultural programs. This reduces the costs of new entrants from Eastern Europe. The U.S. pesticide restriction would please EU farmers who contend that they have to be subsidized in order to compensate for stricter environmental laws. The United States would see improved water quality and health benefits. Compliance costs for U.S. farmers would be offset by higher prices and exports.

A conceptual model shows that the U.S. and EU iso-welfare contours must have particular characteristics for a potential bargain to occur. This model is tested for the coarse grains and oilseeds markets. The iso-welfare had such characteristics for both regions for coarse grains because they are competing exporters. The U.S. iso-welfare contours are negatively sloped, quasi-concave and indexed such that increases in the U.S. restriction, given a constant EU policy, lower U.S. welfare. The EU iso-welfare contours are negatively sloped, quasi-convex and indexed so that a cut in the EU support policy lowers EU welfare for a given U.S. pesticide restriction.

In the oilseeds market, where the European Union is a net importer, the slope of the EU iso-welfare contour is positive. The European Union loses its incentive to tradeoff liberalization of its support for a U.S. pesticide restriction. Thus, the trade status of players in a particular commodity market affects whether or not a bargain between environmental and trade policy can be realized.

In the absence of including an externality for U.S. pesticide use in the EU and/or U.S. welfare function, the willingness of the United States to cut pesticide use is less than the cut the European Union must have to induce liberalization. If the European Union places a large enough benefit on the reduction in pesticide use, the cut in support offered could be sufficient to induce the United States to restrict pesticide use. In the empirical model of the coarse grains market, that benefit would need to exceed $0.21 per person.

It is critical to recognize that the foundation for the shape of these two region's iso-welfare curves is the current political system and the emphasis it places on producers relative to consumers and government revenue. A different political climate would lead to different marginal utilities placed on producers, consumers and government cost and, therefore, lead to different solutions. Sensitivity analysis reveals that the producer weight significantly affects the shape of the iso-welfare contours and whether a bargain can be reached.

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