The Optimal Byrd Tariff in Vertical Markets

Troy G. Schmitz, Andrew Schmitz, and James L. Seale, Jr.

Arizona State University and University of Florida

Abstract This paper develops the theory of the optimal tariff under the Byrd Amendment when producers are also processors. The optimal tariff in this case is equal to the optimal processor tariff (when the processor is not also a producer) and is smaller than the optimal producer tariff (when the producer is not also a processor). In a vertical market structure, the welfare of a producer/processor (P/P) increases if tariffs are imposed on raw product imports because a P/P keeps the tariff revenue under the Byrd Amendment. The P/P maximizes joint welfare under a positive Byrd tariff since the tariff allows the P/P to behave in a noncompetitive manner, but this is true only under competitive conditions. Under imperfect competition, the optimal Byrd tariff is zero.

Keywords: antidumping duties, Byrd Amendment, countervailing duties, tariffs

JEL Classification: F13, D60, K33

1. Introduction

The proceeds from tariffs normally go to the government (Schmitz and Schmitz, 1994). However, the Continued Dumping and Subsidy Offset Act (CDSOA) of 2000 allowed producers and processors to keep the proceeds of tariffs if they were successful in petitioning the U.S. government to impose antidumping (AD) or countervailing (CV) tariffs on competing imports. This is also referred to as the Byrd Amendment. This amendment has led to claims of over $15 trillion from thousands of U.S. companies since 2000. For example, in 2007, there were approximately 9,000 claims filed under the Byrd Amendment claiming over $3.2 trillion in damages. As a point of comparison, the entire value of all U.S. imports was only $1.4 trillion in 2007. Hence, the majority of claims are not acted upon. The CDSOA has resulted in actual disbursements of over $1.9 billion from 2001 through 2007. Approximately 50% of all CDSOA disbursements, in terms of value, have gone to only five of the 770 recipient companies. Roughly two-thirds of all payments have gone to the steel, bearings, and candle industries.

In 2003, the World Trade Organization (WTO) asked the United States to bring the CDSOA into conformity with WTO rules. However, President Bush was unable to convince congress to repeal the act. In January 2004, Brazil, Canada, Chile, the European Union, India, Japan, Korea, and Mexico imposed import duties on U.S. exports covering a total value of trade up to 72 percent of the total disbursements made under the CDSOA in 2003. Because the United States had still not complied with the WTO ruling by 2005, Canada, the European Union, Mexico, and Japan imposed additional duties beyond those applied in 2004 (GAO, 2005). Partly in response to these
complaints, the Byrd Amendment was repealed in 2007. However, there are still many accounts that have not yet been settled, and it will take several years before all disbursements are paid. This is the reason that Japan and the EU again imposed CV duties in 2008.

Schmitz and Seale (2004) developed the optimal tariff under the Byrd Amendment from the perspective of producers involved in AD cases. Later, Schmitz, Seale, and Schmitz (2006) developed the optimal Byrd tariff for processors. Like in the producer case, under the Byrd Amendment, there is a positive tariff, as the proceeds are given to the processors rather than to the government. However, one can cite many cases in which firms engaged in trade are vertically integrated from production of the raw material to the retailing of the final product. In this case, the processor is also the producer. Thus an interesting question remains: What does the Byrd tariff look like when producers are also processors? This paper develops the theory of the optimal tariff under the Byrd Amendment from the perspective of a producer processor (P/P) in a vertical market channel. The optimal P/P tariff is greater than the optimal Byrd tariff as derived by Schmitz, Schmitz and Seale (2006). The welfare of the P/P increases under an optimal Byrd tariff because the P/P keeps the tariff revenue. The P/P gains from the tariff both as the producer of the raw product and from processing it. Even though the Byrd Amendment has been withdrawn, the theory of tariffs in vertical market structures contributes to an important body of literature on tariff theory.

2. Optimal Tariffs under the Byrd Amendment in Competitive Markets

In this section we find the optimal tariff (under the Byrd Amendment) from the perspective of producers and compare it to the optimal tariff (under the Byrd Amendment) from the perspective of processors facing competitive conditions. We then compare the results, in which producers and processors are separate entities, to the optimal tariff (under the Byrd Amendment) from the perspective of a processor who is also a producer (P/P).

To analyze these different tariffs under different market structures, we begin by using a framework similar to that found in Schmitz and Seale (2004) and Schmitz, Seale, and Schmitz (2006). Consider the following linear approximations for the derived demand curve $P_D$, domestic supply curve $P_S$, excess derived demand curve $P_{ED}$, and excess supply curve $P_{ES}$:

\[ P_D = \alpha + \beta Q_D \]
\[ P_S = \alpha + \beta Q_S \]
\[ P_{ED} = \gamma + \delta l \]
\[ P_{ES} = \gamma + \delta l \]  

Under competitive conditions, if the government imposes a specific tariff $T$ it drives a wedge between the excess derived demand and the excess supply curve. In equilibrium, the following relationship must hold under competitive conditions regardless of which vertical market structure is imposed:

\[ T = P_{ED} - P_{ES} \]
Inserting the relationships for \( P_{ED} \) and \( P_{ES} \) and solving for imports yields:

\[
I = \frac{T + \gamma - c}{\alpha - \beta}
\]  

(3)

Therefore, the tariff revenue received from imports \((TI)\) is:

\[
TI = \frac{T(T + \gamma - c)}{(\alpha - \beta)}
\]  

(4)

Furthermore, the domestic quantity demanded and the domestic quantity supplied can be expressed in terms of the parameters of the supply and demand curves and the tariff using (1-3) so that:

\[
Q_D = \frac{c - \alpha}{\beta} + \frac{(\alpha - \beta)(T + \gamma - c)}{\beta(\alpha - \beta)}
\]  

(5)

\[
Q_D = \frac{c - \alpha}{\beta} + \frac{(\alpha - \beta)(T + \gamma - c)}{\beta(\alpha - \beta)}
\]  

(6)

### 2.1 Optimal Tariff for Processors

Schmitz, Seale, and Schmitz (2004) show that under competitive conditions, in the absence of the Byrd Amendment, the total revenue accruing to the processor always equals the total cost of purchasing and processing the input, and therefore, a tariff does not alter processors’ profit maximizing behavior. However, if the Byrd Amendment is in place and processors receive the tariff revenue \(TI\) is maximized. Hence, the optimal tariff, from the perspective of a processor (who is not also a producer) can be found by solving the following maximization problem:

\[
MAX_T \{TI\}
\]  

(7)

We find the optimal processor tariff \(T_0\) by taking the derivative of (7) with respect to the specific tariff \(T\), making use of (3), setting it equal to zero, and solving for \(T\):

\[
\frac{\partial (TI)}{\partial T} = 1 + T \frac{\partial I}{\partial T} = 1 + T \frac{1}{\alpha - \beta} = 0
\]  

(8)

After simplification, the optimal processor tariff can be written as:

\[
T_0 = (\beta - \alpha)I
\]  

(9)

### 2.2 Optimal Tariff for Producers

Assuming competitive market conditions, the optimal tariff from the perspective of producers (in the case where producers instead of processors receive the tariff revenue from the Byrd
Amendment) can be found by maximizing the sum of producer surplus $PS$ and the tariff revenue $TI$:

$$\text{MAX}_T \{PS + TI\} = \text{MAX}_T \left\{ \frac{\beta Q_S^2}{2} + TI \right\} \quad (10)$$

Taking the derivative of (10) with respect to $T$, setting it equal to zero, and solving for the optimal producer tariff $T_1$ by making use of (5) yields:

$$\frac{\partial (PS + TI)}{\partial T} = \frac{\beta}{2} \frac{\partial Q_S^2}{\partial T} + I + T \frac{\partial I}{\partial T} = \frac{\beta}{2} (2Q_S) \frac{d}{\beta(d-d)} + I + T \frac{1}{(d-d)} = 0 \quad (11)$$

After solving for $T$, rearranging terms, and simplifying, the optimal producer tariff $T_1$ can be written as:

$$T_1 = (d-d)I - dQ_S = T_0 - dQ_S \quad (12)$$

Since $d < 0$, the optimal producer tariff $T_1$ is always larger than the optimal processor tariff $T_0$.

### 2.3 Optimal Tariff for a Joint Profit Maximizing P/P

Consider a domestic market structure in which processors are also producers (P/P). Under competitive conditions, the tariff drives a wedge between the price of purchasing inputs abroad and the cost of producing inputs domestically. The total outlay $TO$ of the P/P for inputs can be divided into a foreign component $TO_F$ and a domestic component $TO_D$. The outlay for foreign inputs is equal to the amount purchased abroad $I$ multiplied by the equilibrium price (found along the excess demand curve after a tariff wedge is imposed vertically between the excess demand and excess supply curves). The outlay for domestic inputs is equal to the quantity of inputs $Q_S$ produced domestically by the P/P multiplied by the per-unit cost of producing $Q_S$ in equilibrium (found along the resulting domestic supply curve after a tariff wedge is imposed vertically between the excess demand and excess supply curves).

If the P/P can lobby for the optimal tariff from its perspective, such a tariff will be one in which the P/P can exploit foreign exporters and domestic consumers. The joint maximizing P/P will lobby for an optimal P/P tariff that maximizes total revenue $TR$ minus total outlays $TO$ plus tariff revenue $TI$ with respect to the tariff $T$. Mathematically, the optimal P/P tariff $T_2$ is the solution to:

$$\text{MAX}_T \{TR - TO + TI\} = \text{MAX}_T \left\{ P_D Q_D - (P_{ED} I + P_S Q_S) + TI \right\} \quad (13)$$

Using (2), maximization problem (13) can be rewritten as:

$$\text{MAX}_T \left\{ P_D Q_D - ((P_{ED} - T)I + P_S Q_S) + TI \right\} \quad (14)$$

After regrouping terms, (14) becomes:

$$\text{MAX}_T \left\{ P_D Q_D - P_{ED} I - P_S Q_S + TI \right\} \quad (15)$$
Finally, after simplification and using the facts that \( Q_D = I + Q_S \) and, in competitive equilibrium, 
\( P_D = P_{ED} = (P_{ES} + T) = P_S \), the optimal P/P tariff can be derived as the solution to the following (Schmitz, Seale, and Schmitz, 2006):

\[
\text{MAX}_T \{ T \}.
\]  

Interestingly, this is the same maximization problem for the processor, equation (7) above, and maximization with respect to \( T \) results in equation (9). Hence, under the Byrd Amendment, the optimal P/P tariff \( T_2 \) is equal to the optimal processor tariff \( T_0 \) and is smaller than the optimal producer tariff.

The welfare for processors, producers, and P/P under competitive conditions is illustrated using Figure 1 in which the X-axis represents the tariff and the Y-axis represents welfare under different situations. In free trade, there is no tariff. Producer welfare is simply equal to producer surplus at the free trade price and processor welfare (in the case where processors are not also producers) would be zero. At the other extreme, under no trade, the tariff would be prohibitive (i.e., set greater than or equal to the difference between the intercept of the excess demand curve and the intercept of the excess supply curve). Producer welfare would be equal to producer surplus under autarky, with no tariff revenue. Processor welfare would still be zero.

Now consider a positive non-prohibitive tariff under competitive conditions in which producers and/or processors collect the tariff revenue. Under the Byrd Amendment, welfare for processors (in the case where processors are not also producers) is maximized at \( T_0 \). The welfare for processors associated with \( T_0 \) is equal to \( w_0 \) in Figure 1. On the other hand, welfare for producers (in the case where producers are not also processors) is maximized at \( T_1 \). Finally, under the P/P vertical market structure (i.e. the case where processors are also producers) the optimal tariff is \( T_2 \) which equals \( T_0 \) but the total welfare for the P/P at the optimal tariff level is now equal to \( w_0 + (w_0 + w_1) \) or \( 2w_0 + w_1 \).

3. Welfare Impacts

Consider a competitive P/P industry buying inputs for processing from abroad who also produce the input domestically. To derive the optimal P/P tariff, the excess supply curve for the exporter of an input for further processing is given by \( ES \) (Figure 2). The importer’s domestic supply schedule for producing the same input is \( S_d \). The demand curve for the processor’s output is \( D_c \). The processor’s derived demand curve for the input is \( D_d \). The free trade price for the input, absent of transport costs, is \( P_f \). Exports are given by \( q_f \), which are exports of the raw products, since \( D_d \) is the derived demand schedule facing producers.

Under free trade, the raw-product processor would purchase \( q_f \) from abroad at price \( P_f \) and would purchase \( q_1 \) domestically at price \( P_f \) (remembering that the domestic processor also produces the domestically purchased input). The total outlay for the raw product would become:

\[
(P_f \cdot q_f) + (P_f \cdot q_1).
\]
In essence, the total quantity of the input to be processed equals \((q_f + q_1)\) or \(q^*\). A portion of the processed input comes in the form of imports, and the remainder is produced domestically. Under constant processor costs, given the consumer demand for the final product \(D_c\), the P/P produces \(q^*\) of the final product for sale at \(P^*\).

Now, suppose the P/P is effective when lobbying for a tariff on the raw product of size \((P_t - P_p)\). The processor now imports only \(q_t\) of the input to be processed at price \(P_t\). Under the Byrd Amendment, tariff revenue \(abP_pP_t\) is reimbursed to the processor; hence, its effective outlay on imports is reduced to \((P_p \cdot q_t)\). On the other hand, raw-product-processor expenditures on domestic inputs increase from \((P_j \cdot q_t)\) to \((P_t \cdot q_2)\). Combining these two effects, total expenditures by the processor on purchases of both imports and the raw product produced actually decrease when the tariff revenue is rebated to the processor. When compared to free trade, a tariff of size \((P_t - P_p)\), which turns out to be the optimal P/P Byrd tariff, causes the processor to process \(q^{**}\) of the input for sale at price \(P^{**}\).

Imports for the profit-maximizing P/P under the tariff are represented by \(q_t\) for which the processor pays producers in the exporting country price \(P_p\). Producers in the importing country (who are also processors) now receive a higher price of \(P_t\), but consumers are also charged a higher price. Export producers lose \(P_pP_jb'\), import consumers lose \(P_tP_jgh\), domestic producers gain \(P_tP_je\), and processors gain \(abP_pP_t\) (Just, Hueth, and Schmitz, 2005).

At the optimal tariff \(P_t - P_p\), P/P profits (which include economic rents) are at a maximum. A P/P under the Byrd Amendment gains \(abP_pP_t\) from the tariff relative to free trade, which is exactly equal to the tariff revenue rebated to the processor by the government. However, now that the industry is vertically integrated, the P/P receives benefits both as a processor and as a producer (i.e., \(abP_pP_t + P_tP_j\)).

Interestingly, under the optimal P/P tariff case, a P/P who receives the tariff revenue from the Byrd Amendment can essentially behave noncompetitively in the sense that the government tariff functions as an instrument whereby a P/P can accrue non-competitive economic rents.

In terms of the economic impact relative to free trade of an optimal Byrd tariff for a P/P, note the following:

\[
\Delta \pi(P/P) = \Delta TR - \Delta TC + \Delta TR^0 + \Delta ER
\]  
(17)

where \(\pi = \) profits, \(TR = \) total revenue, \(TC = \) total costs, \(TR^0 = \) tariff revenue, and \(ER = \) producer economic rent.

\[
\Delta TR = [(P*Oq*j) - (P**Oq**j)] < 0
\]
\[
= -(kq** q* j) + (P** p* k j) < 0
\]  
(18)

\[
\Delta TC = [+(kq* q* j) - (P** p* k j)] < 0
\]  
(19)

\[
\Delta TR^0 = (abP_pP_t)
\]  
(20)
\Delta ER = P_i P_f ec \quad (21)

Therefore, \( \Delta \pi = ab P_p P_i \) (tariff revenue rebated to the processor) + \( P_i P_f ec \) (added economic rents to producers).

### 4. P/P in Imperfectly Competitive Markets

Consider the P/P in the context of imperfect competition in which the P/P has monopsony power in purchasing the imported raw product and also has monopoly power in selling the processed product in the domestic market. The P/P can differentiate between the foreign and domestic market for the raw product and will choose the optimal combination of inputs purchased abroad and the quantity that it produces domestically, which maximizes its joint profit. Essentially, the P/P with market power will choose to process the total quantity that results from equating the marginal revenue of the processed product sold in the domestic market to the sum of the domestic supply curve and the foreign marginal outlay.

To show the P/P case, we start with the P/P maximization problem, that is, to maximize P/P profit:

\[
\text{MAX}_{l, q_s} \{ \pi = P_D Q_D - P_E I - P_S Q_S \}. \quad (22)
\]

Using \( Q_D = I + Q_S \), the first-order conditions for profit maximization with respect to \( I \) and \( Q_S \) is:

\[
\frac{\partial \pi}{\partial I} = \frac{\partial P_D}{\partial I} Q_D + \frac{\partial P_S}{\partial I} I - P_E I - P_S Q_S = \alpha + 2bI + 2bQ_S + \gamma - 2\alpha I = 0 \quad (23)
\]

And

\[
\frac{\partial \pi}{\partial Q_S} = \frac{\partial P_D}{\partial Q_S} Q_S + \frac{\partial P_S}{\partial Q_S} Q_S - \frac{\partial P_D}{\partial Q_S} Q_S - P_D = \alpha + 2bI + 2bQ_S - \beta I = 0 \quad (24)
\]

From the first-order conditions, we solve for the optimal levels of \( I \) and \( Q_S \) that maximize the noncompetitive P/P’s profit; that is,

\[
I = \frac{\beta (\alpha - \gamma) + 2b(\gamma - \alpha)}{2(\beta - 2b) - b\beta} \quad \text{and} \quad Q_S = \frac{\beta (\alpha - \gamma) + b(\alpha - \gamma)}{\beta (\alpha - \beta) - b\beta} \quad (25)
\]

Summing, we obtain the quantity demanded under the optimal levels of \( I \) and \( Q_S \):

\[
Q_D = \frac{\beta (\alpha - \gamma) + 2\beta (\alpha - \alpha)}{2(\beta - 2b) - b\beta} \quad (27)
\]
Interestingly, from the above, the P/P with monopoly and monopsony power will not lobby for a tariff since there is no need to do so. The optimal P/P tariff under imperfect competition is zero. Furthermore, the joint quantity produced under the P/P structure turns out to be less than even what it would be under no trade. Correspondingly, the domestic price is higher than in the case of no trade. As a result, the profits for the noncompetitive P/P are greater under zero tariffs than they are under an optimal P/P tariff with a competitive market structure.

5. Conclusion

Under competitive conditions, the optimal Byrd P/P tariff is identical to the optimal Byrd processor tariff. It is lower than the optimal Byrd producer tariff. The P/P lobbies for tariffs under the Byrd Amendment due to the potential benefit as processor and producer. The tariff structure derived under competition essentially allows the P/P to behave noncompetitively. However, a P/P has no incentive to lobby for tariffs, if the sector is noncompetitive. The P/P is better off under noncompetitive conditions than it is under the competitive Byrd tariff.

Interestingly, Senator Byrd sent a letter to Congress on August 15, 2008 asking to bring back the Byrd Amendment, arguing that it simply offsets the legal fees involved with AD cases. Because of the volatile nature of politics and the economy in the United States in late 2008, it is quite possible that this amendment could eventually get resurrected. However, as this and most other studies regarding the welfare implications of the Byrd Amendment have shown, the CDSOA did more than just offset legal fees – it increased the incentive for both producers and processors to lobby for higher tariffs – which, in turn, had a negative impact on U.S. consumers and foreign exporters.

Endnote

Contact person: Andrew Schmitz, Professor and Eminent Scholar, Food and Resource Economics Department, University of Florida, Post Office Box 110240, Gainesville, FL 32611-0240; (352) 392-1826 x415 [voice], (352) 392-3646 [fax], Email: aschmitz@ufl.edu.

References


Figure 1. Optimal Byrd Tariff

Figure 2. Processor Tariff and the Byrd Amendment