EFFECTS OF US ANTIDUMPING UNDER THE BYRD AMENDMENT: THE CASE OF CATFISH

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ABSTRACT

The Byrd Amendment permits US firms that petition successfully for antidumping duties to collect tariff revenues. Whether these payments strengthen the duty's ability to raise price depends crucially on market structure. In a competitive market where domestic and imported goods are imperfect substitutes, the payments are akin to a production subsidy and thus undermine the duty's ability to raise price. Applying the theory to antidumping duties imposed by the United States on catfish imports from Vietnam, a three-equation model estimated using monthly data from January 1999 to August 2006 showed the duties to have had a modest yet positive effect on the US price. Although the weak price effect is consistent with supply enlargement induced by the payments, our econometric results suggest substitution effects coupled with incidence shifting are stronger causal factors.

Keywords: antidumping, Byrd Amendment, catfish tariff, trade policy

INTRODUCTION

Import competing firms in the United States are increasingly turning to antidumping duties as an "easy" means to gain protection (Irwin). Although the reasons for this are varied (Zanardi 2004; Prusa 2005), a contributing factor is the Continued Dumping and Subsidy Offset Act passed by the US Congress in October 2000. This Act, commonly known as the "Byrd Amendment" (BA), permits producers and processors who petition successfully for antidumping duties to collect tariff receipts. The ability to collect tariff receipts provides an added incentive to seek protection, and to participate in the petition process (Reynolds 2006).

Most studies of BA focus on how the "offset payments" to domestic firms affect producer and consumer welfare using imperfect competition models (Collie and Vandenbussche 2005; Evenett 2005; Chang and Gayle 2006; Falvey and Wittayarungruangsri 2006). Although such models are appropriate for industrial goods such as steel that are the major beneficiaries of BA (Schmitz and Seale, 2004), they have less relevance for agricultural products where product differentiation is weak and firms are more numerous. Indeed, in their study of the effects of BA on tariff levels lobbied for by U.S. agricultural groups, Schmitz and Seale (2004) assume a homogenous product and perfect competition. Reimer and Stiegert (2006) note that "tests of market structure and behavior in international food and agricultural markets…universally find that price-cost markups are small or nonexistent in most markets." Although zero markups do not preclude oligopoly behavior, Occam's razor argues for a simple market-clearing model. A test presented later affirms this choice in the context of the present study.

The market structure issue is important because BA is properly viewed as a production subsidy since offset payments are based on firm output. A production subsidy under perfect competition implies an outward shift in the domestic industry's supply curve. The enlarged supply undermines the ability of the duty to raise price. This is in contrast to imperfect competition models where BA is shown to magnify the duty's effect on price (Evenett 2005).

In a perfectly competitive market the apparent paradox vanishes because the increase in domestic supply induced by BA erodes the price and demand for the foreign good, making foreign producers worse off. Non-petitioning producers who are not eligible for offset payments are also made worse off if the subsidy effect dominates the tariff effect leading to a decline in domestic price.

The purpose of this research is to determine the price effects of antidumping duties under the Byrd Amendment in a competitive market situation. The analysis differs from Schmitz and Seale (2004) in that the domestic and imported goods are treated as differentiated (as opposed to homogenous) products, and the supply shift induced by BA is explicitly taken into account. In addition, empirical evidence is provided using catfish as a case

study. Catfish represents as useful case study in that it shares characteristics with other agricultural products subject to antidumping, data exist to measure impacts, and a federal labeling law passed in 2001 to differentiate domestic from imported catfish affords the opportunity to test whether such laws are a useful adjunct to antidumping policy.

The "catfish war" generated national media attention with articles appearing in *The New York Times*, *Wall Street Journal*, *Christian Science Monitor*, and *The Economist* discussing the policy and ethical dilemmas posed by the dispute. The dispute was precipitated by a surge in imports of frozen catfish fillets from Vietnam that coincided with a period of low farm prices in the domestic market (Table 1). Although Vietnam's share of the US frozen fillet market at peak imports was less than 13 percent, and frozen fillets account for only a fraction of the total demand for US farm output, the domestic industry saw the low and declining price of the Vietnamese product as a threat. It responded by launching a media campaign to differentiate domestic catfish from and the imported product, by securing federal legislation requiring catfish imports from Vietnam be labeled "basa" or "tra," and by filing antidumping petitions. The petitions resulted in an average tariff of 64 cents per pound in 2003 on a base (fob) import price of $1.21. Two years after full implementation of the tariff the fob import price had declined by $0.28 to $0.93 per pound and the US price had risen by $0.26 to $2.67 per pound. An *ex ante* analysis based on a simulation model suggested a catfish tariff would have little effect on domestic price owing to the highly elastic nature of US demand for imported fish (Kinnucan 2003). This study tests that prediction by determining the extent to which the foregoing price movements can be ascribed to the antidumping measures.

Table 1. Catfish Price and Quantity Data, United States, 1999-2005

Item	Unit	1999	2000	2001	2002	2003	2004	2005
Vietnam fillet price (fob)	$/lb.	2.04	1.52	1.26	1.29	1.21	1.15	0.93
US fillet price	$/lb.	2.76	2.83	2.61	2.39	2.41	2.62	2.67
US tariff	$/lb.	--	--	--	--	0.64	0.61	0.49
US farm price	$/lb.	74	75	65	57	58	70	72
Imports from Vietnam	mil. lbs.	2	7	17	10	4	7	17
US fillet production	mil. lbs.	120	120	115	131	125	122	124
US farm production	mil. lbs.	597	594	597	631	661	630	601

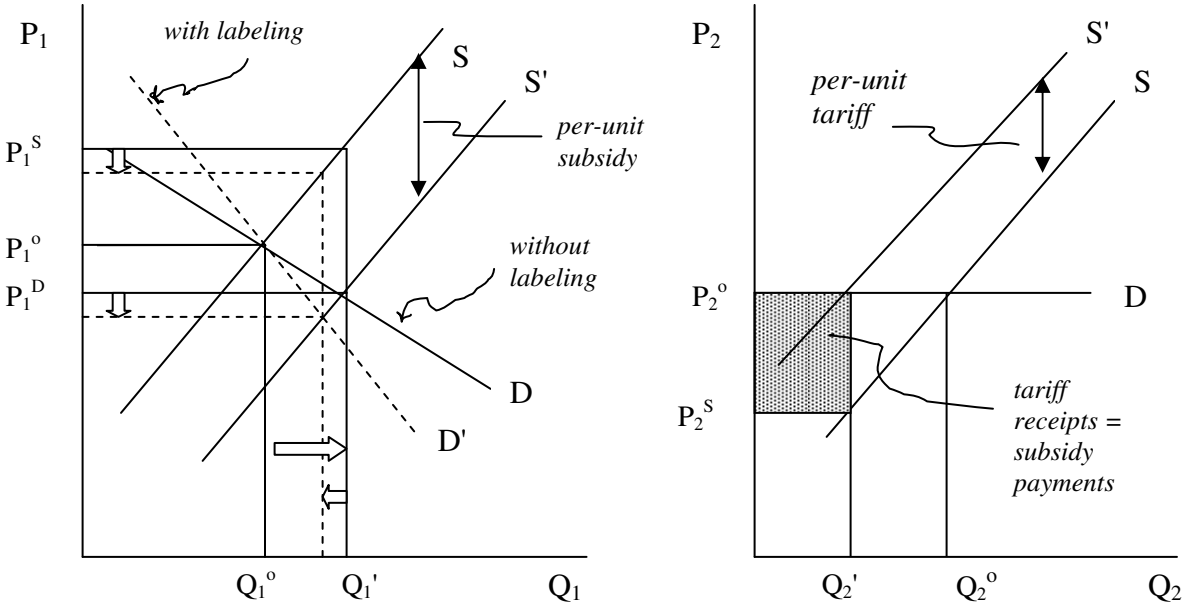
Note: fillets and imports are frozen; farm production is liveweight. Source: Harvey (2006); authors' computation.

ANALYTICAL FRAMEWORK

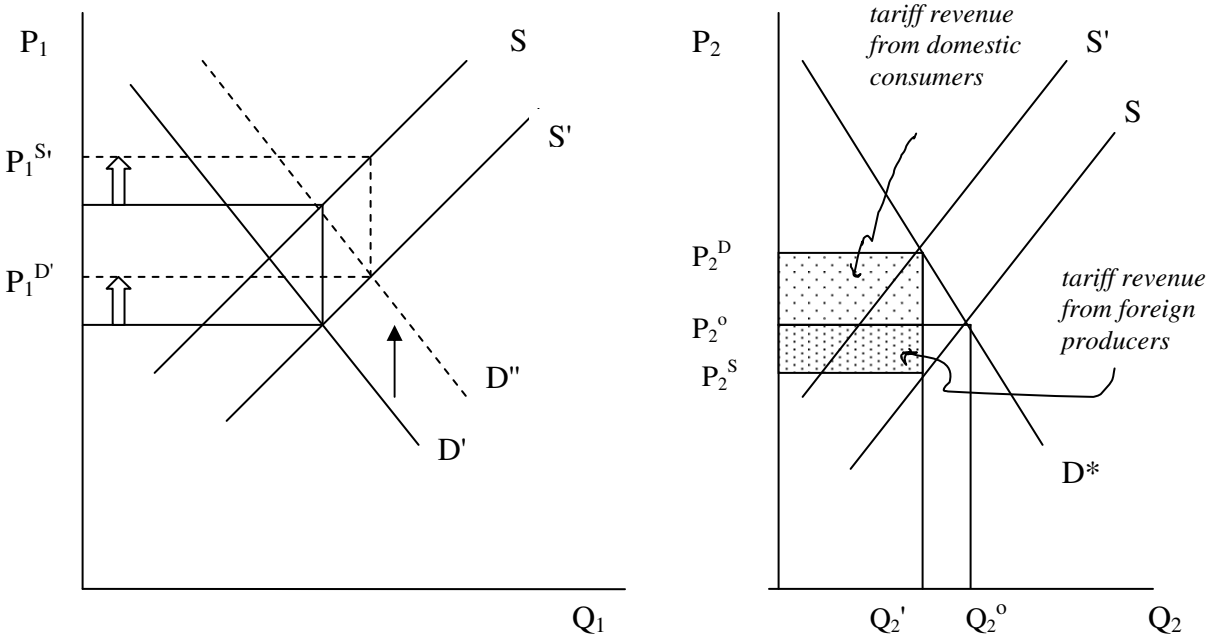
A critical factor governing the efficacy of the tariff *cum* subsidy scheme is incidence. This is shown in Figure 1 where in Panel A we isolate the subsidy effect by treating the price of the imported good as temporarily exogenous. With the domestic price of the imported good fixed the tariff's full burden is borne by foreign producers and the tariff has no effect on the demand for the domestic good. Redistributing the tariff revenue to domestic producers causes the domestic supply curve to shift down by the amount of the per-unit subsidy, which places a wedge between the producer and consumer price of the domestic good. The producers' share of the subsidy wedge depends on the price elasticities of supply and demand for the domestic good and will decrease as demand becomes less elastic in relation to supply. Thus, for example, if labeling causes the demand for the domestic good to become less price elastic, as shown in Panel A, it will redistribute the benefits of the subsidy in favor of consumers.

The role of tariff incidence is shown in Panel B. The ability of the tariff to increase the demand for the domestic good depends on the substitutability of the domestic good for the foreign good, but also on the domestic consumers' share of the tariff wedge. If import demand is less elastic than import supply, as depicted in Panel B, most of the tariff will appear as a rise in the domestic price of the foreign good as opposed to a decline in the foreign sellers' price. In this instance, and assuming the two goods are substitutes, the induced increase in demand for the domestic good will be relatively large. The added demand increases the equilibrium supply and demand prices for

Panel A. Exogenous Foreign Price



Panel B. Endogenous Foreign Price



Domestic Good Foreign Good

Figure 1. Effects of Antidumping Duty under the Byrd Amendment

the domestic good, augmenting the benefit domestic producers receive from the subsidy, but at the expense of domestic consumers.

Comparing Panels A and B the equilibrium demand price of the domestic good may rise or fall depending on whether the tariff effect outweighs the subsidy effect. In Panel B domestic consumers of the foreign good are unambiguously harmed by the tariff/subsidy scheme as they pay more for the imported good. Domestic consumers of the domestic good may be better or worse off depending on the relative strengths of the subsidy and tariff effects. If incidence shifting of the tariff is complete, as in Panel A, the subsidy is financed entirely by foreign producers and the tariff/subsidy scheme has no effect on domestic consumer welfare. If tariff incidence shifting is incomplete, as in Panel B, the cost of the subsidy is shared with domestic consumers of the foreign product and their welfare declines along with the welfare for foreign producers. The upshot is that the incidence of the subsidy and tariff wedges is crucial in assessing policy impact.

To measure the impacts indicated in Figure 1 we use an equilibrium displacement model. The model and methods are similar to those used by Alston (1986) to examine the effects of agricultural policy on poultry trade, by Metcalf (1992) to examine the effects of environmental regulations on pork trade, and by Kinnucan and Myland (2005, 2006) to examine the effects of tariffs on salmon trade. The endogenous variables in the model are proportionate changes in the prices and quantities of frozen catfish fillets in the US market, the product subjected to the antidumping duty. (Hereafter we drop the adjective "frozen.") The production subsidy associated with BA is treated as endogenous, dependent on the exogenous tariff rate, and level of imports in the post-tariff equilibrium.

The domestic demand for US fillets is a function of the price for US fillets, the price of Vietnam fillets, the price of other goods, and consumer income; the domestic demand for Vietnam fillets is a function of the same variables. Therefore, the demand side of the model is represented as:

$$EQ_1 = -\eta_{11} EP_1^D + \eta_{12}\, EP_2^D + \eta_{13}\, EP_3 + \iota_1 EY \tag{1}$$

$$EQ_2 = \eta_{21} EP_1^D - \eta_{22}\, EP_2^D + \eta_{23}\, EP_3 + \iota_2 EY \tag{2}$$

where the operator $E(x) = dx/x = d\ln x$ denotes proportionate change. Subscripts for the quantity (Q) and price (P) variables denote source/product (1 = US, 2 = Vietnam, 3 = other); the superscript "D" on the US and Vietnam price variables denotes demand prices. The price of other goods and consumer income (Y) are treated as exogenous. The parameters η_{ij} and ι_i are price and income elasticities of demand, respectively, with the own-price elasticities η_{ii} expressed as absolute values. Under the maintained hypothesis that the goods are normal and substitute for one another, all parameters in (1) and (2) are positive. Labeling may shift or rotate these curves, an issue addressed in the empirical model presented later.

The domestic supply of US fillets is a function of the price of US fillets *inclusive of the subsidy*, herein labeled P_1^S. The domestic supply curve is shifted by C_1, a variable to represent factors that alter domestic processors' marginal cost of producing fillets. Similarly, the domestic supply of catfish fillets from Vietnam is a function of the price of Vietnam fillets *exclusive of the tariff*, herein labeled P_2^S. The supply curve for Vietnam fillets is shifted by C_2, a variable to represent factors that alter the marginal cost of producing and shipping Vietnam fillets to the United States. Therefore, in proportionate change the supply side of the model is represented as:

$$EQ_1 = \varepsilon_1 EP_1^S + \delta_1\, EC_1 \tag{3}$$

$$EQ_2 = \varepsilon_2 EP_2^S + \delta_2\, EC_2 \tag{4}$$

where the parameters ε_i and δ_i are supply elasticities with respect to price and the shift variables, respectively. In this study, the supply curves are assumed to be upward sloping ($\varepsilon_i > 0$).

The antidumping duty on Vietnam fillets places a wedge between the supply and demand prices for Vietnam fillets as follows:

$$P_2^D = P_2^S \cdot T$$

where $T = 1 + \tau$ and τ is the *ad valorem* tariff rate. Since the tariff in initial equilibrium is zero, in proportionate change the tariff wedge is modeled as:

$$EP_2^D = EP_2^S + \tau. \tag{5}$$

From (5) if the demand price is unaffected by the tariff $EP_2^S = -\tau$ and the supply price falls by the full amount of the tariff. This is the situation depicted in Figure 1, Panel A. In general, however, the tariff is split between and rise in the demand price and a fall in the supply price such that $EP_2^D - EP_2^S = \tau$.

The subsidy introduced by the Byrd Amendment places a wedge between the demand and supply price of US fillets as follows:

$$P_1^S = P_1^D \cdot S$$

where $S = 1 + \varsigma$ and ς is the *ad valorem* subsidy defined as the ratio of the per-unit subsidy to the supply price. Since the subsidy in initial equilibrium is zero, in proportionate change the subsidy wedge is modeled as:

$$EP_1^S = EP_1^D + \varsigma. \tag{6}$$

From (6) the *ad valorem* subsidy is split between a rise in the supply price of US fillets and a fall in the demand price such that $EP_1^S - EP_1^D = \varsigma$.

The subsidy is endogenized by setting the subsidy rate proportional to the tariff rate:

$$\varsigma = \varphi \cdot \tau \tag{7}$$

where $0 < \varphi < 1$. (The implicit assumption here is that the tariff would not generate sufficient revenue to provide a proportionate subsidy larger than the proportionate tariff itself.)

Equations (1) – (7) contain seven endogenous variables ($EP_1^D, EP_1^S, EP_2^D, EP_2^S, EQ_1, EQ_2,$ and ς) and four exogenous variables (EP_3, EY, EC_1, EC_2 and τ). Since only the demand price of US fillets and the supply price of Vietnam fillets are observable, we solve for equilibrium in the two markets by setting (1) = (3) and (2) = (4) making use of (5) and (6) to eliminate EP_1^S and EP_2^D. Substituting (7) into the resulting equations yields the following price relations:

$$EP_1^D = \frac{\eta_{12}}{\varepsilon_1 + \eta_{11}} EP_2^S + \frac{(\eta_{12} - \varphi\varepsilon_1)}{\varepsilon_1 + \eta_{11}}\tau + \frac{\eta_{13}}{\varepsilon_1 + \eta_{11}} EP_3 + \frac{\iota_1}{\varepsilon_1 + \eta_{11}} EY - \frac{\delta_1}{\varepsilon_1 + \eta_{11}} EC_1 \tag{8}$$

$$EP_2^S = \frac{\eta_{21}}{\varepsilon_2 + \eta_{22}} EP_1^D - \frac{\eta_{22}}{\varepsilon_2 + \eta_{22}}\tau + \frac{\eta_{23}}{\varepsilon_2 + \eta_{22}} EP_3 + \frac{\iota_2}{\varepsilon_2 + \eta_{22}} EY - \frac{\delta_2}{\varepsilon_2 + \eta_{22}} EC_2. \tag{9}$$

The coefficients of τ in (8) and (9) indicate the effect of the tariff on observed prices when the price of the competing product is held constant. With this caveat in mind and focusing first on (9) competitive market clearing implies the supply price of Vietnam fillets will fall, but by less than the amount of the tariff. Incidence depends on the relative magnitudes of the supply and demand elasticities for Vietnam fillets, and will bear more heavily on US consumers as demand becomes less elastic in relation to supply.

The more interesting result is from (8) where the tariff *cum* subsidy under competitive market clearing is shown to have an ambiguous effect on the price of the protected good. The positive effect predicted by imperfect competition models occurs only if the outward shift in the demand curve for US fillets induced by the tariff exceeds the outward shift in the supply curve for US fillets induced by the subsidy, i.e., $\eta_{12} > \varphi\varepsilon_1$. If the subsidy effect

exceeds the tariff effect such that $\eta_{12} < \varphi\varepsilon_1$ a tariff under BA has a perverse effect in the sense that the price of the protected good falls.

Permitting prices to adjust simultaneously complicates the tariff effect, but does not alter the basic conclusions derived from (8) and (9). The tariff's net price effects are obtained by setting $EP_3 = EY = EC_i = 0$ and solving (8) and (9) simultaneously to yield:

$$EP_1^D = \frac{\varepsilon_2\eta_{12} - \varphi\varepsilon_1(\varepsilon_2 + \eta_{22})}{D}\tau \tag{10}$$

$$EP_2^S = \frac{-[(\eta_{11}\eta_{22} - \eta_{12}\eta_{21}) + \varepsilon_1(\eta_{22} + \varphi\eta_{21})]}{D}\tau \tag{11}$$

where $D = (\varepsilon_1 + \eta_{11})(\varepsilon_2 + \eta_{22}) - \eta_{12}\eta_{21}$. Under the maintained hypothesis consumers are more sensitive to changes in own price than to changes in substitute price the composite term $(\eta_{11}\eta_{22} - \eta_{12}\eta_{21})$ in (11) is positive, which implies with upward-sloping supply $D > 0$. Hence, in competitive equilibrium a tariff under BA unambiguously depresses the supply price of the foreign good and has an indeterminate effect on the demand price of the protected good.

As expected, "turning off" BA be setting $\varphi = 0$ removes the indeterminancy and attenuates the negative effect of the tariff on the foreign supply price. The attenuation occurs because the subsidy depresses the protected good's price, which erodes the demand for the foreign good through second-round or market feedback effects. This backshift in demand is eliminated with subsidy removal. The upshot is that in a competitive market the Byrd Amendment exacerbates the negative effect of the antidumping duty on foreign sellers. This is in contradistinction to Evenett's (2005) result based on a duopoly model that BA makes the foreign firm better off relative to the equilibrium without BA.

EMPIRICAL MODEL

To test whether the catfish market exhibits the behavior predicted by the foregoing theory we estimated the following three-equation system:

$$\Delta\ln Q_{1,t} = a_0 + a_1 TARIFF_t + a_2 LABEL_t + \sum_{k=3}^{5} a_k D_{k,t} + a_6\Delta\ln P_{1,t}^D + a_7\Delta\ln P_{2,t}^S + a_8\Delta\ln P_{salmon,t} + a_9\Delta\ln Y_t + a_{10}\Delta\ln Q_{1,t-1} + e_{1,t} \tag{12}$$

$$\Delta\ln P_{1,t}^D = b_0 + b_1 TARIFF_t + b_2 LABEL_t + \sum_{k=3}^{5} b_k D_{k,t} + b_6\Delta\ln P_{2,t}^S + b_7\Delta\ln P_{salmon,t} + b_8\Delta\ln Y_t + b_9\Delta WAGE_t + b_{10}\Delta\ln P_{livefish,t} + b_{11}\Delta\ln P_{1,t-1}^D + e_{2,t} \tag{13}$$

$$\Delta\ln P_{2,t}^S = c_0 + c_1 TARIFF_t + c_2 LABEL_t + c_3 PRELIM_t + \sum_{k=4}^{6} c_k D_{k,t} + c_7\Delta\ln P_{1,t\,t}^D + c_8\Delta\ln P_{salmon,t} + c_9\Delta\ln Y + c_{10}\Delta\ln ENERGY_t + c_{11}\Delta\ln FREIGHT_t + c_{12}\Delta\ln P_{2,t-1}^S + e_{3,t} \tag{14}$$

where $\Delta\ln x_t = \ln x_t - \ln x_{t-1}$ denotes the first-difference operator. Equation (12) corresponds to the domestic demand relation (1); equations (13) and (14) correspond to the price relations (8) and (9). Equations (13) and (14) contain all the information in the structural model (1)-(7) and in this sense equation (12) is superfluous. However, the cross-price elasticity $a_7 = \eta_{12}$ indicates the extent to which tariff-induced increase in the Vietnam price will shift the demand curve for the US product, which is useful in interpreting the estimated coefficients of (13). The time subscript *t* denotes months (*t* =1, 2, …, 92 for January 1999 through August 2006) and the $e_{i,t}$ (*i*= 1, 2, 3) denote random disturbance terms.

Previous research indicates the demand for catfish is seasonal, peaking in the Lenten period, and that it takes between three and twelve months for demand and prices to respond to supply/demand shocks (Zidack, Kinnucan and Hatch 1992; Kinnucan and Miao 1999; Quagraine and Engle 2002). Accordingly, lagged dependent variables are included in (12) - (14) to account for dynamics and quarterly dummy variables are included to account for seasonal demand shifts. Specifically, D_k are zero-one variables that represent the first three calendar quarters of the year. Salmon fillets are hypothesized to be the major substitute for catfish frozen fillets. Hence, the wholesale price of salmon fillets, $P_{salmon,t}$, along with US disposable per capita consumer income, Y_t, are included in (12) - (14) as demand shifters.

The $P_{1,t}^D$ and $P_{2.t}^S$ variables in these equations are the prices of frozen catfish fillets received by US processors and Vietnamese exporters to the US, respectively, in month *t*. The latter price is f.o.b., i.e., it is the price received by exporters *before* the US duty is paid. These prices as well as all other monetary variables in the model are deflated by the US CPI.

The remaining variables are defined as follows: $Q_{1,t}$ is the per-capita quantity of frozen catfish fillets sold by US processors in month *t*; $TARIFF_t$ is a dummy variable that assumes the value of one during the tariff period (August 2003 through August 2006) and zero otherwise; $LABEL_t$ is a dummy variable that assumes the value of one during the labeling law period (December 2001 through August 2006) and zero otherwise. Major cost factors for US processors are the price of live fish and labor. Hence, supply shifters in (13) are defined as $WAGE_t$, the average wage rate for US manufacturing workers in month *t*, and $P_{livefish,t}$, the average price received by US catfish farmers in month *t*. Major cost factors for Vietnamese processors and exporters are energy and shipping to the United States. Hence, supply shifters in (14) are defined as $ENERGY_t$, the world energy price index in month *t*, and $FREIGHT_t$, the Pacific freight rate index in month *t*.

Feenstra (2004, p. 247) argues that under duopoly the antidumping duty must be treated as endogenous. The reason is that during the investigation stage, which can last a year or longer, the foreign firm has an incentive to raise price so as to lower the duty should the investigation find in favor of the domestic firm. That is, strategic behavior causes the price of the foreign good to increase *before* the duty is imposed. Because this strategic behavior is ruled out if firms are price takers, to provide an indirect test of the perfect competition model we include a dummy variable $PRELIM_t$ that assumes the value of one during the preliminary investigation period (June 2002 through July 2003) and zero otherwise.

ESTIMATION RESULTS

The system contains four endogenous variables: US quantity, US and Vietnam price, and US farm price. Accordingly (12) - (14) was estimated as a system using Generalized Method of Moments (GMM) that corrects both for simultaneous-equation bias and cross-equation correlation in the error terms. However, Seemingly Unrelated Regression (SUR) estimates are also presented to assess the sensitivity of results to simultaneous-equation bias. Prior to estimation we tested for unit-roots using Dickey-Fuller tests. Results affirmed all series are stationary in logarithmic first differences. First differencing coupled with the presence of lagged dependent variables resulted in the loss of the first two observations; hence, estimates are based on 90 observations (March 1999 through August 2006).

Focusing first on the SUR estimates, results in general are satisfactory in that most of the estimated coefficients have the expected sign and Durbin-*h* statistics indicate a lack of serial correlation (Table 2). The R^2s are higher for US quantity and price (0.56 and 0.58) than for Vietnam price (0.24), as might be expected owing to the use of proxy variables in the latter equation. Overall, the model does a better job of explaining movements in US price and quantity than movements in Vietnam price. Similar conclusions follow from the GMM estimates, which will serve as the basis for the remaining discussion indicated otherwise.

Table 2. Estimated Demand and Price Relations for Frozen Catfish Fillets, US Market, Jan. 1999-Aug. 2006

Variable	SUR Estimates			GMM Estimates		
	US Quantity	US Price	Vietnam Price	US Quantity	US Price	Vietnam Price
Intercept	-0.087	-0.003	-0.030	-0.091	-0.004	-0.006
	(-5.12)	(-1.39)	(-0.94)	(-12.1)	(-9.51)	(-0.54)
TARIFF	0.020	0.004	-0.048	0.025	0.005	-0.098
	(1.15)	(2.01)	(-0.89)	(3.96)	(8.41)	(-9.13)
LABEL	-0.0002	-0.001	0.036	-0.001	-0.0002	0.057
	(-0.01)	(-0.45)	(0.69)	(-0.23)	(-0.31)	(7.05)
PRELIM	--	--	-0.0064	--	--	-0.037
			(-0.11)			(-4.73)
US Price	-2.40	--	4.08	-3.01	--	7.33
	(-3.75)		(3.38)	(-6.30)		(11.2)
Vietnam Price	0.11	0.013	--	0.10	-0.013	--
	(2.20)	(1.95)		(6.83)	(-4.54)	
Salmon Price	-0.11	0.028	-0.12	-0.09	0.022	-0.15
	(-1.07)	(2.25)	(-0.65)	(-3.62)	(10.3)	(-2.61)
Income	1.49	0.16	-0.91	1.60	0.11	-1.33
	(1.92)	(1.61)	(-0.62)	(9.92)	(5.11)	(-3.90)
Farm Price	--	0.16	--	--	0.08	--
		(4.34)			(2.12)	
Wage Rate	--	0.25	--	--	0.37	--
		(1.61)			(9.58)	
Energy Price	--	--	0.18	--	--	0.15
			(1.02)			(3.74)
Shipping Price	--	--	-1.21	--	--	-1.57
			(-1.72)			(-10.2)
Lagged US Quantity	-0.49	--	--	-0.48	--	--
	(-6.32)			(-30.5)		
Lagged US Price	--	0.30	--	--	0.44	--
		(3.55)			(11.9)	
Lagged Vietnam Price	--	--	-0.400	--	--	-0.444
			(-4.22)			(-16.3)
Quarter 1	0.194	0.006	0.016	0.202	0.008	-0.016
	(8.93)	(2.06)	(0.40)	(33.1)	(10.6)	(1.54)
Quarter 2	0.023	0.002	0.041	0.028	0.003	0.030
	(1.24)	(0.94)	(1.07)	(7.21)	(4.79)	(2.59)
Quarter 3	0.085	-0.001	0.032	0.085	-0.001	0.041
	(4.38)	(-0.42)	(0.88)	(20.6)	(-2.01)	(3.22)
R^2	0.559	0.578	0.237	0.547	0.521	0.135
Durbin-*h*	-1.19	-0.08	-0.11	-0.67	0.00	0.44
s.e. of regression	0.0648	0.0083	0.1222	0.0656	0.0089	0.1301

Note: Numbers in parentheses are asymptotic t-ratios; see text for details.

Demand Equation

Results suggest US fillets are a superior good in that demand is sensitive both to price and income. The estimated own-price elasticity is -3.01 (*t*-ratio = -6.3) and the estimated income elasticity is 1.60 (*t*-ratio = 9.9). These elasticities are short run in that they indicate the percent change in quantity in the current month to isolated one percent changes in own-price and income in the current month. The associated long-run elasticities are obtained by dividing the short-run elasticities by one minus the estimated coefficient of the lagged dependent variable (Nerlove 1958). This estimated "adjustment coefficient" is -0.48 (*t*-ratio = -30.5) yielding long-run elasticities of -2.03 and 1.08, respectively, for own-price and income. Thus, the demand for US catfish fillets at the wholesale level is less responsive to price and income in the long run than in the short run, perhaps reflecting inventory behavior. Over the sample period processor inventories of frozen fillets averaged 70 percent of sales on monthly basis, providing some scope for meeting short-run increases in market demand by drawing down inventories rather than increasing production.

Importantly, US fillets are a poor substitute for Vietnam fillets; the estimated short-run cross-price elasticity is 0.10 (*t*-ratio = 6.8) implying an estimated long-run cross-price elasticity of 0.07. This suggests tariff-induced increases in the price of Vietnam fillets will have little impact on the demand for US fillets. One reason US fillets may be a poor substitute for Vietnam fillets is the former's higher cost: over the sample period the US price on average was twice the Vietnam f.o.b. price, $2.63/lb. versus $1.34/lb. Even with a 60 percent tariff the average tariff-inclusive Vietnam price at $2.14/lb. is well below the average US price. Hence, unless buyers see a significant quality difference between the US and Vietnam products, there would be little inducement to switch to the US product given the observed price ranges. The upshot is the tariff is not apt to be effective at raising the US price, as is clear from equation (8) when $\eta_{12} = 0.07$.

US catfish and salmon fillets are weak complements as evidenced by an estimated short-run cross-price elasticity of -0.09 (*t*-ratio = -3.6). Recalling that this is a wholesale level relationship, the complementary relationship may reflect menu offerings of institutional buyers (especially restaurants) as opposed to actual substitution effects by final consumers at retail. In any event, salmon prices appear not to be an important determinant of catfish demand, at least for frozen fillets.

The estimated coefficients of the quarterly dummy variables are significant and show the expected pattern, namely a heightening in demand during the Lenton period. Specifically, the estimated coefficient of D_1 is 0.202 (*t*-ratio = 33.1), which suggests demand in the first calendar quarter is 20 percent higher than in the fourth quarter, *ceteris paribus*. Demand increases again during the third quarter, albeit by a lesser amount 8.5 percent.

The estimated intercept is negative and significant, indicating trend decreases in demand over the sample period. That is, in the absence of changes in relative prices and income the demand for US frozen fillets is expected to decline over time, which suggests a weakening in consumer preferences.

Turning to the policy variables, the estimated coefficient of *TARIFF* is 0.025 and significant (*t*-ratio = 3.96) while the estimated coefficient of *LABEL* is insignificant. Hence, the labeling law had no effect on the demand for US fillets. The tariff effect, though statistically significant, is not economically significant. That is, despite the tariff's size (40 - 65 percent depending on the dumping margin assigned to the foreign firm) it shifted the demand curve for the US product to the right, i.e., in the quantity direction, by a mere 2.5 percent. This modest shift is consistent with the tiny long-run cross-price elasticity ($\eta_{12} = 0.07$) estimated in the same equation.

US Price Equation

Consistent with the demand equation the estimated coefficient of *TARIFF* is positive (0.005) and significant (*t*-ratio = 8.4) while the estimated coefficient of *LABEL* is insignificant. Hence, the labeling law was futile in that it affected neither the price nor quantity of US fillets. Although the tariff was effective in that it increased US price as well as demand, the price effect was modest, less than one percent. Recalling the Byrd Amendment renders the sign of the tariff coefficient ambiguous (see equation (8)), the positive coefficient suggests the tariff effect dominates the subsidy effect, albeit modestly.

Estimates of the remaining coefficients are less than 0.5 in absolute value, indicating US price is insensitive both to supply and demand shocks and to changes in the Vietnam fillet price. The most important variable to affect the US price is labor costs with an estimated coefficient for $\Delta WAGE_t$ equal to 0.37 (*t*-ratio = 9.6) followed by

consumer income with an estimated coefficient for ΔY_t equal to 0.11 (*t*-ratio = 5.1). These are short-run elasticities. The estimated coefficient of the lagged dependent variable is 0.44 (*t*-ratio = 11.9) implying long-run elasticities for labor cost and income equal to 0.66 and 0.20, respectively. Increases in farm price and salmon price have positive effects on US price, but the effects are modest, with long-run elasticities equal to 0.14 and 0.04, respectively. Quagrainie and Engle's (2002) estimate of the farm-US fillet price transmission elasticity from a VAR model is somewhat larger at 0.322.

The estimated coefficient for Vietnam price switches from positive in the SUR estimate to negative in the GMM estimate, but the estimated coefficients in both cases are tiny, 0.013 and -0.013. Quagrainie and Engle (2002) estimate the same elasticity at -0.004 and insignificant. Combining these estimates, it appears the Vietnam fillet price has had little, if any, effect on the US fillet price.

Vietnam Price Equation

The estimated coefficient of *PRELIM* is significant and negative, indicating the Vietnam price fell during the investigation period. Because the duopoly model discussed by Feenstra predicts foreign price should rise during the investigation period, this constitutes evidence in favor of the perfect competition model used here. That is, there is little evidence either in the raw data (see table 1) or in our econometric estimates to suggest Vietnam exporters had sufficient market power to raise price during the investigation period to reduce the antidumping duty.

The estimated coefficient of *TARIFF* is -0.098 and significant (*t*-ratio = -9.1). Thus, the tariff reduced the fob price received by Vietnam exporters, as the perfect-competition model predicts. The estimated reduction in Vietnam price of 9.8 percent is much larger than the estimated increase in US price of 0.5 percent, which suggests the tariff did more to punish Vietnam producers than to reward US producers, a finding consistent with Kinnucan's (2003) analysis. The estimated coefficient of -0.098 suggests 81 percent of the tariff appears as a rise in the US consumer price for Vietnam fillets. This implies import demand is less elastic than import supply, which means most of the tariff is borne by US consumers rather than Vietnam producers. Despite the high US incidence, the tariff *per se* (ignoring the subsidy) is not a potent policy instrument as US demand for US fillets is insensitive to the price of Vietnam fillets. In other words, the tariff *sans* subsidy harms US consumers and Vietnam producers with little in the way of benefits for US producers.

The labeling law appears to have had the unintended consequence of benefiting Vietnam producers. Specifically, the estimated coefficient of *LABEL* is 0.057 (*t*-ratio = 7.1), which suggests the labeling law increased the Vietnam price 5.7 percent, *ceteris paribus*. The positive effect suggests US buyers value the ability to identify source origin. In this sense the law was not devoid of public benefits.

The Vietnam price is highly sensitive to the US price with an estimated coefficient of 7.33 (*t*-ratio = 11.2). The corresponding long-run elasticity, obtained by dividing the short-run elasticity by one minus the estimated coefficient of the lagged dependent variable, is 5.01. Quagraine and Engle's (2002) estimate of the same elasticity is 3.56. The asymmetric price response is intuitive given the price advantage enjoyed by the Vietnam product. Thus, while Vietnam price has little effect on US price, the Vietnam price is highly sensitive to the US price, especially in the short run when imports are relatively fixed in supply. For example, assuming a US tariff incidence of 81 percent, the tariff-inclusive price of Vietnam fillets in 2004 was $1.64 versus $2.62 for US fillets. If buyers view the products as similar in quality, as the positive coefficient for *LABEL* suggests, an increase in the US price would provide a powerful incentive for buyers to switch to the relatively cheaper imported product.

Increases in the price of energy raise the price of Vietnam fillets, although the effect is modest with a short-run elasticity of 0.15 (*t*-ratio = 3.7). Vietnam price is negatively related to changes in income, shipping costs, and salmon price. The negative coefficient for salmon price suggests imported catfish and salmon and catfish are complements, which may reflect the fact that fish buyers at wholesale handle both products and imports constitute a significant share of US salmon consumption (Kinnucan and Myrland 2005). The quarterly dummy variables suggest a seasonal pricing pattern opposite the US pattern with a strengthening in the Vietnam price during the third quarter when the US price is weakening and vice-versa during the first calendar quarter. This suggest imports are responsive to seasonal shifts in domestic supply and demand, which may explain the lack of seasonal price variation for frozen fillets found in Quagraine and Engle's study.

CONCLUDING COMMENTS

A basic theme of this research is the Byrd amendment renders the domestic price effect of an antidumping duty indeterminate owing to the implicit production subsidy. Thus, there is little reason to expect the price of the

protected good to rise following imposition of the duty as the upward pressure on price associated with the tariff is offset by the downward pressure on price associated with the subsidy. Indeed, in the case of catfish we found the antidumping duties of between 40 and 60 percent imposed by the United States between 2003 and 2006 on frozen catfish fillets imported from Vietnam raised the US price of frozen fillets by less than one percent.

Although it is tempting to attribute the modest price effect to enlarged supply induced by the Byrd payments, our econometric estimates suggest weak demand-side effects coupled with incidence shifting may be at play. Specifically, the cross-price elasticity of demand of US fillets with respect to Vietnam price is estimated at less than 0.10, and 19 percent of the tariff is estimated to have been absorbed by Vietnam producers in the form of a lower export price. This tariff "leakage" coupled with the minute cross-price elasticity implies the shift in the demand curve for US fillets associated with tariff was modest. Indeed, the demand equation estimated in this study placed the demand shift at less than three percent.

It appears, therefore, that in the absence of the Byrd Amendment, which permitted the domestic industry to collect some $9.2 million in tariff revenues over the sample period, equivalent to 3 percent of wholesale value, the antidumping duty yielded little in the way of benefits for domestic producers. And what benefits that were generated came at the expense of domestic consumers and foreign producers. This conclusion is consistent with a growing body of evidence that suggests antidumping and countervailing duties are impotent instruments of protection for farm products (Asche 2001; Brester, Marsh, and Smith 2002; Kinnucan 2003; Kinnucan and Myrland 2005).

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