Veterinary Standards as Barriers to Trade:

The Case of Poultry Trade between the U.S. and the EU

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Extended Abstract:

This paper studies the recent U.S./EU controversy regarding the equivalence of their poultrymeat decontamination methods and the resulting requests for mandatory product treatments and import bans. We assess the scientific evidence on poultry decontamination methods; develop graphical models of mandatory product treatments and import bans; and estimate the price effects of the EU ban on U.S. poultry imports. We find that the scientific evidence regarding the safety and effectiveness of various poultry meat decontamination methods appears ambiguous. A costly mandatory product treatment (with ambiguous health benefits) will lead to a price increase and a welfare loss in the EU. The impact of the EU's ban on U.S. poultry imports is minuscule given the small quantity of imports involved and considering that other suppliers are likely to make up the shortfall.

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1. Introduction

Trade in animals and meat products, though relatively free in terms of traditional trade barriers, is in practice strongly impeded by veterinary regulations and standards. A 1996 USDA survey finds that the U.S. may be losing $912 million U.S. animal and meat exports owing to questionable animal health regulations (Roberts and DeRemer). U.S. meat exports to Europe encounter most problems.

Veterinary regulations are frequently motivated by domestic health and safety concerns. However, they may be used as technical trade barriers.[1] Moreover, when nations with diverging regulations trade, exporters incur additional costs of complying with multiple regulations. The WTO's Agreement on Sanitary and Phytosanitary Measures seeks to prevent the misuse of veterinary regulations and standards. The agreement favors international harmonization (Krissoff et al.). In the absence of harmonization, countries are encouraged to reach Veterinary Equivalence Agreements (VEAs). Regulations and standards should be considered *equivalent* if one country can show that its measures -- albeit different -- meet the other country's legitimate objectives. Veterinary equivalence allows products to be traded with minimal customs checks.

The U.S. and the European Union (EU) recently negotiated a new VEA. This agreement covers bilateral trade in animals and meat products of more than $ 2 billion. Officials, however, could not agree on the equivalence of their poultrymeat decontamination methods. The EU demanded that U.S. processors use a more costly chemical to decontaminate poultry carcasses and banned U.S. poultry imports because of noncompliance.

This paper studies the role of veterinary regulations in U.S./EU poultrymeat trade. We first discuss the VEA and scientific evidence on poultrymeat decontamination. Section 4 includes simple

[1]Technical trade barriers may arise when countries use diverging regulations and standards to correct for market inefficiencies arising from externalities (Roberts and DeRemer). They can be economically efficient.

conceptual models for mandatory product treatments and import bans. To assess the maximum possible price effect of the EU's import ban we estimate the EU's price flexibilities in Section 5.

2. The U.S./EU Dispute on Veterinary Equivalence[2]

Until 1997, imports of meat products to the EU were subject to national legislation of the 15 EU members. Because of the 1992 single market program, the EU moved from national to EU-wide legislation in 1997. The EU Commission started negotiating new VEAs with third countries in 1993.

Negotiations with the U.S. proved particularly difficult. After much verbal warfare, EU and U.S. negotiators reached a VEA covering pet food and all meats other than poultrymeat in April 1997. A VEA for poultry was not reached because the EU considers the U.S.' use of chlorinated water to decontaminate poultry carcasses as unsafe and ineffective. It argues that chlorine poses a health risk to humans and that it hides contamination problems occurring earlier in the production chain. The European Commission suggested that the U.S. use the more costly trisodium phosphate (TSP) in place of chlorine. In April 1997 the EU banned U.S. poultrymeat imports ($54 million).

The U.S. maintains that the EU regulation is a disguised trade barrier and that chlorine-treated poultrymeat is safe. Officials argue that the use of chlorine in swimming pools and drinking water has not caused problems. U.S. producers also argue that they need to use chlorine to meet stricter domestic rules on bacteria levels. The U.S. also pointed out that its poultry industry would oppose a switch to the more expensive TSP. The U.S. retaliated to the EU's import ban by banning EU poultry imports amounting to a $1 million value annually. Both parties have mentioned the possibility of challenging their respective embargoes in the WTO.

The trade affected by the bans is small. The U.S., the world's largest poultry producer and exporter, largely exports low-value cuts, which are not favored by EU consumers. U.S. poultry

[2]This section is based on reports in Agra Europe that appeared between 10/96 and 3/98, the New York Times, May 1, 1997, and the Wall Street Journal, August 21, 1997).

exports to the EU peaked in 1996 at 40,000 tons. EU poultry exports to the U.S. are negligible.

3. Scientific Background and Evidence

Consumption of meat contaminated with bacteria and other pathogens may lead to illness and death. Several cost of illness studies quantify the number and cost of illnesses and deaths (Roberts and Unnevehr; USDA, 1995; Buzby and Roberts; Crutchfield et al.). The results strongly depend on the value of statistical life estimates used. Based on two different values, Buzby and Roberts estimate that the total annual costs of the seven most common foodborne illnesses ranged between $6.5 and $13.3 billion or $19.7 to $34.9 billion. Crutchfield et al. find that the costs of foodborne illness from meat and poultry sources fall between $2.0 and $7.2 billion using the conservative Landefeld and Seskin approach to valuing life. Two bacteria, Salmonella and Campylobacter, cause 80% of the illnesses and 75% of the deaths. Poultry products are the foods most commonly contaminated with Salmonella and Campylobacter. Researchers estimate that between 10% and 93% of raw poultry products are contaminated (USDA, 1995; Smith DeWaal, Waldroup et al.).

Immersion chilling, a processing procedure commonly found in U.S. processing firms, contributes to the cross-contamination of poultry products.[3] In the poultry processing chain, birds are chilled in large containers of water, so-called immersion chillers, after they have been inspected, stunned, scalded, de-feathered, eviscerated, inspected, and washed. Immersion chilling leads to cross-contamination of poultry products because the carcasses bump against each other in the tanks. To minimize cross-contamination during immersion chilling poultry processors may use chlorine.

The EU and U.S. consumer groups question the effectiveness and safety of chlorine. Whereas chlorine has been shown to reduce the overall level of bacteria on poultry and extend its shelf life, it may not eliminate Salmonella. Williams et al. show that the rate of Salmonella contamination of

[3]Microbial contamination can also occur on the farm or when food handlers use inappropriate preparation, cooking, and storing techniques.

poultry increased for 58% prior to evisceration to 72% post chill. Moreover, chlorine is controversial as a food additive. Chlorine in water can produce toxic byproducts. The American Public Health Association has called for using alternatives to chlorine whenever possible. USDA, on the other hand, found that the health impact of chloroform resulting from chlorine is minimal (Smith DeWaal).

Many poultry processors in other countries use air chilling rather than immersion chilling. Other alternatives that reduce the contamination of poultry carcasses include competitive exclusion (treatment of the live birds with competing bacteria), steam pasteurization, use of TSP, vent sealing, and irradiation (Smith DeWaal). The EU suggested that the U.S. use TSP as an alternative to chlorine. The scientific evidence on the effectiveness of TSP, however, appears ambiguous. One U.S. processing firm company found that TSP effectively eliminates Salmonella and reduces other pathogens. Studies of other processing plants did not uphold this result (Smith DeWaal).

4. Graphic Analysis

This section develops two very simple conceptual models to explore the trade and price effects of costly mandatory product treatments and country-specific import bans.[4] Our models ignore the potential beneficial effects of the mandatory product treatment and ban on human life and health because the scientific evidence on this matter appears inconclusive.

MANDATORY PRODUCT TREATMENT. Figure 1 displays the effects of a mandatory product treatment in a two-panel graph. This graph is based on a model for regulatory barriers by Thilmany and Barrett. For simplicity, we assume that the world consists of an importer and the rest of the world and we ignore transaction costs and other trade and domestic policies. D_0 and S_0 in panel 1 denote the importer's demand and supply schedules whereas ED_0 and ES_0 in panel 2 show the

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[4] Some U.S. poultry processors may use TSP because U.S. poultry exports to the EU have not ceased in 1998 (USDA, 1998). Alternatively, various EU members may not enforce EU rules.

world's excess demand and excess supply. Under free trade the world market clears at P_0. Imports amount to B (consumption) - A (production).

The EU's request that U.S. processors replace chlorine with TSP increases the cost of most U.S. poultry exporters. The excess supply schedule shifts left from ES_0 to ES_1. This shift, however, will be negligible because U.S. poultry exports to the EU are small. The regulation does not affect domestic and other suppliers that largely use alternative processing techniques. We anticipate that a change in U.S. processing techniques will not affect EU poultry demand because EU consumers are largely unaware of the dispute and not adequately informed about the safety implications of various poultry processing techniques. Moreover, they cannot readily identify the origin of the poultry meat they buy. Given no change in the importer's demand and supply, a leftward shift of the export supply curve yields a price increase from P_0 to P_1. At P_1 imports decline to D-C. Compared to the free-trade situation, the trade volume declines from Q_0 to Q_1 and welfare in the importing country by ABCD. Poultry producers in the importing country benefit whereas consumers lose.[5]

IMPORT BAN. The EU import ban affects 40,000 tons of U.S. poultry meat (U.S. Congress). Its impact depends on whether other suppliers fill this gap. First, assume that other suppliers do not fill the gap. Figure 2 displays the effects of this scenario in a two-panel graph. Under free trade, markets clear at P_0. The importer imports L-K and the trade volume corresponds to Q_0. Following Peterson, Paggi, and Henry's work on the EU hormone ban, we model a country-specific ban as a shift in the excess demand curve to the right from ED_0 to ED_1. This fall in excess demand

[5]Van Ravenswaay and Hoehn point out that consumers may respond to food contamination problems by avoiding products, switching brands, or taking averting or mitigating actions. Veterinary regulations may have a positive effect on demand, if they alleviate consumer concerns about product safety and reduce product avoidance. If consumers perceive poulty products as safe because of the regulation, demand may shift from D_0 to D_1 and import demand from ED_0 to ED_1. The new equilibrium price, P_2, is higher than the free trade price, P_0. The net welfare of the importer increases or decreases depending on the size of the shift in the excess demand. In Figure 1 the trade volume increases from Q_0 (B-A) to Q_2 (F-E). Net welfare increases because EFGH exceeds ABE If the shift in demand, however, is small, the trade volume and welfare decrease (Thilmany and Barrett).

leads to a reduction in the world price from P_0 to P_1 and in the trade volume from Q_0 to Q_1. In the EU the price will rise from P_0 to P_2. The price increase benefits EU producers, hurts EU consumers, and leads to a net welfare loss of KLMN.[6]

Second, because poultry can be readily produced in many countries other than the U.S., there is a high likelihood that other countries will make up for the fall in U.S. exports to the EU. Furthermore, international arbitrage, resale, and transshipments are possible. Houck, when discussing country-specific export embargoes, points out that country-specific quantitative measures create short-term disruptions and uncertainties but frequently no significant long-run effects.

6. Empirical Analysis of the EU Poultry Market

We use a system of three equations to study the impact of the EU's ban on U.S. poultry imports on EU poultry prices:

$$\log EQ^d = \alpha_0 + \alpha_1 \log EP + \alpha_2 \log EGDP + u_t \tag{1}$$

$$\log EQ^s = \beta_0 + \beta_1 \log EP + \beta_2 T_{eu} + v_t \tag{2}$$

$$EP = \delta_0 + \delta_1 \Delta I + \delta_2 EP_{-1} + \delta_3 EP_{-2} + w_t \tag{3}$$

where	EQ^d	quantity demanded	T_{eu}	time trend
	EQ^s	quantity supplied	ΔI	inventory change
	EP	real price	u_t, v_t, w_t	stochastic terms
	$EGDP$	per capita real GDP		

We use constant-elasticity functional forms to estimate EU demand and supply. EU poultry demand depends on the poultry price and per capita GDP, both in real terms. Economic theory suggests that demand decreases if the price of a product rises ($\alpha_1 < 0$) and that it increases if per capita income goes up ($\alpha_2 > 0$). EU poultry supply depends on the EU poultry price and a time trend variable. Theory suggests that a higher poultry price yields an increased supply of poultry ($\beta_1 > 0$).

[6] Alternatively, we could have displayed the country-specific import ban as an import quota. The importer's import demand curve then becomes vertical at Q_1. The impact of the ban on welfare and prices is as above.

The time trend variable represents technical change in the poultry industry, which has a positive effect on supply ($\beta_2 > 0$). The third equation captures the effect of inventory changes and past prices on the EU poultry price. ΔI equals the difference between supply and demand. An increase in inventory is expected to have a negative impact on the poultry price ($\delta_1 < 0$).

We use data from 1975 to 1994 to estimate the above system of equations. Table 1 includes detailed information regarding our data and data sources. Because quantities and prices are determined simultaneously, we use the two-stage least square (2SLS) estimation method. In the first estimation, the Durbin-Watson *d* value of equation 2 indicated positive autocorrelation. To remedy this problem we use the Cochrane-Orcutt iterative procedure and assume that the disturbance term, v_t, is generated by an AR(1) scheme.

Table 2 reports our results and test statistics. Almost all coefficient estimates in the EU's supply and demand equations are statistically significant and have the expected signs. We find that the price elasticity of demand for poultry in the EU amounts to -0.117 and the price elasticity of supply to 0.37.[7] Both estimates are low: a change in the EU's poultry price has a relatively small effect on the quantity of poultry demanded or supplied. Note that low price elasticities imply high price flexibilities. If the poultry demand and supply change by 1%, the poultry price will change by 8.5 and 2.7%. Our results for the price equation are not as promising. Although the equation fits the data well and does not show autocorrelation, coefficient estimates are not statistically significant -- possibly due to multicollinearity. Inventory changes appear to have a minor impact on the EU poultry market. Contrary to our expectations, we find that an increase in inventory has a positive effect on the EU poultry price. Note, however, that this effect is minimal at 0.001.

The impact of a country-specific import ban on the EU will depend on whether other suppliers

[7]The demand elasticity estimate is significant beyond the 1% level whereas the supply elasticity is insignificant.

fill the gap left by U.S. poultry imports. First, consider the less likely scenario of other suppliers not filling the gap again. If poultry supply in the EU decreases by 40,000 metric tons, the EU price increases by 1.2%. The ban leads to a welfare transfer from consumers to suppliers. If, on the other hand, other suppliers make up for the fall in U.S. imports, the effect of the ban should be minimal.

5. Conclusion

This paper studies the recent U.S./EU controversy regarding the equivalence of their poultrymeat decontamination methods and the resulting requests for mandatory product treatments and import bans. The paper leads to the following conclusions.

First, the scientific literature on poultry processing reveals that a moderate to sizable fraction of the U.S. raw poultrymeat supply may be contaminated with bacteria and that the U.S. practice of immersion chilling contributes to cross-contamination.[8] At this point there is not much evidence that TSP, the chemical favored by the EU, is more effective than chlorine, the chemical commonly used in the U.S. In addition, the scientific evidence on the health effects of chlorine appears ambiguous.

Second, we develop graphical models to examine the trade, price, and welfare effects of mandatory product treatments and import bans. We find that a costly regulatory regulation, such as the EU's demand that U.S. processors use TSP, will lead to a poultry price increase and a welfare loss in the EU (unless EU demand for poultrymeat increases significantly owing to the regulatory change). The EU ban on U.S. poultry imports will have a minor effect — even if other suppliers do not fulfill the gap left by U.S. exporters — because U.S. exports of poultry to the EU are small.

Third, we estimate a system of supply, demand, and price equations for the EU using 2 SLS techniques to quantify the price effects of the EU import ban. We find that the price flexbility on the EU poultry market is relatively large. If other suppliers do not fill the gap left by U.S. imports, the

[8]Consumers can avert contamination problems by properly handling, cooking, and storing meat.

EU poultrymeat price may increase by up to 1.2%. A long-term price change is unlikely because other suppliers are likely to replace U.S. suppliers.

However, the ban's long-run impacts may be significant for two reasons: (1) Eastern European and Baltic countries have applied for EU membership. Eastern European and Baltic countries will enact a similar ban once they enter the EU. These countries imported an additional $160 million of US poultry products in 1996. (2) Russia, the largest export market for U.S. poultrymeat worth almost $1 billion, has modeled many of its new regulations on EU regulations. U.S. industry observers worry that if the U.S. agrees to the substitution of chlorine by organic salts, Russian authorities may demand a similar costly commitment (Agra-Europe, April 25, 1997).

In future, we plan to extend our analysis of veterinary regulations. At this point, given ambiguous scientific evidence, we do not consider the health benefits of using the more costly TSP or the ban. Cost-of-illness studies, as well as contingent valuation, hedonic, and averting expenditure measures are possible tools to empirically measure the benefits of food safety regulations. Furthermore, we do not empirically analyze the economic effects of a mandatory product treatment. This requires estimating the compliance cost for moving from chlorine to TSP. We also ignore the consumers' response to changes in regulations. Finally, we need to consider product differentiation.

Table 1: Variables — Definition, Values, and Sources

Variable	Definition	Mean	Minimum	Maximum	Data sources
EQ^d	EU demand of poultry (1,000 metric tons)	5,522.75	4,174	6,926	USDA, PS&D view (93002)
EQ^s	EU supply of poultry (1,000 metric tons)	5,530.2	4,143	6,974	USDA, PS&D view (93002)
EP	EU price of poultry (ECU/ton)	1167.5	1092.87	1,592.34	Commission of the European Communities, The Agricultural Situation
EGDP	EU per capita GDP (US$)	17,388	13972	20,110	OECD, National Accounts (1995)
T_{eu}	EU time series variable	10.5	1	20	
ΔI	EU inventory change (1,000 metric tons)	7.3	-133	123	USDA, PS&D view (93002)

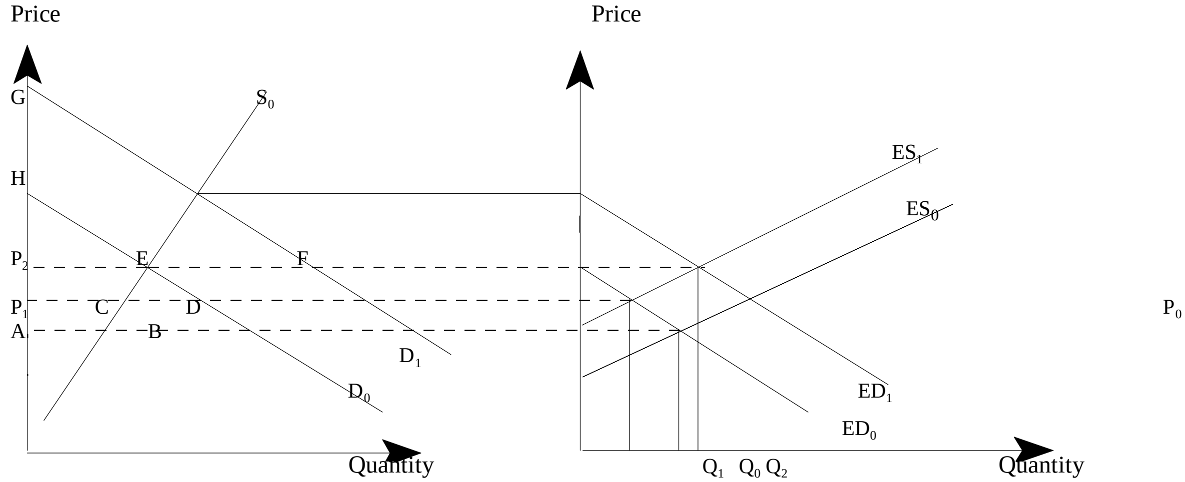
Notes: We approximate the EU price by using the production-weighted average of the prices for Germany, the UK, France, and the Netherlands. We deflate the EU's poultry price and per capita GDP using the EU's GDP deflator (Commission of the European Communities).

Table 2: 2SLS Estimation Results for the EU Market

Variables	EU demand function (1)	EU supply function (2)	EU price function (3)
CONSTANT	7.20 (5.01)**	12.62 (4.81)**	-5.40 (-0.08)
logEP	-0.117 (-3.45)**	0.372 (1.00)	..
logEGDP	0.929 (7.37)**	..	..
T_{eu}	..	0.05 (1.96)*	..
ΔI	..	..	0.001 (0.60)
EP_{-1}	..	..	0.840 (1.08)
EP_{-2}	..	..	0.079 (0.11)
R^2	0.990	0.928	0.849
Adjusted R^2	0.989	0.913	0.817
Durbin-Watson *d*	1.63	1.89	2.20
Observations	18	18	18

Notes: Values in parentheses are t-statistics. */**: estimates are significant beyond 10%/1% level of significance.

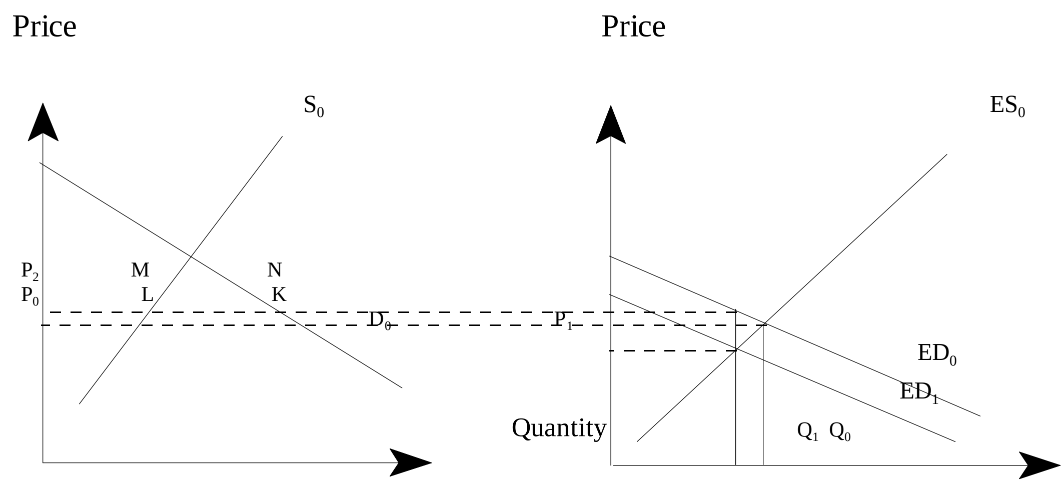
Figure 1: Mandatory Product Treatment.



Panel (1): Importer **Panel (2): World market**

Figure 2: Import Ban.

Panel (1): Importer **Panel (2): World market**



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