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ABSTRACT

The determinants of U.S.-Canada pork trade from 1973 to 1985 are econometrically modeled. While the strong U.S. dollar had negative and significant effects on net exports to Canada, these effects are overwhelmed by Canadian supply shifts. Implications for existing and potential countervailing duty policies are discussed.

Keywords: Exchange Rates, Pork Trade, U.S.-Canada, Countervailing Duty.

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EXCHANGE RATE ADJUSTMENT AND THE U.S.-CANADIAN HOG AND PORK TRADE

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1. Introduction

The years from 1977 through 1985 witnessed an uprecedented increase of 1800% in Canadian hog and pork exports to the United States, while U.S. exports to Canada fell sharply to insignificant levels. This massive expansion and shift in trade volume occurred while supply and demand conditions between the U.S. and Canadian markets diverged, and while the Canadian dollar rapidly depreciated against the U.S. dollar, losing over 30% of its value from 1977 to 1985.

The dramatic increase in Canadian hog and pork exports ultimately lead to the imposition in 1985 of a countervailing duty on hog imports into the U.S. Since the 1985 duty, pork imports have continued to increase, rising 52% through 1988, and the U.S. International Trade Commission recently ruled that these imports are damaging U.S. producers. A decision on whether Canadian producers receive meaningful subsidies and on the appropriateness of a countervailing duty is expected by mid-1989.

This paper provides a reduced form model of pork supply,[2] demand and stocks in the U.S. and Canada, and empirically estimates this model using data from 1973-1985. The purpose is to analyze the determinents of the U.S.-Canada

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[2]Henceforth "pork" shall refer to both live hogs and pork products. Volumes are expressed in carcass weight equivalents.

pork trade pattern during these years, with specific attention paid to the influence of exchange rate adjustments.[3] Results suggest that while the strong dollar acted to increase U.S. net imports of pork, the magnitude of these effects is overshadowed by the magnitude of input and output price effects.

The current model is unique because it measures exchange rate effects through a strong dollar variable, defined in terms of deviations from purchasing power parity (PPP). Several authors cite exchange rates as a possible cause of the trade shift (Gilson, 1985; Goodloe, 1985; Lanoie, 1984; Owen, 1984b; Gilmour and Cluff, 1986) but do not present empirical evidence. Martin (1985a) finds nominal exchange rates to be statistically significant determinants of trade flows; however, the U. S. International Trade Commission (ITC) finds that real exchange rates are unimportant in explaining the increase of U.S. imports in the 1980's (ITC, 1984). Coleman (1986) and Meilke and Coleman (1986) find that exchange rate effects are insignificant in pork supply, although they do not directly enter any exchange rate variable into the estimation. None of these studies relates exchange rates to U.S.-Canadian pork price parity. The current paper provides a direct measure of the dollar's strength in the pork market, based on the purchasing power parity concept, and relates this variable to North American hog trade patterns.

The paper proceeds as follows. Section 2 describes the recent North American pork trade patterns. Section 3 provides a definition of the strong dollar, and presents a history of the dollar's strength from 1973-1985. The econometric model is developed in section 4, and the results are presented and discussed in section 5. Section 6 contains policy implications and

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[3]The period from 1973-85 is chosen because the U.S. and Canadian dollars were allowed to float and pork trade between nations was relatively unhindered.

conclusions.

2. Trade History

When compared to other traded agricultural commodities and manufactured goods, dressed pork trade between the United States and Canada has been relatively free of government interference. Hog trade is more restricted because Canada quarantines U.S. hog imports to control psuedorabies. Until the March, 1985 countervailing duty the U.S. imposed few barriers on hog imports from Canada.[4]

In the early 1970's the U.S. annual pork export volume to Canada grew rapidly, reaching a peak of 170 million lbs. in 1977, an increase of over 1,200% from 1971 exports (Figure 1). The U.S. was a net exporter of pork to Canada from 1974 to 1978. However, after the 1977 peak, U.S. export volume fell sharply until by 1985 exports to Canada were just 14 million lbs. In contrast Canadian exports to the U.S. increased from 30 million pounds in 1977 to 571 million pounds in 1985. These shifts in trade volume changed the U.S. from a net exporter to Canada of 169 million lbs. in 1977 to a net importer of 557 million lbs. in 1985.

The major factors cited as explanations of this trade phenomenon have been structural shifts in production, government subsidization of the Canadian pork industry, and high U.S./Canadian exchange rates.

Lanoie (1984), Gilson (1985) and Gilmour and Cluff (1986) suggest that excess Canadian supply lead to the shift in trade patterns (Canadian pork production increased 61% from 1977 to 1980, and rose slightly in the next five

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[4] A countervailing duty of 5¢ U.S. per pound of live hog inputs from Canada was imposed on the grounds that Canada was subsidizing pork production and hence causing injury to U.S. hog producers. This duty was subsequently lowered to 2 1/2¢ per pound.

years; U.S. production increased 26% from 1977 to 1980 and fell slightly thereafter). However, they do not explain why this excess supply condition occurred--whether it is because of exchange rates, production subsidies, or some other factor.

Martin (1986) and Warley and Barichello (1986) cite the decline in Canadian corn and feed grain prices relative to U.S. prices as a cause of expanded Canadian production. They attribute some of this relative price decline to scientific advancements in Canadian corn technology, implying that the Canadian pork supply curve may have seen a structural shift to the right. The ITC feels that the structural shift was caused by Canadian stabilization policy (ITC, 1985).

With the exception of the ITC, all the cited authors suggest that exchange rate movements are important in explaining the trade patterns. However, none of the authors directly relate exchange rate movements to Canadian supply shifts.

3. Exchange Rate History and the Strong Dollar

This section defines a measure of the strength of the U.S. that is based on the purchasing power parity concept, and provides an historical sketch of recent fluctuations in the dollar's strength.

The strength of the U.S. dollar relative to the Canadian dollar in the pork market is defined to be:

$$(1) \quad S = P_{US} / P_{CN} - E$$

where P_{US} is the US price of pork, P_{CN} is the Canadian price of pork, and E is the exchange rate measured in \$US/\$CN.[5] If S is positive then the dollar is

[5]In the econometric estimation the relative price P_{US}/P_{CN} is measured by ratio of the price of hogs at seven interior U.S. markets to the price of hogs at either the Toronto market or the Winnipeg market.

said to be "strong" relative to the Candian dollar in the pork market. Since S=0 means that PPP holds in the pork market, the measure of dollar's strength is determined by positive deviations from PPP. If S is negative then the U.S. dollar is said to be "weak" relative to the Canadian dollar.

When the U.S. dollar is strong relative to the Canadian dollar then the price of pork in the U.S. exceeds the converted U.S.$ price of pork in Canada. This suggests that producers or middlemen have incentives to ship pork from Canada to the U.S. in order to take advantage of the higher U.S. price. Hence one possible explanation for the shift in the U.S.-Canada pork trade is a shift in the relative strength of the U.S. dollar.

The U.S. dollar has been very strong in the North American pork market since 1982 (Figure 2). In the four years prior to that, the dollar fluctuated between being mildly weak and mildly strong; and from 1973 to 1977 the dollar was in a protracted period of weakness. A comparison of Figures 1 and 2 suggests that the appreciation and depreciation of the U.S. dollar against the Canadian dollar strongly corresponds to the net U.S. export position in pork.

4. The Econometric Model

The model consists of supply equations for eastern and western Canada and the U.S., demand equations for Canada and the U.S., and pork stock equations for Canada and the U.S. There are two supply equations for Canada because hog production techniques and constraints differ between the two regions. The general forms of the equations are

$$(3) \quad H_i = \delta_{0i} - w_i\delta_{1i} + P_i\delta_{2i} \pm PPPs\ \delta_{3i} + D_i\delta_{4i}$$

$$(4) \quad Stock_j = \beta_{0j} + LAG(Stock_j)\ \beta_{1j} + H\ \beta_{2j} + P_j\beta_{3j} \pm PPP\ \beta_{4j} + D_j\beta_{5j}$$

$$(5) \quad q_k = \gamma_{0k} - \gamma_{1k}P_k + y_k\gamma_{2k} + P_{sk}\gamma_{3k} \pm PPP\gamma_{4k} + D_k\gamma_{5k}$$

Eqn. (3) gives the supply function for each production region i. H denotes the supply of hogs, measured in pork equivalent; w is a vector of deflated input costs; P is the deflated output price; S is the measure of the dollar's strength; and D is a vector of seasonal and other production dummy variables. Stocks in the U.S. and Canada are determined by eqn. (4). In this eqn. $STOCK_j$ is the stock level in country j, H is the total supply of hogs: $H=\sum_i H_i$ and D_j is a vector of dummy variables influencing stock levels. Eqn. (5) gives the demand function for each demand region k. q is the per capita quantity demanded, y is deflated per capita disposable personal income, P_{sk} is a vector of deflated retail prices of pork substitutes in region k, and D_k is a vector of demand dummy variables.

The seven equations form a block recursive system, with the three supply equations being predetermined and estimated using an OLS procedure. The two stock equations and the two demand equations simultaneously determine stocks and prices, and so are estimated using an instrumental variables (2SLS) technique.[5] The data sources and data used in estimations are found in Koenig (1987).

5. Empirical Results

Space constraints prohibit the presentation of the full regression results for the complete system of seven equations (complete results are in

[5]Future extensions will include estimation using a full information procedure, and the impostion of trade and disappearance identities on the system of equations.

Koenig, 1987). However, much of the relevant information can be captured by the elasticities of the dependent variables with respect to the important explanatory variables (Table 1).

The estimations yield a real hog supply price elasticity of 0.18 for the U.S. supply response equation and 0.043 for the eastern Canada equation. A real hog price elasticity of 0.60 for western Canada suggests that its production is more responsive to price changes than are eastern Canadian or U.S. production levels. This is consistent with expectations since the western Canada region has a lower concentration of modern, high-capacity production units. The real feed price has a negative effect on supply in eastern Canada and the United States. The U.S. elasticity is -0.23, which is consistent with earlier studies using nominal feed costs. However, the Eastern equation has a feed price elasticity of -2.441, which suggests that supply response is very sensitive to feed price changes. A high elasticity is expected since the region has traditionally been dependent on outside feed supplies.

All endogenous variables are inelastic with respect to the strength of the U.S. dollar. The strong dollar is statistically significant only in the Canadian supply equations, and has elasticities of 0.037 for the eastern region and 0.178 for the western region. The insignificance of the strong dollar variable in U.S. equations supports the hypothesis that Canada is a small country relative to the United States and hence Canadian production is more sensitive to deviations from PPP.

The hypothesis that the strong U.S. dollar was a major factor in increasing Canadian production and increasing exports to the U.S. since 1977 is only partially supported by estimation results. A strengthening U.S. dollar does have a positive and statistically significant effect on Canadian

production. However, results suggest that changing input and output prices, not the strong dollar, have been the dominating factors in increasing Canadian production and expanding trade between the two countries. The strong dollar certainly contributed to the U.S. pork trade deficit in the late 1970's when the U.S. switched form a net exporter to a net importer. However, the magnitude of the pork trade deficit in the mid-1980's cannot be explained by the strong dollar. In the mid-1980's the most important forces in determining the trade balance appear to be the declining real feed costs in eastern Canada, and adjustment lags to hog price changes in western Canada.

Based on the estimated elasticities, the magnitude of the strong dollar effects for 1978 and 1984 are compared with the magnitude of input cost effects as measured by feed costs in eastern Canada and cattle margins (an opportunity cost of hog feeding) in western Canada (Table 2). Between January, 1978 and January, 1979 the strength of the dollar increased by 445% in the eastern-Canadian market and by 246% in the western Canadian market. These increases act to boost Canadian production by 340 million lbs., some 80 million lbs. more than the actual increase (the difference is attributable to other effects, such as the strong negative effect from rising input prices and the positive effect from increased demand). However, from January, 1984 to January, 1985 the strength of the dollar rose only 8% in western Canada and fell by 23% in eastern Canada, leading to almost negligible production effects. In contrast, the total effect of feed prices and cattle margins was to increase production by 193 million lbs.

For both 1978 and 1984 the magnitude of the input price effects dominates the magnitude of the strong dollar effects. This does not imply that changes in the strength of the dollar are unimportant: clearly the 1978 example shows otherwise. However, to explain the tremendous change in the US-Canada pork

trade pattern, explanations much deeper than the strong U.S. dollar must be sought. The 1984 example suggests that shifting supply conditions may play a dominant role.

6. Policy Implications and Conclusions

In August 1985 the ITC imposed a permanent countervailing duty of 5¢ (Canadian) per pound of live hog imports from Canada, after finding that provincial price stabilization policies constituted subsidies to Canadian producers and resulted in injury to U.S. hog producers (Schmitz and Sigurdson argue against this finding).[6] Recently the ITC has again found that pork imports are damaging U.S. producers. As a result of this finding, the U.S. Department of Commerce is investigating the effect of such policies on dressed pork, and whether a countervailing duty should be placed on dressed pork imports (Hilker, 1989).

One counter-argument centers on the idea that exchange rate adjustments have been the dominant cause of shifting trade patterns:

> Most trade shifts and trade disputes in recent years appear to have arisen from the relatively high value of the U.S. (with respect to the Canadian) dollar, which has placed U.S. products and producers at a disadvantage relative to their Canadian counterparts. This suggests that macroeconomic factors such as exchange rate shifts have had a greater effect on recent bilateral trade adjustment than trade barriers or inherent absolute or comparative advantage [Normile et al. 1986, pp. 51-52, parentheses in original].

If this argument is true, then policy makers need not be so concerned with production subsidies and countervailing duties.

The results of the current paper indicate that the strong U.S. dollar does have an important influence on pork U.S.-Canada pork trade patterns, and

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[6]The recently signed U.S.-Canada Free Trade Agreement does not remove the duty, but does allow such subsidy based duties to be argued before a Binational Dispute Settlement Panel.

suggests that the recent weakening of the dollar will lead to improvements in the pork balance of trade. However, the results also suggest that shifting comparative advantage (from either market or policy causes) has been much more important in the pork market.

The estimation results in this paper suggest that a Canadian subsidy of an amount equal to the duty would have little impact on the U.S.-Canada pork trade patterns.[7] While it is argued that Canadian policy in the 1970's and early 1980's lead to increased eastern Canadian pork production, the current results suggest that this policy effect may be eroding.[8] However, the results in no way suggest that this erosion will lead to a reestablishment of the U.S. as a net exporter of pork to Canada. Rather, it appears that reducing U.S. hog and pork production costs is the best way to restore a more favorable trade balance.

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[7]Calculated using a duty of 5¢ per lb. Brandt et al (1987) find that the decline in U.S. hog price due to increasing imports is less than 1/2 that.

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[8]In the 1970's policies to encourage diversification away from dairy production in eastern Canadian agriculture may have created a favorable situation for eastern Canadian pork producers. In the mid-1980's this policy induced advantage seems to have eroded. Also, in western Canada, hog price stabilization during a period of declining western cattle feeding margins may have increased the profitability of hogs relative to cattle, leading to a shift away from cattle production and into hog production. In 1986 Canada signed the National Tripartite Stabilization Plan (NTSP) to provide nationally uniform support levels to all participating hog producers (providincial stabilization plans must be eliminated by 1990).

TABLE 1

MEAN AVERAGE ELASTICITIES

	United States	Canada	Western Canada	Eastern Canada
Supply Response				
Hog Price	0.179#		0.595#	0.043
Feed Price	-0.229			-2.441
Cattle Margin			-0.529	
Grain Stocks			0.120	
PPP	0.008#		0.178	0.037
Demand for Consumption				
Hog Price	-0.304	-0.410		
Beef Price	0.342	0.339		
Log of Income	-3.031	-4.149#		
PPP	0.0007#	-0.002#		
Demand for Storage Stocks				
Slaughter Volume	0.300	0.013#		
Hog Price	-0.146	-0.011#		
PPP	0.000#	0.002#		

* Mean average values of variables calculated with data from March 1973 through March 1985.
# Elasticities based on a coefficient estimate that is not significant at the five percent level.

TABLE 2

ESTIMATED PRODUCTION EFFECTS OF THE STRONG DOLLAR AND INPUT PRICES

INDEPENDENT VARIABLES AND CHANGES

	S_E	FEED PRICE	S_W	CATTLE MARGIN
Jan. 1978	-0.0378	218.7	0.0357	386.32
Jan. 1979	0.1307	259.7	0.1234	472.44
% Δ 1978	445%*	19%	246%	22%
Jan. 1984	0.1570	308.2	0.1883	474.59
Jan. 1985	0.1215	290.6	0.2035	495.79
% Δ 1984	-23%	-6%	8%	4%

ESTIMATED EFFECTS ON PRODUCTION

	S_E	FEED PRICE	S_W	CATTLE MARGIN
Elasticity	0.037	-2.441	0.178	-0.529
% Δ 1978	16%	-45%	44%	-12%
ΔQ 1978	161×10^6 lbs	-441×10^6 lbs	179×10^6 lbs	-48×10^6 lbs
% Δ 1984	-1%	14%	1%	-2%
ΔQ 1984	-12×10^6 lbs	208×10^6 lbs	9×10^6 lbs	-15×10^6 lbs

FIGURE 1

EXPORTS TO THE OTHER COUNTRY

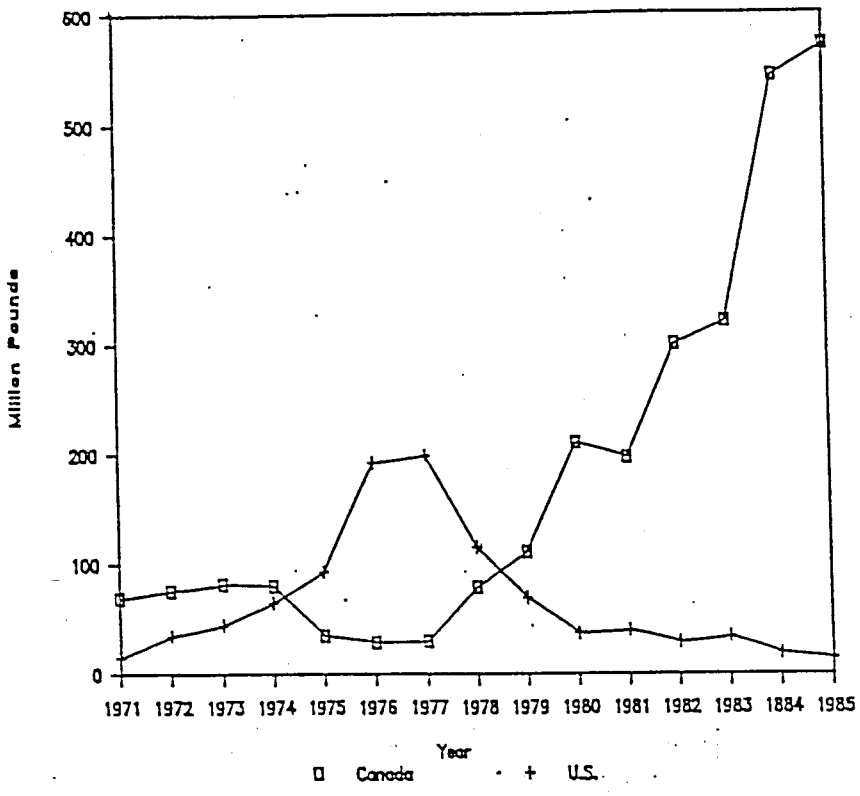
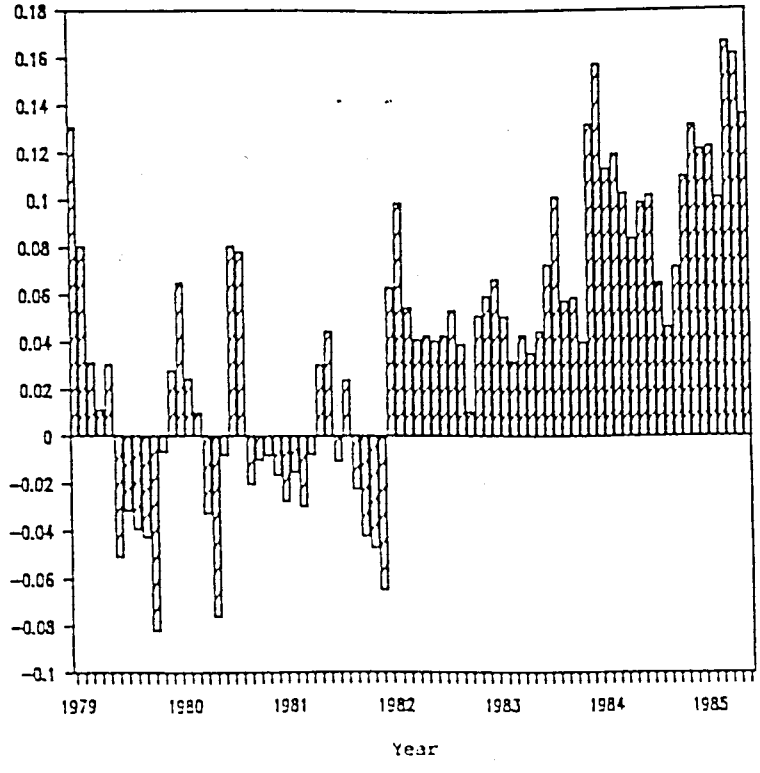


FIGURE 2

STRENGTH OF THE U.S. DOLLAR



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