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Flexible Exchange Rates and Commodity Price Changes

The Case of Japan

Cathy L. Jabara
Nancy E. Schwartz

Knowledge of the degree to which exchange rate changes are passed on to consumers in importing countries is important in determining how changes in exchange rates affect domestic prices. This report analyzes the responsiveness of Japanese wholesale prices to changes in the yen/U.S. dollar exchange rate from 1974 to 1984 for beef, corn, cotton, soybeans, and wheat. The degree to which U.S. exporters and Japanese importers pass on exchange rate changes (exchange rate pass-through) depended on the market structure characteristics for the particular commodity, and on whether the U.S. dollar was increasing or decreasing relative to the yen.

Keywords: Agricultural trade, exchange rates, export demand, Japan, agricultural prices.

The authors wish to thank Carlos Aranda, Stephen Haley, Barry Klineoff, and Nicole Hallenger for helpful comments.

* This report was prepared for the Department of Agriculture and Applied Economics community outside the U.S. Department of Agriculture.

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ABSTRACT

[Knowledge of the degree to which exchange rate changes are passed on to consumers in importing countries is important in determining how changes in exchange rates affect demand for U.S. agricultural exports. This report analyzes the responsiveness of Japanese wholesale prices to changes in the yen/U.S. dollar exchange rate from 1974 to 1984 for beef, corn, cotton, soybeans, and wheat. The degree to which U.S. exporters and Japanese importers pass on exchange rate changes (exchange rate pass-through) depended on the market structure characteristics for the particular commodity, and on whether the U.S. dollar was increasing or decreasing relative to the yen.]

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SUMMARY

Most analyses of exchange rate changes and trade include price arbitrage for traded goods when assessing how changes in exchange rates affect U.S. prices and demand for exports. Under this assumption, the law of one price (LOP) holds for traded goods; that is, the prices of traded commodities in the domestic currency of the importing country vary in proportion with the exchange rate. This report analyzes the degree to which changes in Japanese wholesale prices for beef, corn, cotton, soybeans, and wheat reflected changes in the yen/U.S. dollar exchange rate from 1974 to 1984.

Two hypotheses were tested. First, if the agricultural commodity market was competitive, changes in the Japanese price, relative to the U.S. price, would reflect changes in the yen/U.S. dollar exchange rate. Second, if the market was not competitive [that is, if U.S. exporters or Japanese importers absorbed exchange rate changes through higher (or lower) profit margins], changes in Japanese prices, relative to U.S. prices, would not be affected by the exchange rate.

The degree of exchange rate pass-through depended on the market structure for the particular commodity, and on whether or not the U.S. dollar was increasing or decreasing relative to the yen. During the seventies, exchange rate changes were generally passed through to consumers, at least by importers and exporters. However, we found deviations from the LOP during 1974-75 when the United States placed an embargo on soybeans, the Japanese placed prohibitive import quotas on beef, and the Organization of Petroleum Exporting Countries (OPEC) substantially increased oil prices. Exporters and importers, on average, did not pass through exchange rate changes during the eighties to Japanese beef, corn, and soybean prices. Exporters and/or importers passed the exchange rate change through for an increase in the value of the dollar, but did not pass through for a temporary decline during this period.

Flexible Exchange Rates and Commodity Price Changes

The Case of Japan

Cathy L. Jabara
Nancy E. Schwartz*

INTRODUCTION

Changes in exchange rates affect U.S. agricultural exports. The strong value of the dollar, combined with high U.S. loan rates, has caused a dramatic decline in U.S. agricultural exports over the past 4 years (3, 9, 14). ^{1/} Declines in the value of the dollar also may have stimulated U.S. agricultural exports during the seventies (14). However, empirical evidence on the importance of the exchange rate on U.S. agricultural export demand is mixed. For instance, Batten and Belongia used quarterly data from 1971 to 1984 to estimate an elasticity of U.S. export demand with respect to a real exchange rate (defined as a trade-weighted index of the foreign exchange value of the dollar, adjusted for changes in inflation differentials) of -0.71. Their analysis showed that U.S. exports were affected more by changes in growth in foreign income than in the exchange rate. Krissoff and Haley, using a similar model to Batten and Belongia's, redefined the exchange rate variable to include the real dollar value of the currencies of only the major agricultural importers and exporters. By this method, they obtained larger elasticities of export demand with respect to the real exchange rate--ranging from -1.25 to -1.34--but they also found U.S. export demand was more sensitive to foreign income.

According to Batten and Belongia, arguments citing the importance of the exchange value of the dollar do not recognize the distinction between real and nominal exchange rate changes. However, another explanation is that U.S. exporters and agricultural importers failed to pass through the full effect of an exchange rate change to final consumers in the importing country. Under perfect competition and instantaneous adjustment, price arbitrage across countries ensures that the law of one price (LOP) holds for traded goods. Under this assumption, domestic currency prices in importing countries increase (decrease) with an appreciation (depreciation) in the value of the dollar, thus reducing (raising) agricultural export demand. However, if markets are not competitive [that is, if importing countries stabilize

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^{1/} Underscored numbers in parentheses refer to literature cited in the References section.

internal prices, or if U.S. exporters alter their export prices to offset an exchange rate change], trade volumes tend not to be affected by the exchange rate because the consumer is paying the same price for the same volume of goods.

There were substantial deviations of traded goods' prices across countries during the floating rate period, thus there is doubt on the empirical validity of the LOP. Frenkel found that exchange rate changes during the seventies were much larger than changes in the ratios of national price levels. Insularity of national price levels from exchange rate changes, however, is generally presumed to apply only to manufactured and brand-name products--fixed-price goods--which are invoiced for a given period in the home currency of the importing country. According to McKinnon, a rigid pricing strategy is desirable for domestic and export sales of these products in order to maintain their market shares by avoiding undue instability in traded prices from unexpected, and possibly temporary, changes in exchange rates.

On the other hand, agricultural products, which are traded in U.S. dollars on auction, are assumed to be flex-price goods. Domestic currency prices in the importing country potentially increase in proportion to any change in the value of its currency, subject to quotas or other trade restrictions that would cut off this increase. In this regard, Collins, Meyers, and Bredahl (CMB) note that insulating price policies in many importing countries tend to reduce the effect of changes in the value of the U.S. dollar and lower the U.S. elasticity of export demand. However, CMB do not estimate the extent to which importing countries actually pass an exchange rate change through to domestic consumers; they also do not examine if U.S. exporters do not pass the full exchange rate change through.

This report looks specifically at the nature and timing of adjustments by exporters and importers to changes in the U.S. exchange rate from 1974 to 1984. This report sheds light on the nature of commodity price adjustments with regard to exchange rate movements in both competitive and noncompetitive import markets. By examining the pass-through effect in two periods, one generally characterized by a declining dollar (1974-80) and the other by a rising dollar (1980-84), we examine the possibility of differential behavior of exporters and importers in the two periods. To fully understand how exchange rate changes affect U.S. agricultural exports, we look at the behavior of individual importers and exporters to those changes.

To study the links between exchange rate changes and consumer prices, five Japanese/U.S. commodity markets are used. Japan was chosen because it is the largest single-country market for U.S. agricultural exports. Marketing conditions for agricultural commodities in Japan range from competitive to strictly controlled, thus allowing us to examine the relationship between market structure in the importing country and the effects of exchange rate changes.

APPROACH

Exchange rates serve important roles in international markets by balancing (1) goods markets and (2) asset markets. In goods markets, foreign exchange rates link goods prices across countries through goods market arbitrage; to do otherwise implies there are unexploited profit opportunities. Asset models of exchange rates stress their role in determining the relative prices of assets

denominated in different currencies. Since exchange rates can be highly volatile, and goods prices do not incorporate all transitory elements in the short run, the LOP may hold only in the longer run.

If traded goods are arbitrated, so that the law of one price holds, an exchange rate change will result in prices for traded goods equalizing across countries. More specifically, for products exported by the United States to Japan, and assuming transport costs and border charges are zero or remain constant,

$$P = eP^* \quad (1)$$

where:

P is the domestic (Japanese) wholesale price,

e is the yen per dollar exchange rate, and

P^* is the foreign (U.S.) wholesale price.

This equation can be written in terms of percentage changes as:

$$\frac{dP}{P} = \frac{de}{e} + \frac{dP^*}{P^*} \quad \text{or,} \quad (2)$$

$$\frac{dP}{P} - \frac{dP^*}{P^*} = \frac{de}{e}, \quad (3)$$

A distinction should be drawn between the theory of Purchasing Power Parity (PPP) and the LOP. In its most general form, PPP maintains that the exchange rate is proportional to the ratio of price levels in two countries. Under PPP, P and P^* are aggregate price levels and the exchange rate is determined simultaneously with price levels in each country. Under the LOP, P and P^* are prices of specific commodities and the exchange rate is exogenous.

According to equation (3) the percentage change in wholesale prices between two countries should equal the percentage change in the exchange rate. That is, a depreciation (appreciation) in the value of the yen should result in a change in the Japanese price equal to the exchange rate change plus or minus any concurrent percentage change in the U.S. wholesale price. This is the result obtained under perfect competition and instantaneous adjustment. On the one hand, if domestic wholesalers or government agencies in Japan maintain stable consumer prices by varying their margins in response to a change in import costs, there would be no change in the Japanese price ($dP = 0$ for a given de). If U.S. exporters offset an exchange rate movement by raising (lowering) their dollar-denominated Japanese export prices ($dP = 0$ for a given de), Japanese import costs do not change.

Dohner developed a profit-maximizing model of firm behavior to explain observed tendencies on the part of exporters to maintain local currency prices following an exchange rate change. According to his model at any moment a firm has a stock of customers or market share that will grow or diminish over time, depending on the firm's price relative to those of its competitors. Dohner defines the real exchange rate for an exporting firm as its marginal cost of production relative to the price prevailing in the foreign market in

terms of local currency. An exporting firm experiencing a favorable change in its real exchange rate (the result of a dollar depreciation) can either enjoy the windfall of an increased profit margin or pass the exchange rate change through to the importer by lowering the selling price to attract more customers. A firm experiencing an unfavorable turn in its real exchange rate (such as a dollar appreciation) may try to protect its stock of customers by maintaining its local currency selling price or cut losses by raising its foreign sales price, even though it loses customers over time. ^{2/} The behavior of the firm will depend on its marginal cost, change in customer valuation, and the speed at which customers change firms. In addition, the more fleeting the change, the smaller the price response due to reluctance of the firm to alter its investment in market share in response to temporary changes in its cost/price position.

To test the degree to which Japanese prices for traded goods respond to exchange rate changes, a regression of the following general form can be used:

$$PD_t = a_0 + a_1 X_t \quad (4)$$

where:

$$PD_t = \frac{dP_t}{P_t} - \frac{dP^*_t}{P^*_t}, \text{ and}$$

$$X_t = \frac{de_t}{e_t}$$

for any period t .

In a competitive market and with instantaneous adjustment, the true parameters should take on the following values: $a_0 = 0$, and $a_1 = 1$. The smaller the adjustment, the less competitive the market and the less commodity prices in the importing country are affected by exchange rates.

DATA AND METHODOLOGY

Following a similar analysis by Dunn in which he examined the relationship between price and exchange rate changes between Canada and the United States for six nonagricultural markets, equation (4) was estimated for Japan and the United States for five agricultural commodities: beef, corn, cotton, soybeans, and wheat for 1974-84. ^{3/} The five commodities chosen are all goods

^{2/} Dohner's model is cast in the framework of an exporter who receives the local currency of the importer in return for export sales. This is not strictly applicable for U.S. exporters in the case of agricultural trade since this trade is denominated in dollars. For dollar-denominated trade, the pass through could be blocked by exporters who lower (raise) their dollar-denominated export prices for a dollar appreciation (depreciation) in order to protect customers, in the first instance, or to enjoy an increased profit margin in the second case.

^{3/} In the following analysis, we assumed that U.S. wholesale prices are not determined by the yen/U.S. dollar exchange rate. Although U.S. commodity prices are affected by movements in the overall level of the exchange rate, the amount of trade with Japan in these specific agricultural commodities is too small to determine either the overall exchange rate or U.S. commodity prices.

in which generally (1) imports are a large share of Japanese consumption, and (2) U.S. exports are a relatively large share of Japanese imports (table 1). In this case, a change in the yen/U.S. dollar exchange rate should affect Japanese prices unless administered pricing policies or government controls on imports prevent the pass-through, or U.S. exporters change their export prices to offset the change.

Time series data for Japanese and U.S. wholesale prices demonstrate the influence of the exchange rate on changes in the relationship between Japanese and U.S. prices. Percentage changes in relative prices were calculated for 6-month periods by subtracting the percentage change in the U.S. wholesale price from the concurrent percentage change in the Japanese price. A one-period lag was included in order to allow for systematic price changes in a later period following a movement in the exchange rate. The data were obtained from the Bureau of Labor Statistics, Wholesale Price Indexes, and Bank of Japan, Price Indexes Annual, various years. The price responses were estimated using the ordinary least squares technique (OLS).

Using only wholesale prices, it is not necessarily apparent whether the impediment to a competitive pass-through is in the internal Japanese market or in the export market. The various degrees of domestic price control exercised by Japanese wholesalers for agricultural commodities in Japan are shown in table 2. For corn, cotton, and soybeans, commodities which are freely sold and traded, the import price serves as the wholesale price. In this case, the

Table 1--Japanese imports and import shares for selected agricultural commodities, 1975, 1980, and 1983

Commodity	Imports			Import share in consumption 1/		
	1975	1980	1983	1975	1980	1983
	1000 mt			Percent		
Beef 2/	44.9	121.9	137.4	11.0	23.0	22.0
U.S.	(3.5)	(22.4)	(37.7)			
Corn	7,470.1	12,829.9	14,700.9	100.0	100.0	100.0
U.S.	(5,353.9)	(11,674.0)	(13,438.3)			
Cotton	692.0	719.1	666.3	100.0	100.0	100.0
U.S.	(207.3)	(314.1)	(315.9)			
Soybeans	3,333.7	4,400.6	4,994.9	96.0	96.0	96.0
U.S.	(3,041.1)	(4,225.6)	(4,646.1)			
Wheat	5,654.2	5,682.3	5,816.3	96.0	91.0	89.0
U.S.	(3,003.8)	(3,352.4)	(3,347.8)			

1/ Share of total imports in apparent consumption (production plus net trade).

2/ Fresh, chilled, or frozen.

Source: United Nations' trade data and Food and Agriculture Organization Production Yearbooks, various years.

pass-through is determined by whether or not U.S. exporters adjust their dollar-denominated export prices to offset an exchange rate change as discussed earlier.

For the controlled commodities, wheat and beef, two prices exist: the price paid for imports, and the domestic wholesale price paid by Japanese consumers. Import procedures for wheat and beef involve a two-step procedure in which licensed importers purchase from exporters, and then resell to the licensing agency (the Livestock Industry Promotion Council for beef and the Food Agency for wheat). 4/ The pass-through to the import price for these commodities is affected by exporter behavior, as well as the behavior of Japanese importers in passing the exchange rate change through to the controlling agency. For example, Longworth notes that the existence of high quota profits on beef, as represented by the difference between domestic prices and import costs, incites the Japanese importer to add a specified amount to the LIPC offer sheet, thus enabling the importer to capture some of the quota rents. 5/ Lack of pass through to the second price, the domestic price, is the result of domestic pricing and marketing policy.

To shed more light on the reasons behind a low pass-through for the controlled commodities, we estimated equation (4) twice, using the Japanese import price

Table 2--Determination of wholesale prices for selected agricultural products, Japan

Commodity :	Domestic price	:	Import price
:	:	:	:
Beef	Wholesale prices for carcass beef maintained within a price stabilization band. Mean of band related to average market prices over previous 7 years.	:	Beef imported under quota by licensed traders on behalf of retailers or LIPC <u>1/</u> . Import beef sold by LIPC at fixed prices or by competitive tender. LIPC sales maintain domestic market prices within band.
Corn	Same as import price.	:	Imports by private trade. Sold to formula feed manufacturers. Formula feed subject to price stabilization measures.
Cotton	Same as import price.	:	Imports by private trade. Sold to textile mills.
Soybeans	Same as import price.	:	Same as corn.
Wheat	Wheat sold by Japanese Food Agency to millers at fixed price.	:	Wheat imported under quota by licensed traders and resold to Food Agency.

1/ Livestock Industry Promotion Council.

4/ The LIPC handles about 90 percent of quota beef, and the remainder is imported directly by licensed traders.

5/ Japanese beef imports are subject to a 25-percent import tariff. However, this ad valorem fee should not affect the degree of exchange rate pass-through.

for dP/P in the first instance, and the wholesale price for dP/P in the second. Equation (4) shows whether the exchange rate change is being passed on to the Japanese import agencies, and then whether these agencies pass this change on to domestic consumers.

The 1974-84 analysis period can be generally broken down into two subperiods, one in which the U.S. dollar declined in value against the yen (January 1974-June 1980), and another in which the dollar rose in value against the yen (July 1980-December 1984). ^{6/} McCalla noted that by 1980 restrictive monetary policy in the United States, anticipation of a stronger U.S. policy against inflation, as well as other factors led to a rise in the value of the U.S. dollar. These effects were further exacerbated by a domestic fiscal policy of U.S. deficits which raised U.S. interest rates relative to those in foreign countries and further attracted foreign savings. Spittaller suggested that, in the particular instance of an increase in the value of an exporting country's currency against the currency of a country that figures prominently in export sales, suppliers would lower their selling prices to forestall some of the expected reduction in sales.

We tested for this possible differential behavior of U.S. exporters in periods when the yen/U.S. dollar exchange rate was declining or increasing in two ways. First, we included an interaction variable to see whether the pass-through effect significantly differed before and after July 1980. We included additional interaction variables to test whether exporters' behavior was significantly different in specific periods when the dollar increased relative to the yen or decreased relative to the yen, both before and after July 1980.

RESULTS

OLS regression results relating changes in Japanese/U.S. prices to changes in the yen/U.S. dollar exchange rate are shown in table 3. ^{7/} (The data are shown in figures 1-8 in the Appendix.) In two cases, wheat and beef, estimates were made using the Japanese import price for dP/P in addition to

^{6/} The two regression equations estimating the trends in the yen/U.S. dollar exchange rate from quarterly data over 1974-84 are:

$$\begin{array}{ll} (1) & X_1 = 329.52 - 4.85t_1 \\ & \quad (9.34) \quad (-2.57) \end{array} \quad \begin{array}{l} \bar{R}^2 = 0.90 \\ DW = 1.60 \end{array}$$

$$\begin{array}{ll} (2) & X_2 = 216.86 + 1.95t_2 \\ & \quad (23.43) \quad (2.26) \end{array} \quad \begin{array}{l} \bar{R}^2 = 0.42 \\ DW = 1.36 \end{array}$$

where: t = time, X = yen/U.S. dollar exchange rate, 1 refers to the 1974-June 1980 period, and 2 refers to the July 1980-December 1984 period, and $()$ refers to t -values. A Cochrane-Orcutt procedure was used to correct for serial correlation.

^{7/} Estimates of equations in table 3 were also made using Zellner's seemingly unrelated regression technique, to account for deviations from LOP which could apply across commodities. These results are not shown because there was no gain in efficiency from using this technique. However, this result further confirms the work of Protopapadakis and Stoll, who found that deviations from LOP were not highly correlated across commodities, but arose from shocks in the individual commodity markets.

Table 3--Regression of changes in relative prices on changes in the exchange rate, 1974-84

1. Beef import	$PD_1 = -.019 + 2.339^*X_1 - 7.769^{**}DBX_1 - 2.784^{**}D_1X_1$ (-.45) (2.97) (-2.32) (-2.47)	$\bar{R}^2 = .30$ N = 22 DW = 2.09
2. Corn	$PD_1 = .015 + 1.170^*X_1 - .856^{**}D_1X_1$ (1.31) (5.72) (-2.77)	$\bar{R}^2 = .61$ N = 22 DW = 1.79
3. Cotton	$PD_1 = .002 + .880^*X_1 - 3.595^{**}DCX_1 - .439D_1X_1$ (1.28) (2.84) (-2.73) (-.95)	$\bar{R}^2 = .35$ N = 22 DW = 1.84
4. Soybeans	$PD_1 = .003 + 1.267^*X_1 - 4.766^{**}DSX_1 - 1.021^{**}D_1X_1$ (1.95) (4.78) (-4.23) (-2.60)	$\bar{R}^2 = .60$ N = 22 DW = 2.57
5. Wheat import	$PD_1 = .024 + 1.009^*X_1 - .576D_3X_1$ (1.62) (4.39) (-1.08)	$\bar{R}^2 = .46$ N = 22 DW = 2.19
6. Domestic beef	$PD_1 = .025 + 1.138^*X_1 - 2.340^{**}D_1X_1$ (.81) (2.00) (-2.73)	$\bar{R}^2 = .21$ N = 22 DW = 2.69
7. Domestic wheat	$PD_1 = .044 - .505X_1 + 1.337^*X_0 - 2.331^{**}D_2X_0$ (1.66) (-1.14) (2.83) (-2.68)	$\bar{R}^2 = .23$ N = 22 DW = 1.90

Notes: PD_1 = Percentage change in Japanese price minus percentage change in U.S. price over 6-month periods.

X_1 = Concurrent percentage change in Japanese price of U.S. dollar.

X_0 = Percentage change in the exchange rate lagged one period of 6 months.

DB = Denotes prohibitive import quotas on beef. DB = 1 January 1974-December 1975; = 0, all other periods.

DC = Denotes drop in cotton imports from OPEC oil price increases. DC = 1 January 1974-December 1975; = 0 all other periods.

DS = Denotes U.S. soybean embargo. DS = 1 January 1974-December 1975; = 0 all other periods.

D_1 = 1 July 1980-December 1984; = 0 all other periods.

D_2 = 1 January 1981-December 1984; = 0 all other periods.

D_3 = 1 January 1982-December 1984; = 0 all other periods.

() = t-values.

* Indicates coefficients are statistically different from zero using a 0.05 level one-tailed t-test;

** Indicates coefficients are statistically different from zero using a 0.05 level two-tailed t-test.

the estimate with the wholesale price. For cotton, soybeans, and corn, wholesale prices were identical to import prices, thus reflecting that marketing and pricing for these commodities in Japan are uncontrolled.

The interaction variable, D_iX_1 , $i=1...3$, is included to test whether the response to exchange rate changes was significantly different before and after 1980. In two equations, those for domestic and imported wheat, the "best fit" was obtained with an interaction variable which tested for a differential response in a period later than July 1980.

Additional interaction variables to represent the effects of changes in Japanese trade policy and international events which affected the relationship between exchange rates and traded prices during 1974-84 were also included in the imported beef, soybean, and cotton equations. The additional interaction variable for beef represents Japanese trade restrictions prohibiting beef imports in 1974-75, whereas for soybeans it represents the U.S. soybean embargo which took place during the same period. For cotton, the additional interaction variable accounts for the sharp drop in Japanese cotton imports and the slump in the Japanese textile industry following the OPEC-induced oil price increases in 1973. Thus, the exchange rate effect for imported beef, soybeans, and cotton is estimated holding these effects constant. ^{8/}

All of the estimated coefficients for X_1 , the variable measuring changes in the yen/U.S. dollar exchange rate, are significantly different from zero at the 5-percent confidence level or higher, using a one-tailed t-test. In the domestic wheat equation the exchange rate exhibits a lagged impact. Thus exchange rate changes appear to have affected internal prices in Japan prior to July 1980, holding trade policy and international effects constant. Among these equations, none of the estimated coefficients is statistically different from 1, using a two-tailed t-test at the 5-percent confidence level. This indicates that when the interaction variables were not in effect, the LOP generally held. Table 3 also indicates that the full exchange rate pass-through occurred fairly rapidly, within 6 months, for the commodities to which LOP applied.

Estimated results for corn, cotton, and soybeans indicate the extent to which U.S. exporters passed on a given exchange rate change to Japanese importers during the analysis period, all other things held constant, whereas results for imported beef and wheat also account for importer behavior (see pp. 5-6). For imported wheat and cotton, there appeared no significant difference in exporter or importer behavior in the seventies and eighties, as the interaction variables testing for this difference were not statistically significant at an acceptable level of confidence in those equations. The LOP generally held for these commodities throughout this period, with the exception of the 1974-75 period for cotton. The relatively low R^2 's for cotton and imported beef, however, suggests that temporary deviations from the LOP have been relatively more important for these commodities, than for corn, soybeans, and wheat, probably because these commodities are less homogeneous, and product quality and timeliness in product availability are as important as price in buying decisions.

For corn, soybeans, and imported beef, there appears to have been a change in traders' behavior after July 1980. The full effect of an exchange rate change

^{8/} An F test, conducted at the 5-percent level of significance, indicated that including all the dummy variables in equations 1, 2, 4, 6, and 7 improves the fit of the estimated equations.

was not passed on to the Japanese import price after the July 1980 period for these commodities. In the case of corn and soybeans, the estimated coefficients indicate that only 0.31 and 0.25 percent of a 1-percent change, respectively, in the yen/U.S. dollar exchange rate was passed on to importers, on average, after July 1980. The sum of the estimated coefficients for X_1 and X_1D_1 in each of these equations is statistically different from 1.

In the case of imported beef, the sum of the estimated coefficients for X_1 and X_1D_1 equals -0.45. This indicates that, contrary to our tested hypothesis, an appreciation (depreciation) in value of the dollar against the yen resulted, on average, in a decline (increase) in the Japanese import price relative to U.S. beef prices (this result will be discussed further in a following section).

Effects of exchange rates on Japanese domestic prices for beef and wheat are shown in equations (6) and (7) in table 3. Prior to July 1980, internal beef prices reflected changes in the value of the U.S. dollar. This result is surprising because we assume that quotas on beef imports would cut the link between Japanese and international prices. Domestic beef prices in Japan are stabilized between ceiling and floor prices, which change according to production costs and a moving average index of domestic beef prices over the past 7 years.

The exchange rate pass-through estimated for domestic beef after July 1980, -1.20, indicates that an increase in the value of the dollar against the yen was associated with a decline in Japanese beef prices relative to U.S. prices on average during this period. Such effects of this pass-through show that the stabilization prices for beef were unchanged from Japanese fiscal year 1981 to fiscal year 1985 due to concerns over large budgetary expenditures for beef and pressures to increase import quotas.

Equation (7) shows that changes in domestic prices for wheat prior to July 1980 were associated with exchange rate changes, but had a lagged effect. Changes in resale prices for wheat are normally effective around February and are held constant for the remainder of the year. However, Japanese wheat resale prices during the estimation period changed only 5 times out of the 22 observation periods. Japanese wheat prices had lagged changes in the yen/U.S. dollar exchange rate, probably because exchange rates and U.S. wheat prices moved in opposite directions prior to 1981. For example, an increase in the U.S. wheat price was generally associated with a decline in the yen/U.S. dollar exchange rate. Thus, no change in the internal Japanese price was consistent with the LOP during this period. After 1981, U.S. wheat prices and exchange rates moved in the same direction so that a constant domestic Japanese resale price was no longer consistent with the LOP.

While suggesting a structural change in exporter/importer behavior for soybeans, corn, and imported beef after July 1980, the estimated equations in table 3 do not specifically indicate how this behavior changed after this period. For instance, when the dollar increased against the yen after July 1980, did traders limit the amount of the exchange rate pass-through in contrast to their passing on any decreases in the value of the dollar (as suggested by Spittaller), or did the opposite occur? Table 4 is designed to address this question. The results in this table differ from those in table 3: interaction variables representing specific increases or decreases in the value of the yen against the dollar before and after July 1980 are included to test for a change in exporter behavior for imported beef, corn, and soybeans.

Table 4--Regression of changes in relative prices on changes in the exchange rate, 1974-84

1. Beef import	$PD_1 = -.009 + 4.390^*X_1 - 7.861^{**}DBX_1 - 3.176E_1X_1 - 3.837E_2X_1 - 5.975^{**}E_3X_1$ $(-1.32) \quad (2.50) \quad (-2.34) \quad (-1.33) \quad (-1.92) \quad (-2.33)$	$\bar{R}^2 = .30$ $N = 22$ $DW = 2.40$
2. Corn	$PD_1 = -.003 + 2.031^*X_1 - 1.388^{**}E_1X_1 - .830E_2X_1 - 2.485^{**}E_3X_1$ $(-1.76) \quad (5.42) \quad (-2.71) \quad (-1.94) \quad (-4.52)$	$\bar{R}^2 = .74$ $N = 22$ $DW = 2.10$
3. Soybeans	$PD_1 = .019 + 1.235^*X_1 - 4.771^{**}DSX_1 - .617E_2X_1 - 1.286^{**}E_3X_1$ $(1.12) \quad (4.61) \quad (-4.23) \quad (-1.05) \quad (-2.65)$	$\bar{R}^2 = .59$ $N = 22$ $DW = 2.55$

Notes: PD_1 = Percentage change in Japanese price minus percentage change in U.S. price over 6-month periods.
 X_1 = Concurrent percentage change in Japanese price of U.S. dollar.
 DB = Denotes prohibitive import quotas on beef. $DB = 1$ January 1974-December 1975; = 0, all other periods.
 DS = 1 January 1974-December 1975; = 0 all other periods.
 E_1 = 1 for a decrease in the yen/U.S. dollar exchange rate prior to July 1980; = 0 all other periods.
 E_2 = 1 for an increase in the yen/U.S. dollar exchange rate after July 1980; = 0 all other periods.
 E_3 = 1 for a decrease in the yen/U.S. dollar exchange rate after July 1980; = 0 all other periods.
 $()$ = t-values.
 $*$ Indicates coefficients are statistically different from zero using a 0.05 level one-tailed t-test;
 $**$ Indicates coefficients are statistically different from zero using a 0.05 level two-tailed t-test.

Table 4 also indicates significant changes in exporter/importer behavior with respect to whether the yen/U.S. dollar exchange rate increased or decreased both before and after July 1980. The behavior suggested by the estimated results differs from that suggested by Spittaller in that a ratchet effect holds, with exchange rate changes passed on in full in the case of an appreciation of the dollar, but held back in the case of a dollar depreciation. Lack of exchange rate pass-through for a dollar depreciation in the second period, in which the overall trend in dollar values was increasing, suggests that traders viewed the dollar declines as temporary, and thus adjusted the prices of their exports to offset the dollar decline.

The estimated coefficient for corn on X_1 indicates that a 1-percent appreciation of the dollar in the first period (prior to July 1980) resulted in a 2-percent increase in the Japanese import price relative to the U.S. price. This coefficient is significantly different from 1 at the 5-percent confidence level, thus indicating that Japanese import prices tended to overshoot the LOP with respect to an increase in the value of the dollar. However, a 1-percent depreciation of the dollar during this period resulted in only a 0.64-percent pass-through. In the second period (after July 1980), a 1-percent increase in the value of the dollar against the yen resulted in a 1.2-percent pass-through. This coefficient is not significantly different from 1, thus indicating the LOP held for a dollar appreciation during this period. However, a 1-percent decline in the dollar during this same period resulted in -0.45-percent pass-through, suggesting that U.S. exporters tended to raise their export prices to offset the effect of a dollar decline.

No significant difference in exporter behavior for soybeans was found with respect to a depreciation or appreciation in the first period. The LOP applied in both of these cases. Similar to corn, in the second period exporters passed through an exchange rate change for an appreciation of the dollar, but not for a depreciation.

Exporters and/or importers of beef seemed to adjust their selling prices with an exchange rate change to capture some of the profits from the beef program in Japan. The estimated coefficient on X_1 of 4.390 indicates that a 1-percent appreciation of the dollar resulted in a 4-percent increase in the Japanese import price relative to the U.S. price in the first period. With import quotas on Japanese beef imports, exporters and/or importers tended to use the occasion of a temporary increase in the value of the dollar to extract some of the quota rent by further increasing the yen import price. However, because of the high standard error on this coefficient, it statistically differs from 1 only at the 10-percent level of confidence. The estimated pass-through of -1.585 for a depreciation of the dollar in the second period suggests that exporters and/or Japanese importers tended to raise their selling prices to capture some of the windfall gain from a dollar decline. The remainder of the results for imported beef suggests a lower estimated exchange rate pass-through for a dollar depreciation in the first period and approximate pass-through of a dollar appreciation in the second period.

No significant difference in exporter behavior with respect to an exchange rate increase or decrease was found for wheat and cotton. U.S. exports of these commodities have relatively small market shares, as compared with those of corn and soybeans. This greater degree of competition for wheat and cotton may explain why exporters were more willing to pass on dollar declines for these commodities during the second period.

CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

To fully understand the impact of exchange rate changes on prices, and to quantify the impact on world trade, much more research must be done on the behavior of importers and exporters. Most analyses of exchange rates and trade include price arbitrage for traded goods as a necessary condition for determining the effects of exchange rates on U.S. price and export demand. Agricultural commodities are generally treated as flex-price goods; prices of imported commodities in the domestic currency of the importing country are therefore assumed to vary in proportion with the exchange rate. This report tends to substantiate this claim, at least during the seventies, although significant deviations from the LOP were obtained in certain instances during this period. These deviations were the result of both Japanese and U.S. trade policy interventions, as well as international events which occurred outside the agricultural sector, such as the OPEC oil price increases of 1973/74.

For cotton, corn, and soybeans, commodities which are freely traded by Japan, exchange rate changes during the seventies were passed through completely and fairly rapidly by exporters and Japanese importers. For beef and wheat, products on which Japanese import and domestic price controls exist, a large exchange rate pass-through was also obtained, at least to the import price. The estimated exchange rate pass-through for beef, however, was occasionally affected by Japanese import controls. On the import side, some pass-through was found for domestic beef prices, whereas lagged exchange rate changes were associated with changes in domestic Japanese wheat prices relative to U.S. wheat prices.

While unchanged for wheat and cotton, a relatively low average exchange rate pass-through was found for soybeans, corn, and beef in the eighties--a period in which the dollar on average appreciated against the yen. Exporters of soybeans, corn, and beef passed on an exchange rate increase during this period, but not a decline in the dollar. This suggests, in the case of corn and soybeans, that dollar declines were viewed as temporary, and therefore did not affect exporters' behavior. For beef imports, which are restricted by quotas, exporters and/or importers used the decline in the value of the dollar to raise their prices and capture some of the quota rents which would otherwise go to the LIPC.

Although it is difficult to generalize from an analysis of exchange rate changes on traded goods prices for just two countries, agricultural commodity prices may not be as flexible as commonly perceived. Thus, studies such as the one by Batten and Belongia (which estimated the average impact on import demand of a change in the value of the dollar during the seventies and eighties) may be biased downward because a lack of a pass-through when the dollar declined in the eighties would have lowered the average response of imports to exchange rates. Moreover, recent declines in the U.S. dollar, if they are perceived to be permanent, should have a more important effect on lowering foreign prices for U.S. agricultural commodities, and thereby increasing U.S. export demand. More research on exporter and importer behavior is required to more fully understand the impact of exchange rate changes on U.S. agricultural trade.

REFERENCES

- (1) Batten, Dallas, and Michael T. Belongia. "The Recent Decline in Agricultural Exports: Is the Exchange Rate the Culprit?" St. Louis Federal Reserve. Review. 66 (1984). pp. 5-14.
- (2) Chattin, Barbara, and John E. Lee. "United States Agricultural Policy in a 'Managed Trade' World," in United States Farm Policy in a World Dimension, Special Report 305. Agr. Exp. Stat., Univ. Missouri at Columbia. Nov. 1983, pp. 18-27.
- (3) Collins, Keith J., Willie H. Meyers, and M.E. Bredahl. "Multiple Exchange Rate Changes and U.S. Agricultural Commodity Prices," American Journal of Agricultural Economics. 62 (1980). pp. 656-65.
- (4) Dohner, Robert S. "Export Pricing, Flexible Exchange Rates, and Divergence in the Prices of Traded Goods," Journal of International Economics. 16 (1984). pp. 79-101.
- (5) Dunn, Robert M. "Flexible Exchange Rates and Oligopoly Pricing: A Study of Canadian Markets," Journal of Political Economy. 78 (1970). pp. 140-51.
- (6) Frenkel, Jacob A. "Flexible Exchange Rates, Prices, and the Role of 'News': Lessons from the 1970's," Journal of Political Economy. 89 (1981). pp. 665-705.
- (7) Krissoff, Barry, and Stephen Haley. "An Analysis of Agricultural Export Variation," unpublished paper. U.S. Dept. Agr., Econ. Res. Serv. March 1986.
- (8) Longmire, Jim, and Art Morey. Strong Dollar Dampens Demand for U.S. Agricultural Exports. FAER-193. U.S. Dept. Agr., Econ. Res. Serv. Dec. 1983.
- (9) Longworth, John W. Beef in Japan. New York: University of Queensland Press, 1983.
- (10) McCalla, Alex F. "Impact of Macroeconomic Policies upon Agricultural Trade and International Agricultural Development," American Journal of Agricultural Economics. 64 (1982). pp. 861-68.
- (11) McKinnon, Ronald I. "The Exchange Rate and Macroeconomic Policy: Changing Postwar Perceptions," Journal of Economic Literature. 19 (1981). pp. 531-57.
- (12) Protopapadakis, Aris, and Hans R. Stoll. "Spot and Futures Prices and the Law of One Price," The Journal of Finance. 38 (1983). pp. 1431-55.
- (13) Schuh, G. Edward. "Future Directions for Food and Agricultural Trade Policy," American Journal of Agricultural Economics. 66 (1984). pp. 242-47.
- (14) Spittaller, Eric A. "Short-Run Effects of Exchange Rate Changes on Terms of Trade and Trade Balance," IMF Staff Papers. 27 (1980). pp. 320-48.

APPENDIX: VARIABLE NAMES USED IN FIGURES 1-8 1/

EXR - Yen/U.S. dollar exchange rate

JBIP - Japanese beef import price in yen

JBP - Japanese beef wholesale price in yen

JCP - Japanese corn wholesale price in yen

JCTP - Japanese cotton wholesale price in yen

JSP - Japanese soybean wholesale price in yen

JWIP - Japanese wheat import price in yen

JWP - Japanese wheat wholesale price in yen

USBP - U.S. beef wholesale price in dollars

USCP - U.S. corn wholesale price in dollars

USCTP - U.S. cotton wholesale price in dollars

USSP - U.S. soybean wholesale price in dollars

USWP - U.S. wheat wholesale price in dollars.

1/ Figures 1-8 present the semiannual percentage changes in these values.
See text for additional explanation and sources of data.

Figure 1. Changes in the Japanese Yen/U.S. Dollar Exchange Rate, 1974-84

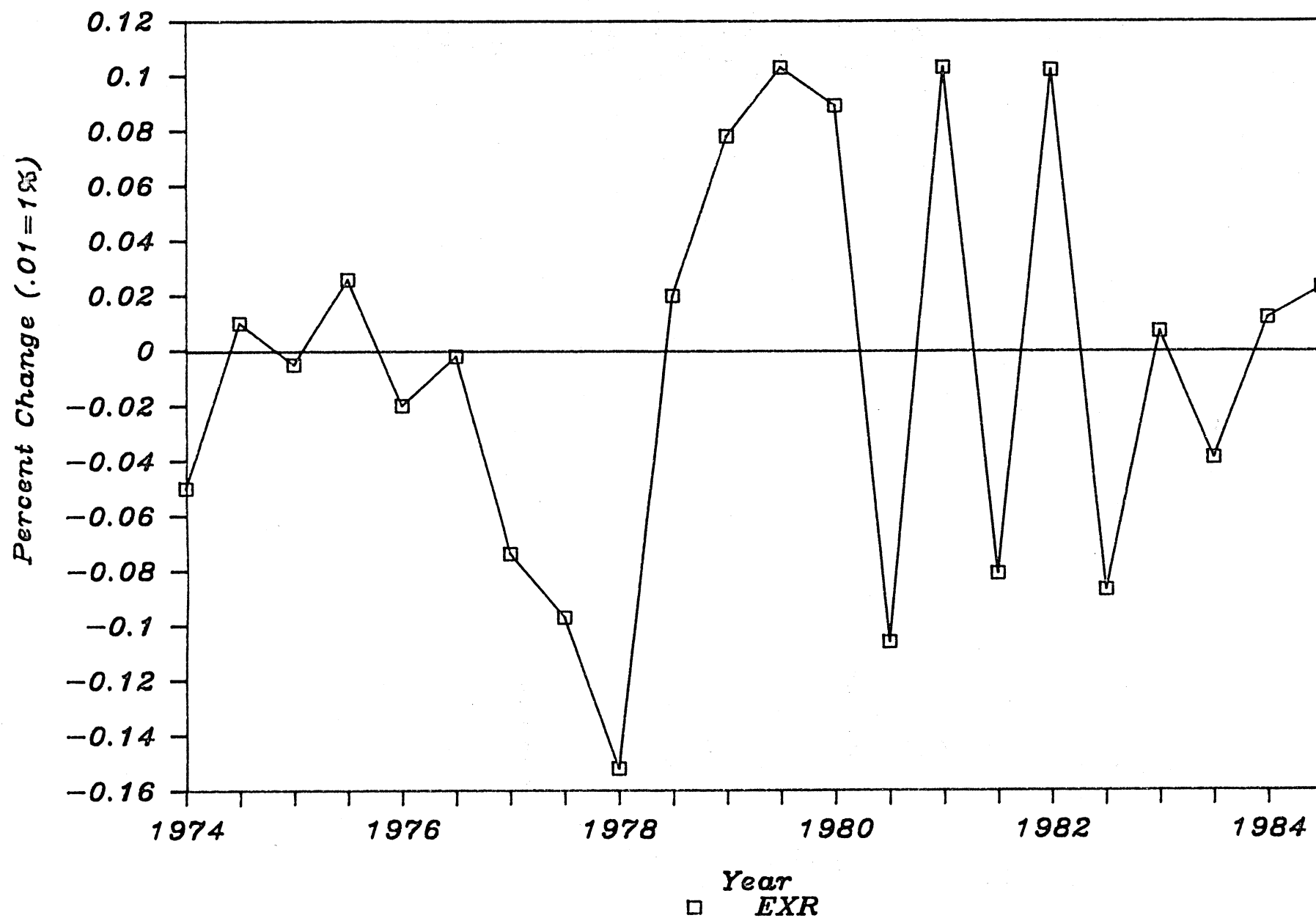


Figure 2. Six-Month Changes in U.S. Domestic and Japanese Wheat Import Prices and Exchange Rate, 1974-84

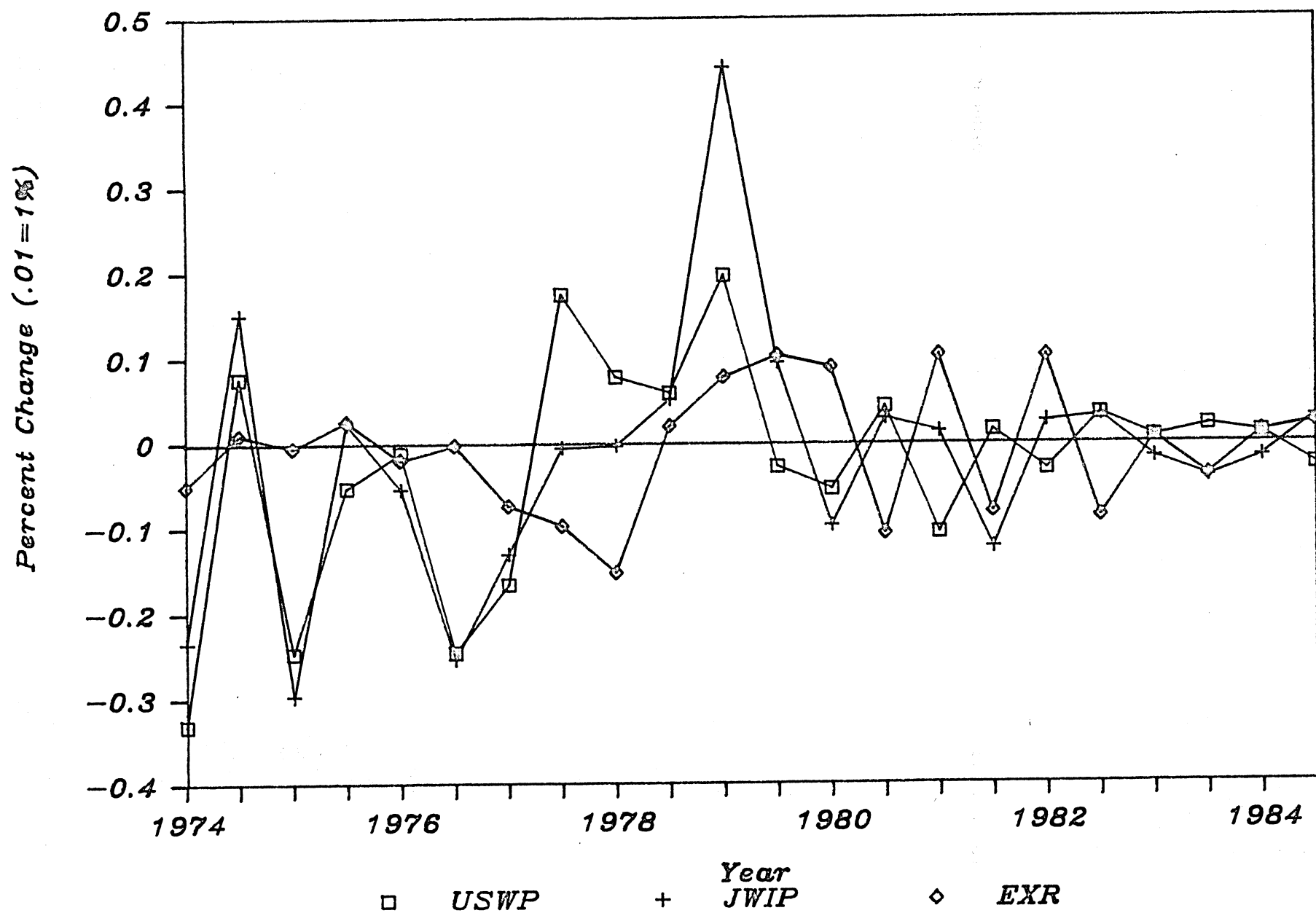


Figure 3. Six-Month Changes in U.S. and Japanese Corn Prices and Exchange Rate, 1974-84

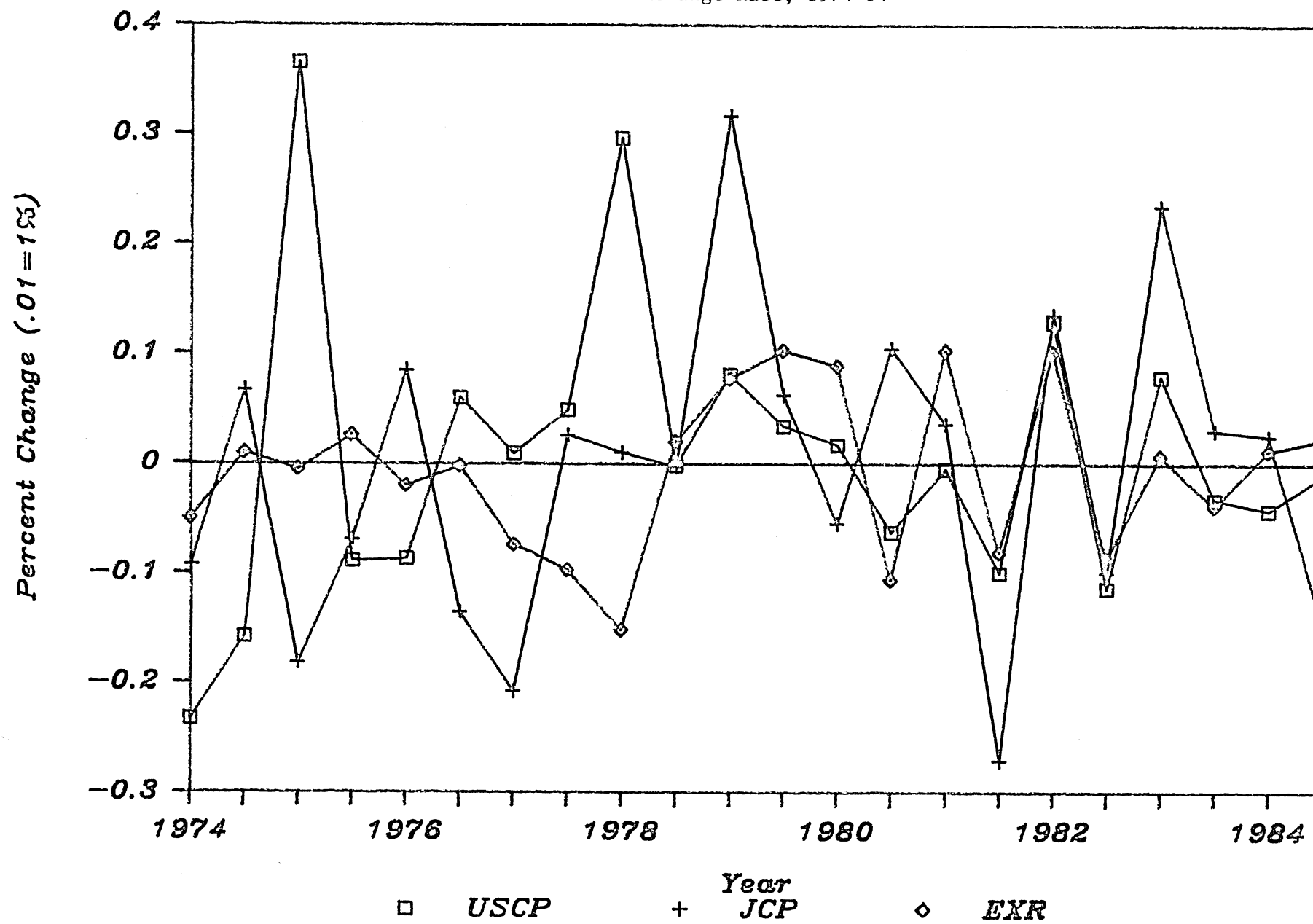


Figure 4. Six-Month Changes in U.S. and Japanese Soybean Prices
and Exchange Rate, 1974-84

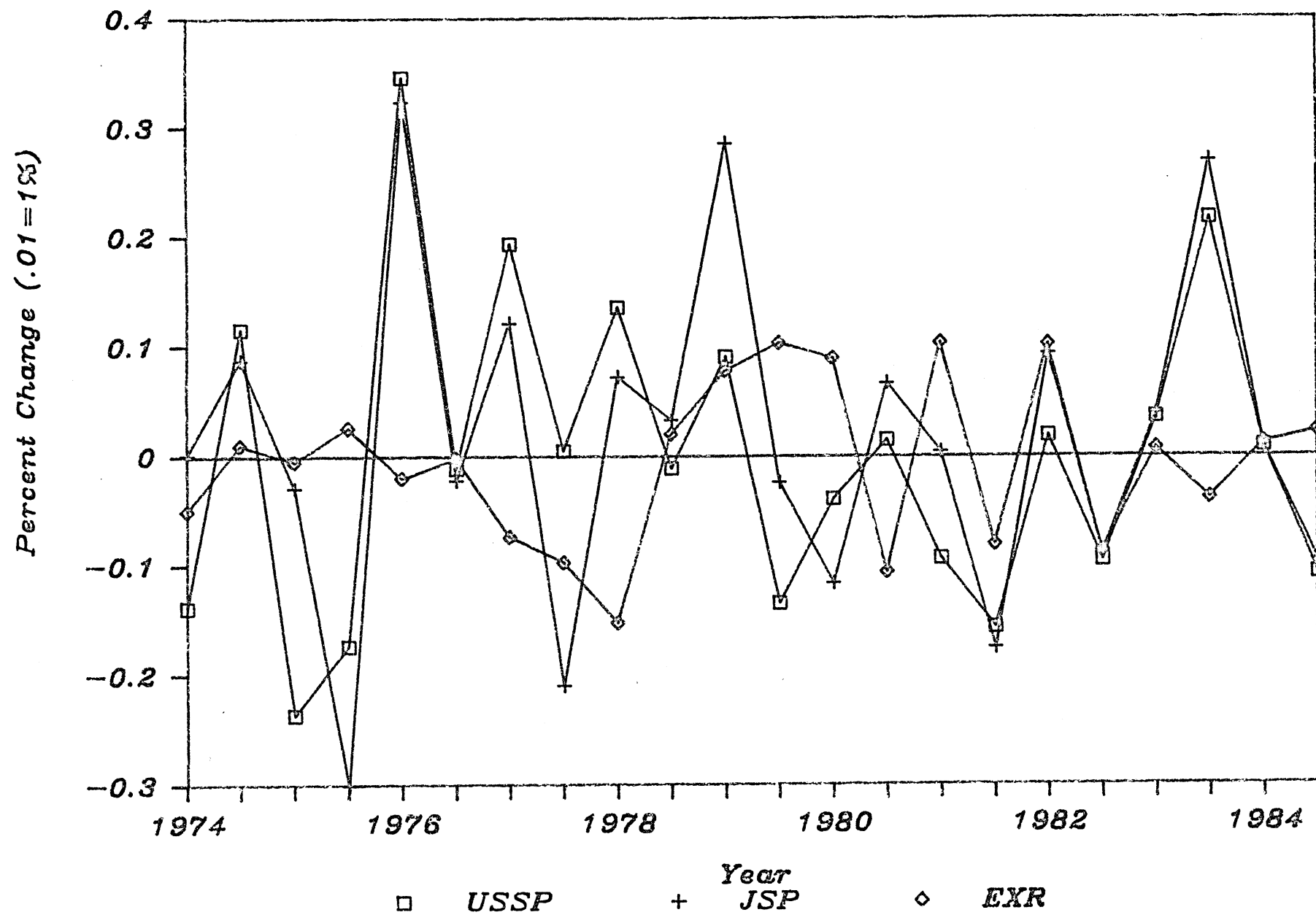


Figure 5. Six-Month Changes in U.S. and Japanese Cotton Prices and Exchange Rate, 1974-84

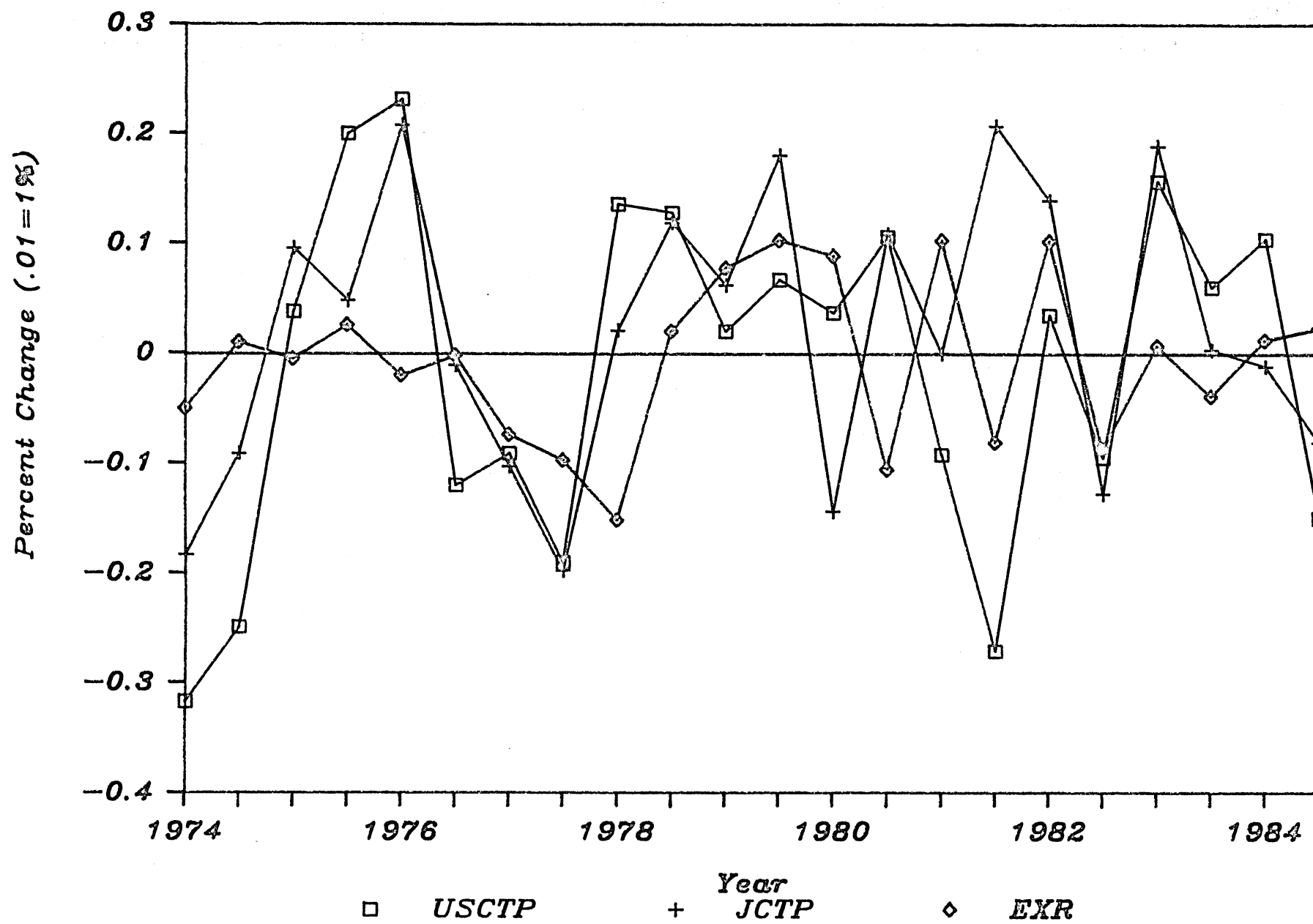


Figure 6. Six-Month Changes in U.S. Domestic and Japanese Import
Beef Prices and Exchange Rate, 1974-84

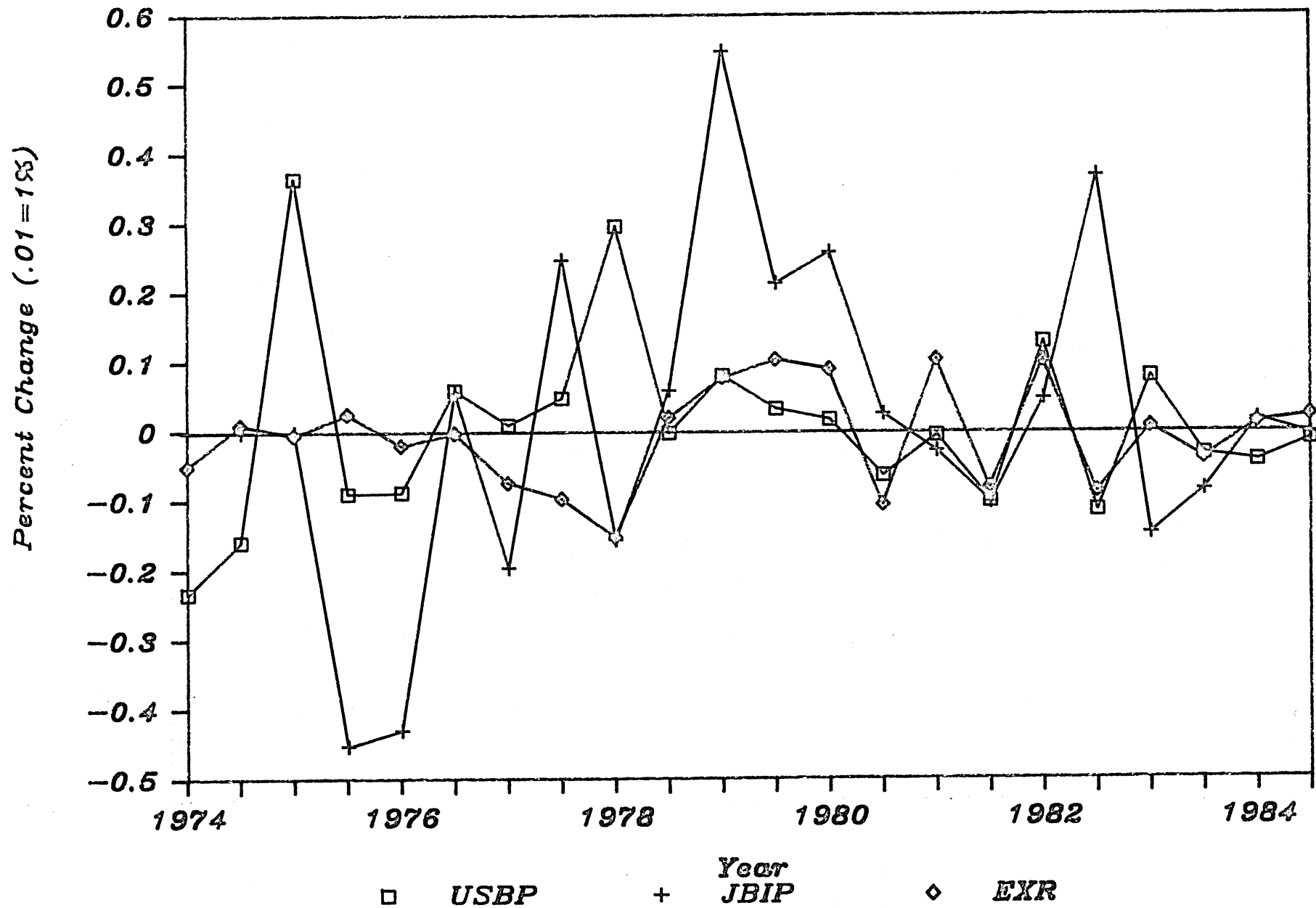


Figure 7. Six-Month Changes in U.S. and Japanese Domestic Wheat Prices and Exchange Rate, 1974-84

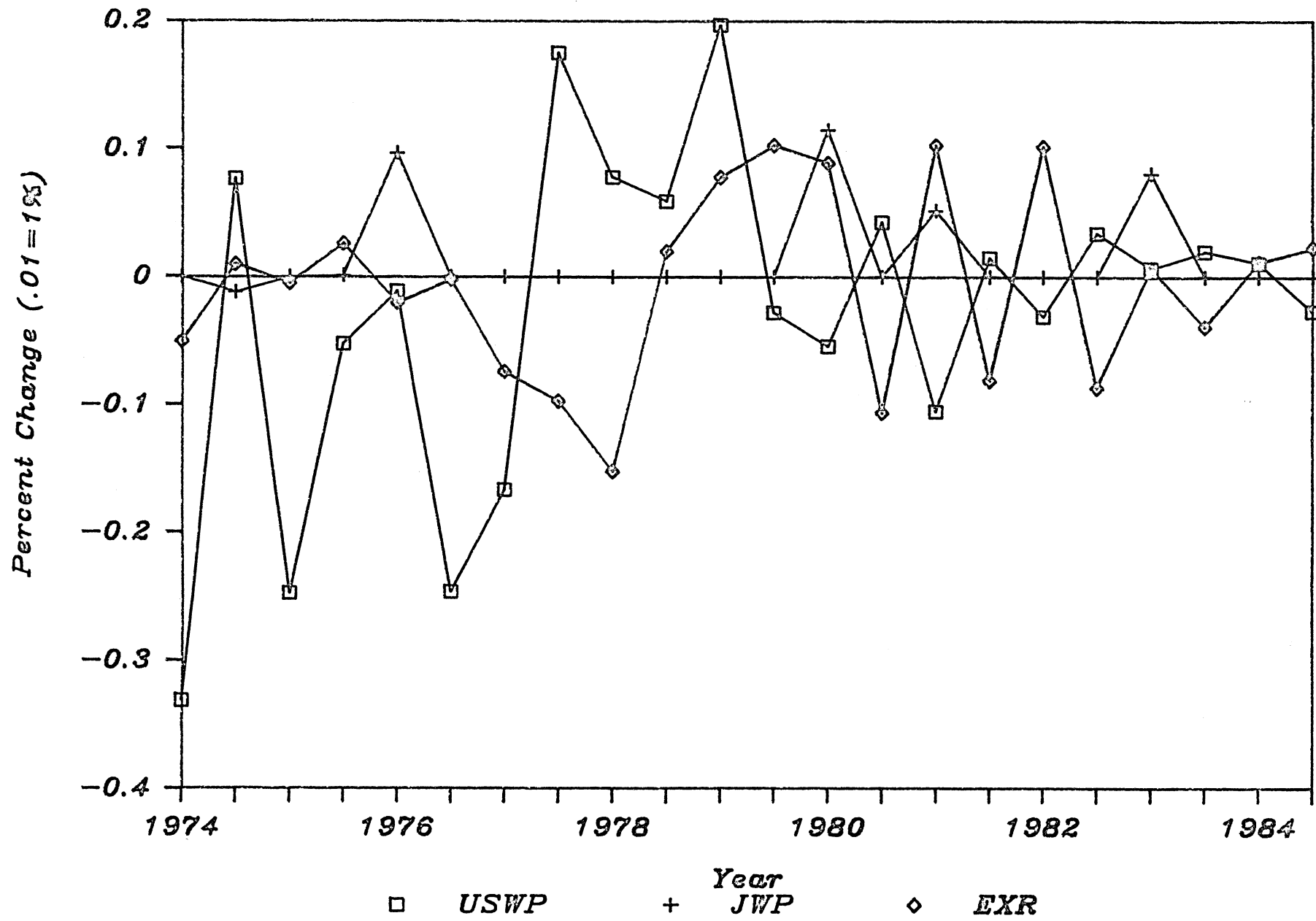


Figure 8. Six-Month Changes in U.S. and Japanese Domestic Beef Prices and Exchange Rate, 1974-84

