DOLLAR EXCHANGE RATE VARIABILITY AND AGRICULTURAL POLICY: CONSEQUENCES ON WORLD AGRICULTURAL PRICES WITH REFERENCE TO ARGENTINA

by

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VIII Latin American Meeting of the Econometric Society (San Jose de Costa Rica)

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The purpose of this paper is to analyze the consequences of dollar real exchange rate changes in agricultural markets with special reference to Argentina. This is done under different assumptions concerning exchange rate policies for Argentina and other countries involved, and also under different assumptions on market structure. Another main interest is also to know how U.S. agricultural and trade policies influence the markets in which Argentina sells its products.

Conclusions of the analysis are that a real dollar exchange rate change will have several consequences for world agricultural product markets. An appreciation of the dollar will result always in a lower price for the product with uncertain effects on the quantity traded. This will depend upon the elasticities and shifts of the world demand and supply functions, which reflect their respective rates of exchange, their relative importance in the world market and their net trade positions.

The domestic impacts will depend upon their respective exchange rate regimes. The U.S. and other exporters with exchange rates pegged to the dollar will lose, since will sell less at a lower price. Countries with floating exchange rate to the dollar (as Argentina in our example), will most probably benefit (as a whole) since, in spite of the lower international price for the product, quantity exported and foreign exchange earnings will most likely increase.

For a real dollar depreciation conclusions are reversed.

The U.S. agricultural policy is introduced in the model through the effects of the loan rate. For a real appreciation of the dollar, the combination of stocking with support pricing will lead to a higher U.S. domestic price than that of the world market, with less quantity exported. In the short run this could lead to a slight increase in the world market price. However, in the long run, as the U.S. and, consequently, the world stocks will be increasing, this will tend to lower the world price.

Econometric work done thus far, shows results according with the model, while it is expected that better results could be obtained if a longer period is examined. However, much has still to be done, specially with respect to the consequences for Argentina.

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I. INTRODUCTION

Great advances in research have been made in recent years to integrate macroeconomic and specific -agricultural and commercial- policies.

With respect to macroeconomic variables, while the majority of authors think the linkage goes from macro variables to agricultural markets, others focus on agriculture as a source of instability within the overall economy.

This reasoning was mainly influenced by explosive changes in food and oil prices occurred in the early seventies. Nevertheless, David Orden (1986) has found little evidence of impacts on the macroeconomic variables arising from shocks to agricultural exports or prices.

Among macroeconomic variables, the exchange rate is one of the most important one, principally when -as Orden pointed out- the exchange rate moves markedly, as it has over the last years, regardless of the underlying causes for the exchange rate realignment. That is, the exchange rate itself is the main macroeconomic variable of interest for some purposes.

For most world agricultural products, the United States dollar exchange rate is of extreme importance, since the majority of agricultural prices are set in this currency.

Consequences of changes in the dollar real exchange rate have been studied for domestic United States (U.S.) markets and also for

the world and overseas markets.

According to Johnson, Grennes, and Thursby (1977) "an insightful paper by Schuh called attention to the relationship between currency markets and agricultural product and factor markets. He argues that overvaluation of the dollar prior to 1971 depressed the prices of U.S. agricultural products...". The authors say that their article is an attempt to test that hypothesis by considering the exchange rate and other explanatory variables that should also affect agricultural prices and compare their relative importance. The variables selected from orthodox trade theory are tariffs, export taxes, and transport costs. They found many distortions in the agricultural pricing of grains. In addition to a dollar devaluation that took place in the early seventies, all major importers and exporters, except the United States, adopted protective policies to insulate their consumers from sharply rising prices. They found that a dollar devaluation had a smaller impact on the U.S. domestic price than foreign commercial policy, and that fragmentary evidence indicated that continuation of distortions in U.S. shipping policy was as important as the devaluation of the dollar.

Chambers and Just (1979) say that, thus far, the results have been mixed. While Schuh, Fletcher, Just, and Schmit have suggested that exchange rate devaluations have been an important determinant of agricultural exports and have led in part, to the high domestic prices of the early 1970s, Vellianitis-Fidas, Kost, and Greenshields -like Johnson, Grennes and Thursby- have found that the exchange rate devaluation had relatively little impact on the agricultural sector of the economy. Chambers and Just say that it appears that the

divergence in the results may be due to the alternative specification of export or excess demand and supply equations, and therefore, their purpose on their paper is to review critically both the theoretical and empirical results. They found that empirical results including a separate exchange rate variable have tended to suggest that U.S. agricultural prices are exchange rate elastic and that exchange rates are important determinants of agricultural trade flows.

Collins, Meyers, and Bredahl (1980) observe that while the dollar has depreciated against the currencies of many developed countries (in the seventies) it appreciated against those of many less developed countries. Therefore, an analytical model that considers multilateral exchange rate is essential. They also incorporate rates of inflation and trade restrictions. An important conclusion is that the computed exchange rate effects on U.S. commodity prices, despite abstractions, consider many factors heretofore ignored by researchers. They say that the strength of the model lies on the simultaneous consideration of prices, consumption and production levels, and exchange rates for a nearly exhaustive set of major trading nations. The advantage of integrating alternative prices and intervention policies is that it moves distinctly toward realism.

Chambers and Just (1981) have found that exchange rate fluctuations have had a significant real impact on agricultural markets by altering the volume of exports and the relative split between exports and domestic use of the three commodities considered: wheat, corn and soybean.

A comprehensive model which integrate macroeconomic variables

with taxes and subsidies in the U.S. agricultural sector is the one of Rausser, Chalfant, Love, and Stamoulis with special emphasis on money markets.

Longmire and Morey (1983) developed a graphic analysis to show how a real appreciation of the U.S. dollar affects trade and prices for the U.S. domestic markets, the U.S. exports and overseas domestic markets. They also analyze how the U.S. Government programs modified market adjustments. Based on Collins, Meyers, and Bredahl (1980), Longmire and Morey developed an analytical model, which is used for the empirical research.

Along the same line of Longmire and Morey (1983), McCalla and Josling (1985) developed a model to analyze the consequences of a U.S dollar appreciation on world, U.S. domestic and overseas wheat and cotton domestic markets. They assume that the wheat market has four participant countries including two exporters, the United States and Argentina, and two importers, Egypt and Mexico.

The purpose of this paper is to advance in this line of work, trying to analyze in more detail the consequences of dollar real exchange rate variability for Argentina. This is done under different assumptions concerning exchange rate policies for Argentina and other countries involved, and also under different assumptions on market structure. A major point of interest is also to study how U.S. agricultural and trade policies influence the markets in which Argentina sells its products. Empirical work is done -in this first step- to test the effect of the variables considered on the international prices relevant for Argentina. A future task will be to estimate the impact on Argentine export markets, on how argentine

exchange rate behaves with respect to the one of the U.S., its impact on international reserves, domestic markets, changes on welfare, and on prices received by farmers.

II. A SIMPLIFIED WORLD AGRICULTURAL PRODUCT MARKET WITH U.S. AGRICULTURAL POLICY

A. Basic Assumptions

Assume that: 1) The supplier countries are the United States, Argentina and "other countries" (OC). On the demand side let us consider just "other countries".

2) There are two international currencies which determine two areas of prices, transactions and payments. The currencies being: a) the U.S. dollar (US$) area, and b) another area composed of a basket of hard currencies represented by the yen. All countries belong to one of these areas and have their exchange rates pegged or floating with respect to one of these currencies. The effect of a change in the exchange rate of one hard currency are, obviously, different according to the type of exchange rate of the various countries. These possibilities are shown in Chart 1 and analyzed below.

CHART 1

EXCHANGE RATES WITH RESPECT TO THE U.S. DOLLAR AND THE YEN

	Pegged Exchange Rates				Floating Exchange Rates	
	Q. of dollars per $ C1	Q. of $ C1 per Yen	Q.of doll. per 1 yen	U.S. doll.	Q. of $ C2 per dollar	Q. of yens per $ C2
I	1	1	1	1	1	1
II	1	1/2	1/2	1	2	1
III	1	2	2	1	1/2	1

References: I. Initial Position (equilibrium). II. U.S. Dollar Appreciation. III. U.S. Dollar Depreciation. $ C1; $ C2: One unit of country 1 (or country 2) currency.

In stage I all currencies have the same value; they can be exchanged one to one. In stage II there is a real appreciation of the dollar. Let us look at this case taking Argentina as an example. If Argentina has a pegged exchange rate to the U.S. dollar, it will also appreciate its currency in the same percentage as the dollar, to keep the same exchange rate. That is to say, for Argentina the value of the dollar will still be at one austral (A). Assuming an appreciation of a hundred per cent, the austral will buy just one half of the number of yens as it did before. If Argentina -or any other country- has a exchange rate floating vis-'a-vis the dollar, a real appreciation of the dollar is equivalent to a depreciation (devaluation) of the austral (and other floating currencies). Argentina gets two dollars for each austral. Obviously, the converse reasoning applies for a dollar depreciation.

B. Floating Exchange Rate for Argentina

1. The Initial Position

Let us start the analysis assuming Argentina has its exchange rate floating vis-'a-vis the dollar. The case is illustrated in Figure 1. Section a) shows the domestic market for Argentina. Demand (Da) and Supply (Sa) functions are depicted as being in australes (A). In absence of foreign trade, the domestic price would be very low since the country has low production costs. Section b) shows the excess supply function of Argentina (ESa) denominated in U.S. dollars. We will assume -as it is the case for most agricultural products- that prices are denominated in U.S. dollars.

In the next panel (section c) the excess supply for the United States (ESus) is depicted, kinked at the internal support price (Ii).

The excess supply of other exporting countries (OA) is not shown, since the supply function of those countries whose currencies are pegged to the U.S. dollar, will behave in similar fashion as the one of the United States. For those with floating exchange rates their supplies will be similar to the one of Argentina. The relevance of looking at them separately will depend upon the market structure for the product analyzed. Summing up horizontally all the excess supply functions (including the ones for other countries yields the world export supply function (Sw) (section d).

Section e) shows the aggregate excess demand function for countries with pegged exchange rates, while the one for countries with floating exchange rates is in section f). The horizontal summation yields the world demand function (Dw).

The world market is in equilibrium at Pw. and quantity traded is Qw. At that price -and assuming neither trade barriers nor transportation costs- Argentina produces qs, sells qd in the domestic market and Q in the world market (section b).

2. A Real U.S. Dollar Appreciation

Now assume that the dollar appreciates in real terms relative to the yen. If Argentina has a floating exchange rate to the dollar, keeping its exchange rate at the initial position relative to the yen has the same effect of a real depreciation (relative to the dollar).

The consequences for the market are as follows: As the Argentine exporters sell their dollars earned in foreign trade in the domestic market, they get now more australes than before for each dollar. The price in australes will be increased in the same percentage as the dollar appreciation. The higher the price the larger the quantity

supplied and smaller the quantity demanded. Analytically, this is equivalent to an ad valorem export subsidy on Argentine exports. An ad valorem subsidy will make the dollar (excess) supply function rotate downward from ESa to ESa' by the percentage of the austral "devaluation" (ceteris paribus).

The dollar appreciation will not have (ceteris paribus) any effect on United States excess supply function, or in other countries with exchange rates pegged to the U.S. dollar. Consequences for countries with floating exchange rates will be similar to the one for Argentina. By adding all the excess supply functions we get the new world supply function, labeled Sw'.

On the demand side, for countries with floating exchange rates to the dollar, a dollar appreciation has the effect of an import tax, rising domestic prices. Consequently, for any international price, demanders will be willing to buy less than before, according with their respective demand curves. In such a case the excess demand curve will rotate downward to the left from EDfr to EDfr', by the percentage of the real appreciation of the dollar. For those countries with exchange rates pegged to the U.S. dollar, their excess demand does not change (ceteris paribus). By adding again horizontally the new excess demand with the unchanged ones we get the new world demand function Dw'.

The new world equilibrium price is Pw', lower than the previous one. The quantity traded will be larger or smaller depending upon the elasticities and on the size of shifts of the world demand and supply functions. These functions reflect the characteristics of different countries: such as their rates of exchange, world market share and

net trade positions. In this example, quantity traded is also less than before.

Let us now analyze the impacts on domestic markets. At the new world price Pw', Argentine exporters increase sales from Q to Q'. In spite of the fact that the international price is now lower, Q1 translates to austral price via the old excess supply function ESa. This results in an increase in domestic (austral) prices to Pa'. Producers are now better off and, obviously, consumers are worse off. The Argentine foreign exchange earnings in this example are marked in Figure 1 b) by vertical hatching, while losses, as a consequence of the lower international price, are marked by horizontal hatching. The net gains in foreign exchange depends upon the elasticities of the Argentine excess supply functions and the elasticities of the world demand and supply functions. The more inelastic the supply and demand functions, the greater will be the decrease in price. The greater the number of suppliers the more elastic will be the supply function and the smaller will be the decrease in price. If Argentina is a small country in the market for a particular product, its impact on the world supply and in the change on price will be small. This will benefit Argentina since the gains in foreign exchange could be much greater than the losses and the producers' income will also increase.

The United States sells less at a lower price, which means losses in foreign exchange -shown in section c) by the horizontal hatched area. There are also increases in Government costs as surpluses increase and prices fall bellow support levels.

On the demand side, impacts will depend upon the rate of exchange. Those countries with pegged exchange rates to the dollar

will benefit since they will buy more quantity at a lower price and, in terms of welfare, consumers will be better off, as the consumer surplus increases. If the agricultural good is produced in the country, farmers will be, obviously, worse off -unless the government pays a subsidy, in which case the society will lose part of the benefits gained by importing the product at a lower price. With respect to foreign exchange earnings, net gains will depend upon the elasticities of the respective demand functions for each country. If the demand is inelastic, as we assumed in the example, the fall in the international price will yield a net foreign exchange saving. Conversely, if the demand is elastic, the country will spend more on imports.

For countries with floating exchange rates the effects are much more complicated. Whether the country will buy more or less depends upon the elasticity of their excess demand functions (the old one and the new one) and how much the international price has really fallen. Most probably the country will buy less, as it is the case in this example. Consumers will have to pay more; the new quantity qd' must be converted in domestic currency oft the old excess demand function EDfr. Also welfare, measured by the consumer surplus, will decrease. Producers will be better off, since they will get a higher price for more production, which could substitute partially or totally the reduction in imports depending the elasticities of supply and demand functions. Finally, concerning the foreign exchange earnings, the country will always spend less.

Summarizing, a dollar appreciation will always result in a lower world price for the product with uncertainty in the quantity traded

The United States and other exporters with pegged exchange rates to the dollar will definitely lose, since they will sell less at a lower price. Argentina and other exporters with floating exchange rate will probably benefit since, in spite of the lower price, the quantity exported and foreign exchange earnings will most likely increase

The analysis for a specific agricultural export product for Argentina will lead to a more accurate conclusion. The best situation for Argentina is when all the importing and exporting countries have pegged exchange rates to the dollar and Argentina is a small country with floating exchange rate. In this very particular case the world price will remain the same and Argentina will get the biggest increase in foreign exchange earnings and Argentine producers the highest domestic price. If Argentina is a big country in the market of this product, the international price will tend to fall and traded quantities will increase. For Argentina, foreign exchange earnings and domestic prices will decrease. Assuming that exporters with floating exchange rates enter to the market, the price will tend to decrease more and the quantity traded to increase. The entry of importing countries with floating exchange rates will lead to the model already discussed.

3. Removing the "Ceteris Paribus" Clause

If we now remove the "ceteris paribus" clause, a real appreciation of the dollar (an austral "devaluation") would lead to several other effects, both on supply and demand.

On the supply side: a) It will lead to an increase in production costs since the price of imported inputs will now increase

by the percentage of the "devaluation". Although imported inputs are not a significant part of total costs, the supply function will still rotate slightly to the left.

b) As a consequence of the increase in prices of agricultural traded goods relative to the agricultural non-traded goods, farmers will try to increase the production of the former. There are three possibilities (or a combination of them): 1) To devote more land, although there is not too much room to do this since production of the Pampean Region is almost totally traded. However, a reallocation of land could take place in favor of grain by moving breeding cattle to marginal zones where no export production is possible. Land devoted to dairy products could partially be reallocated to grain production, since some of their exports are done with a private subsidy -from the same dairy farmers and the dairy industry. 2) Better relative prices for traded goods will lead to an increase in production by introducing new technology, which usually will lead to 3) increasing inputs other than land; mainly by increasing the use of industrial inputs like fertilizers, chemicals and equipments (with some imported components). These increments in production will shift the domestic supply function to the right to Sa" and a new excess supply function for Argentina ESa' should appear to the right of ESa. All these movements are depicted in Figure 1, sections a', b', and c'.

On the demand side, the "devaluation" of the austral increases prices of traded goods (mainly "wage goods") and inputs for consumer goods and, therefore, the consumer price index (CPI) goes up. Also some other consumer imports will increase in price causing a

reduction in real disposable income for the non-agricultural sector of the economy. As the majority of the argentine population is in this sector, the demand curve shifts to the left, to Da'.

The combination of these two expected shifts, the demand function to the left and the supply function to the right will lead to a shift of the excess supply function to the right to ESa". This will cause an improvement in the results obtained for the "general case".

C. Pegged Exchange Rate for Argentina

If Argentina had a pegged exchange rate, when there is a real appreciation of the dollar, the austral would also appreciate in real terms by the same percentage as the dollar. In this case Argentina will suffer the same consequences as the United States. That is, the excess supply function will not change, ceteris paribus. Therefore, at a lower international price a smaller quantity will be produced and exported, foreign exchange earnings will decrease, and production for domestic market will increase. Consumers will be, obviously, better off, but the country as a whole will loose. Removing the ceteris paribus clause, will probably result in a shift of the excess supply to the left worsening the country's position.

D. Introducing the Effects of United States Agricultural and Commercial Policies in the Market

United States agricultural domestic and trade policies which we assume are most relevant with respect to our work are

a) Export PIK. Among the several instruments of commercial promotion, the most important one is the export PIK. As this program was established for the years 1986-88, it has no effect in the period

analyzed, which finished in 1986.

b) P. L. 480. The Agricultural Trade and Development Assistance Act, known as PL (Public Law) 480 is probably the trade instrument with more tradition. According with this law, the government of the United States can grant food or sell foodstuffs at very favorable conditions to low income countries. To the extend that these countries are not potential demanders in the world agricultural markets, its effects can be ignored.

c. Target price: This policy has the effect of increasing production, as it is higher than the world market price. However, at the same time, as it is combined with land diversion and set-aside, will bring a reduction in production. Its overall effect on world price for each product depends on several circumstances, and one measure could balance the other. For this reason it is not considered in our analysis.

d. Payment in Kind (PIK) Program. This is another important instrument, in force from the agricultural year 1982/83. As this measure has also a short period of overlapping with the period studied, it is assumed it have had no effect.

e. Loan Rate. As this measure could combine support pricing with stocking, it can produce important effects on US exports, US and world stocks, and finally, on world prices. Their expected effect are as follows:

For a real appreciation of the US dollar, it was showed it will result in a lower world price in dollars for the agricultural product, with uncertainty in the quantity traded. The United States will sell less at a lower price. So, the combination of stocking with

support pricing will lead to a higher US domestic price than that of the world market with a less quantity exported. In the short run this could lead to a slight increase in the world market price. However, in the long run, as the US and, consequently, the world stocks will be increasing, this will tend to lower the world price. The loan rate is the most price-distorting aspect of the US cereals program, and for this reason this variable was introduced in the estimated model. It is expected that this policy will have an inverse relationship with the world price in US dollars for the agricultural product. Obviously, world stocks should also be introduced in the model and also an inverse relationship with price is expected.

III. EMPIRICAL RESULTS

A. Data Analysis

In order to get a rough idea of the relationships between the main variables that entered in the model previously discussed, some diagrams will be presented.

Figure 2 shows the behavior of the US dollar effective (nominal) exchange rate (against 15 other industrial-country currencies) and the real exchange rate. The most important thing to notice is the close relationship between both variables.

In Figure 3, prices in 1980 dollars of grains relevant for the U.S. and Argentina are depicted; they are: wheat, corn, soybean, sorghum, and sunflower. They show a slight downward sloping trend, and also a pick during 1973 and a lower one in 1974.

The other figures are associations diagrams constructed in the following way: First the dollar exchange rate is ordered from the

lowest to the highest value observed in the period analyzed. This will give then an increasing "trend" for this variable for the rearranged years. Then the second variable, the one that will be related to the exchange rate, is graphed according to the values that it takes in the corresponding year.

Four association diagrams are presented. Figure 4 shows the association between nominal prices of wheat, corn and soybean with the effective (nominal) exchange rate. While in Figure 5 this association is with nominal prices of sorghum and sunflower. Figure 6 shows the association between real prices of wheat, corn and soybean with the real exchange rate and in Figure 7 the association is with the real prices of sorghum and sunflower.

Figures 4 and 6 shows a clear negative association between the nominal prices of wheat, corn, and soybean with the effective exchange rate; and between the same variables in real terms. This is not the case for sorghum and sunflower, where a small negative association is found.

In the different figures it can be noticed the extreme values of the variables in the years 1973 and 1974. This could be a reflection of the oil crises.

B. Econometric Analysis

1. The Model

In the descriptive and graphical analysis developed in Section II an implicit structural model for price and quantity determination were presented. From this structural model, two reduced equations can be derived, one for price and another for quantity of the agricultural product. For the moment only the reduced form for prices

will be discussed.

Two alternative reduced forms will be proposed. The first assumes instantaneous adjustment; and the second assumes a very simple partial adjustment mechanism. Formally, these two cases are represented by:

(1) $\ln P^i_t = a_0 + a_1 \ln E^j_{t-1} + a_2 \ln LR_{t-1} + a_3 \ln S_t + a_4 D73$

$$a_5 D74 + a_6 t + u_t$$

(2) $\ln P^i_t = b_0 + b_1 \ln E^j_{t-1} + b_2 \ln LR_{t-1} + b_3 \ln S_t + b_4 D73 +$

$$b_5 D74 + b_6 t + b_7 \ln P^i_{t-1} + v_t$$

The variables are defined as:

P^i_t is world prices of wheat, or corn, or soybean;

a1 is a constant;

E^j_{t-1} is the US dollar exchange rate (EE for the effective, and ER for the real).

S^i_t is the stock of wheat, or coarse grains;

D73 is a dummy variable for the year 1973;

D74 is a dummy variable for the year 1974

t is the time trend;

P^i_{t-1} is price of wheat, or corn, or soybean lagged one year.

u_t (or v_t) is the error term what is assumed to be homocedastic, and serially uncorrelated.

The exchange rate and loan rate variables are presented as lagged one year with respect to the dependent variable, because they

represent the expectation of these variables for period t.

The models are presented in logarithm terms, and a nominal and real version of them estimated. Even though the structural model will generate a reduced form in real terms for the prices of goods, exchange rate, loan rate, and stock, it is possible to extend it to the variables in nominal terms.

As the models (1) and (2) are specified, a_1 stands for exchange rate elasticity of price both in the short and long-run; and b_1 represents the short-run elasticity in the partial adjustment model. The same interpretation holds for the other variables. The long run elasticities could be obtained by dividing the short run coefficients by the coefficient of the lagged variable substructed from one.

The coefficient of the time trend represents the average rate of growth of the prices, after having taken out the other determinants of the price behavior. Other variables, not considered in the model, could cause this independent trend.

In equation (2) the lagged variable , $\ln P_{t-1}$, could either represent the partial adjustment of the effects of the independent variables on $\ln P_t$; or one could interpret it as testing the importance of the behavior of $\ln P_t$ as an stochastic process, of the first order autoregressive model. In both cases, it is very convenient to verify the stability of the results of the first model.

2. Econometric Results

For the two models two periods were used for the estimation: Period (a), for the years 1971-1986 (except for corn, which is 1972-1986); and period (b) for years 1975-1986, since the stock variables were available from 1975 on. In all cases, equations with

the highest R^2 and highest t statistics values were selected.

a. Estimates in nominal values.

Table 1 shows the results of the estimates of model (1) in nominal terms. Therefore, the independent variables like the exchange rate, the loan rate, and price lagged one period are also in nominal values. Also for the dependent variable, which is the nominal price of wheat, or corn, or soybean.

For period (a) the R^2 are quite high, but they are lower for period (b), as should be expected as this is only twelve years long. For the same reason the values for the Durbin-Waston test fall in the indeterminate zone.

For both periods the coefficients of the intercept are significant at 99 % confidence level.

All coefficients of the exchange rate variable (EE) have the expected sign according to the implications of the model developed before. For period (a) and for regression W1Nb' in period (b), all are significant at 99 % of. For the other regression of wheat it is significant at 95 % while for corn it is at 90 %.

With respect to the coefficients for the loan rate (LR), one has positive sign and the two others negatives, all in period (a), but only the one for wheat -with positive sign- is significant (at 98 %). For period (b) the coefficients of this variable were not significant and, when included, they lowered both the R^2 and the R^2, so these regressions were not selected. The exception was regression W1Nb, and for that reason was included.

For the stock variable all coefficients have also the expected negative sign, but only the one for equation W1Nb' is significant (at

the level of 95 %). It must be pointed out that the degrees of freedom are few, as it is a very short period. Nevertheless regressions were computed to know if at least the sign of these coefficients are as expected. Neither the stock for corn nor for soybean was obtained, but just for coarse grains (corn, barley and sorghum). As corn is by far the most important of these grains, the stock of coarse grain was used as a proxy for stock of corn. Nevertheless, the stock of coarse grains is not representative for soybean, and for this reason, these regressions were excluded.

For period (a) two dummy variables were introduced to neutralize the effects of the big increment in prices during the oil crisis. The coefficients for both variables are significant at 99 % for wheat; they are not significant for corn, and the dummy variable for 1973 (D73) is significant at 99 % for soybean.

The trend variable is significant in all regressions -many of them at 99 %. As expected in a case of nominal variables, all the coefficients have positive signs -and are quite high-, which means an upward shift of price functions over the time.

Table 2 summarize the estimates for nominal prices of wheat, corn, and soybean under the partial adjustment assumption, model (2). Due to the small number of observations, only period (a) was selected.

In all regressions the R^2 are high. Although not directly applicable, the values for the Durbin-Watson test are showed.

Coefficients for the constant are significant, except for SB2.

The coefficients for the exchange rate all have the expected negative signs and are significant for wheat (98 %), and corn (95 %),

while they are not for soybean. These elasticities are lower than the ones obtained from the instantaneous adjustment model. It has to be remember that these are short run elasticities. In order to get the long run elasticities each coefficient should be divided by the coefficient of the lagged variable subtracted from one.

For the loan rate, the coefficients are positive in the case of corn and S2Na and negative for S2Na', but no one is significant (only the one for corn could be significant at the level of 80 %).

The coefficients for the lagged variable have all positive sign and all are significant. This could be interpreted as indicating that the model is autorregresive of order one. Also, the values for the coefficients of wheat (0.53) and soybean (0.66 and 0.54) would tell that the adjustment of their respective prices to changes in the independent variables will take a little bit more than two years. While for corn the adjustment would take three years, since the coefficient is 0.73.

The dummy variable for year 1973 is significant in all regressions at 99 % and the one for year 1974 is at 95 %. Coefficients for D73 are in the majority of cases higher than for D74, as it was expected according to the higher increase in prices in 1973.

b. Estimates in real values.

But let us now move to the most interesting econometric results, the consequences of real changes of the variables in the determination of the real price of each of the products analyzed. As before, the two models were estimated. The results of model (1) are shown in Table 3, while the ones for model (2) are in Table 4, in

both cases for the same periods (a) and (b).

Looking at R^2 and at $\bar{R}^2$ in Table 3, it can be seen that the degree of explanation for most of the regressions is quite high, and better than the ones for the same model with nominal prices (Table 1). As in the previous cases, and for the reasons already discussed the Durbin-Watson statistics fall in the indeterminate zone.

The coefficients for the constant terms are all significant at 99 %, except for the one of corn in period (b) which is as 90 %.

Estimated coefficients for the real exchange rate all have the expected negative sign in period (a), and all are significant -for wheat at 99 %- except for the corn equation. For period (b) the coefficient in the wheat equation is negative while the one in the corn equation is the only one positive throughout the regressions, but no one significantly different from zero.

The coefficients for the loan rate show negative sign, and in the soybean equation are significant at 99 %. For wheat and corn the coefficient for the loan rate is not significant (for wheat it could be at 80 %).

The stock variable has the expected negative sign. The coefficient in the wheat equation is significant at 90 %, while the one in the corn equation is not.

As before, the dummy variables are significant in the majority of cases, and several at 99 %.

Something very interesting to notice is that the coefficients of trend (all significant, except the ones of wheat) has now negative sign, indicating the diminishing in real prices through both periods. In regressions in nominal values the trend has positive sign and

quite high values f . the coefficients.

Finally, Table 4 summarizes the results of model (2) -partial adjustment assumption- in real terms.

Coefficients of the intercept are significantly different from zero, except in regression of corn in period (a).

All coefficients of real exchange rate have the expected negative sign, but only the one of equation for wheat in period (a) is significant (at 95 %). As in the same model, but for the case of nominal prices, their values are lower than the ones obtained in the instantaneous adjustment model. It should be remembered again that these are short run elasticities; the long elasticities run may be obtained as before.

For the loan rate, the coefficient in the equation for corn is the only one with positive sign through both model in real terms. However it is no significant. In the eqution for wheat and soybean it has a negative sign, but only the last one is significant (at 95 %). As expected -short run elasticity- this is lower than the two other obtained for the same period with model (1).

The stock variable shows the expected negative sign, but in no case it is significant.

Price lagged one period is significant for corn (99 %) and soybean (95 %), but not for wheat in period (a). In period (b) none of the two are significant. No long run elasticity can be obtained, since in the cases when the coefficients for the lagged variable are significant, the coefficients for the other variables are not.

As before, the dummy variables were significant; all at 99 %, except for the one of corn which is at 95 %.

c. Summary.

All exchange rate elasticities have the expected negative sign according to the implications of the model (except for one case, not significant). In 62 % of the regressions estimated the coefficient was significant, most of the times for the models in nominal values. Also the elasticities are higher -in absolute values- for these last cases. Obviously, short run elasticities are lower than the ones obtained by the instantaneous adjustment model. Long run elasticities were not computed, because when the coefficient for the exchange rate was significant, the coefficient of the price lagged was not, and conversely. With respect to each product, wheat is the grain with greater stability and -except for model 1, period (a)- the elasticities are higher than for corn or soybean. This could be showing greater substitutability among corn and soybean.

With respect to the loan rate the most relevant thing is that the only significant coefficient in nominal terms is positive, and that is the sign for most cases for these estimates. However, for the estimates in real terms, all the signs are negative. This is what is expected according with the model. While in nominal values the loan rate combined with stocking can in the short run raise world prices, in the long run and in real terms, it would tend to lower them.

The elasticities of stock all have negative signs, as expected, while only in two cases the coefficients were significant. However it is probably due to the period analyzed being too short.

According with the coefficients of price lagged, adjustment is faster for wheat than for soybean, and specially for corn.

Finally, trend is always positive for the estimates in nominal

values -according with inflation-, but is always negative in real values, indicating the diminishing in real prices through the time for both periods.

Table 1. OLS estimates of the reduced form for nominal prices of wheat, corn, and soybean, under the instantaneous adjustment assumption.

REG.#	VARIABLES							R^2	$\bar{R}^2$	DW
	Const.	Exchg. Rate (EE)	Loan Rate (LR)	Stock (S)	D73	D74	t			
				Period (a): 1971-1986						
W1Na	8.98	-1.43	0.38		0.49	0.36	0.03	0.95	0.92	2.10
	(4.67)	(4.26)	(2.96)		(4.69	(3.72)	(3.37)			
C1Na	14.51	-1.91	-0.44		0.21	0.29	0.09	0.72	0.56	1.45
	(4.44)	(3.66)	(1.18)		(1.20)	(1.60)	(2.35)			
S1Na	14.11	-1.91	-0.34		0.46	0.19	0.07	0.85	0.77	1.22
	(6.58)	(5.41)	(1.37)		(3.42	(1.35)	(3.59)			
				Period (b): 1975-1986						
W1Nb	11.30	-1.32	0.22	-0.39			0.05	0.79	0.67	1.59
	(4.15)	(3.38)	(0.94)	(1.18)			(2.60)			
W1Nb'	12.93	-1.36		-0.57			0.07	0.77	0.68	1.58
	(7.66)	(3.54)		(2.11)			(4.05)			
C1Nb	9.94	-0.92		-0.32			0.05	0.44	0.22	1.62
	(4.39)	(2.01)		(1.61)			(2.19)			

References: W, C, and S are wheat, corn and soybeans respectively. Const. is the constant. D73 and D74 are the dummy variables for years 1973 and 1974, respectively; t is trend, R^2 is the R squared and $\bar{R}^2$ is the adjusted R squared; DW is the Durbin-Watson Statistic. The numbers in parenthesis under the value of the coefficients are the values of the respective t statistic in absolute value. All the coefficients are elasticities except for trend and dummy variables. For corn period (a) is always 1972-1986. Source: Prices, Bolsa de Cereales de Buenos Aires, Numero Estadistico 1986; Exchange rates: Morgan Guaranty Trust Company of New York, "World Financial Markets", several issues; Loan rate: US Department of Commerce, Statistical Abstract of the United States, 1987 (the loan rate was deflated by the US WPI source: IMF, IFS); Stocks, FAO, Monthly Bulletin, several issues.

Table 2. OLS estimates of the reduced form for nominal prices of wheat, corn, and soybean under the partial adjustment assumption.

REG.#	VARIABLES								R^2	$\bar{R}^2$	DW
	Const.	Exchg. Rate (EE)	Loan Rate (LR)	Stock (S)	Price Lagged (P_{t-1})	D73	D74	t			
					Period (a): 1971-1986						
W2Na	7.69 (2.76)	-1.25 (2.75)			0.53 (2.92)	0.49 (3.30)		0.02 (1.49)	0.88	0.83	1.94
C2Na	3.96 (2.36)	-0.79 (2.38)	0.21 (1.74)		0.73 (4.21)	0.53 (3.22)	0.35 (2.58)		0.84	0.75	2.18
S2Na	3.58 (1.94)	-0.53 (1.48)	0.09 (.81)		0.66 (4.39)	0.56 (4.37)			0.85	0.80	2.07
S2Na	7.58 (1.77)	-1.03 (1.72)	-0.16 (0.59)		0.54 (1.91)	0.54 (3.97)		0.03 (1.04)	0.87	0.80	1.88

References: Same as Table 1.

Table 3. OLS estimates of the reduced form for real prices of wheat, corn and soybean, under the instantaneous adjustment assumption.

REG.#	VARIABLES							R^2	$\bar{R}^2$	D'
	Const.	Exchg. Rate (ER)	Loan Rate (LR)	Stock (S)	D73	D74	t			
				Period (a): 1971-1986						
W1Ra	11.48	-1.07	-0.43		0.47	0.45	-0.01	0.92	0.88	1.6
	(8.70)	(4.16)	(1.74		(4.27)	(4.03)	(1.64)			
C1Ra	9.27	-0.48	-0.46		0.27	0.32	-0.03	0.84	0.74	1.6
	(4.39)	(1.26)	(1.44)		(1.61)	(2.09)	(2.50)			
S1Ra	8.41	-0.77			0.52	0.24	-0.03	0.86	0.81	1.2
	(5.98)	(2.49)			(3.70)	(1.78)	(3.42)			
S1Ra'	10.26	-0.88	-0.36		0.53	0.20		0.87	0.82	1.3
	(7.93)	(3.02)	(3.55)		(3.81)	(1.41)				
S1Ra"	10.52	-0.92	-0.38		0.52	0.18		0.87	0.82	-.-
	(7.52)	(3.00)	(3.44)		(3.54)	(1.20)				
				Period (b): 1975-1986						
W1Rb	8.58	-0.41		-0.52			-0.01	0.88	0.84	1.5
	(5.22)	(1.05)		(1.96)			(0.82)			
C1Rb	4.94	0.24		-0.23			-0.05	0.87	0.81	2.3
	(2.20)	(.57)		(1.33)			(2.13)			

References: Same as Table 1, except that all the variables are real.

Table 4. OLS estimates of the reduced form for real prices of wheat, corn, and soybean, under the partial adjustment assumption.

Reg.#	VARIABLES							R^2	$\bar{R}^2$	DW
	Const.	Exchg. Rate (ER)	Loan Rate (LR)	Stock (S)	Price Lagged P_{t-1}	D73	D74			
				Period (a): 1971-1986						
W2Ra	7.60	-0.84	-0.17		0.33	0.57	0.41	0.92	0.88	1.31
	(2.43)	(2.49)	(.56)		(1.60)	(5.34)	(3.42)			
C2Ra	2.62	-0.37	0.09		0.70	0.49	0.29	0.86	0.78	2.32
	(0.75)	(1.03)	(.26)		(3.01)	(3.68)	(2.02)			
S2Ra	5.22	-0.35	-0.26		0.45	0.55		0.89	0.86	1.82
	(1.98)	(0.94)	(2.41)		(2.30)	(4.41)				
				Period (b): 1975-1986						
W2Rb	7.90	-0.52		-0.43	0.22			0.89	0.85	1.54
	(3.65)	(1.50)		(1.53)	(1.08)					
C2Rb	6.89	-0.38		-0.37	0.25			0.80	0.73	2.28
	(2.15)	(1.11)		(1.49)	(0.78)					

References: Same as Table 3.

IV. CONCLUSIONS

A real dollar exchange rate change will have several consequences for world agricultural product markets. An appreciation of the dollar will result always in a lower price for the product with uncertain effects on the quantity traded. This will depend upon the elasticities and shifts of the world demand and supply functions, which reflects their respective rates of exchange, their relative importance in the world market and their net trade positions.

The domestic impacts will depend upon their respective exchange rate regimes. The United States and other exporters with exchange rates pegged to the dollar will definitely lose, since will sell less at a lower price. Consumers in the importing countries will benefit since will buy more at a lower price, but farmers will be worse off. Countries with floating exchange rate to the dollar (as Argentina in our example), will most probably benefit (as a whole) since, in spite of the lower international price for the product, quantity exported and foreign exchange earnings will most likely increase. The effect on importing countries are much more complicated, but consumers will definitely be worse off while producers will be better off.

Removing the "ceteris paribus" clause for Argentina will allow for some other effects that may result in a shift to the left of the demand and the supply to the right. This will lead to a right shift of the excess supply and the country's final position will be better than with the "ceteris paribus" assumption.

If Argentina had a pegged exchange rate, and there is a real appreciation of the dollar, the austral will appreciate in real terms

in the same percentage as the dollar does. In this case Argentina will suffer the same consequences as the United States. Removing the "ceteris paribus" clause, the analysis shows that the excess supply may shift to the left, worsening the country's situation.

For a real dollar depreciation conclusions are reversed.

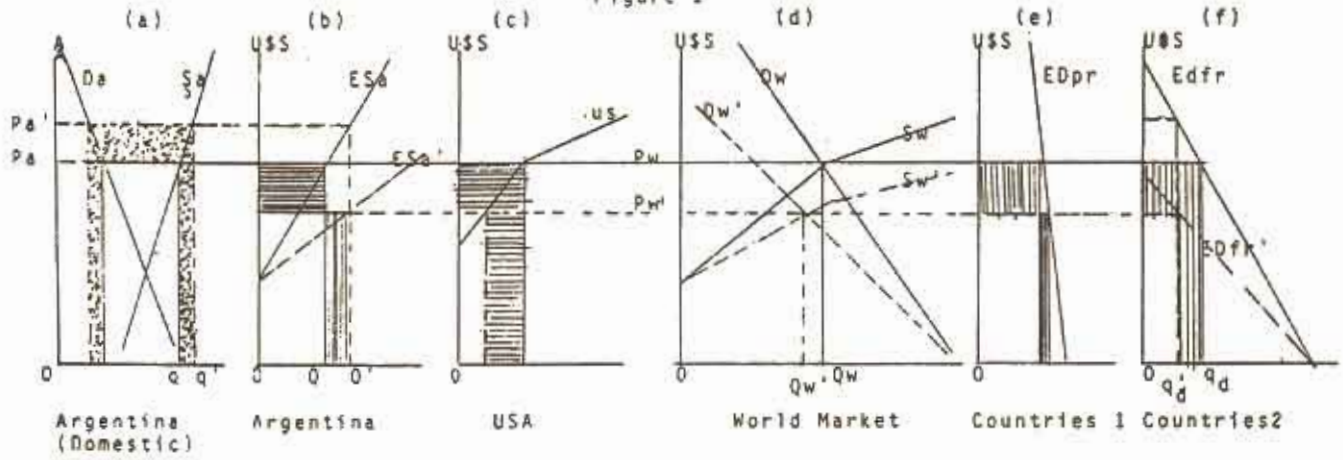
The U.S. agricultural policy is introduced in the model through the effects of the loan rate. For a real appreciation of the dollar, the combination of stocking with support pricing will lead to a higher U.S domestic price than that of the world market, with less quantity exported. In the short run this could lead to a slightly increase in the world market price. However, in the long run, as the U.S. and, consequently, the world stocks will be increasing, this will tend to lower the world price.

Econometric work done thus far, tends to confirm the implications of the model. It is expected that better results could be obtained if a longer period is examined. However, much still has to be done

to be done, specially -as was pointed out when the purpose of the paper was announced- with respect to the consequences for Argentina.

Stanford, CA., June 1988.

Figure 1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World Market
Countries 1
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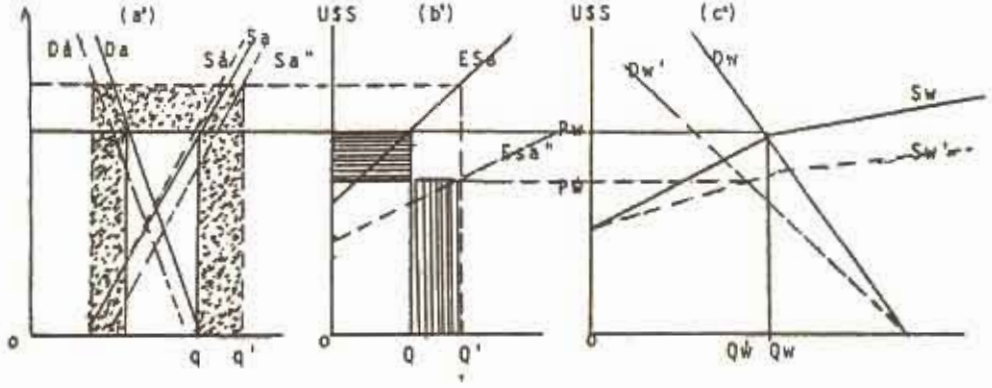
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Fg. 2: US NOMINAL & REAL EXCHANGE RATES
Index Numbers. (Base 1980-82=100)

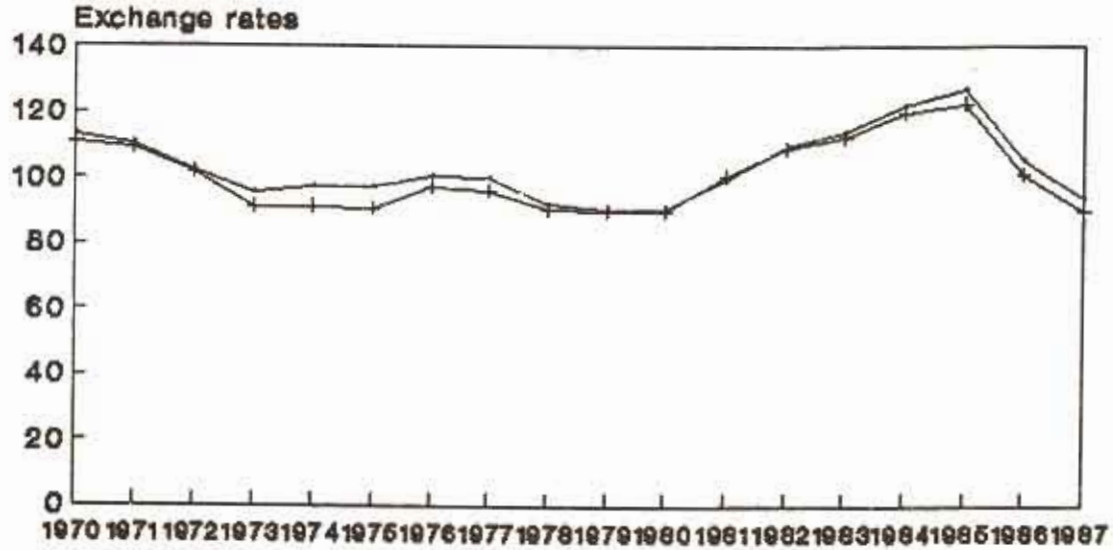
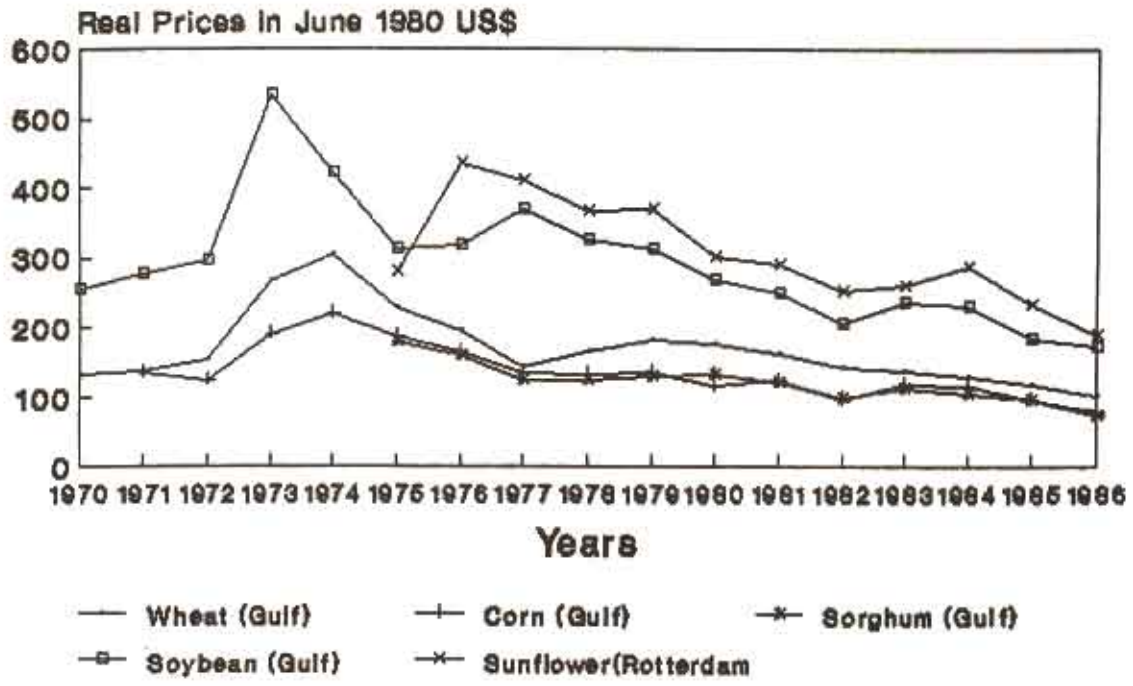
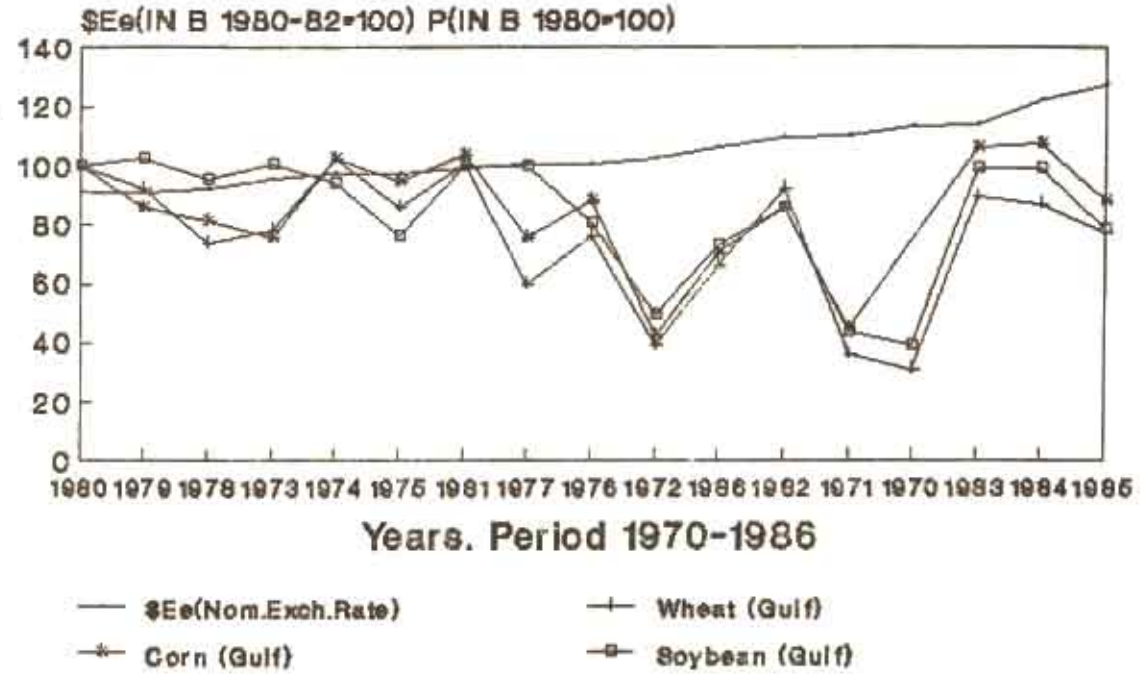


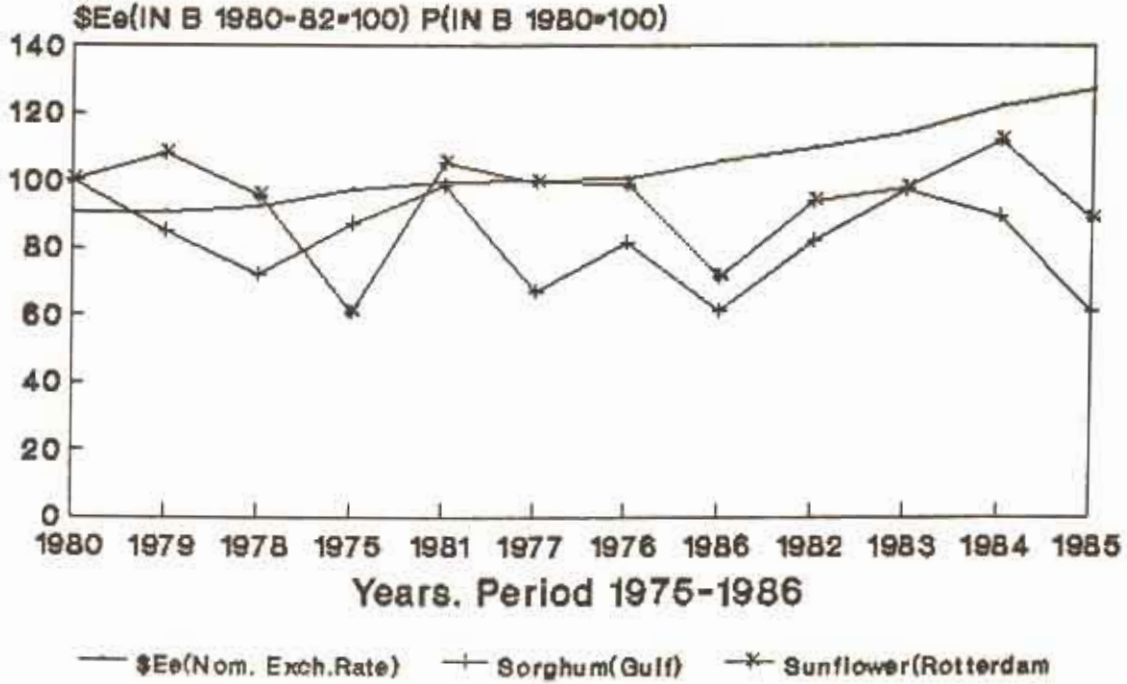
Figure 3: GRAIN REAL PRICES
Annual Data



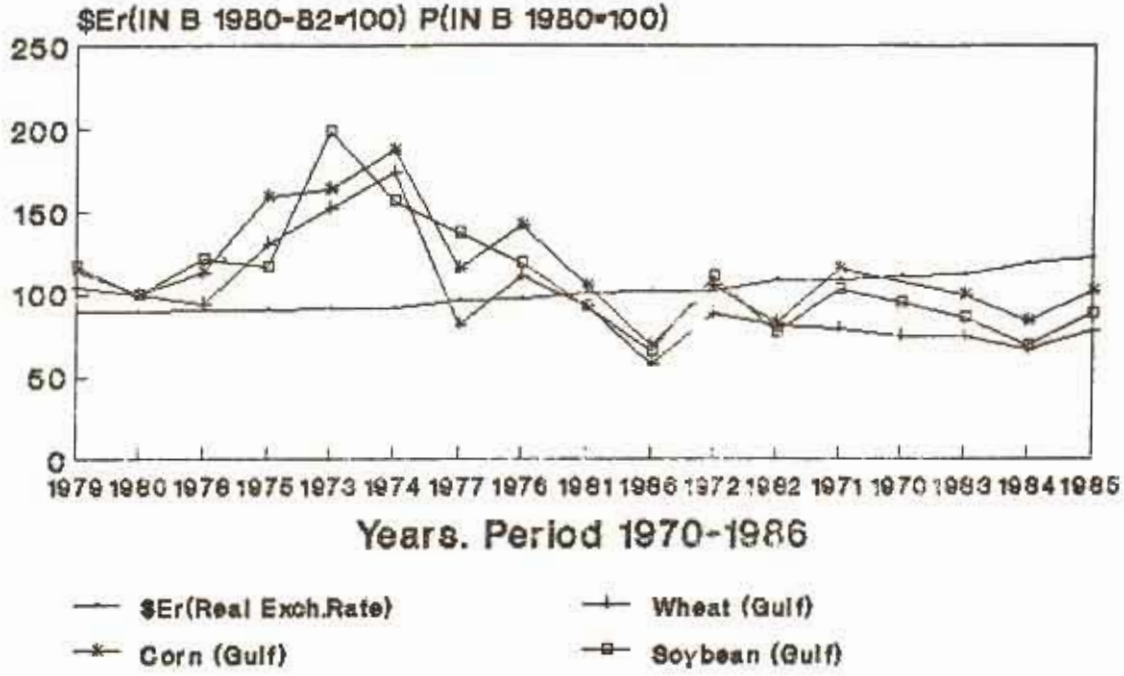
F.4:ASSOCIATION BETWEEN NOMINAL PRICES & NOMINAL EXCHANGE RATE(Ascend. order)



Fg.5:ASSOCIATION BETWEEN NOMINAL PRICES & NOMINAL EXCHANGE RATE (Ascend. Order)



Fg.6: ASSOCIATION BETWEEN REAL PRICES & REAL EXCHANGE RATE (Ascending order)



Fg.7: ASSOCIATION BETWEEN REAL PRICES & REAL EXCHANGE RATE (Ascending Order)