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## Effects of Macroeconomic Policies on Sectoral Prices

Yair Mundlak, Domingo Cavallo, and Roberto Domenech

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*The effect of macroeconomic policies on the relative prices of internationally traded and domestic goods has been the subject of extensive study. Analysis of the way in which these policies then affect prices at the sectoral level is complicated by the heterogeneity of sectoral production: even the prices of single products usually are determined by both domestic and traded components. We present a framework which first traces the influence of macropolicy on the relative prices of exports, imports, and home goods. It then accounts for each sector's degree of "tradability," which is based on the importance of trade in sectoral income, and the influence of macroeconomic policy on sectoral prices. To illustrate the use of this approach, it is applied to a simulation of trade liberalization in Argentina. Our results suggest that economywide policies had substantial negative effects on both the real exchange rate and the incentives to agricultural exports.*

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In an open economy, the prices of tradable products are determined by world prices, nominal exchange rates, and taxes. The prices of products which are not tradable are determined by domestic supply and demand, which are themselves influenced by the actions and policies of the government. Some very important economic decisions depend on the price of tradables relative to that of nontradables—the real exchange rate. We examine here the way in which broader government policies affect the real exchange rate, and through it, prices at the sectoral level.

Analyses of the real exchange rate generally aggregate all production into two sectors, tradables and nontradables. This aggregation simplifies the discussion and helps illuminate some important issues, but it has limited empirical relevance: there are no products which can be classified as purely tradables or nontradables. To illustrate, a television set is a tradable product, but the price of a television set quoted in a department store in the Ginza district of Tokyo reflects inputs, such as location, which are not tradable. Thus, if we are to

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understand price differentials over time, across sectors or countries, we require a measure of the share of the tradable component in the price of a product. This measure is useful in evaluating the response of sectoral prices to policies which are not sector-specific.

We apply this approach in an evaluation of the relative effects of Argentina's currency overvaluation on agriculture and nonagriculture, first analyzing the determinants of the real exchange rate and then relating the real exchange rate to sectoral prices. The structural relationships depend on the degree of openness of the economy, which is taken into account.

Time series data for 1913–84 are used to estimate real agricultural and nonagricultural prices, the real exchange rate, and proxies for the degree of openness of the economy. On the basis of these estimates, we then simulate the effect of policy changes that would make the economy more stable and more competitive in world markets.

## I. THE REAL RATE OF EXCHANGE

### *Modeling Commercial Policy*

Much of the empirical work on the effects of tariffs on the real exchange rate has followed the framework of Dornbusch (1974), which serves as a point of departure for this analysis. The economy is divided into three sectors: exportables ( $x$ ), importables ( $m$ ), and home goods ( $h$ ). It is assumed that Argentina can be treated as a small open economy in the sense that it is a price taker in world markets. In this case, the prices of the two traded goods,  $P_j$ , are determined by the world price,  $P_j^*$ , the nominal exchange rate  $E$  (expressed in units of domestic currency per unit of foreign currency), and the trade tax,  $T_j = (1 + t_j)$ , where  $t_j$  is the tax rate, which is positive for imports and negative for exports.

$$(1) \quad P_j = P_j^* E T_j, \quad j = x, m$$

The domestic supply and demand of each of the two traded goods need not be equal because the gap is closed by trade. But for the home good, domestic supply and demand are equalized through the adjustment of  $P_h$ . Thus reflecting market clearing in the home goods sector, we set its excess supply function to zero to obtain the following implicit function:

$$(2) \quad \Phi \left( \frac{P_x}{P_h}, \frac{P_m}{P_h} \right) = 0$$

Under weak conditions equation 2 can be differentiated logarithmically to yield:

$$(3) \quad d \ln \left( \frac{P_x}{P_h} \right) = \frac{\Delta_m}{\Delta_m + \Delta_x} (d \ln P_x - d \ln P_m)$$

where  $\Delta_j$  is the elasticity of excess supply of the home good with respect to the price of the  $j$ th tradable good. We integrate equation 3, write  $\omega = \Delta_m / (\Delta_m +$

$\Delta_x$ ), decompose the price of the tradables into world price ( $P'$ ) and taxes,  $T$ , and label  $T = T_x / T_m$  to obtain:

$$(4) \quad \ln \left( \frac{P_x}{P_h} \right) = a + \omega \ln \left( \frac{P'_x}{P'_m} \right) + \omega \ln T$$

where  $\omega$  is the elasticity of the price of exportables (measured in terms of the domestic product) with respect to the terms of trade (the price of exportables in terms of importables). It should be noted that  $\omega$  can vary: it is not necessarily a constant as assumed in empirical studies. Assumed constancy may produce a good local approximation for marginal changes but may be too restrictive when the data reflect big changes.

Equation 4 expresses the determination of the price of exportables in terms of the home good. It is positively related to the terms of trade,  $P'_x/P'_m$ , and negatively related to the two trade taxes,  $t_m$  and  $t_x$ . The converse is true for the price of importables, which is obtained by rearranging terms:

$$(4') \quad \ln \left( \frac{P_m}{P_h} \right) = a - (1 - \omega) \ln \left( \frac{P'_x}{P'_m} \right) - (1 - \omega) \ln T$$

Thus, both  $P_x/P_h$  and  $P_m/P_h$  constitute measures of the real exchange rate, but they behave differently in response to foreign terms of trade or taxes. A more conventional measure of the real exchange rate,  $e$ , is obtained by aggregating these two measures using the geometric averages of the foreign prices,  $P'$ , and the taxes,  $T$ :

$$(5) \quad e = P' T^E / P_h$$

The behavior of  $e$  in response to changes in the foreign terms of trade and taxes depends on the weights used in the aggregation. To demonstrate, let  $P' T^E \equiv (P'_x T_x)^b (P'_m T_m)^{1-b}$ , insert this term in equation 5, combine with equation 4, and rearrange to get:

$$\ln e = a - (1 - b - \omega) \ln \left( \frac{P'_x}{P'_m} \right) + (1 - b - \omega) \ln T_m - (1 - b - \omega) \ln T_x$$

When  $b = 1$  (that is, the foreign price is measured by the export price),  $e$  varies positively with the foreign terms of trade. The opposite is true for the case where  $b = 0$ , (the foreign price is measured by the import price).

#### *Previous Estimations of the Real Exchange Rate Equation for Argentina*

Earlier estimates of the real exchange rate equation for Argentina were obtained by Rodríguez and Sjaastad (1979); Cavallo and Garcia (1985); and Mundlak, Cavallo, and Domenech (1987). They differ somewhat in the variables used and the periods of analysis. On the whole the estimated values for the degree of substitution between imports and home goods,  $\omega$ , were relatively low (see Sjaastad and Clements 1981 to compare results for some other countries).

To see the implications of low values for  $\omega$ , we rewrite equation 3:

$$(6) \quad d \ln P_h = (1 - \omega) d \ln P_x + \omega d \ln P_m$$

The smaller is  $\omega$ , the closer is the comovement of  $P_h$  and  $P_x$ . This implies that in Argentina the price of the home good moved more closely with  $P_x$  than with  $P_m$ . Therefore, changes in  $t_x$  have a dominant influence on home goods prices when compared with changes in the import tax (as shown in Cavallo and Mundlak 1982). Furthermore, calculations of the aggregate real exchange rate, assuming no trade taxes and using the various estimates of  $\omega$  from these studies, show that the market exchange rate was lower than its actual level. This is in contrast to the common belief that trade liberalization should increase the real exchange rate. Our result is a consequence of the low value of  $\omega$ .

It is important to note that in the present model the price of the home good changes only as a result of changes in the domestic prices of the tradables, but such changes displace the system from its equilibrium, which can only be restored by a change in  $P_h$ . Therefore there is only one way to eliminate overvaluation of the real exchange rate, and this is by changing taxes on trade. This follows directly from equation 6, which helps to focus on the role of taxes but abstracts from other considerations which are important in interpreting the data. These factors are taken up in the next section.

#### *Extensions: The Role of Macro Policy*

The foregoing model is basically a derivative of the Heckscher-Ohlin-Samuelson model with a nontradable sector added. As such it assumes a constant-returns-to-scale technology, full employment, and perfectly competitive factor markets. Demand is derived from utility maximization of the private sector, which has a one-period time horizon. Deviations from these assumptions affect the results. Various aspects of a more general framework are reviewed and discussed in Dornbusch (1987), Edwards (1988), and Snape (1988).

With taxes and the foreign price of tradables given, anything that affects domestic prices affects the real exchange rate directly, and also indirectly through the effect on  $E$ . These factors are generated by macro policies and are related to the relative size of the public sector, fluctuations in its expenditures, and the methods of financing those expenditures. Trade policies also determine the openness of the economy. And finally, long-term factors affect the supply or demand for the various products.

Capital inflows increase the supply of tradables and the level of expenditures; because all goods are normal (that is, have positive income elasticities), the demand for nontradables thus increases. Because prices must increase in response to the increased demand, the real exchange rate should decline.

While our previous discussion has implicitly assumed that demand consists only of private consumption, the analysis can be generalized to include investment. If investment constitutes a different share of the home good, this change in the composition of expenditures also changes the real exchange rate. The

composition of expenditures becomes more important when the analysis is extended to include government, which has a different composition of constraints on demand and budget than does the private sector. In general, home goods are a larger share of government than private expenditures.

The effect of government on the real exchange rate is stronger when the government runs a deficit because of the macroeconomic effects of its means of financing. When the government borrows to finance a deficit and the economy is financially open, this results in a capital inflow, which causes a decline in  $e$ . When the economy is financially closed, the borrowing will drive up the rate of interest and thus reduce private sector expenditures. This change of expenditure composition causes a decline in  $e$ .

When the deficit is financed by an expansion of the money supply and the economy is financially closed, the monetary expansion causes an increase in prices and the expenditure of the private sector is reduced by the inflationary "tax." Again, because of the change in composition of expenditure in favor of government,  $e$  declines. If the economy is financially open, and the nominal exchange rate is fixed, however, the monetary expansion will raise private demand. This is matched in part by a rise in net imports or by an increase in the capital inflows, causing  $e$  to decline. This effect on  $e$  is reinforced by the increase in demand for the home good. The mechanism will change when the nominal exchange rate is flexible, but nevertheless  $e$  declines.

The real exchange rate is also affected by the relative income elasticity of demand for the home good and tradables. If the demand for the home good is income elastic, this means that as income increases the demand for home goods rises relative to the demand for tradables, and therefore  $P_h$  rises so that  $e$  declines.

Restrictions on trade modify the adjustment mechanisms of the economy and therefore the determination of the real exchange rate. Limits on imports, for example, tend to lower  $e$ . In order to incorporate trade restrictions in the empirical analysis, there must be a way to measure the degree of openness of the economy (this is discussed below).

Much of the discussion of the determinants and effects of the real exchange rate is related to short-term variations with resources and technology held constant, whereas empirical analyses commonly use data that reflect changes over time. Changes in resources and technology affect the supply of the various goods differentially. Home goods production is generally thought to be more labor-intensive, so that capital accumulation reduces the price of the more capital-intensive tradable sectors, which implies a decrease in  $e$ . Changes in technology may take different forms, which we shall not detail here. The net effect of such changes can be determined empirically.

#### *Introducing the Macro Variables*

Previous estimates of the real exchange rate (equation 4) for Argentina, with macropolicy variables added, indicate that macroeconomic policy has had an

important effect on the real rate of exchange (see Cavallo and Mundlak 1982, Cavallo and Garcia 1985, Cavallo 1986, and Mundlak, Cavallo, and Domenech 1987). The main conclusion derived from these studies is that overvaluation of the Argentine currency arose not just from commercial policy but also from macro and incomes policies. Moreover, these effects were shown to depend on the structural features of the economy. That has led us to a more detailed specification of exchange rate determinants, including government consumption ( $g$ ) and borrowing ( $f$ ), money growth ( $\mu$ ), and income ( $Y$ ):

$$(7) \quad \left(\frac{P_x}{P_h}\right) = \omega(\hat{P}_x - \hat{P}_m) - \epsilon_x \hat{g} - \epsilon_d f - \epsilon_m \hat{\mu} + \epsilon_y \hat{Y}$$

where  $\hat{x} = d \ln x$ . The variable  $g$  measures the share of government consumption in total income,  $f$  is the share in total income of the fiscal deficit financed by borrowing, and  $\mu$  is the proportion of money in nominal income evaluated in terms of foreign prices and converted to local prices by the nominal exchange rate:  $\mu = M/EP^*Y$ . Thus,  $\hat{\mu}$  measures the rate of growth of the money supply over and above real growth in gross domestic product (GDP), foreign inflation, and nominal devaluation. A positive sign for  $\hat{\mu}$  implies that the monetary expansion is inflationary. The effect of this variable depends on the velocity of money, but we have not accounted for this in our analysis.

Total real income,  $Y$ , is introduced to reflect changes in the composition of demand, and variations in resources and technology in production. A further refinement would eliminate the transitory variations in this variable and allow us to analyze only the longer-term sources of growth. Relatedly, changes in sectoral incentives affect the pace of capital accumulation and technical change (Mundlak, Cavallo, and Domenech 1989a). However, at any point in time the capital stock and technology are predetermined, and their long-term variations can be approximated by  $Y$ .

We are not interested here in separating out the long-term supply and demand effects. It should be noted, however, that such structural changes have an effect on the importance of trade in the economy and therefore on the impact that various shocks have on the real rate of exchange. For this reason a measure of the importance of trade is introduced.

Changes in the importance of trade also reflect restrictions on trade and capital mobility. Such restrictions have an important effect on the prices of the home good and therefore on the real exchange rate. To allow for such effects, the coefficients in equation 7 are formulated as linear functions of our proxies for the degrees of commercial and financial openness. We use a ratio of the value of trade to total income to measure the openness to trade. Financial openness is measured as the ratio of the official exchange rate to the black market rate,  $e/E_b$ . Restrictions in commercial and financial markets are interconnected, most directly here because import restrictions encourage the growth of the black market to meet excess demand for imports and for the foreign

exchange they require. It is not hard to think of more ideal measures, but the problem is the lack of appropriate available data.

We assume that  $\omega$ , and the elasticities of real income ( $Y$ ) and government consumption ( $g$ ), depend only on the share of trade in total income. The elasticities of the fiscal deficit financed by borrowing ( $f$ ) and of the money supply ( $\mu$ ) are assumed to depend on both of these openness variables. A summary of the results appears in table 1.

The elasticity of the real exchange rate with respect to the terms of trade as reflected in the values of  $\omega$  computed from the regression are plotted in figure 1. The value ranged between 0.6 and 0.7 before 1925, when the economy was very open to the rest of the world. In that period, the price of the home good was more closely related to the price of imported goods than to the price of exports. This reflected a high degree of substitution in production and demand between the domestic and the imported good. As the restrictions imposed on imports increased over the following two decades,  $\omega$  declined. The lowest values are observed in the early 1950s, when the economy was very closed. Recall that lower values of  $\omega$  mean that the prices of home goods are more closely related to the domestic price of exports than to prices of imports.

Since the late 1950s,  $\omega$  has oscillated around 0.25. This low value of  $\omega$  explains why changes in export taxes produce only a small change in the

Table 1. *Determinants of the Real Exchange Rate, 1916–84, Argentina*

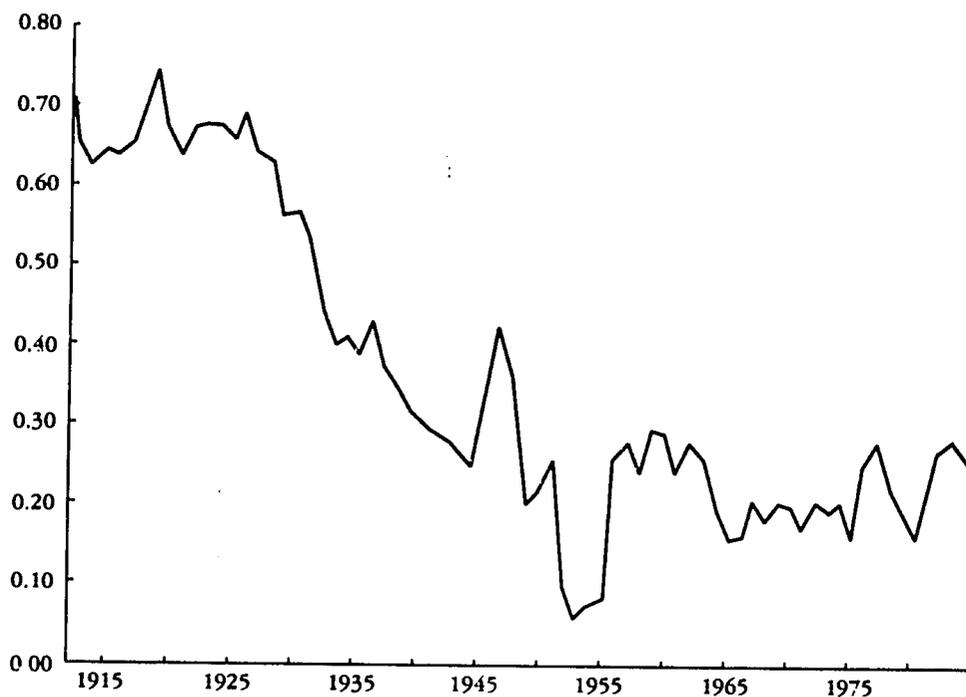
Macroeconomic variable (change in)	Coefficient	Average value of the coefficient
Terms of trade: $d \ln P_e - d \ln P_m$	0.72 + 0.29 log $DO_t$ (5.1) (2.5)	0.37
Real income: $d \ln Y$	0.24 (1.6)	0.24
Government consumption: $d \ln g$	0.43 log $DO_t$ (6.7)	-0.52
Borrowing for fiscal deficit financing: $f^a$	-1.69 - 2.04 log $DO_t$ (3.7) (2.3)	-1.13
Monetary expansion: $d \ln \mu$	-0.44 + 0.2 log $DO_t$ (5.1) (2.1)	-0.45

Note:  $P_e$ ,  $P_m$ , and  $P_h$  are prices of exports, imports, and home goods respectively, with  $P_e$  and  $P_m$  valued inclusive of taxes, at the nominal exchange rate;  $g$  is the share of government consumption in real income;  $f$  is borrowing to finance the fiscal deficit, as a share of total income;  $\mu$  is the ratio of the money supply to total income in foreign prices valued at the nominal exchange rate— $\mu = M/EP^*Y$ ;  $DO_t$  is the share of trade in total income;  $DO_t$  is the ratio of official to black market exchange rates. The equation was estimated by ordinary least squares; the dependent variable is  $(d \ln P_e - d \ln P_h)$ . The intercept of the equation is 0.02 with a  $t$ -ratio of 1.6; the coefficient of  $DO_t$  is 1.39 with a  $t$ -ratio of 3.1;  $R^2$  is 0.87; and the Durbin-Watson statistic ( $DW$ ) is 1.65. Absolute values of the  $t$ -ratios are in parentheses.

a. Defined in absolute terms (as share of total income), not as change.

Source: Mundlak, Cavallo, and Domenech (1989b).

**Figure 1. Elasticity of the Real Rate of Exchange with Respect to  $P_x/P_m$ , 1913-84, Argentina**



*Note:* Vertical axis shows elasticity of the price of exportables with respect to the terms of trade ( $\omega$ ).  $P_x$  = price of exports;  $P_m$  = price of imports.

*Source:* Mundlak, Cavallo, and Domenech (1989a).

effective real exchange rate for exports. When  $t_x$  goes down, the domestic producer price of exportables, equation 1, increases accordingly. With other variables held constant, equation 4 indicates that  $1 - \omega$  of the increase in  $P_x$  is transmitted to  $P_h$ . Thus, with  $\omega = 0.25$ , the price of the home good increases by 75 percent of the increase in  $P_x$ . This in turn implies that the real rate of exchange for exportables, measured as the difference between the rates of change of the two prices, increases only by 25 percent of the initial increase in  $P_x$ . In other words, a 20 percent reduction in the export tax produces only a 5 percent increase in the price of the exported good relative to the price of the home good.

The intuitive explanation is as follows. When the tax on exports is reduced, the increased incentive to produce exportable goods induces an increase in exports and thereby an increase in income. As all goods are assumed to have positive income elasticities, their demand increases accordingly. That generates excess demand for the home good and forces its price to increase. Restrictions on imports cause some of the augmented demand for imports to be diverted to

the home good and thereby generate a further increase in the price of the home good. The increased price of exportables also reduces the demand for them and further increases the demand for the home good. As a consequence, domestic prices increase and the real exchange rate decreases to absorb much of the initial increase in export prices. It is in this sense that domestic prices move in line with export prices. Of course, the outcome would be different if imports were allowed to increase without restriction, that is, if the economy were open. This suggests that reducing import restrictions would allow more of the income increase to be absorbed by imports, reducing the pressure on home goods prices. Therefore a given change in  $t_x$  would have a stronger effect on the relative price of exportables vis-à-vis the home good.

Government consumption has a negative effect on the real exchange rate. This is so because government expenditures have a larger share of nontraded goods than do private expenditures taxed away and because home goods prices rise when the substitution between imports and domestic goods is low due to import restrictions.

The effect of the fiscal deficit financed by borrowing is more pronounced when the economy is financially open, that is, when there is no black market premium on foreign exchange. The increase in the deficit requires increased foreign financing and produces either a decline in the nominal rate of exchange or an increase in domestic prices, or a combination of both. When domestic financial markets are completely closed, that is, when the black market premium is very large, financing the deficit by domestic borrowing produces a very strong crowding-out effect on private expenditures.

The effect of money supply and nominal exchange rate management also depends on the openness of the economy. When the economy is financially open, monetary expansion over and above the value of income valued at foreign prices affects the real exchange rate with an elasticity of  $-0.44$ . This means that a 10 percent increase in  $\mu$  produces a 4.4 percent reduction in the real rate of exchange. The elasticity becomes larger in absolute value when the economy is more closed to financial transactions with the rest of the world. This is because financial openness will dampen the real effect of nominal shocks in the money supply or in the exchange rate since capital inflows or outflows will respond quickly to such shocks. This dampening effect does not operate when the flows are obstructed, and a large black market premium is created.

## II. SECTORAL TRADABILITY AND SECTORAL PRICES

The analysis outlined above provides the basis here for evaluating the effect of macro and trade policies, through the real exchange rate, on sectoral prices. The various shocks considered above affect the sectoral prices largely because they affect the relative prices of the tradables, and it is therefore important to examine this effect first. Having done this, we can now move to the analysis of the sectoral prices.

In dealing with sectoral analysis, it should be kept in mind that a sector is often heterogeneous in that it is importing and exporting at the same time. To deal with this problem, it is assumed that each sector can be subdivided into three subsectors: (i) domestic production of goods actually exported, (ii) domestic production of goods actually imported, and (iii) domestic production of nontraded goods. Thus the aggregate price for sector  $i$ ,  $P_i$ , can be represented as a geometric average of  $P_x$ ,  $P_m$ , and  $P_h$ :

$$(8) \quad P_i = P_x^{\alpha_1} P_m^{\alpha_2} P_h^{1-\alpha_1-\alpha_2}, \quad i = 1, 2$$

where sector 1 is agriculture, 2 is nonagriculture, and  $\alpha_1$  and  $\alpha_2$  are some functions of the quantities in question.

In the case of Argentina, almost no domestically produced agricultural products are also imported, and nonagricultural exports are negligible. Incorporating this into equation 8, the two sectoral prices are:

$$(9) \quad \frac{P_1}{P_{1h}} = \left(\frac{P_x}{P_h}\right)^{\alpha_1}, \quad \frac{P_2}{P_{2h}} = \left(\frac{P_m}{P_h}\right)^{\alpha_2}$$

where  $\alpha_i$  indicates the share of the traded component and as such constitutes a measure of the degree of tradability of sector  $i$ . Equation 9 relates the two measures of the real rate of exchange to the sectoral prices relative to the price of the home good.

The degree of tradability depends on economic variables which generate changes in supply and demand, but in the first place they should reflect the degree of openness of each sector. We accomplish this by allowing  $\alpha_i$  to depend on the share of total trade in sectoral income ( $DO_i$ ):

$$\alpha_i = \alpha_i' + \beta_i \ln(DO_i)$$

The prices  $P_1$ ,  $P_2$ ,  $P_x$ , and  $P_m$  are observed, but by the very fact that the home sector is not well defined, there are no direct observations on  $P_h$ . There are data on the price index of government services,  $P_3$ . The empirical analysis is carried out under the assumption that whatever the "correct"  $P_h$  is, it is related to  $P_3$  and that this relation depends on the aforementioned macropolicies which affect the demand for and supply of domestic goods. The following specification is used:

$$(10) \quad \ln\left(\frac{P_h}{P_3}\right) = h_i \ln(\text{MPI})$$

where  $h_i$  is a vector of coefficients to be estimated and MPI denotes a vector of macropolicy variables. Combining equations 9 and 10, an estimable function is obtained for the relation of the price of sector  $i$  to our proxy for home goods prices:

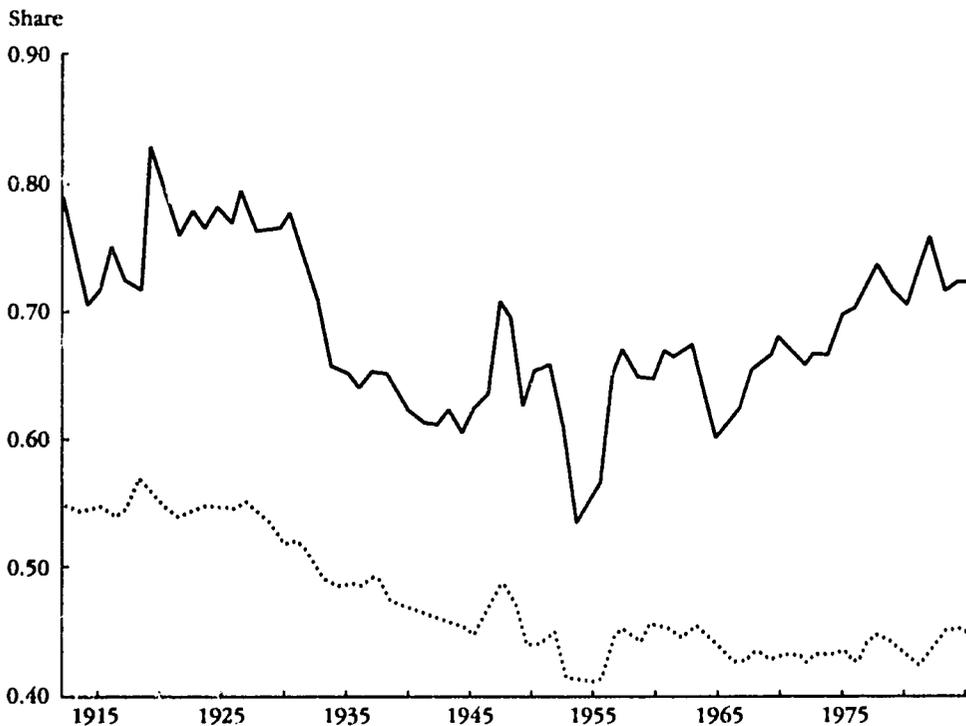
$$(11) \quad \ln\left(\frac{P_i}{P_3}\right) = \alpha_i \ln\left(\frac{P_{IT}}{P_3}\right) + (1 - \alpha_i)h_i \ln(\text{MPI})$$

where  $P_{iT}$  is equal to  $P_1$  for  $i = 1$  and  $P_m$  for  $i = 2$ .

Equation 11 was estimated for sectors 1 and 2, using ordinary least squares (OLS) on first differences. The results of this analysis are summarized by plotting the estimates for the shares of the traded component,  $\alpha$ , in figure 2.

In Argentina before 1930 the traded component of agriculture oscillated around 75 percent, while that of nonagriculture was about 55 percent. These were the highest values of  $\alpha$  in both sectors and reflected the existence of an open trade regime. From that year until the beginning of the 1950s, the share of the traded component declined as the trade restrictions grew. This trend was briefly interrupted in the years immediately following World War II, mainly as a result of the extraordinary boom in world trade at a time when Argentina had exceptionally high levels of grain stocks. From 1947 to 1954 the  $\alpha$ s reached their lowest values. After 1955, the share of exports in agricultural output grew, and by the 1980s the composition was similar to that which had pre-

Figure 2. *Sectoral Degree of Tradability, 1913-84, Argentina*



Key: ..... nonagriculture (excluding government); — agriculture.

Note: This is the share of trade in sectoral output.

Source: Mundlak, Cavallo, and Domenech (1989a).

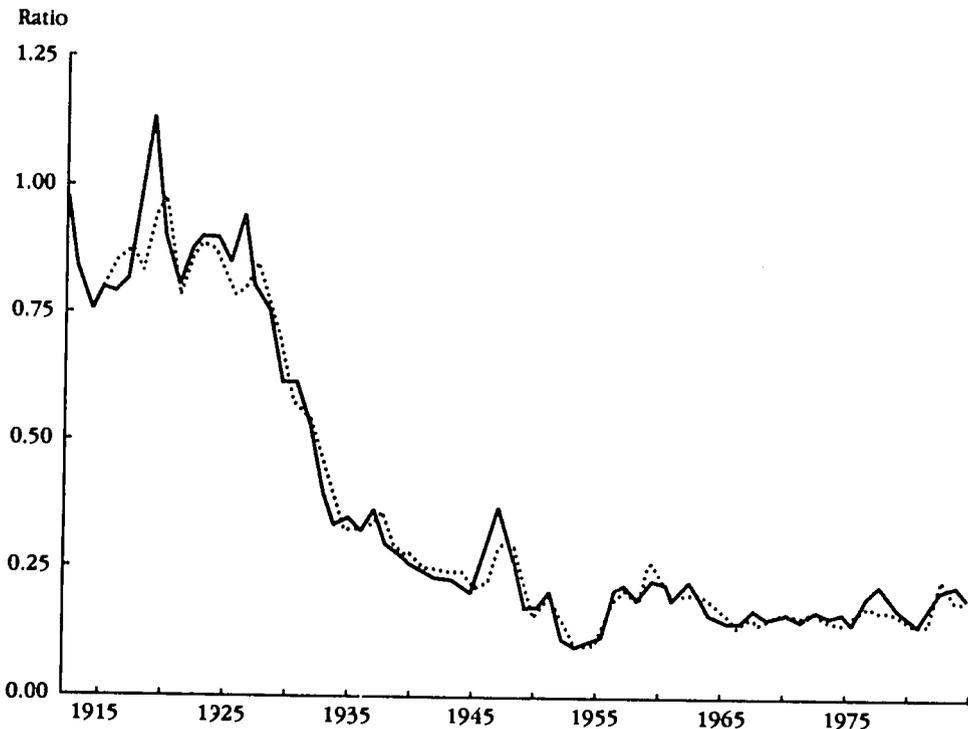
vailed before 1930. However, traded nonagriculture output remained low: since 1955 it has been about 42 percent.

### III. THE DEGREE OF COMMERCIAL OPENNESS

The degree of openness reflects government decisions and world market conditions and as such it is exogenous in this framework. However, our measure of openness depends on endogenous variables and our empirical analysis accounts for this.

Commercial openness is measured here as the share of total trade in total income (plotted in figure 3). Note the significant reduction in the relative importance of trade that took place after the Great Depression. Government policies were implemented to attenuate the effects of the world depression and were similar to policies adopted by most other countries. They included high taxes on foreign trade, quantitative restrictions on imports and controls on

Figure 3. *Indicator of the Degree of Commercial Openness, 1913-84, Argentina*



Key: ..... fitted; — actual.

Note: This is the ratio of total trade to total income.

Source: Mundlak, Cavallo, and Domenech (1989a).

foreign exchange, and increasing government expenditures and fiscal deficits. In Argentina, however, this declining trend in trade continued up to 1955, except during 1946–47, when high world demand for Argentine exports increased the value of trade to about 40 percent of total income. Despite the postwar revival of world trade, Argentina increased its restrictions and the value of trade reached its nadir at about 20 percent during 1952–55. Since 1956 this value has oscillated between 20 and 25 percent.

During the postwar period macroeconomic policy was characterized by higher government expenditures, higher fiscal deficits, and increased volatility in the rate of monetary expansion. Stricter restrictions on financial transactions with the rest of the world were imposed, and commercial policy relied more heavily on quantitative restrictions than on taxation.

This review of the historical experience suggests that the degree of commercial openness ( $DO_t$ ) may depend on commercial policy, the degree of financial openness,  $DO_f$ , the foreign terms of trade, and perhaps other determinants. More formally:

$$(12) \quad DO_t = f(\text{commercial policy}, DO_t, \frac{P^*}{P_m}, \dots)$$

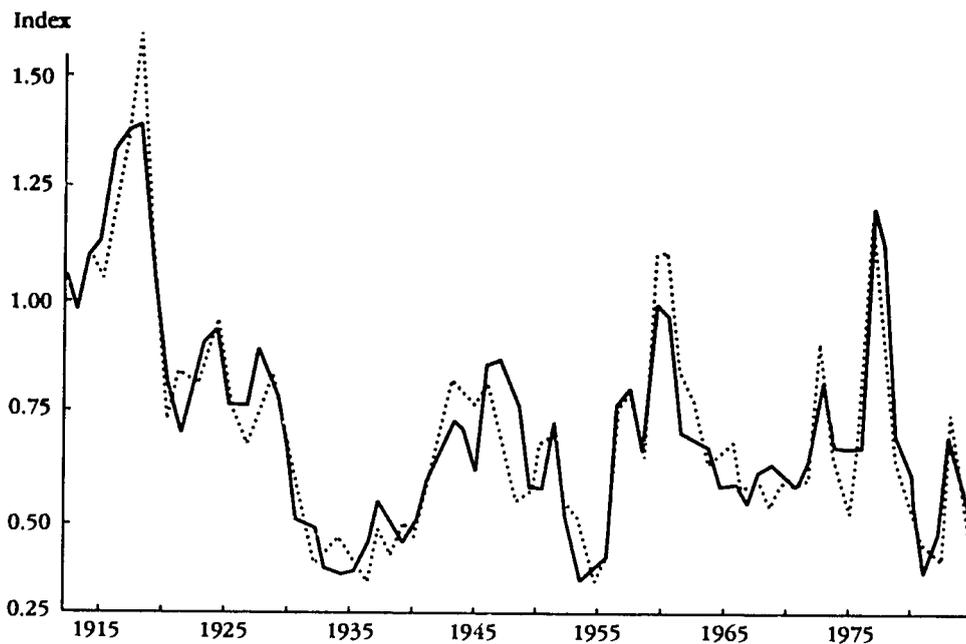
The lagged value of  $DO_t$  is included to represent the more permanent structural changes that affect trade. To estimate equation 12, it is necessary to distinguish between trade taxes and quantitative restrictions. Because no annual data are available for the quantitative restrictions, however, macropolicy indicators are introduced in the empirical equation to capture their effects. Foreign terms of trade were not significant and were eliminated from the equation.

#### IV. SIMULTANEOUS ESTIMATION

It is now possible to assemble the equations for the degree of commercial openness, the real exchange rate, the relative prices for agriculture and non-agriculture (excluding government), and to build a system that is estimated simultaneously using three-stage least squares. The results are reported in the appendix, and in general they are very similar to the OLS estimates. The values based on the static simulations of relative prices fit the data very closely (figures 4–6). Because policy shocks change the dynamic paths of prices, however, in evaluating policy changes, dynamic simulations are used. Those are shown as the base run in figures 10–13 below.

#### V. SIMULATION OF A TRADE LIBERALIZATION PROGRAM

The system is now used to simulate the response of sectoral prices to a program of trade liberalization that is implemented with consistent macroeconomic policies. The attempt to open the Argentine economy in the late 1970s

**Figure 4. *The Real Exchange Rate for Exports, 1913-84, Argentina***

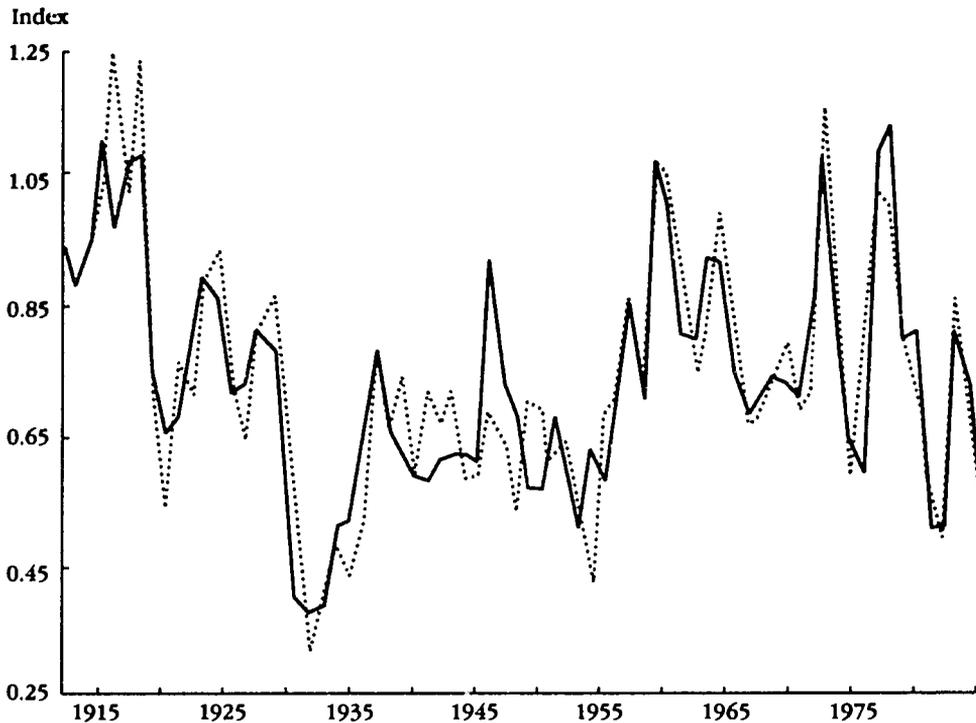
Key: ..... fitted; — actual.

Source: Mundlak, Cavallo, and Domenech (1989a).

failed mostly because of the inconsistent and inappropriate policies that were followed (Cavallo and Cottani 1986).

The trade liberalization exercise is carried out for a limited set of commercial and macroeconomic policies. Modifications in commercial policy are introduced into the system in the year 1930. They consist of complete elimination of export taxes ( $T_e = 1$ ) and imposition of a 10 percent import tariff ( $T_m = 1.1$ ); the actual values are plotted in figure 7. For fiscal policy, it is assumed that public expenditures followed their historical levels except for two actual nonsustainable jumps: a smooth increase in the growth of expenditures between 1946 and 1953, and a jump to a constant level from 1973 on (figure 8).

Eliminating these two sharp rises in public expenditures reduces the simulated deficit; we assume by the amount of the expenditure cuts. We then allow borrowing to decline by an equal amount so that the level financed by monetization remains unchanged (figure 9).

Figure 5. *The Relative Price of Agriculture, 1913-84, Argentina*

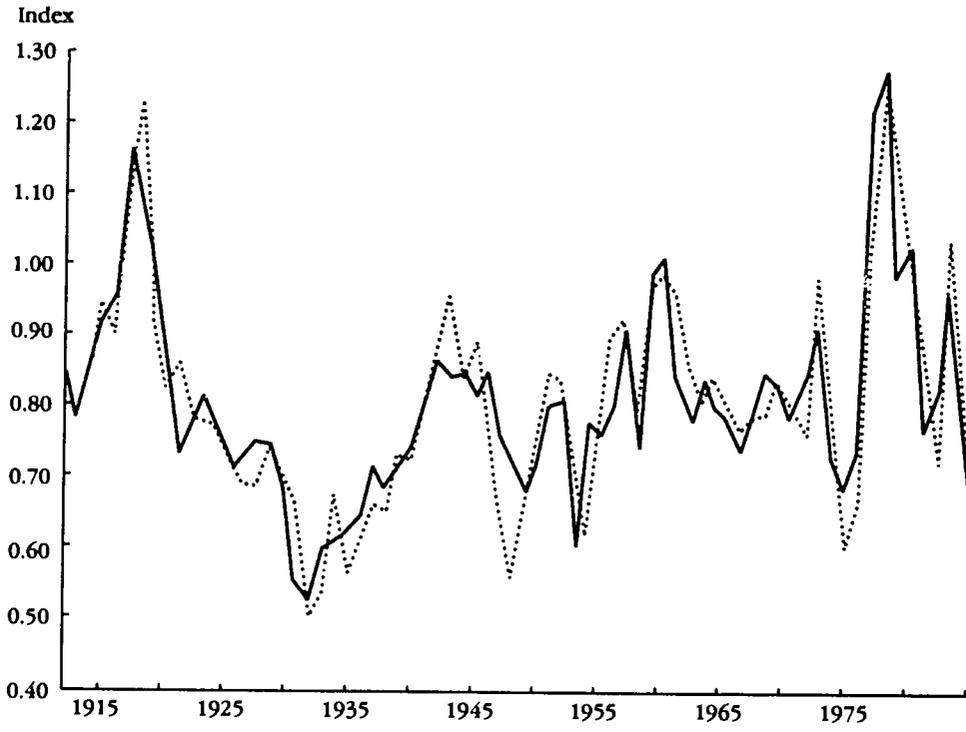
Key: ..... fitted; — actual.

Source: Mundlak, Cavallo, and Domenech (1989a).

We hold the rate of change of  $\mu$  at its average level for the 1930–84 period:  $-0.008$ . We assume that the system is financially open so that there is no black market premium on the exchange rate.

We compare the simulated values of our measures of commercial openness, the real exchange rate, and sectoral prices with the base run values (figures 10–13). As can be seen, all the relative prices respond strongly to trade liberalization. This response is quantified in table 2, where the increases in the “free-trade” values relative to the actual values are reported.

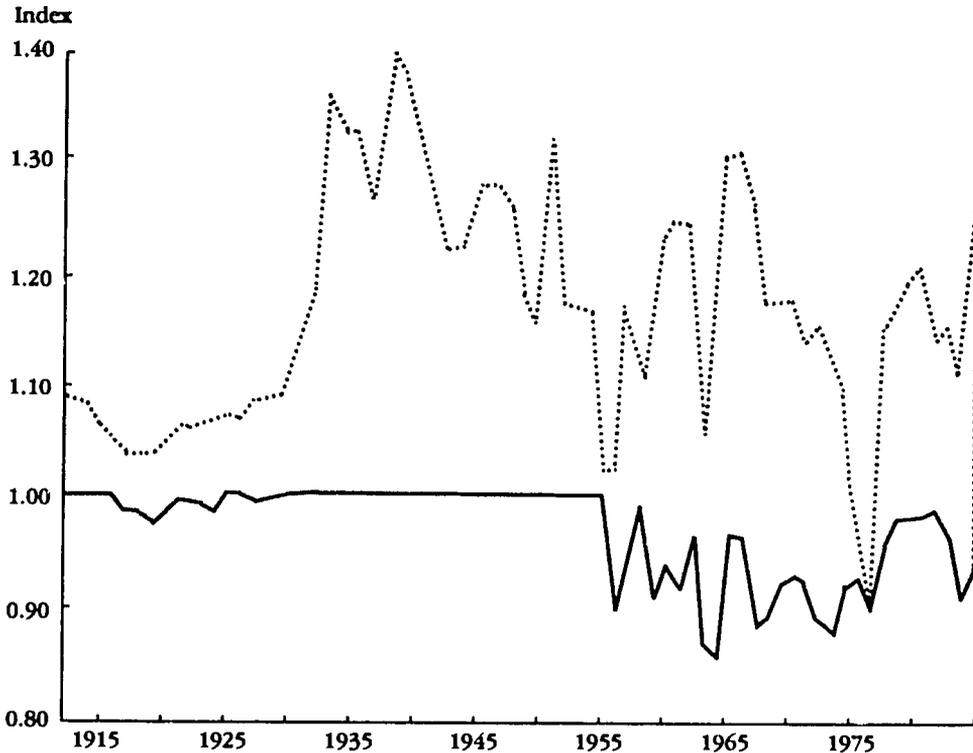
These results imply that if the Argentine economy had been more integrated with the world economy after 1929, the relative volume of trade would have been almost 70 percent higher than its actual level. Moreover, domestic relative

**Figure 6. *The Relative Price of Nonagriculture, 1913-84, Argentina***

Key: ..... fitted; — actual.

Source: Mundlak, Cavallo, and Domenech (1989a).

prices would have been more in line with international prices, implying much greater price incentives for both agriculture and nonagriculture. For the period 1930–84, the price of agriculture would have been, on average, 40 percent higher, and the price of private nonagriculture would have been almost 20 percent higher relative to our measure of home goods prices,  $P_3$ . A greater supply of agricultural and nonagricultural goods might have dampened somewhat the changes in relative prices, but this would not change the general pattern. Finally, as it is shown elsewhere, these changes in sectoral prices have a very substantive positive effect on sectoral and overall growth (Mundlak, Cavallo, and Domenech 1989a).

Figure 7. *Index of Trade Taxes, 1913-84, Argentina*

Key: .....  $1 + t_m$ ;  $t_m$  = tax on imports. —  $1 - t_x$ ;  $t_x$  = tax on exports.

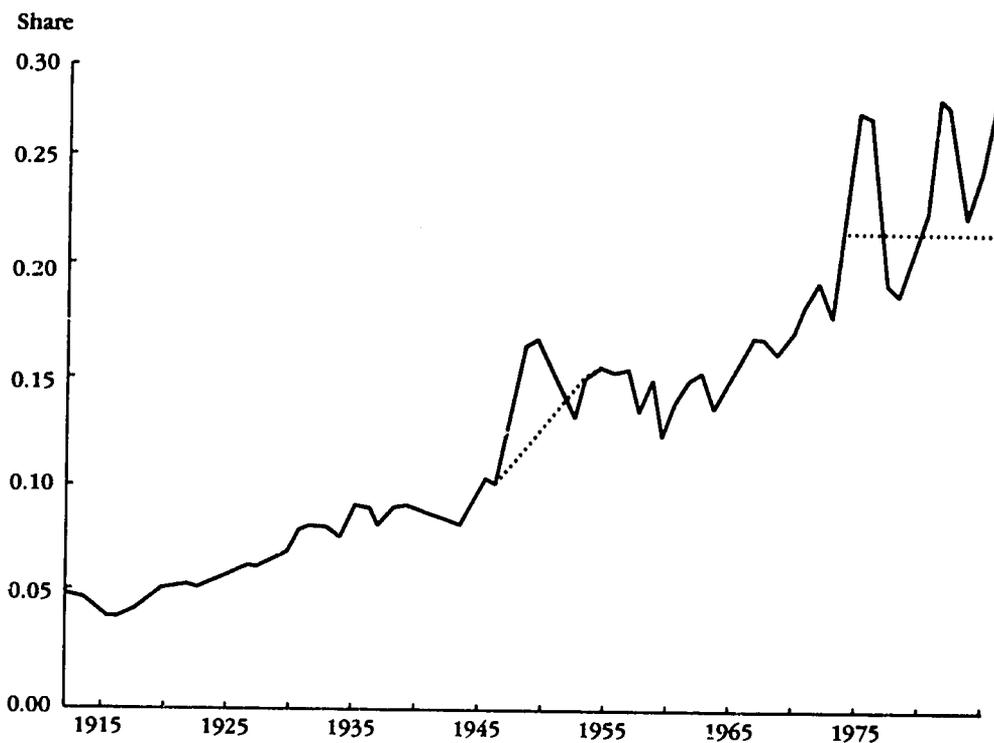
Source: Mundlak, Cavallo, and Domenech (1989a).

## VI. CONCLUSIONS

A framework has been developed for evaluating the effect of macroeconomic and trade policies on sectoral incentives. Variations in the prices of home goods affect the real exchange rate, and through it, sectoral prices, according to their relative importance in sectoral output, or simply the degree of tradability.

We extend the standard model of the effect of tariffs on the real exchange rate to include the effects of government consumption, borrowing to finance the fiscal deficit, changes in the money supply, and income growth, which reflects capital accumulation and technical changes on the supply side, and

**Figure 8. Government Expenditures, Actual and Imposed Values, 1913-84, Argentina**



*Key:* ..... imposed; — actual.

*Note:* This is government consumption as a proportion of total income.

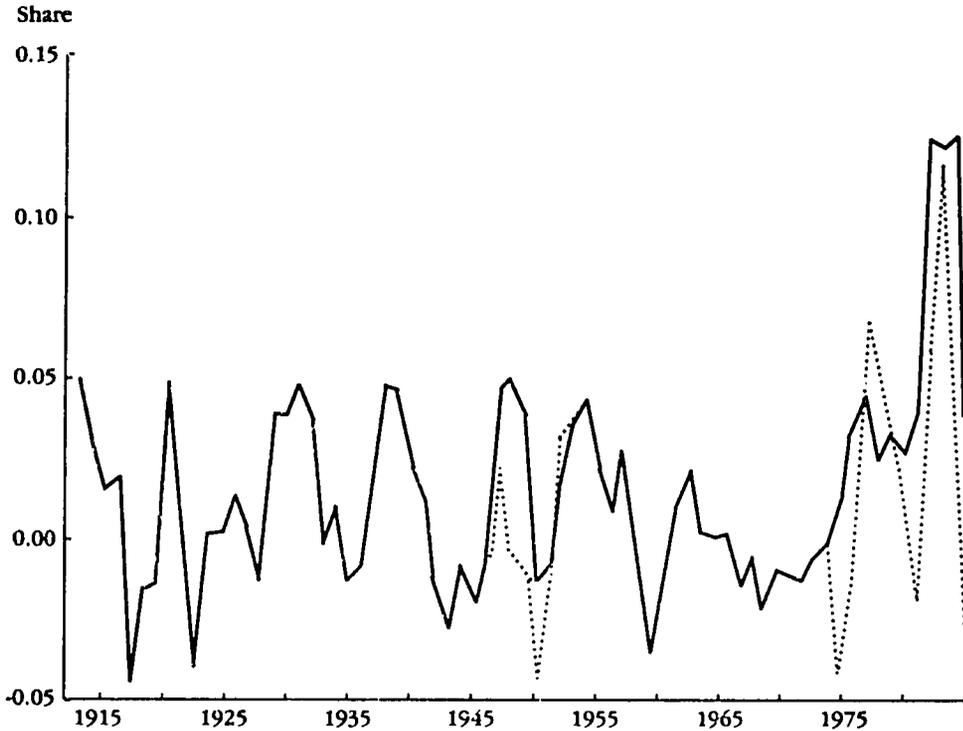
*Source:* Mundlak, Cavallo, and Domenech (1989a).

changes in demand composition. The effects of these variables depend on the restrictions on commercial and financial transactions. To reflect these elements, we include a measure of the value of trade in total income, and the ratio of the official to black market exchange rates.

Under this structure the elasticity of the real exchange rate with respect to the terms of trade is higher under a more open regime and lower when the possibilities for substitution between home and traded goods are limited.

While this framework provides insights into the relations between some macroeconomic policies and the real exchange rate, their influence on sectoral prices is obscured by the heterogeneity of production even within relatively

**Figure 9. Debt-Financed Fiscal Deficits, Actual and Imposed Values, 1913-84, Argentina**



**Key:** ..... imposed; — actual.

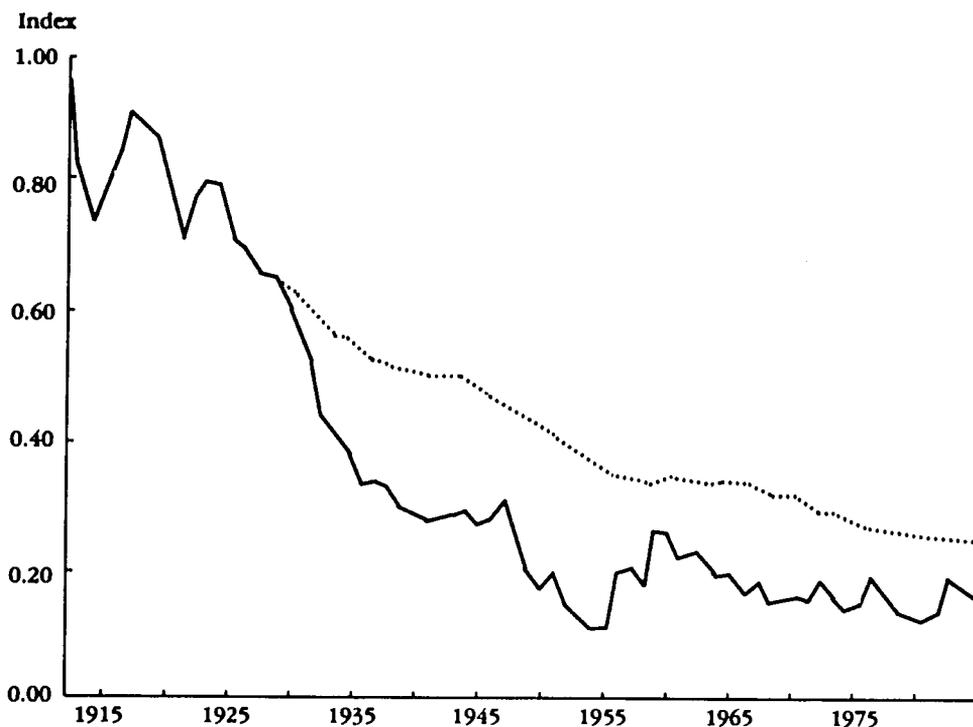
**Note:** This is the fiscal deficit financed by borrowing as a proportion of income.

**Source:** Mundlak, Cavallo, and Domenech (1989a).

disaggregated product groups. Most product groups have both traded and nontraded components and therefore are affected by changes in the real exchange rate. This allows us to measure the degree of tradability from the relation of sectoral prices and the real exchange rate. This relation depends on the openness of the sector to trade, indicated here by the share of trade in sectoral income.

We applied this approach to an evaluation of the consequences of macroeconomic policy in Argentina from 1913 to 1984. To assess the extent to which a more open trade regime and restrained macropolicies would affect sectoral prices, we simulated a policy of low uniform tariffs on imports and elimination

**Figure 10. Degree of Commercial Openness under Simulated Trade Liberalization, 1913-84, Argentina**



**Key:** ..... simulated; — base run.

**Note.** This is the share of total trade in total income.

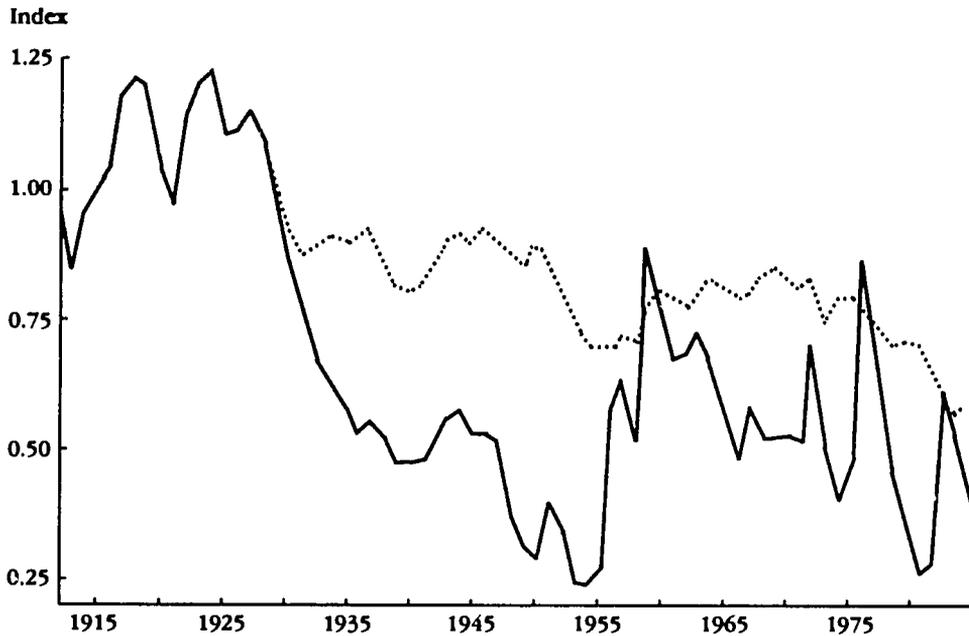
**Source:** Mundlak, Cavallo, and Domenech (1989a).

of export taxes from 1930 on, combined with changes in the macro variables. The counterfactual analysis suggests that such policies would have increased incentives to agricultural and nonagricultural production by nearly 40 and 20 percent, respectively. As a result, the volume of trade would have been almost 70 percent higher.

Such changes in incentives are of importance because of their powerful effect on production and growth. Increased sectoral incentives encourage capital accumulation, intersectoral resource transfers, and the implementation of new techniques and adoption of new technology. These relations have been extensively studied, and we have evaluated them in detail using the Argentinian example (see Munciac, Cavallo, and Domenech 1989a).

The main message is clear. There is, however, a danger that these results will

Figure 11. *The Real Exchange Rate under Simulated Trade Liberalization, 1913-84, Argentina*



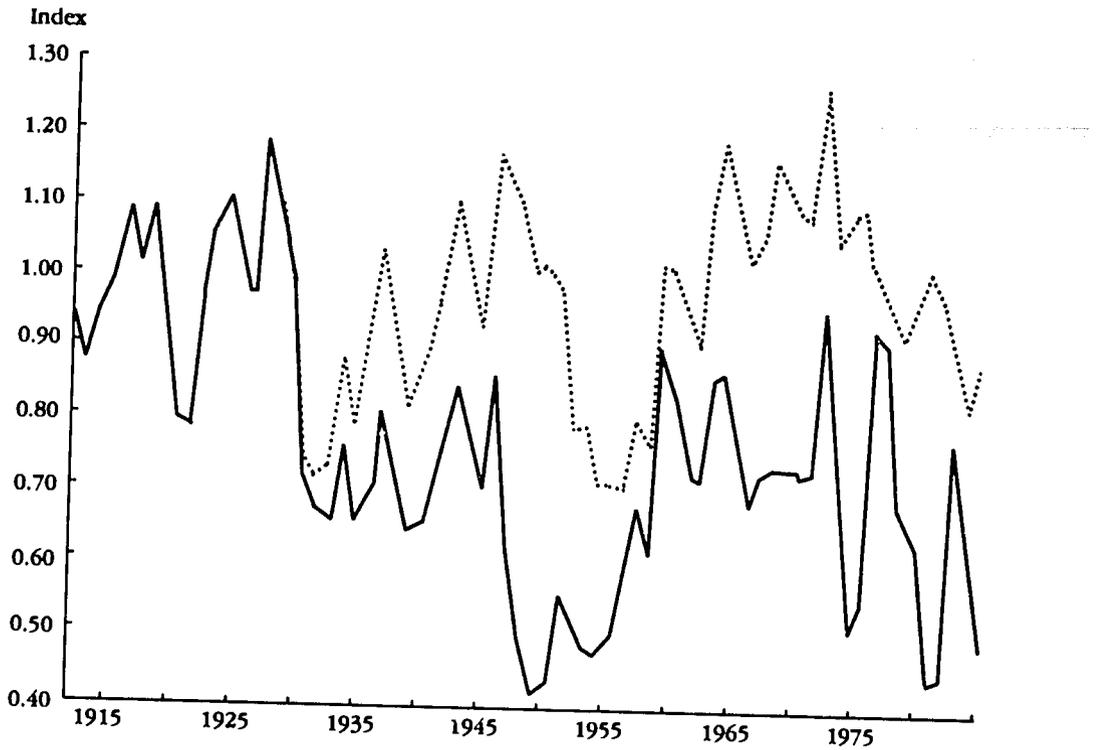
Key: ..... trade liberalization scenario; — base run.

Source: Mundlak, Cavallo, and Domenech (1989a).

be attributed to some specific conditions which are not widely applicable. The purpose of the analysis is to derive the results within a framework which is universally applicable. If there is something which is specific to Argentina it is that it has had very favorable initial conditions and that its relatively poor performance can be attributed to its policies. This shows the cost of wrong policies but at the same time also indicates what are the potential gains from alternatives which take the long-run consequences into account.

The four equations were estimated by nonlinear three-stage least squares. The exogenous variables are  $g$ ,  $\mu$ ,  $DO_t$ ,  $P_x'/P_m'$ ,  $\dot{Y}$ , and  $f$ . Note that the system has a recursive structure.  $DO_t$  is determined only by predetermined variables;  $P_x/P_3$  is determined by  $DO_t$  and the predetermined variables. Finally, sectoral prices are determined by  $DO_t$ ,  $P_x$ ,  $P_3$ , and predetermined variables. The two symbols,  $\hat{x}$  and  $d \log x$ , are used interchangeably.

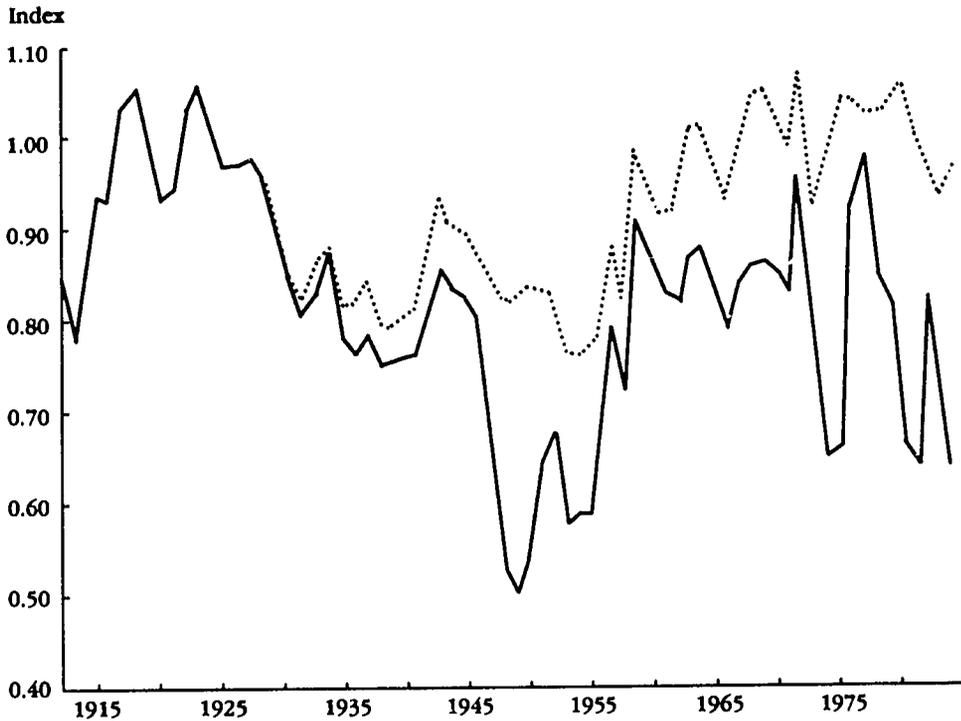
**Figure 12. *The Relative Price of Agriculture under Simulated Trade Liberalization, 1913-84, Argentina***



**Key:** ..... trade liberalization scenario; — base run.

**Source:** Mundlak, Cavallo, and Domenech (1989a).

**Figure 13. The Relative Price of Nonagriculture under Simulated Trade Liberalization, 1913-84, Argentina**



**Key:** ..... trade liberalization scenario; — base run.

**Source:** Mundlak, Cavallo, and Domenech (1989a).

**Table 2. Simulations of the Response of Relative Prices to Trade Liberalization, Averages, 1930-84, Argentina**

Variable	Simulated base run	Simulated trade liberalization scenario	Increase <sup>a</sup>
Share of trade in total income ( $DO_t$ )	0.24	0.40	0.67
Real rate of exchange ( $e$ )	0.54	0.82	0.52
Relative price of agriculture ( $P_1/P_1$ )	0.68	0.95	0.40
Relative price of nonagriculture ( $P_2/P_1$ )	0.77	0.91	0.18

a. Ratio of trade liberalization to base run values minus 1.

**Source:** Mundlak, Cavallo, and Domenech (1989b).



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