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AGRICULTURE AND ECONOMIC GROWTH IN ARGENTINA, 1913-84

Yair Mundlak
Domingo Cavallo
Roberto Domenech

November 1989

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FOREWORD

In 1982 Domingo Cavallo and Yair Mundlak received an award for quality of research discovery from the American Agricultural Economics Association for IFPRI Research Report 36, *Agriculture and Economic Growth in an Open Economy: The Case of Argentina.* The research was sponsored jointly by IFPRI and the Instituto de Estudios Económicos Sobre la Realidad Argentina y Latinoamericana (IEERAL) of the Fundación Mediterránea, and it in turn built on earlier prize-winning research by Mundlak, presented in Research Report 6, *Intersectoral Factor Mobility and Agricultural Growth.* The model developed for the study makes it possible to explore the effects of policies directed at agriculture as well as general macro and trade policies, taking into account interaction with other sectors of the economy.

IFPRI and IEERAL have again cooperated in sponsoring this research, which is an expansion of the earlier work. Yair Mundlak, Domingo Cavallo, and Roberto Domenech apply the model to a larger body of data, extending the time period covered from 1946-73 to 1913-84 in order to measure the effects of Argentine's macro and trade policies during the Great Depression and the volatile 1970s and 1980s.

In this segment of the research, government is presented as a separate sector. Thus, the effect of government actions, such as consumption, investment, the deficit, and its financing, on the private sector are evaluated. The message that emerges for agriculturally based economies is clear. Inward-looking policies that gave high protection to the industrial sector and taxed agricultural exports, reinforced by expansionary macroeconomic policies, severely restricted the overall economic growth of Argentina.

This study on Argentina is part of IFPRI's research program on trade and macroeconomic linkages and agricultural growth. Other country studies include Chile, Colombia, Nigeria, Pakistan, the Philippines, and Thailand.

John W. Mellor
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Carlos Sánchez
Director, IEERAL

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1

SUMMARY

Economic growth is the process by which societies increase their average per capita consumption. Data indicate that growth rates are not the same across countries, nor are they the same over time in a given country. The search for an explanation of such variations has been one of the most pressing subjects in economics. As a matter of definition, growth is achieved by increasing per capita resources (capital) and by improving the efficiency of their use. In an open economy, the increase in capital stock depends on its profitability relative to the rest of the world. The efficiency of resource use is achieved by fully utilizing resources through existing and improved technology. Change in technology is strongly related to capital accumulation.

Theories and views of growth such as these have to be confronted with the data in order to gain perspective on their relevance for explaining the historical record. This study analyzes the experiences of Argentina during the period 1913-84—an interesting period in view of Argentina's variable growth record. Between 1900 and 1930, Argentina had an average annual per capita growth rate of 1.8 percent, considerably higher than that of the United States (1.3 percent), Australia (0.8 percent), Brazil (1.2 percent), and Canada (1.2 percent). Since then, Argentina has lagged behind in its growth performance, and the gap in income between Argentina and other countries of the new world with similar resource bases has constantly increased. This phenomenon has lasted too long simply to be a response to exogenous random shocks. The reason for this inertia must lie in the domain of policies that were pursued when such shocks occurred and when they did not.

Such a confrontation requires a comprehensive and consistent framework. This study is an effort in this direction. It shows that Argentina heavily taxed its agriculture, a sector in which it has a comparative advantage. This was done directly through export taxes and indirectly through protection of nonagriculture and other restrictions on trade. Macro policies that caused the real exchange rate to decline also had a negative effect on agriculture, which is more tradable than nonagriculture. And, a large deficit financed by borrowing had a more negative effect on agriculture because agriculture is more capital-intensive than nonagriculture. The study shows that Argentina could have attained a growth trajectory similar to that of Australia if it had followed policies that allowed it to fully benefit from its comparative advantage—basically, policies promoting an outward-looking economy where incentives reflect foreign terms of trade, free of distortions such as those followed by Argentina for several decades.

The framework devised is one of sectoral growth, where the economy is disaggregated into three sectors: agriculture, nonagriculture, and government. The underlying theory here is that growth, or lack of it, occurs in response to the economic environment, subject to institutional constraints. Inasmuch as changes in institutions are pertinent, they manifest themselves through economic variables, and it is largely these variables that affect decisions by individuals, whether they be consumers, producers, or traders.

Much of the relevant economic environment is related to the important role that trade plays in the Argentine economy, with agriculture being the exporting sector and nonagriculture the importing sector. Real prices faced by producers depend on world prices, the rate of exchange, taxes on trade, restrictions on trade, or inversely, the

openness of the economy, as well as the price level of the domestically produced product. In the literature such dependency is dealt with under the subject of the real exchange rate, which expresses the amount of domestic resources needed to produce one unit of an aggregate tradable good.

The discussion of the determinants of the real exchange rate and its implications is expanded here in two directions. First, it relates changes in the real exchange rate not only to taxation on trade, as is usually the case, but also to macro policies, or simply to the actions of the government and the central bank. Second, the real exchange rate affects the sectors differently, according to their degree of tradability. This concept is developed and measured here. It shows that agriculture is more tradable than nonagriculture, and therefore it is more sensitive to variations in the real exchange rate. These two extensions are integrated in the analysis to show how sectoral prices are affected by macro and trade policies, as well as by world terms of trade.

The variations in sectoral prices affect sectoral outputs in two ways: first, through intersectoral resource allocations. The empirical formulation of this process is dynamic and allows for variations in sectoral growth rates of resources. Second, the productivity of resources is also affected by sectoral prices, both through the level and stability of prices. This approach recognizes that the scope of producers' decisions is not limited to properly locating themselves on a given production function, but it is much broader in scope in that it also requires a decision on what production functions or techniques producers should employ. The study indicates that because of a lack of incentives, Argentine farmers failed to fully implement new technology, which caused it to fall behind countries such as the United States.

Thus, a framework is developed to allow the economic environment to affect directly resource allocation and productivity. It also includes the determinants of sectoral prices. This framework makes it possible to evaluate the consequences of various policies. This is a dynamic structure that can be estimated empirically and solved to simulate the economy. Specifically, a single model is developed that simulates the path of the Argentine economy over the entire period 1913-84.

This study expands and extends earlier work by Cavallo and Mundlak in several important ways (see IFPRI Research Report 36). It extends the period of analysis from 1946-73 to 1913-84. Such an extension makes it possible to examine two important subperiods: the Great Depression of the 1930s and the consequences of the strong volatility of the macro and trade policies of the 1970s and early 1980s. These periods are examined in detail in the analysis of the consequences of economic policies in Chapter 10. This chapter also analyzes post-World War II policies, a period that was also analyzed in the previous study. These three subperiods differ considerably in their prevailing economic environments and in the policies pursued to deal with adverse conditions.

This study develops an explicit framework for joint determination of the real rate of exchange and sectoral prices. In the previous study, the real rate of exchange was explained by a somewhat arbitrary reduced-form equation. This framework is used to evaluate the effect of changes in macro variables on the growth path of the economy and its sectoral composition.

By introducing government explicitly in the model, the study finds that government action affects the private sector in a variety of ways. First, an increase in government investment has a positive effect on private investment. But, second, the method of financing of government investment matters. Government borrowing decreases private investment. Third, and not independent of the previous findings, an increase in government expenditures tends to decrease private consumption. This might indicate a sub-

stitution in consumption. Fourth, an increase in government expenditures tends to have a positive effect on productivity in nonagriculture. Finally, government activity affects resource allocation and productivity. The previous study did not have an explicit government sector and therefore could not examine these effects.

The level of output in one sector has a positive and substantive effect on the output of the other. As a result, an intersectoral linkage is formed.

These are some of the main extensions over the previous study. The report discusses these extensions in detail, and it considers other topics that need to be covered in order to produce a complete model following conventional analysis. Chapter 2 provides background for discussion. Chapters 3, 4, and 5 establish the relationship between policy changes and economic incentives, modeling the mechanism by which such changes are transmitted to sectoral prices. Chapters 6, 7, and 8 deal with sectoral and aggregate supply, the expenditure system, and resource growth and allocation. The policy simulations are discussed in Chapters 9 and 10, and Chapter 11 summarizes the conclusions.

The basic data on which the study is based are not included in the report but are available upon request from the International Food Policy Research Institute.

2

BACKGROUND

Until the Great Depression of the 1930s, agriculture was the staple sector of the Argentine economy. Between 1860 and 1930, exploitation of the rich land of the pampas strongly pushed economic growth. During this period, Argentina grew more rapidly than the United States, Canada, Australia, or Brazil, countries similarly endowed with rich land, which also accommodated large inflows of capital and European immigrants. During the first three decades of this century, Argentina outgrew the other four countries in population, total income, and per capita income (Table 1).

Beginning in the 1930s, however, Argentine economic vitality deteriorated notably. This loss of vitality was especially dramatic in agriculture. An impression of this phenomenon is provided by a comparison of crop yields in Argentina and in the United States in Figure 1. In the late 1920s, crop yields were similar, but after 1930, yields in Argentina were always below the U.S. levels. Comparing average yields for the periods 1913-30 and 1975-84, agriculture in the United States tripled its yields. In Argentina, they did not even double.[1]

The main purpose of this study is to examine the relationship between agriculture and overall economic growth in Argentina during the period from 1913 to 1984 and, particularly, the influences of economic policies on the sectoral composition of output and on the process of growth.

The Approach

Economic growth generates significant changes in the sectoral composition of an economy. In the early stages of growth, an economy is largely rural, whereas in mature economies, agriculture constitutes only a small portion of the economy. Since a large share of the world's population still lives in rural areas, it is important to understand the dynamics of this process. The subject of sectoral growth can be placed in a broader perspective because the process of growth in mature economies generates other sectoral changes of great importance, such as a shift toward services. This process has many similarities to the process of industrialization.

Growth is generated by an accumulation of physical and human capital and technical change. Technical change itself depends on the pace of capital accumulation. This is true both for the rate of technical change and for its factor bias. The simple fact that the capital-labor ratio increases generates incentives for innovations designed to produce laborsaving techniques (Mundlak 1988). Thus, even though the process of sectoral growth calls for a movement of resources across sectors, it is applied differently to labor and capital.

---

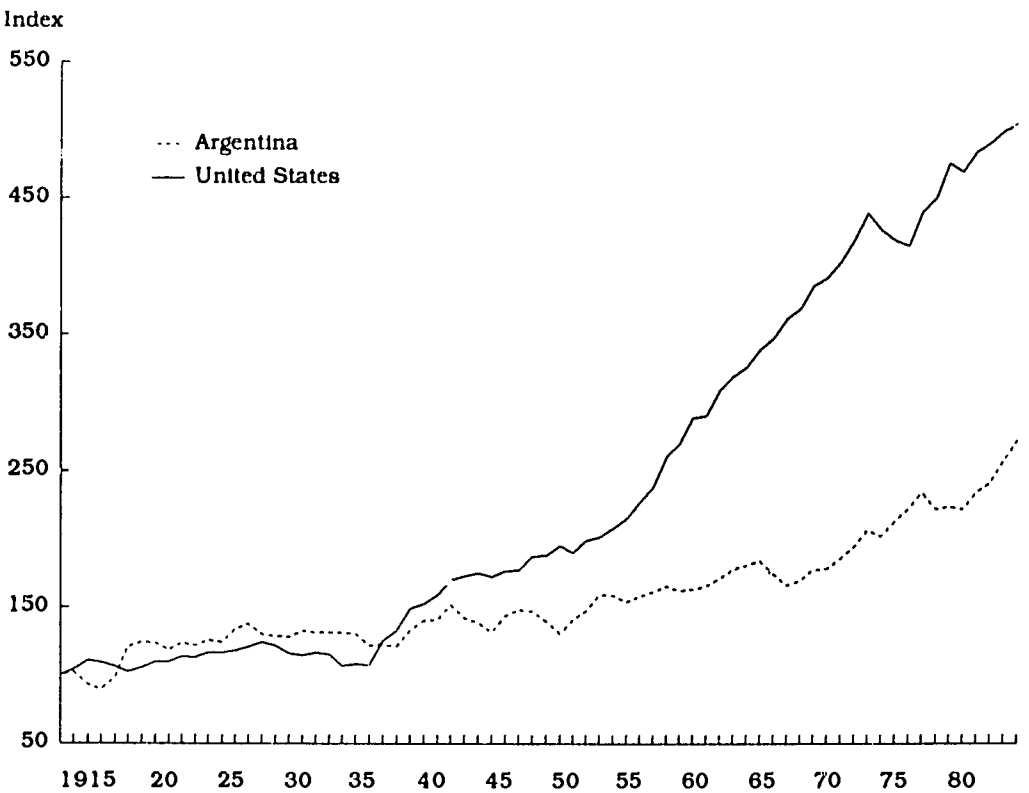
[1] The crops included are barley, corn (maize), cotton, flaxseed, oats, peanuts, potatoes, rice, rye, soybeans, sorghum, sweet potatoes, tobacco, and wheat. For other studies that document the decline in agricultural and overall growth in Argentina, see Ballesteros 1958; Cavallo 1982; Cavallo and Mundlak 1982; Díaz Alejandro 1970, 1984; Ferrer 1963; Fienup, Brannon, and Fender 1967, 1969; Martínez de Hoz 1967; Pinedo 1961; Piñeiro 1968; and Sigaut 1964.

Table 1—Comparative growth in income and population, 1900-04 to 1925-29 and 1925-29 to 1980-84

Period/Item	Argentina	Australia	Brazil	Canada	United States
		(average annual rates in percentages)			
1900-04 to 1925-29					
Population	2.8	1.8	2.1	2.2	1.1
Income	4.6	2.6	3.3	3.4	2.9
Per capita income	1.8	0.8	1.2	1.2	1.3
1925-29 to 1980-84					
Population	1.8	1.7	2.5	1.5	1.3
Income	2.8	3.9	5.5	3.9	3.1
Per capita income	1.0	2.2	3.0	2.4	1.8

Sources: Domingo Cavallo, "Argentina," in *The Open Economy: Tools for Policymakers in Developing Countries*, ed. Rudiger Dornbusch and F. Leslie C. H. Helmers (New York: Oxford University Press for the World Bank, 1988), 267-284.

Figure 1—Crop yields, Argentina and the United States, 1913-84



Notes: This figure is based on a Divisia index of yields in 14 crops in Argentina and the United States. Base year 1913 = 100.

Overall growth increases the possibilities for consumption. The utility functions of consumers are not homothetic: the proportion of the budget they spend on any item depends on their level of income. The income elasticity for food in general is considerably less than one. Also, the price elasticity of demand for food is low. Thus, an equiproportionate increase in income must cause an excess supply in the sector with income-inelastic demand.[2] As a consequence, its relative price declines, and the lower the price elasticity, the larger the decrease in price caused by a given amount of excess supply. As a result, the value of output distributed to factors of production in agriculture declines, their rates of return decline relative to those obtained in nonagriculture, and resources, which have alternative uses, move from agriculture to nonagriculture.

This is a simplified statement of the process and, as such, it ignores many pertinent details that do not change the overall picture. The above description applies to a closed economy. Therefore, on the face of it, the behavior of open economies, such as the economy of Argentina, should be different. This qualification is true. However, the world is a closed economy, and since the process is common to all countries, global excess supply is generated by this process, causing world agricultural prices to decline, thereby affecting exporting countries. In a recent study, it was reported that the trend components of prices of the main agricultural products, deflated by U.S. wholesale prices, declined over the period 1900-84 at a rate of at least 0.5 percent per year (Binswanger et al. 1985). Thus, the called-for adjustment in factor allocation does not skip over exporting countries.

The decline in the relative weight of agriculture in total output calls for intersectoral resource allocation. Such allocation is costly and therefore it is not instantaneous. As a result, there are wide intersectoral gaps in wage rates. Thus, it cannot be assumed that resource allocation at any given time is in equilibrium in the comparative static sense. This has repercussions for almost any empirical question and specifically for the evaluation of the determinants of resource allocation and their time paths. The implication of this for the sectoral growth path of the economy is demonstrated in the study of the growth of the Argentine economy over the period 1947-72 (Cavallo and Mundlak 1982). The particular formulation used for sectoral growth made it possible to evaluate the consequences of significant economic policies implemented in Argentina, which consisted of taxing agriculture, either directly through export taxes or indirectly through the protection of nonagriculture; maintaining a large and highly inefficient public sector; and, not independently, greatly overvaluing the peso. That study showed that these policies caused agricultural growth to lag behind that observed in other countries with grain and livestock, such as the United States.

The previous study also suggested that policies that harmed the performance of agriculture, especially those reflected in currency overvaluation, also had a negative effect on overall growth. The present research looks at both issues in more detail and for a longer period of time. The effect of economic policies on sectoral composition and overall growth is studied for the period 1913-84. Special emphasis is placed on examining the important role of the real rate of exchange. The remainder of this introductory chapter gives a summary description of some characteristics of the sectors of the Argentine economy that are crucial to an understanding of the rest of the report.

[2] The basic determinant of the process is income elasticity. This is an empirical quantity. Many of the studies report income elasticities of food. As income increases, food is purchased with an increasing component of nonagricultural inputs, and, therefore, the income elasticity for the agricultural product is smaller than that reported for food. For details, see Mundlak 1986b.

Characteristics of Economic Policies

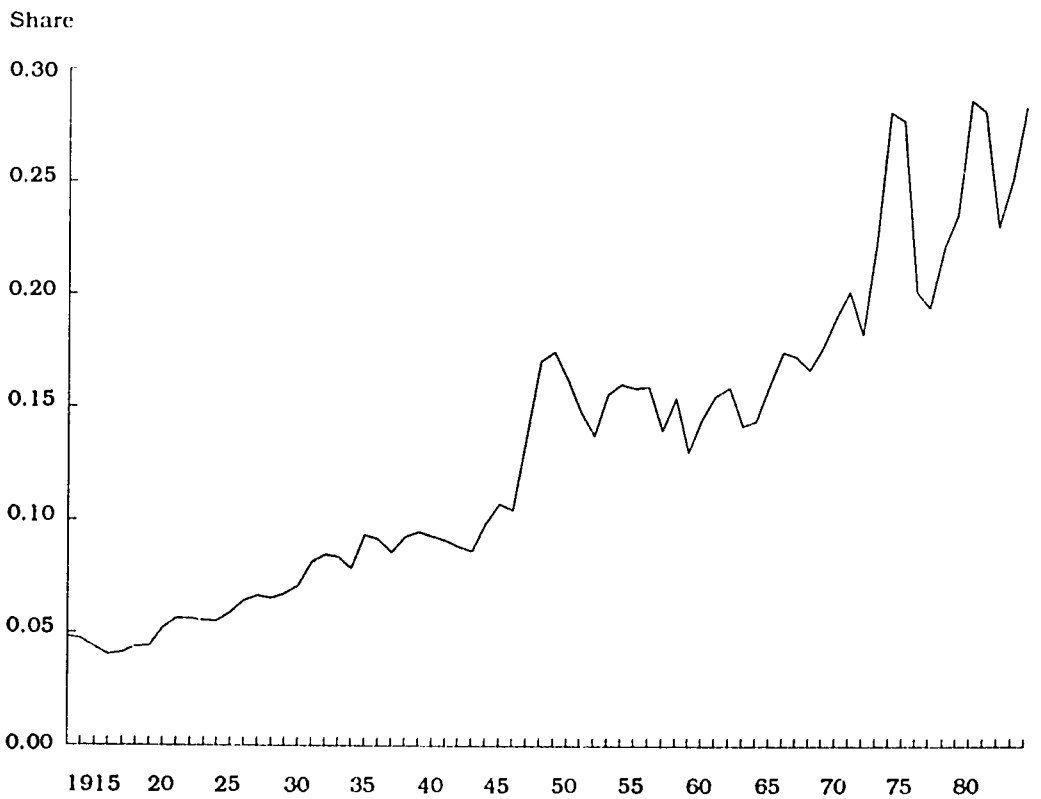
Economic policies are classified here into three main groups: macroeconomic, income, and trade policies.

Macroeconomic policy includes government decisions concerning the size of government expenditures relative to total income, the way in which they are financed, and the rate of growth of the money supply.

Three relevant macro policy indicators were constructed for the period analyzed. The first is the share of government consumption in total income. This measures the size of government expenditures. As can be seen in Figure 2, government expenditures show a clear upward long-term trend. After the mid-1940s, several significant ups and downs can be observed. This suggests that government expenditures drastically increased, reaching levels that could not be sustained later. After a few years, high levels of government spending were partially reversed.

Another indicator of macro policies is the fiscal deficit. Figure 3 plots the fiscal deficit as a proportion of national income and the part financed by borrowing. The

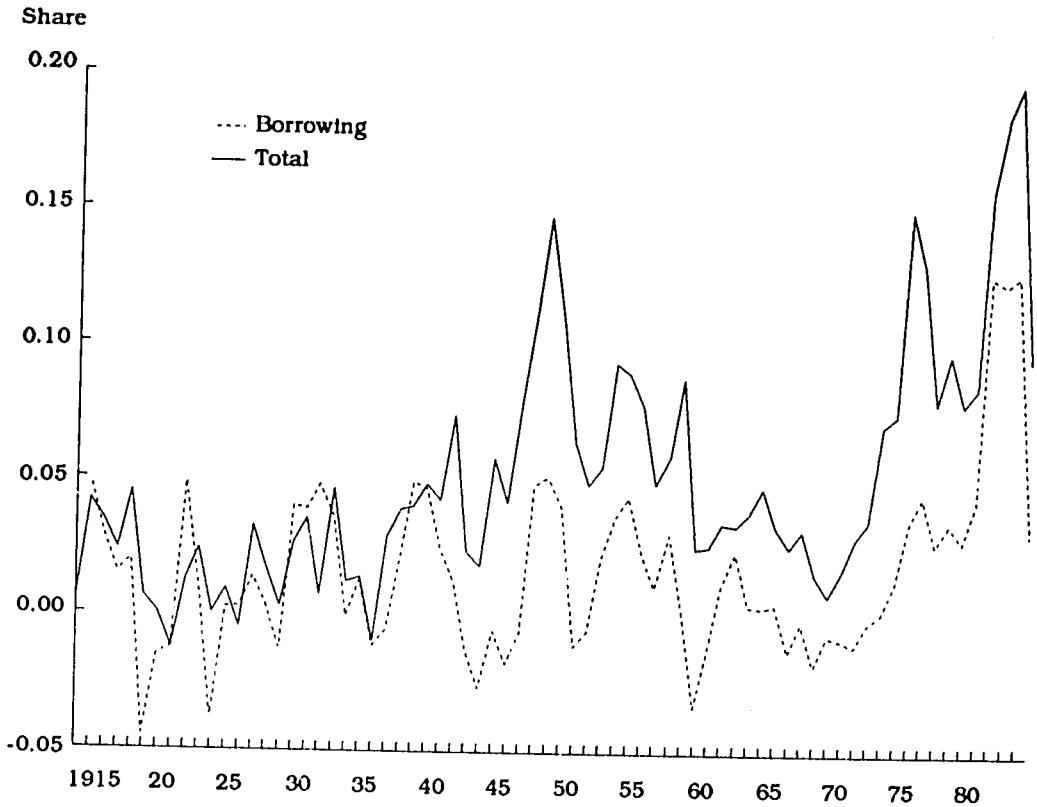
Figure 2—Government expenditures, 1913-84



Sources: Derived from Instituto de Estudios Económicos sobre la Realidad Argentina y Latinoamericana, "Estadísticas de la Evolución Económica de Argentina, 1913-1984," *Estudios* (No. 39, 1986). See the data supplement to this report.

Note: This is government consumption as a proportion of total income in current prices.

Figure 3—Fiscal deficit by source of financing, 1914-84



Sources: Derived from Instituto de Estudios Económicos sobre la Realidad Argentina y Latinoamericana, "Estadísticas de la Evolución Económica de Argentina, 1913-1984," *Estudios* (No. 39, 1986). See Table 20 of the data supplement to this report.

Notes: This is the total fiscal deficit financed by borrowing and monetary expansion as a proportion of total income. Negative values are surpluses.

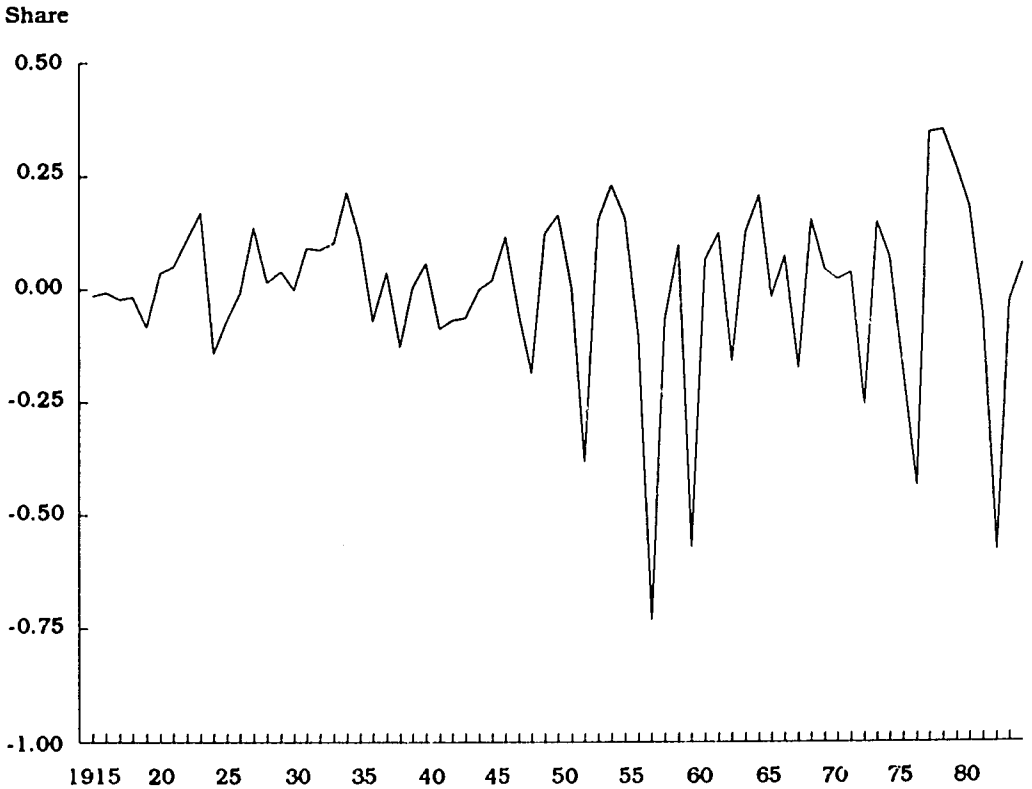
difference between the two indicates the part financed by money creation. After 1930, the fiscal deficit was much larger than the levels it had reached previously, exceeding 10 percent of total income during some subperiods. The sources of fiscal deficit financing changed frequently during the analyzed period.

Figure 4 indicates the rate of growth of the money supply over and above the rate of growth of output valued at foreign prices or, in other words, the rate of devaluation adjusted for real growth and foreign inflation. The plot shows that monetary policy was very unstable after 1930. Some years show large expansions followed by large contractions.

Income policy includes management of some crucial prices and wages. It is usually used to cope with income distribution goals. In the Argentine economy, the two prices most commonly managed, at least in the short run, are the official price of foreign exchange and wages.

A good indicator of income policy is the government wage corrected by average labor productivity. Every time the wage moves upward, the government is attempting to redistribute income in favor of labor. This attempt is usually accompanied by an

Figure 4—Indicator of monetary-exchange rate management, 1914-84



Sources: Derived from Instituto de Estudios Económicos sobre la Realidad Argentina y Latinoamericana, "Estadísticas de la Evolución Económica de Argentina, 1913-1984," *Estudios* (No. 39, 1986). See the data supplement to this report.

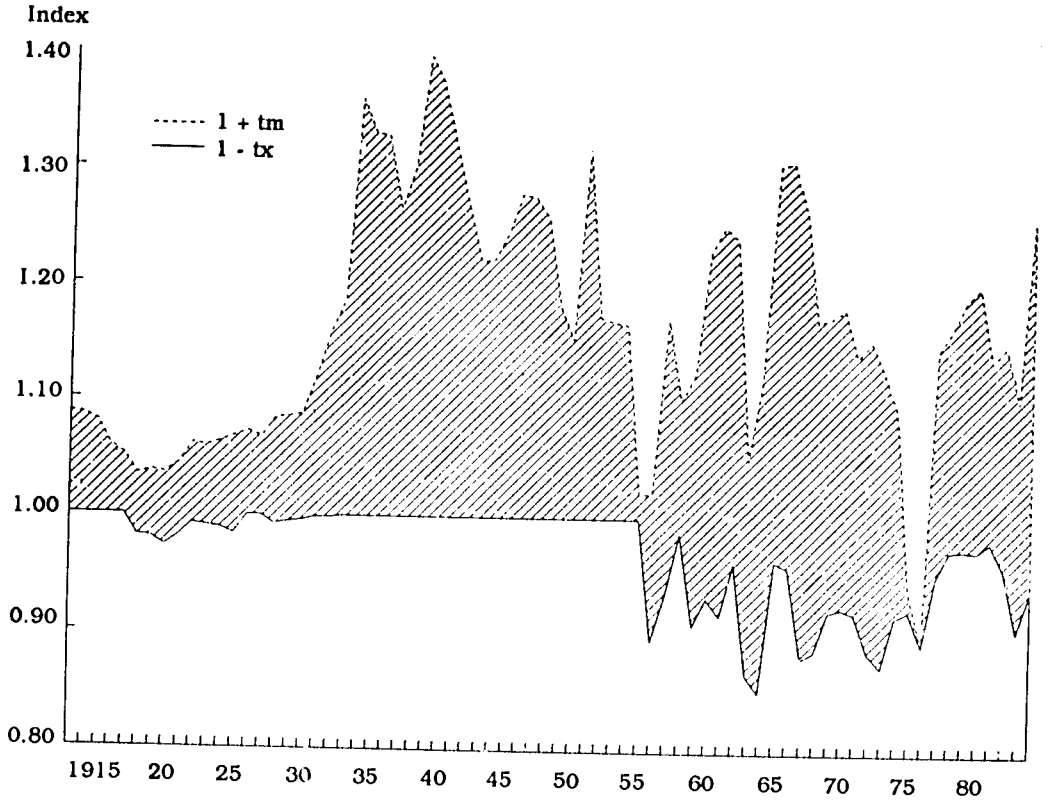
Note: Computed as $\hat{\mu} = \hat{M} - \hat{E} - \hat{P}^* - \hat{Y}$, where M is the M3 stock of money supply, E is the nominal exchange rate, P^* is the foreign price of Argentine imports and exports, Y is real output, and the hat above each variable indicates the rate of growth.

expansionary monetary policy, that is, by a rate of growth of the money supply that exceeds the rate of nominal devaluation adjusted for real growth and foreign inflation.

Trade policy includes taxes on exports and tariffs on imports as well as quantitative restrictions on both sides of foreign trade.

Taxes on exports and tariffs on imports are plotted in Figure 5. The shadowed area indicates the wedge between domestic and foreign prices caused by taxation on foreign trade. Note that this wedge increased significantly after the Great Depression. In addition to taxes on imports and exports, there were periods when the exchange rate was not the same for imports and exports. This indicates an implicit tax in addition to the direct tax on the two traded commodities. These two types of taxation were not determined independently. In practice, whenever the official exchange rate for imports is set at a lower level than the exchange rate for exports, there is an implicit subsidy for imports that counterbalances the effect of taxes. This was particularly relevant during the years 1975-76, when the rate for imports was considerably lower than the rate for exports.

Figure 5—Trade policy, 1913-84



Sources: Derived from Instituto de Estudios Económicos sobre la Realidad Argentina y Latinoamericana, "Estadísticas de la Evolución Económica de Argentina, 1913-1984," *Estudios* (No. 39, 1986). See the data supplement to this report.

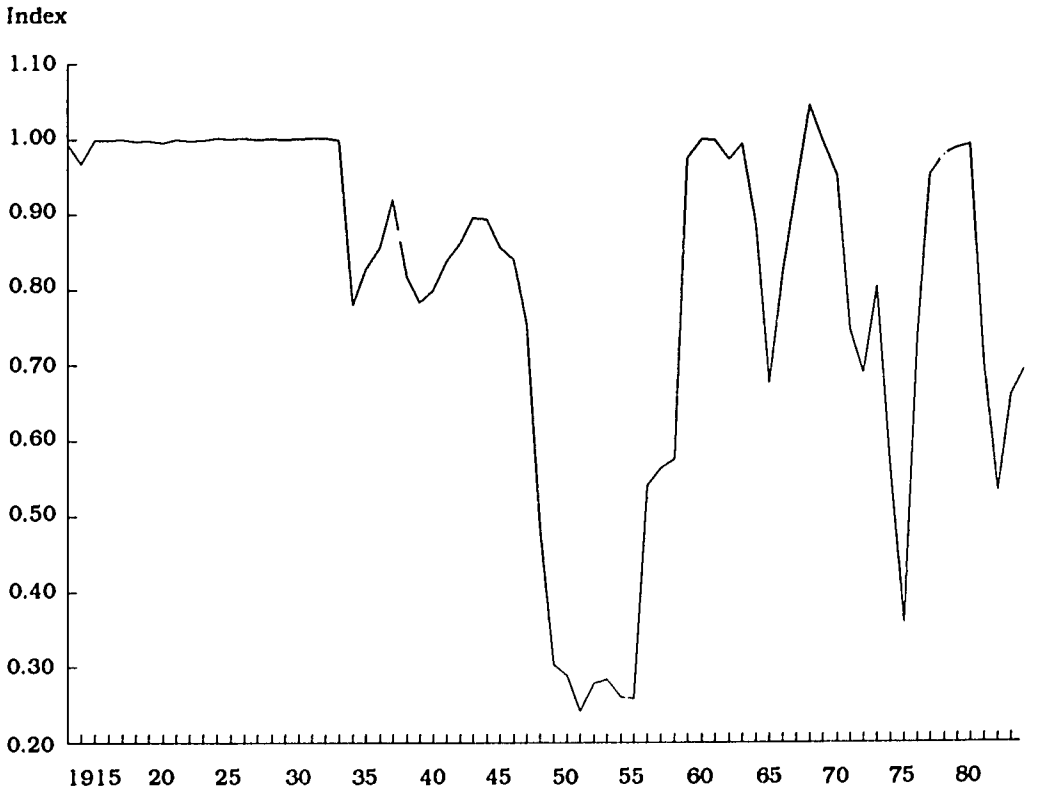
Note: The solid line is $1 - t_x$ and the broken line is $(1 + t_m)(E^m/E)$, where t_x is the proportion of taxes collected on exports over the value of exports, t_m is the proportion of taxes collected on imports over the value of imports, E_m is the nominal exchange rate for imports, and E is the nominal exchange rate for exports.

The reduction in the wedge that Figure 5 shows for later decades does not necessarily mean that trade distortions were reduced. This is because taxes on exports and tariffs on imports were estimated by dividing actual tax revenues by the value of exports and imports, respectively, and therefore do not capture the effect of quantitative restrictions. Whereas, on the export side, taxes have been the most important restrictions on trade, in the case of imports, quantitative restrictions became dominant after the 1940s. Although there is no direct measurement of quantitative restrictions, they usually became more stringent whenever the black market exchange rate departed from the official rate. A measure of the black market premium is presented in Figure 6.

Characteristics of the Economic Sectors

The analysis is carried out by disaggregating the economy into three sectors: agriculture (sector 1), nonagriculture excluding government (sector 2), and government (sector 3).

Figure 6—Degree of financial openness, 1913-84



Sources: Derived from Instituto de Estudios Económicos sobre la Realidad Argentina y Latinoamericana, "Estadísticas de la Evolución Económica de Argentina, 1913-1984," *Estudios* (No. 39, 1986). See the data supplement to this report.

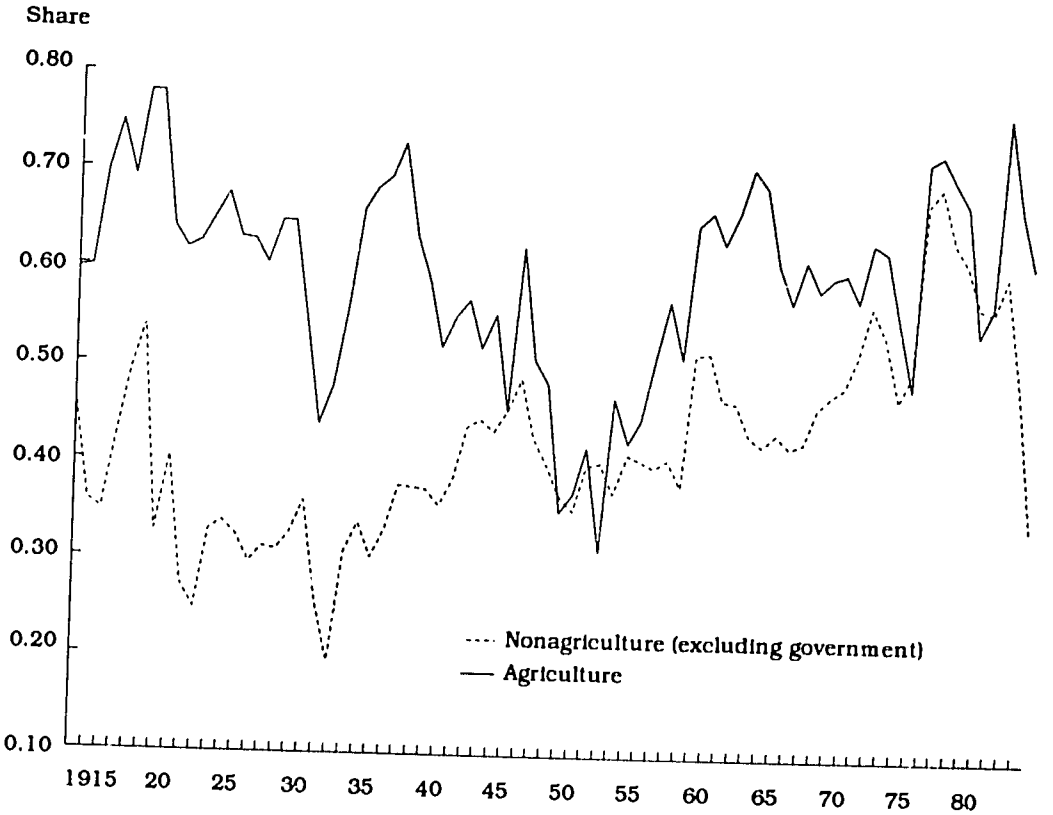
Note: In rigor, this is the inverse of one plus the black market premium on foreign exchange, computed as E/E^b, where E is the official rate of exchange for exports and E^b is the rate of exchange in the black market.

Agriculture is the sector that produces the bulk of exportable goods. Nonagriculture excluding government is the sector that produces import substitutes. Economic policies have different effects on agriculture and nonagriculture due to two basic sectoral characteristics:

First, *agriculture is more capital-intensive than nonagriculture.* The shares of capital measured as the share of nonwage income in total sectoral income are plotted in Figure 7 for each sector. As summarized in Table 2, the share of capital averaged 60 percent in agriculture and 42 percent in nonagriculture. Note, however, that in the latter decades the difference became much smaller.

Second, *agriculture is more internationally tradable than nonagriculture.* This can be seen in Figure 8 where implicit shares of tradables in sectoral output are plotted. Whereas agriculture has an average tradable component of 67 percent of sectoral output, nonagriculture averages only 47 percent (see Table 3). The estimation of the implicit shares of tradables in sectoral output is discussed in Chapter 4.

Figure 7—Sectoral shares of capital, 1913-84



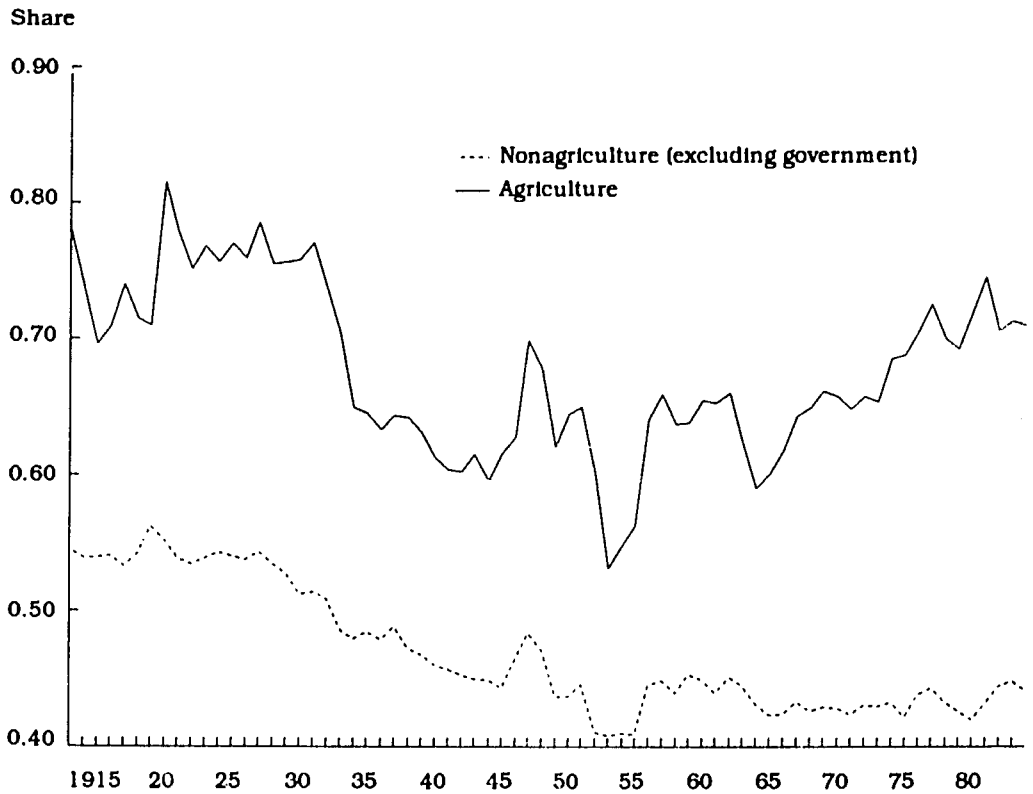
Source: See Tables 3, 6, and 12 of the data supplement to this report.
Note: This is the share of income that accrues to capital in each sector, computed as one minus sectoral labor income.

Table 2– Sectoral shares of capital, 1913-84

Sector	Average	Standard Deviation	Maximum	Minimum
Agriculture	0.60	0.10	0.78	0.31
Nonagriculture excluding government	0.42	0.10	0.69	0.19

Note: Computed as one minus the ratio of the sector's labor income to the sector's total income.

Figure 8—Sectoral degree of tradability, 1913-84



Note: This is the traded share in sectoral output.

Table 3—Sectoral degree of tradability, 1913-84

Sector	Average	Standard Deviation	Maximum	Minimum
Agriculture	0.67	0.06	0.81	0.53
Nonagriculture excluding government	0.47	0.04	0.56	0.42

Notes: Computed from the estimated coefficients for agriculture (α_1) and for nonagriculture (α_2), as reported in Tables 7 and 8.

3

THE REAL RATE OF EXCHANGE

Chapters 3 through 5 deal with the effects of macro and trade policies on sectoral prices. Such policies affect the demand and supply of the various commodities in the economy. Some commodities cannot be traded and therefore their domestic prices have to accommodate the changes caused by the macro policies in order to restore equilibrium. To analyze such effects in the simplest framework, the standard analysis divides the economy into two sectors: tradables and nontradables. The price of the tradable good in terms of the nontradable good is referred to as the real rate of exchange. Such a dichotomy is not sufficiently detailed for analyzing policies or events that differentiate between exports and imports. For this reason, the economy is further divided into three sectors, exportables (x), importables (m), and home goods (h).[3]

The analysis assumes that Argentina can be treated as a small economy in the sense that it is a price taker in world markets. In this case, the prices of the two traded goods are determined by three factors: foreign prices, which are considered to be exogenous, the nominal rate of exchange, which allows the conversion of foreign currency into domestic currency, and taxes on foreign trade. In symbols, the price of the exported good (P_x) is given by

$$P_x = P_x^* E(1 - t_x), \tag{3.1}$$

where P_x^* is the foreign price of exports, E is the nominal exchange rate, and t_x is the tax rate on exports. Similarly, the price of imported goods (P_m) is given by

$$P_m = P_m^* E(1 + t_m), \tag{3.2}$$

where P_m^* is the foreign price of exports and t_m is the rate of protection.

The Price of the Home Good

While the domestic supply and demand of the two traded goods need not be equal because the gap is closed by trade, the same is not true for nontraded home goods (P_h). Because they are nontradable, domestic supply and demand must be equal, and this is achieved through the adjustment of P_h.

The starting point is a standard model that analyzes the determination of P_h in a three-sector competitive economy that consists only of private sectors (Dornbusch 1974).

The supply of the home good, Q_h^s, depends on the two relative prices and on resource endowment and technology denoted by κ. In symbols,

$$Q_h^s = Q_h^s(\underset{-}{P_x/P_h}, \underset{-}{P_m/P_h}, \underset{+}{\kappa}). \tag{3.3}$$

[3] A glossary of symbols, providing a short definition of the variables used, is given in Appendix 1.

Higher prices for exportables and importables will reduce the supply of the home goods because resources will move into the production of the two traded goods. For the time being, the effect of changes in resources and technology is suppressed.

The demand for the nontraded good (Q_h^d) depends on the two relative prices and the level of income:

$$Q_h^d = Q_h^d(\underset{+}{P_x/P_h}, \underset{+}{P_m/P_h}, \underset{+}{Y}). \tag{3.4}$$

The demand is declining in P_h. To simplify the discussion, it is assumed that the demand also increases in the prices of the two traded goods. Finally, all goods are assumed to be normal goods. Income (Y), measured in units of home goods, is

$$Y = Q_h^s + P_x Q_x^s + P_m Q_m^s,$$

and expenditure (C) is

$$C = Q_h^d + P_x Q_x^d + P_m Q_m^d.$$

Under the assumption that consumption (C) equals income (Y), the trade balance constraint is obtained: $P_x E_x + P_m E_m = 0$, where E_j is the excess supply of j, j = x, m. Note that both supply and demand are functions of one endogenous variable only, P_h. Thus, equating Q_h^s to Q_h^d gives an implicit function:

$$\Phi[(P_x/P_h),(P_m/P_h)] = 0. \tag{3.5}$$

Using the implicit function theorem, equation (3.5) can be solved explicitly:

$$P_x/P_h = \Phi(P_m/P_h). \tag{3.6}$$

Differentiating the system logarithmically and rearranging gives

$$(\hat{P}_x - \hat{P}_h) = \omega(\hat{P}_x - \hat{P}_m), \tag{3.7}$$

where $\omega = \Delta_m/(\Delta_m + \Delta_x)$, and $\Delta_j = \varepsilon_j^s - \varepsilon_j^d$, j = x, m, where ε_j^s and ε_j^d are the supply and demand elasticities of the home good with respect to the price of the jth good.

The coefficient ω is close to one when the elasticities of supply and demand for the home good with respect to the price of the exportable good are close to zero, that is, when the degree of substitution in production and demand between the exportable and the home good is very low. In this case P_h will move close to P_m.

On the other hand, ω is close to zero when the elasticities of supply and demand of the home good with respect to the price of the importable good are close to zero; in other words, when substitutability in production and demand between the importable and the home goods is low. In the extreme case where ω is zero, P_h will behave as P_x.

Equation (3.7) can be rewritten as

$$\hat{P}_h = (1 - \omega)\hat{P}_x + \omega\hat{P}_m, \tag{3.8}$$

which indicates that the price of the home good changes only as a result of changes in the prices of the tradables. Integrating (3.7), considering ω to be a constant, and

denoting $p_j = P_j/P_h$, $j = x, m$, gives

$$\ln p_x = a + \omega \ln P_x/P_m, \tag{3.9}$$

which can then be arranged as

$$\ln p_m = a - (1 - \omega)\ln(P_x/P_m). \tag{3.10}$$

This equation provides a framework for evaluating the consequences of some policies. The first policy instrument to consider is taxes on trade. Assuming that the tax revenues are returned to consumers as lump sums, the price of tradables can be decomposed according to equations (3.1) and (3.2) and written:

$$\ln p_x = a + \omega \ln(P_x^*/P_m^*) + \omega \ln[(1 - t_x)/(1 + t_m)], \text{ and} \tag{3.11}$$

$$\ln p_m = a - (1 - \omega)\ln(P_x^*/P_m^*) - (1 - \omega)\ln[(1 - t_x)/(1 + t_m)]. \tag{3.12}$$

Equation (3.11) expresses the determination of the price of exportables in terms of the home good. It is positively related to the terms of trade and negatively related to the two taxes. The converse is true for the price of importables in terms of the home good.

Both p_x and p_m constitute measures of the real effective exchange rate, but they behave differently in response to the exogenous variables, foreign terms of trade or taxes. The more conventional measure of the real exchange rate (e) is

$$e = P^*E/P_h, \tag{3.13}$$

where P^* is a weighted average of the foreign prices, and

$$P^* = (P_x^*)^b (P_m^*)^{1-b}. \tag{3.14}$$

Combining equations (3.11)-(3.14) and rearranging gives

$$\ln e = a - (1 - b - \omega)\ln(P_x^*/P_m^*) - \omega \ln(1 + t_m) - (1 - \omega)\ln(1 - t_x). \tag{3.15}$$

When $b = 1$, that is, when 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 $b = 0$. In this case, the foreign prices are measured by the import price, and the results are identical to those in equation (3.12).

Extensions

Degree of Openness

Restrictions on trade modify the position of the economy and therefore the solution for the real rate of exchange. A common restriction is to limit imports. The effect on the system requires a solution subject to the constraint $E_m \leq E_m^*$, where E_m^* is the quota. Under balanced trade, this also implies a constraint on exports. As a result of this restriction, the domestic price of importables will rise, and this sector will attract

resources. The shift of resources into this sector results in an increase in their prices and therefore an increase in the price of the home good. Consequently, using the definition of P_m as given in equation (3.2), it is clear that P_m/P_h declines, that is, the real rate of exchange declines. Since the decline is caused by an increase in P_h, it leads to a decline in the real rate of exchange regardless of the measure—p_x, p_m, or e. A binding import quota has a shadow price. The shadow price is equal to the increase in the cost of production of a unit of importables resulting from the quota. This increase reflects the cost of the domestic component employed in the importable sector.

Incorporating trade restrictions into the empirical analysis calls for measurement of the degree of openness (DO) of the economy. This measure is discussed below.

Capital Inflow

The foregoing analysis assumed no capital inflow. This is just a matter of convenience. The analysis can be extended to accommodate any level of capital flow. In this case, the expenditure is given by $(C = Y + S^f)$ where S^f is the value of the capital inflow. Capital inflow increases the supply of tradables in the economy and therefore their relative price; thus, the real rate of exchange should decline. This effect, as well as the effects of macro policies to be discussed below, can be analyzed within the simple model of two sectors without separating between exportables and importables. The system can then be written as

$$T^s = Q_T^s(e) + S^f/e, \qquad H^s = Q_h^s(e), \text{ and}$$

$$T^d = Q_T^d(e, Y + S^f), \qquad H^d = Q_h^d(e, Y + S^f),$$

where T^s and T^d are the supply and demand for tradables and H^s and H^d are the supply and demand for home goods, respectively.

The solution of this system can be obtained by analyzing either market. The capital inflow increases the demand for the home good through the income effect of a larger consumption. Therefore, the price of the home good increases, implying a decline in e. Alternatively, capital inflow increases the supply and demand of tradables. However, since the marginal propensity to consume either good is less than 1, demand increases less than supply, and therefore e declines.

Until now demand has been considered to consist only of private consumption. The analysis can be generalized to cover investment as well. The price effect remains the same, but the parameters may change. Therefore, the demand equation will depend on the composition of the expenditures. This is more important when the analysis is extended to include government.

Macro Policies

The demand composition of government, and its budget constraints are different from those of the private sector.[4] It is therefore necessary to take explicit account of this in the analysis. To simplify the exposition, it is assumed that government consumes only home goods. Let H_g^d be the government demand for H. Then, total demand for H is $H^d = H_g^d + H_p^d$, where H_p is the private sector component. To begin, assume that government expenditure is fully financed by taxing the private sector. Then, an increase

[4] For recent discussions of macro policies, see Dornbusch (1987) and Snape (1989).

in government expenditures causes an increase in the demand for the home good and a decline in the demand for the tradable good. The price of the home good increases and the real exchange rate declines.

The effect of government on the real exchange rate is stronger when the government runs a deficit. The deficit is financed either by borrowing or by money creation. When the government borrows and the economy is financially open, the result is a capital inflow, and this leads to a decline in e, as has been shown above. When the economy is financially closed, borrowing will have a crowding out effect. The rate of interest will increase, and this will cause reduction in the expenditure of the private sector necessary to facilitate the expansion of government expenditure. 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, expenditure of the private sector is reduced by the inflationary tax. Again, due to 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, monetary expansion will cause an increase in demand of the private sector. As the two goods are normal, the increase in demand will increase the capital inflow, and this causes e to decline. At the same time, there is an increase in demand for the home good by both sectors, and this reinforces the previous effect. The mechanism will change when E is flexible, but nevertheless e declines.

Long-Term Effects

Much of the discussion on the real exchange rate is related to short-term variations, whereas empirical analyses are based on data that also reflect changes that can be classified as long-term changes. A change in resources may affect the supply of the various goods differently. The home good is perceived to be labor intensive. In this case, capital accumulation reduces the price of the capital-intensive sectors, which implies a decrease in e. Changes in technology may take different forms, which will not be discussed in detail here. The net effect of such changes can be determined empirically.

The income effect, which has so far been neglected, can have an important influence on e, when the income elasticity for the home good is not unitary. If the demand for the home good is income elastic, then, as income increases, other things being equal, the relative demand for H will increase and e will decline. The converse is true when the demand for the home good is income inelastic.

Previous Estimations of the Real Exchange Rate Equation for Argentina

Earlier estimates of the real exchange rate equation did not consider the macro variables and the long-term effects discussed above. Basically, these studies used the specification in equation (3.9). The results are reported in Table 4. They differ somewhat in the variables used and the periods of analysis. Regressions 1 and 2, reported by Rodriguez and Sjaastad (1979), were estimated by using quarterly data and the nonagricultural wholesale domestic price index to measure P_h. Cavallo and García (1985) estimated the same regression using annual data (regressions 3 and 4) and obtained estimates of ω that are substantially lower (0.21 compared with 0.41). They also show that this difference is even wider when the consumer price index is used to represent

Table 4—Previous estimates of the real exchange rate for exports, restricted model, various periods

Regression	Study	Period Considered	Estimation Method	Data	Constant	ω	ρ	R^2	D.W.
1	R-S	1956-77	C-O	Quarterly, P_h is WPI_d	0.044 (0.8)	0.41 (7.4)	0.92	0.82	1.5
2	R-S	1956-77	C-O[a]	Quarterly, P_h is WPI_d	0.002 (0.3)	0.49 (9.0)	0.27	0.43	1.9
3	C-G	1960-84	OLS	Annual, P_h is WPI_d	...	0.21 (2.5)	...	0.54	1.6
4	C-G	1960-84	OLS	Annual, P_h is CPI	...	0.11 (0.8)	...	0.51	1.5
5	C-G	1960-84	OLS	Quarterly, P_h is WPI_d	...	0.374 (7.7)	...	0.87	1.4
6	C-G	1960-84	OLS	Quarterly, P_h is CPI	...	0.30 (4.6)	...	0.88	1.5
7	M-C-D	1913-84	C-O	Annual, P_h is P_3	−0.42 (−2.9)	0.25 (1.1)	0.79	0.63	1.6

Sources and notes: The previous estimates considered here are from the following studies: R-S is Carlos Rodríguez and Larry Sjaastad, *El Atraso Cambiario en Argentina: Mito o Realidad?* (Buenos Aires: Centro de Estudios Macroeconómicos de Argentina, 1979); C-G is Domingo Cavallo and Raul García, "Politicas Macroeconómicas y Tipo de Cambio Real," a paper presented at the Jornadas sobre Economía Monetaria y Sector Externo, Banco Central de la República Argentina, July 1985; and M-C-D is Yair Mundlak, Domingo Cavallo, and Roberto Domenech, "Effects of Trade and Macroeconomic Policies in Agriculture and Economic Growth: Argentina, 1913-84," a paper presented at the International Food Policy Research Institute Workshop on "Trade and Macroeconomic Policies: Impact on Agricultural Growth," Annapolis, Md., U.S.A., May 1987, and at the Econometric Society meeting in São Paulo, August 1987.

Abbreviations for estimation methods and terms are as follows: C-O is Cochrane-Orcutt; OLS is ordinary least squares; CPI is the Consumer Price Index; WPI_d is the Wholesale Domestic Price Index: P_3 is the price of government services; and ρ is the coefficient of the first order autoregression. The numbers in parentheses are t-statistics. Based on the following equation:

$$\log P_x/P_h = \alpha + \log P_x P_m.$$

[a] In this Cochrane-Orcutt estimation, variables are given in logarithmic differences.

P_h (0.11 compared with 0.41). Cavallo and García (1985) also obtained estimates of ω using quarterly data (regressions 5 and 6). Although the differences in this case are of a lesser magnitude, the results also show lower values for ω. Finally, regression 7 was estimated by Mundlak, Cavallo, and Domenech (1987) by using annual data for 1913-84 and measuring P_h as the price of the government sector. Although the estimated coefficient for ω is not statistically significant, it falls within the range of the previous estimates.

In discussing the implications of these estimates of ω, it should be noted that in the absence of trade distortions and other influences of government policies, the real exchange rate obtained from equation (3.15) is

$$\ln e^* = a + (\omega + b - 1)\ln(P_x^*/P_m^*).$$

Therefore, a measurement of "exchange rate overvaluation"[5] can be derived from

$$\ln(e^*/e) = (1 - \omega)\ln(1 - t_x) + \omega\ln(1 + t_m).$$

[5] See Valdés 1985.

Under this approach, the only source of overvaluation is trade policy. Therefore, it can not be eliminated by a nominal devaluation. Actually, the only way to eliminate this kind of real exchange rate overvaluation is to liberalize trade, that is, to set t_x and t_m to be zero. Within this framework, equation (3.15) can be used to compute the free-trade exchange rate (e^*) by imposing $t_x = t_m = 0$.

When the alternative estimates of ω were used to compute the exchange rate (e^*) under free trade, it was found to be lower and not higher than its actual level. Since $\ln(1 - t_x)$ is negative, this result is a consequence of the low value of ω, which means that in Argentina the price of the home good moved closer to P_x than to P_m. Therefore, changes in t_x have a dominant influence on the real rate of exchange when compared with changes in t_m.

The same phenomenon is found in Cavallo and Mundlak (1982), where a model of the Argentine economy is used to simulate the effects of trade liberalization. An equation for the real exchange rate, as specified in equation (3.15), was estimated without imposing any restrictions on the coefficients. The shares of exports and imports are used in computing the average foreign price, P^*. The implied value of b in equation (3.15) is approximately 0.4. This estimation is reproduced in Table 5, regression 1. Since the coefficients are unrestricted, ω can be identified from the estimated coefficient of P_x^*/P_m^* or $(1 - t_x)$, or $(1 - t_m)$. The values that result for ω range from 0.12 to 0.30 depending upon the coefficient used to identify it.

Introducing the Macro Variables

The next phase in the empirical analysis is the introduction of macro variables. Cavallo (1988) reports estimates of the real exchange rate for exports for three periods: 1913-39, 1940-55, and 1956-84. These results show that the influence of macroeconomic policies on the real exchange rate was important in the subperiods 1940-55 and 1956-84. On the other hand, during 1913-39, the period in which the economy operated under a more open trade regime, the real exchange rate was influenced by trade policy and foreign prices more than by macro policies. This is in line with the foregoing discussion. As a consequence, the macro variables now need to be incorporated into the analysis.

Table 5 also summarizes previous estimates of equation (3.15) with macro policy variables added. No restrictions on the coefficients are imposed in these cases, so that each equation produces three different values of ω as before. Regression 4, which is run for the whole period 1913-84, allows the coefficients to vary according to the degree of commercial and financial integration of the economy with the rest of the world. In all these cases (regressions 2, 3, and 4) the results indicate that macroeconomic policy has an important effect on the real rate of exchange. The resulting values for ω varied largely, depending on the degree of openness.

Thus the main conclusion is that overvaluation of the Argentine currency arose not just from trade policy but also from macro and income policies. Moreover, these effects are shown to depend on the structural features of the economy. That leads to a more detailed specification, as given by the following equation:

$$\hat{P}_x - \hat{P}_h = \omega(\hat{P}_x - \hat{P}_m) + \varepsilon_Y\hat{Y} - \varepsilon_g\hat{g} - \varepsilon_f f - \varepsilon_m\hat{\mu}, \qquad (3.16)$$

where the hat indicates the rate of change, and the additional variables are total income (Y), share of government consumption (g), borrowing (f), and the money supply (μ).

Table 5—Previous estimates of the real exchange rate, unrestricted model, various periods

Regression	Study	Period	Estimation Method	Constant	$\log(P_x/P_m)$	$\log(1-t_x)$	$\log(1+t_m)$	$\hat{g}$	f	$\hat{\mu}$	$\bar{R}^2$	D.W.
1	C-M	1943-77	OLS	0.03 (1.1)	−0.48 (−4.5)	−0.70 (−6.9)	−0.25 (−1.6)	...	...	...	0.94	2.2
2	C-G	1960-83	OLS	0.91 (6.0)	−1.05 (−6.0)	−0.96 (−8.0)	−0.62[a] (−1.8)	−2.99 (−9.4)	−1.66 (−3.7)	−0.06[b] (−2.4)	0.93	2.3
3	C	1960-84	OLS	0.79 (4.2)	−0.82 (−3.5)	−1.03 (−7.2)	−0.30 (−1.8)	−2.93 (−6.0)	−1.37 (−2.8)	−0.08[b] (−2.4)	0.90	2.3
4	M-C-D	1916-84	C-O	4.80 (0.15)	0.51 (1.7)	−1.14 (−2.1)	−2.6 (−2.5)	0.8 (0.3)	1.1 (1.4)	−0.1 (−1.3)	0.91	1.4
					+ 0.4DO_2 (2.0)		−1.2DO_2 (−2.5)	+ 3.9DO_2^c (4.2)	−2.5DO_f (−1.6)	−0.4DO_f (−2.0)		

Sources and notes: The dependent variable is log e. The previous estimates considered here are from the following studies: C-M is Domingo Cavallo and Yair Mundlak, *Agriculture and Economic Growth: The Case of Argentina*, Research Report 36 (Washington, D.C.: International Food Policy Research Institute, 1982); C-G is Domingo Cavallo and Raul García, "Politicas Macroeconómicas y Tipo de Cambio Real," a paper presented at the Jornadas sobre Economía Monetaria y Sector Externo, Banco Central de la República Argentina, July 1985; C is Domingo Cavallo, "Exchange Rate Overvaluation and Agriculture: The Case of Argentina," background paper for *World Development Report, 1986* (New York: Oxford University Press for the World Bank, 1986); and M-C-D is Yair Mundlak, Domingo Cavallo, and Roberto Domenech, "Effects of Trade and Macroeconomic Policies in Agriculture and Economic Growth: Argentina, 1913-84," a paper presented at the International Food Policy Research Institute Workshop on "Trade and Macroeconomic Policies: Impact on Agricultural Growth," Annapolis, Md., U.S.A., May 1987, and at the Econometric Society meeting in São Paulo, August 1987. Numbers in parentheses are t statistics. See the glossary of symbols for definitions of variables. OLS is ordinary least squares and C-O is Cochrane-Orcutt.

[a] t_m is an implicit rate of protection.

[b] $\hat{M}-\hat{E}$; $DO_2 = \log(P_e^x X^x / P_2 X_2)$; $DO_f = \log(E/E^b)$.

[c] The ratio of government consumption to income is not in logarithms.

Y is introduced to summarize the long-term effects. At this stage, no attempt is made to differentiate between capital accumulation, technology, and income.

g is obtained from $g = P_g C^g/PY$, where P_g and C^g are the price and quantity of government consumption, respectively. This variable measures the composition of total expenditure.

f is measured by fiscal deficit financed by borrowing as a proportion of income, that is, $f = (B_t^g - B_{t-1}^g)/PY$, where B_t^g is the public debt in year t.

μ is measured as a proportion of the money supply in nominal income evaluated in terms of foreign prices, $\mu = M/P^*EY$.

The coefficients of these variables are allowed to be functions of the degree of commercial (DO_c) and financial (DO_f) openness:

$$\omega = a_0 + a_1 \ln DO_c,$$

$$\varepsilon_y = b_0 + b_1 \ln DO_c,$$

$$\varepsilon_g = g_0 + g_1 \ln DO_c,$$

$$\varepsilon_f = d_0 + d_1 \ln DO_c + d_2 \ln DO_f + d_3 (\ln DO_c)(\ln DO_f), \text{ and}$$

$$\varepsilon_m = f_0 + f_1 \ln DO_c + f_2 \ln DO_f + f_3 (\ln DO_c)(\ln DO_f). \qquad (3.17)$$

The degree of commercial openness, DO_c, is measured as a ratio of value of trade to total income, $(P_{ex}X^x + P_{im}M^m)/PY$, where P_{ex} and P_{im} are the implicit prices of exports (X^x) and imports (M^m), respectively. The degree of financial openness, DO_f, is measured as the inverse of the black market (E^b) premium on foreign exchange E/E^b.

Note that ω and the elasticities of real income and government consumption are assumed to depend only on the degree of commercial openness, whereas those of the fiscal deficit financed by borrowing and money supply are assumed to depend on both measures. Note also that regressing the equation on the domestic terms of trade, rather than separately on the foreign terms of trade and taxes, imposes a single value on ω.

The introduction of equation (3.17) to (3.16) results in a large number of cross-product terms, which in turn result in multicolinearity, and some statistically nonsignificant coefficients. The regression is then reestimated with a reduced number of variables. In order to avoid a specification bias due to omissions of variables, the degree of commercial openness, which is the variable most often excluded by this procedure, is introduced as a separate variable in the equation. A summary of the results for the equation chosen for the subsequent analysis is given in Table 6. The results are interpreted below.

Interpretation of the Empirical Results

Effect of Taxes on Exports and Imports

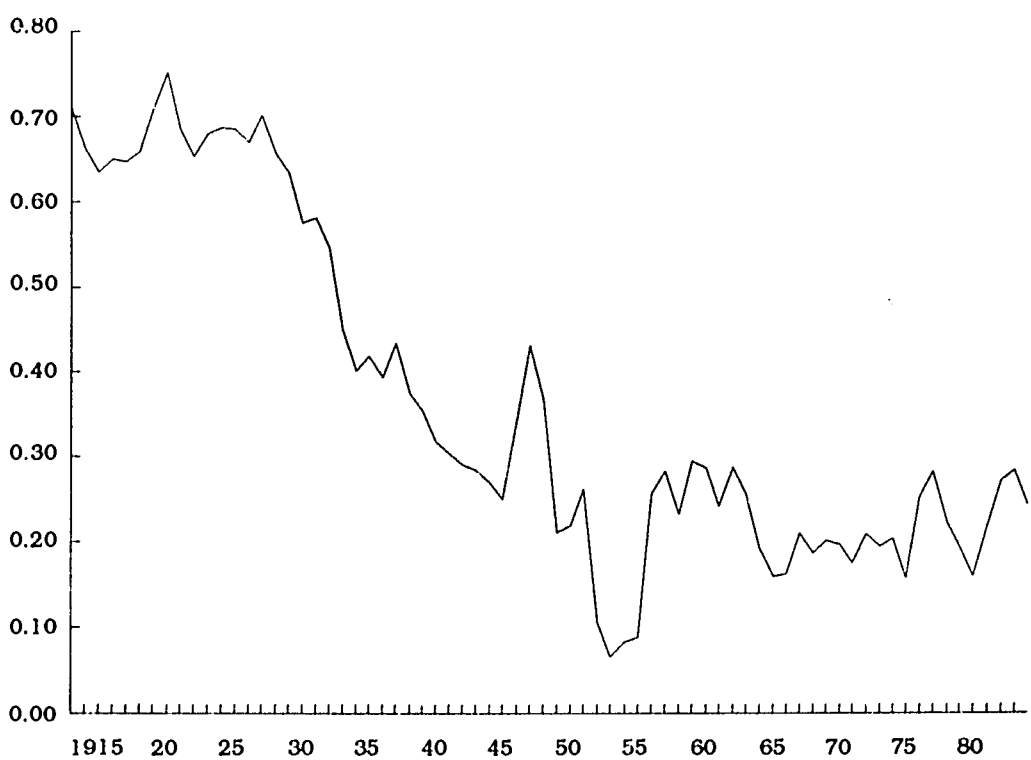
The values of ω computed from the regression in Table 6 are plotted in Figure 9. They range from 0.75 to 0.07. The value was around 0.70 before 1930, when the economy was open to the rest of the world. In that period, the price of home goods was more closely related to the price of imported goods than to the price of exports. This reflects a high degree of substitution in production and demand between the domestic and the imported goods. As the economy became more closed to foreign

Table 6—Estimation of the real exchange rate equation, 1916-84

Variable	Coefficient	Average Value of the Coefficient	Figure in which the Elasticity is Plotted
$\hat{P}_x - \hat{P}_m$	$0.72 + 0.29 \log DO_c$ (5.1) (2.5)	0.37	9
$\hat{Y}$	0.24 (1.6)	0.24	...
$\hat{g}$	$0.43 \log DO_c$ (6.7)	−0.52	10
f	$-1.69 - 2.04 \log DO_f$ (3.7) (2.3)	−1.13	11
$\hat{\mu}$	$-0.44 + 0.02 \log DO_f$ (5.1) (2.1)	−0.45	12

Notes: The dependent variable is $\hat{P}_x - \hat{P}_h$. The intercept of the equation is 0.02 with a t-ratio of 1.6; the coefficient of the degree of openness (DO_c) is 1.39 with a t-ratio of 8.1; $\bar{R}^2$ is 0.87; and the Durbin-Watson statistic (D.W.) is 1.65; t-ratios are in parentheses.

Figure 9—Elasticity of the real rate of exchange with respect to P_x/P_m (ω), 1913-84



Source: Computed from the estimated coefficient of $\hat{P}_x/\hat{P}_m$ reported in Table 6.

trade due to the restrictions imposed on imports, ω went down. The lowest values are observed in the early 1950s when the economy was tightly closed. Lower values of ω mean that the prices of home goods are more closely related to the domestic price of exports than to prices of imports. This has often been mentioned as one of the structural characteristics of the Argentine economy: the domestic prices of exports affect the cost of living because exports are mainly wage goods. As such, they strongly influence wages and domestic prices (Díaz Alejandro 1965, 1970).

Since the late 1950s, ω has oscillated around 0.25. This low value of ω explains why changes in export taxes produce only a small change in the effective real exchange rate for exports. When t_x goes down, the real rate of exchange is reduced and compensates for about 75 percent of the change in t_x. In other words, a 20 percent tax cut on exports will only produce a 5 percent increase in the price of exported goods relative to the price of home goods. The intuitive explanation is as follows. When t_x is reduced, the increased incentive to produce exportable goods induces an increase in exports, but the restrictions on imports prevent the extra export proceeds from being spent abroad. Therefore, a trade surplus is generated, foreign reserves increase, and there is an expansion of the money supply. As a consequence, domestic prices increase and the real exchange rate decreases. Of course, the outcome would be different if imports were allowed to increase unrestrictedly, that is, if the economy were open. In the estimated equation, opening the economy would result in an increase in the value of ω, and therefore, as can be seen in equation (3.1), the change in t_x would have a stronger effect on the relative price of exportables vis-à-vis the home goods.

Effect of Government Expenditures

As can be seen in Figure 10, government expenditures exercise a negative effect on the real rate of exchange. However, this effect is only significant after the 1930s, when the economy became less open to foreign trade. Although government expenditures have a larger component of nontraded goods than the private expenditures taxed away, the strong influence on the price of home goods only occurs when the substitution between imports and domestic goods in production and demand is low due to import restrictions.

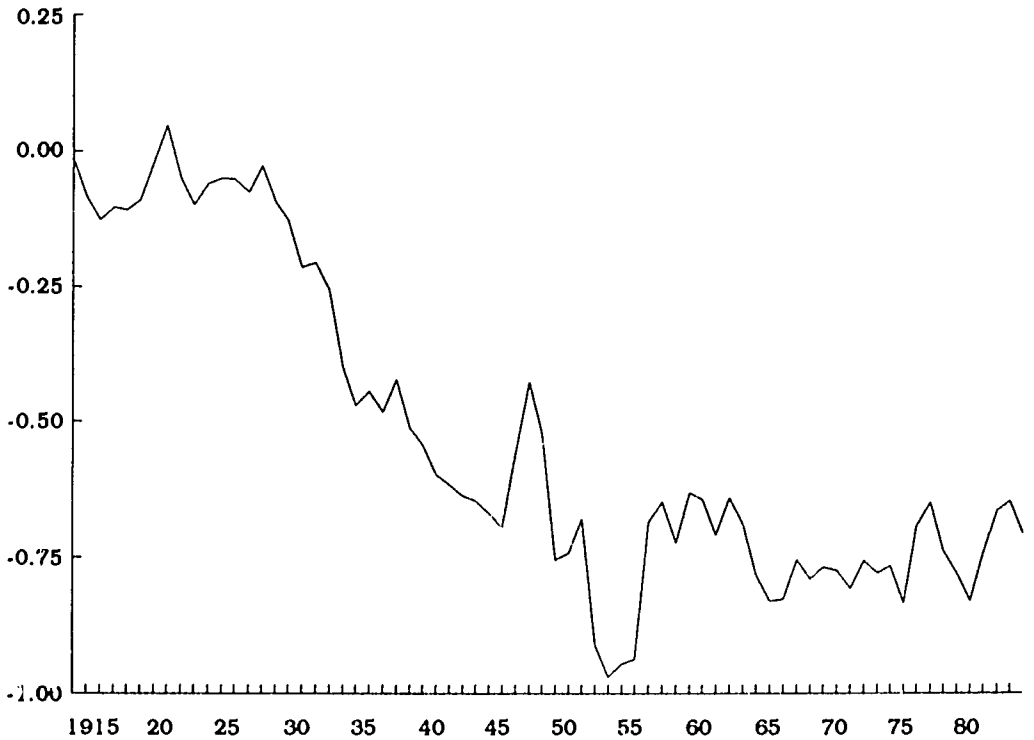
Note that since the 1950s the elasticity of the real rate of exchange with respect to government consumption has been around −0.75. This means that a 10 percent increase in the share of government consumption in total income reduces the real rate of exchange by 7.5 percent.

Effect of the Fiscal Deficit Financed by Borrowing

When the economy is financially open—when there is no black market premium on foreign exchange—the semielasticity of the real exchange rate with respect to the fiscal deficit financed by borrowing as a percentage of income is −1.7 (Figure 11).

This means that an additional debt-financed deficit of 1 percent of income produces a 1.7 percent decline in the real exchange rate. This is because the increased deficit pumps in foreign financing and produces either a decline in the nominal rate of exchange or an increase in domestic prices, or a combination of both effects. This order of magnitude of the effect of government borrowing was observed before the Great Depression and during short periods of financial integration with the rest of the world in 1959-62, 1968-70, and 1978-81. In periods of financial restrictions the semielasticity falls in absolute value, and in years when the economy is extremely closed such as 1949-55, it becomes positive. When domestic financial markets are completely closed,

Figure 10—Elasticity of the real rate of exchange with respect to government expenditures, 1913-84



Source: Computed from the estimated coefficient of $\hat{g} = \hat{P}_g + \hat{C}^g - \hat{P} - \hat{Y}$ reported in Table 6.

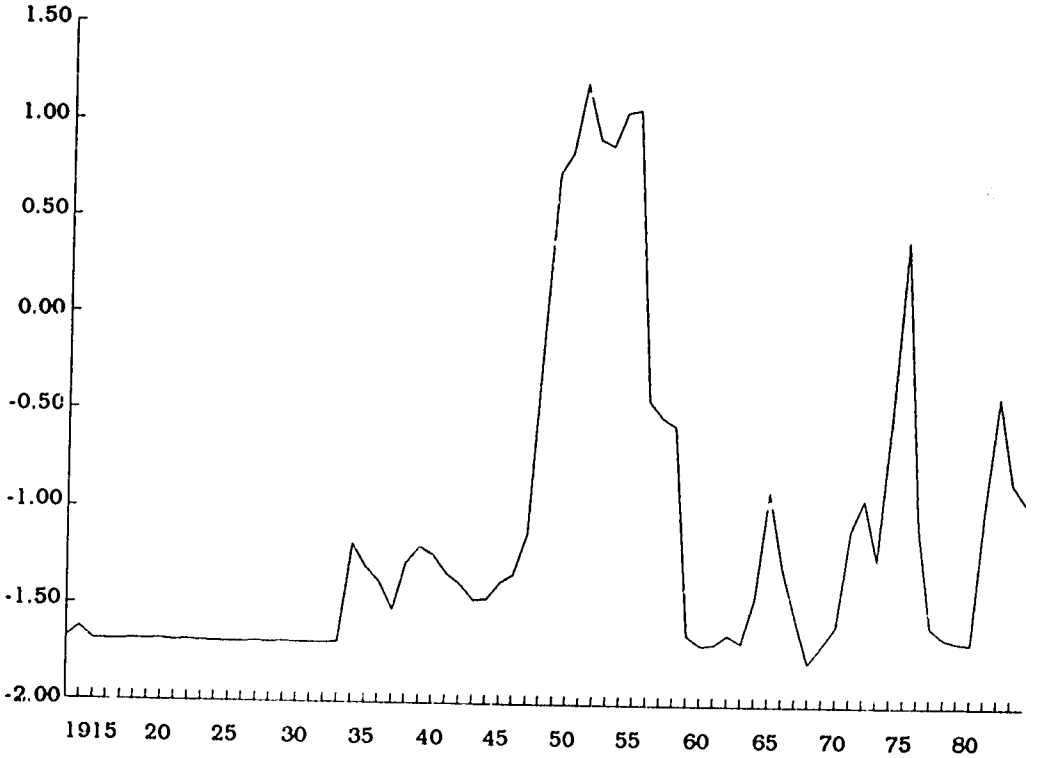
that is, when the black market premium is very large, financing the deficit through borrowing has a strong crowding-out effect on private expenditures. However, in the intermediate situation, when there are milder restrictions on financial transactions with the rest of the world (when the black market premium ranges from 20 to 40 percent), the semielasticity is around −1. This means that an additional debt-financed deficit of 1 percent of income produces a 1 percent reduction in the real exchange rate because flows of foreign financial resources are pumped in and the crowding-out effect is weaker.

Effect of Management of the Money Supply and the Nominal Exchange Rate

When the economy is financially wide open, monetary expansion over and above the expansion of income evaluated at foreign prices affects the real exchange rate with an elasticity of −0.44 (see Figure 12).

This means that a 10 percent increase in the money supply that is not accompanied by changes in the nominal exchange rate, foreign prices, or real income 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

Figure 11—Elasticity of the real rate of exchange with respect to debt-financed fiscal deficit, 1913-84



Source: Computed from the estimated coefficient of f reported in Table 6.

nominal shocks in the money supply or in the exchange rate as the result of the quick response of capital inflows or outflows to such shocks. This dampening effect does not operate when the flows are obstructed and a large black market premium is created.

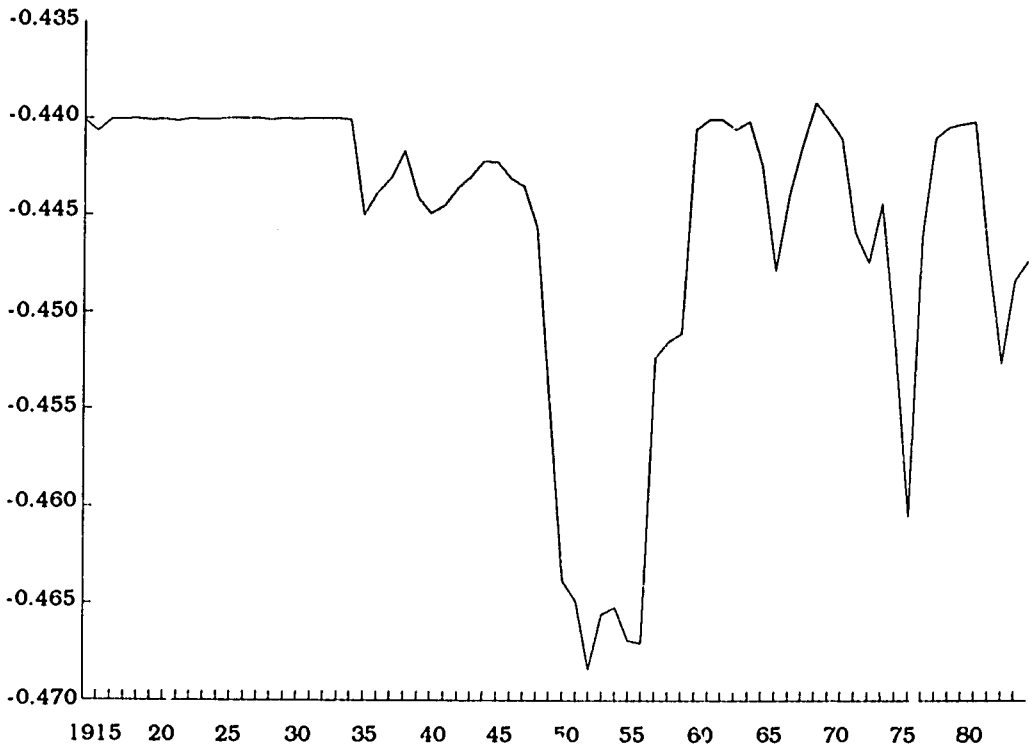
Effect of Commercial Openness

The foregoing discussion indicates that the response of the real exchange rate to variations in its determinants depends on the degree of commercial and financial openness. It is therefore interesting to evaluate how an increase in the degree of commercial openness affects the real rate of exchange. This is done by computing the elasticity of the real rate of exchange with respect to the degree of commercial openness. The results are plotted in Figure 13. The value goes from about zero, when the economy was very open, to more than 0.75, when the economy became relatively closed. This means that opening the economy will result in an increase in the real rate of exchange, and the increase will be proportionally more important the more closed the economy is at the point of departure.

Effect of Financial Openness

Similarly, Figure 14 shows the elasticity of the real rate of exchange with respect to the degree of financial openness. It is mostly negative, indicating that opening the

Figure 12—Elasticity of the real rate of exchange with respect to the money supply ($\hat{\mu}$), 1913-84



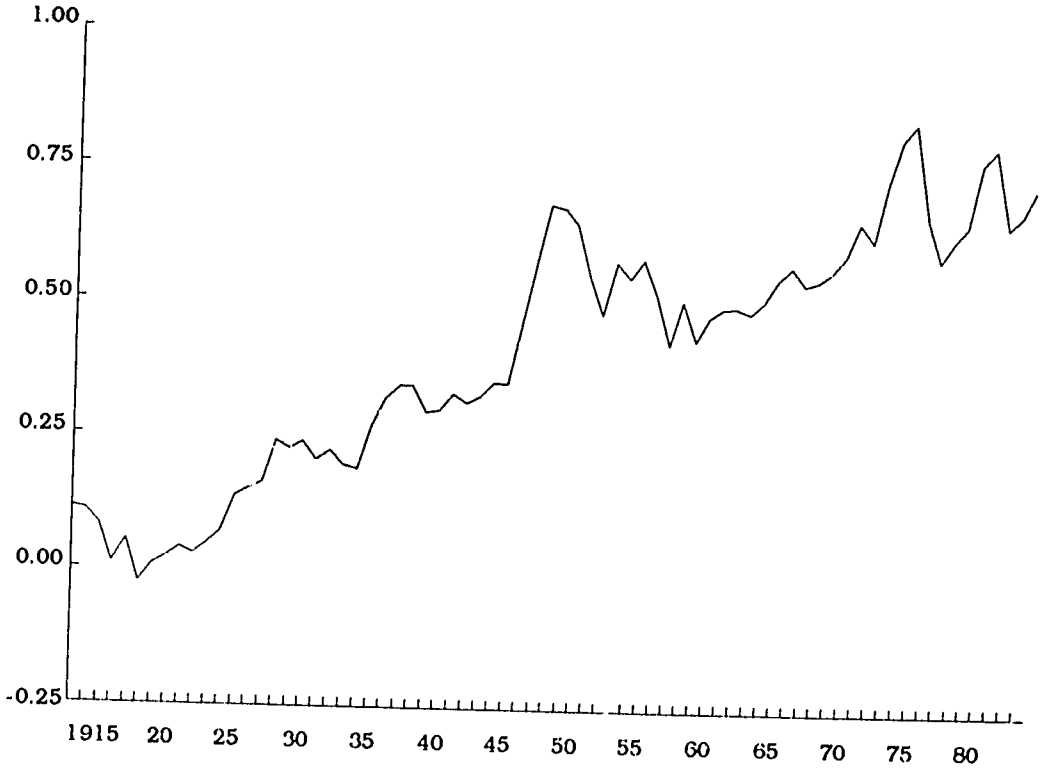
Source: Computed from the estimated coefficient of $\hat{\mu} = \dot{M} - \hat{E} - \hat{P}^* - \hat{Y}$ reported in Table 6.

economy to financial transactions will reduce the real rate of exchange. The reason for this is that, other things being equal, an economy that is more open to foreign financial markets will use foreign savings to a greater degree. A larger supply of foreign savings means a lower real rate of exchange. Of course, opening the economy to financial transactions will have a greater effect, the greater is the fiscal deficit financed by borrowing because the increased deficits will pump in financial resources. This happened intensively around 1980 when the Argentine economy became open to foreign financial markets, and the combination of a large deficit and a domestic financial liberalization acted to absorb large amounts of foreign capital. The result was a large reduction in the real rate of exchange—an extreme appreciation of the domestic currency. This is known as the period of the *atraso cambiario* (overvalued peso).

Effect of Real Income

Although the statistical significance of the coefficient of real income is not strong, its value is positive. This means that the elasticity of demand for the home good with respect to real income is lower than the elasticity of supply. Thus, as income grows the price of the home good goes down and, consequently, the real rate of exchange goes up. Recall that the income variable also represents technical change and capital

Figure 13—Elasticity of the real rate of exchange with respect to the degree of commercial openness, 1913-84



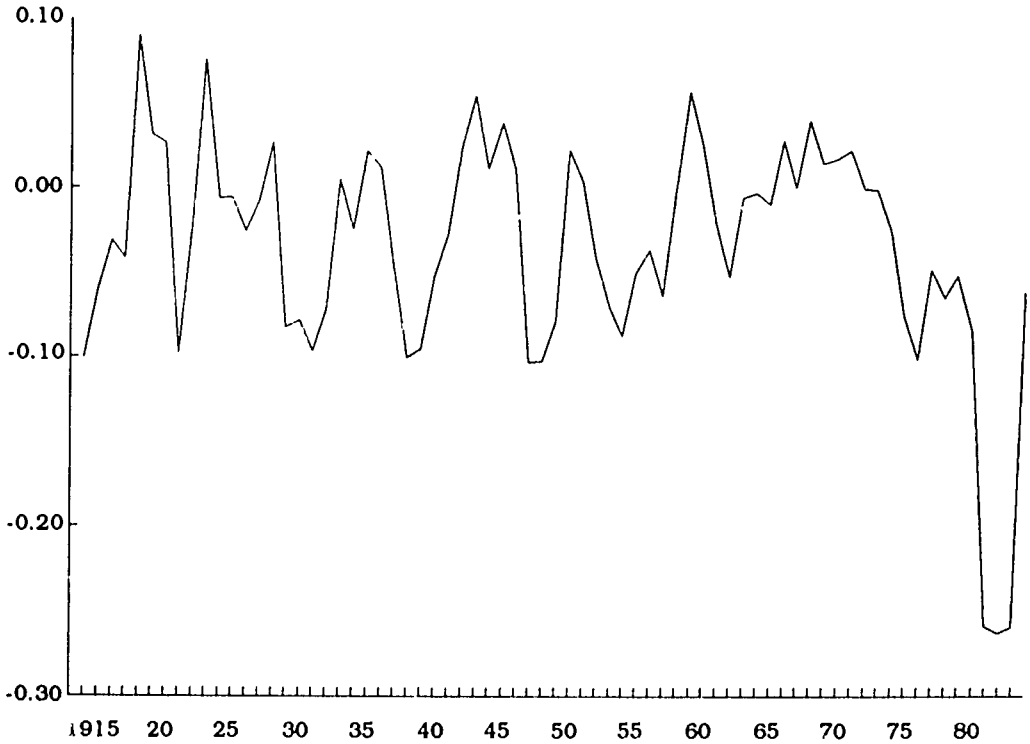
Source: Computed from the estimated coefficients of the regression for the real exchange rate.

accumulation. Hence, it is possible that, on the whole, the combined effect on the supply side was biased in the direction of tradable goods (home goods-saving).

A Concluding Remark

The empirical results obtained for Argentina show that, in addition to foreign prices and trade policies, macroeconomic policies significantly affect the real exchange rate. The next chapter focuses on the links between the real exchange rate and sectoral prices. Thus, the way that macro policies influence economic incentives can be analyzed.

Figure 14—Elasticity of the real rate of exchange with respect to the degree of financial openness, 1913-84



Source: Computed from the estimated coefficients of the regression for the real exchange rate.

4

SECTORAL PRICES

Of the three sectors into which the economy is divided for the purpose of the empirical analysis, government (sector 3) predominantly produces nontraded goods, and its sectoral price, P_3, is taken to represent the price of a domestic good. The other two sectors, agriculture (sector 1) and nonagriculture (sector 2) include both traded and nontraded goods.

In order to see how sectoral prices are determined, it is necessary first to examine the degree of sectoral tradability. This allows the explicit introduction of the ways in which foreign prices, taxes on foreign trade, and the real exchange rate influence the domestic prices of agricultural and nonagricultural goods, P_1 and P_2, relative to the price of government services, P_3.

Degree of Sectoral Tradability

In dealing with sectoral analysis it should be kept in mind that a sector is often both importing and exporting at the same time. This suggests that the sector is heterogeneous. Such heterogeneity is unavoidable when sectors are broadly defined. To deal with the problem explicitly, it is assumed that each sector can be subdivided into three subsectors: (a) domestic production of goods actually exported, (b) domestic production of nontraded goods, and (c) domestic production of goods actually imported. The determination of domestic prices for each of these three components of output is represented in Figure 15.

For the exported good shown in panel a, domestic supply and demand must intersect below the export price. Therefore, the actual demand faced by domestic producers becomes perfectly elastic at the export price. This is the price at which transactions will actually take place. Therefore, at the price of the exported good, P_x, there will be a level of domestic production, Q_x, which will be allocated to domestic consumption (or more generally, absorption) and exports, $C + X = Q_x$.

For the nontraded good shown in panel b, domestic supply and demand intersect between the export and import prices. Therefore, domestic prices and quantities will be set at that intersection (P_h and Q_h) and there will be neither exports nor imports.

Finally, for the imported good shown in panel c, domestic supply and demand must intersect above the import price. Therefore, total supply will become perfectly elastic at the import price. Transactions will take place at this price, P_m, and actual production will be determined by the domestic supply function, Q_m, and domestic consumption, C, exceeding domestic production by the actual imports, M.

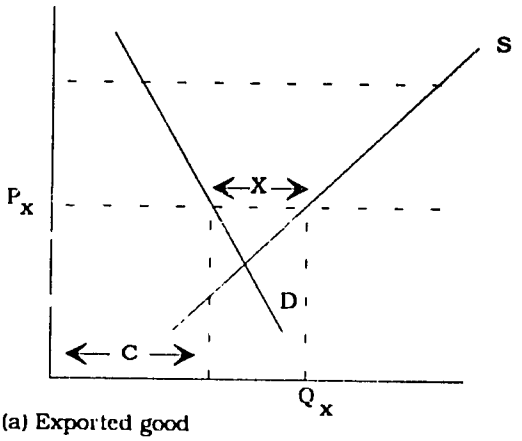
The aggregate price index for sector j, P_j, can be represented as an average of P_x, P_m, and P_h. Using the geometric aggregation and ignoring the sectoral index, j,

$$P_j = P_x^{\alpha_1} P_m^{\alpha_2} P_h^{(1-\alpha_1-\alpha_2)}, \tag{4.1}$$

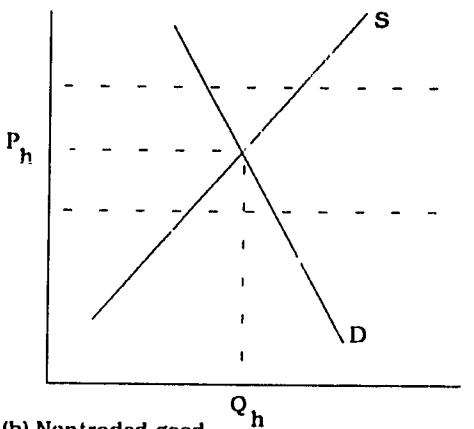
where α_1 and α_2 are functions of the quantities in question.

The prices of the traded goods, as defined in equations (3.1) and (3.2), are computed as the product of three factors: f.o.b. foreign prices in foreign currency, the nominal exchange rate, and a tax.

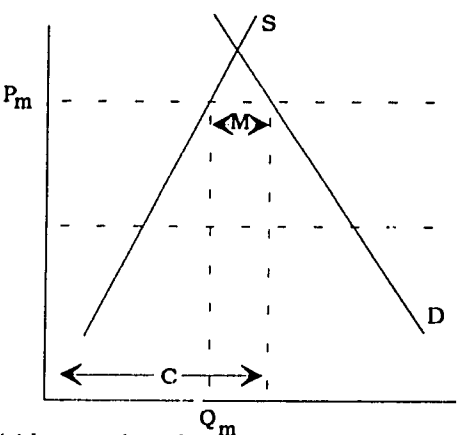
Figure 15—Determination of the domestic price of sectoral output



(a) Exported good



(b) Nontraded good



(c) Imported good

The Sectoral Prices

To obtain the sectoral prices it is useful to note that imported goods constitute an almost negligible proportion of agricultural output, and the same holds for the exported goods of nonagriculture. Once this feature of the Argentine economy is incorporated into equation (4.1) the prices for sectors 1 and 2 can be approximated by

$$P_1 = P_{1T}^{\alpha_1} P_{1h}^{1-\alpha_1}, \text{ where } P_{1T} = P_x^* E(1 - t_x), \tag{4.2}$$

and

$$P_2 = P_{2T}^{\alpha_2} P_{2h}^{1-\alpha_2}, \text{ where } P_{2T} = P_m^* E(1 + t_m), \tag{4.3}$$

or equivalently,

$$P_1/P_{1h} = (P_{1T}/P_{1h})^{\alpha_1}, \tag{4.4}$$

and

$$P_2/P_{2h} = (P_{2T}/P_{2h})^{\alpha_2}, \tag{4.5}$$

where α_j, $j = 1,2$, indicates the traded share of each sector and T and h denote traded and nontraded, respectively. The relative weight corresponding to each sector depends on economic variables that reflect changes in supply and demand. But first they should reflect the degree of openness of each sector. This is allowed for in the empirical analysis by allowing α_j to depend on the degree of openness, where DO_j is a measure of the sectoral degree of openness, and it is computed as the share of total trade in sectoral income.

The prices P_1, P_2, P_{1T}, and P_{2T} are observed, but there is no direct information available on P_{1h} and P_{2h}. The empirical analysis is carried out under the assumption that P_{1h} and P_{2h} are related to P_3, which is taken to represent the cost of production as influenced by government decisions on wage rates. This relation depends on macro policies that affect the demand for domestic goods.

Formally, it is assumed that

$$P_{jh} = f(P_3, MPI), \tag{4.6}$$

where MPI denotes a vector of macro policy variables. The following specification is used:

$$\log(P_{jh}/P_3) = H_j \log(MPI), \tag{4.7}$$

where H_j is a vector of coefficients specified below. Substituting equation (4.7) for P_{jh} in equations (4.4) and (4.5), an estimatable function for P_j/P_{jh} is obtained:

$$\log(P_j/P_3) = \alpha_j \log(P_{jT}/P_3) + (1 - \alpha_j) H_j \log(MPI), \quad j = 1, 2. \tag{4.8}$$

Expression (4.8) was estimated for sectors 1 and 2 in first differences because the regressions in levels were subject to a strong serial correlation in the error terms.

The same macro policy indicators that were used in Chapter 3 as explanatory variables in the real exchange rate equation were used in the estimation of equation (4.8). The coefficient for the proportion of government consumption depends on the sectoral commercial openness as defined above:

$$(1 - \alpha_j) H_{jG} = H_{jo} + H_{j1} \log DO_j, \tag{4.9}$$

Table 7—Price of agricultural goods relative to the price of government services, 1916-84

Variable	Estimated Coefficient	Dependent Variable: $\hat{P}_1 - \hat{P}_3$ Estimate	Average Value of the Coefficient
$\hat{P}_{1T} - \hat{P}_3$	α_1	0.60 + 0.16 log DO_1 (6.3) (2.1)	0.67
$\hat{g}$	$(1-\alpha_1)h_g$	−0.77 (5.6)	−0.77
f	$(1-\alpha_1)h_f$	−0.33 (−1.0)	−0.33
$\hat{\mu}$	$(1-\alpha_1)h_m$	0.17 (1.8)	0.17

Notes: t-statistics are in parentheses. The constant is 0.03 and its t-ratio is 2.4. $\bar{R}^2 = 0.82$; D.W. = 1.90.

whereas the coefficients for f, the ratio of borrowing to income, and for μ, the ratio of the stock of money in income evaluated in foreign prices, depend on DO_1, on DO_f, and on their products (all measured in logs), where DO_f is the degree of financial openness defined in Chapter 3.

As was the case for the estimates of the real exchange rate, when several cross-product terms with a common variable are included in the regression, a multicolinearity problem is generated. Therefore, the estimated regressions reported in Table 7 for sector 1 and in Table 8 for sector 2 are obtained for a smaller number of variables. The interpretation of the results is discussed next.

By definition, the coefficient α_j is the share of traded output in sector j. Therefore, the α's obtained from the estimation of equation (4.8) give the shares of traded output in agriculture and nonagriculture. These values are plotted in Figure 8.

As already stated, agriculture has always been a more highly traded sector than nonagriculture. Before 1930 the traded component of agriculture oscillated around 75

Table 8—Price of nonagricultural goods relative to the price of government services, 1916-84

Variable	Estimated Coefficient	Dependent Variable: $\hat{P}_2 - \hat{P}_3$ Estimate	Average Value of the Coefficient
$\hat{P}_{2T} - \hat{P}_3$	α_2	0.52 + 0.06 log DO_2 (6.3) (1.2)	0.48
$\hat{g}$	$(1-\alpha_2)h_g$	−0.60 (−6.9)	−0.60
f	$(1-\alpha_2)h_f$	−0.42 (−1.9)	−0.42
$\hat{\mu}$	$(1-\alpha_2)h_m$	0.27 (3.7)	0.27

Notes: t-statistics are in parentheses. The constant is 0.02 and its t-ratio is 2.8. $\bar{R}^2 = 0.79$; D.W. = 1.94.

percent, while that of nonagriculture was about 55 percent. These were the highest values of α in both sectors and indicate an open trade regime. From that year until the beginning of the 1950s, the traded component showed a decreasing trend as the economy turned to a more restricted trade regime. This trend was briefly interrupted in the years immediately following World War II, mainly as a result of an extraordinary boom in world trade when Argentina had exceptionally large grain stocks. During the period 1949-54, the values of α reached their lowest point. After 1955, agriculture reversed this trend and progressively became a more traded sector. By the 1980s, the composition of traded versus nontraded output was similar to that which had prevailed before 1930. However, nonagriculture continued to operate under a regime that was much more closed. Since 1955 the traded component of output in sector 2 has been about 42 percent.

All three indicators of macro policies were statistically significant. These effects are discussed below.

Government Expenditures (g)

The estimated results show that government expenditures (g) exert a negative effect on the relative prices of both sector 1 and sector 2. An increase in public expenditures increases the demand for home goods, and, as their price goes up, the prices of sectors 1 and 2 relative to the price of government services fall. According to the size of the estimated coefficients, it can be seen that the effect is stronger in sector 1. This is because agriculture is traded more and a larger component of its price is influenced by foreign competition. Therefore, the numerator of P_1/P_3 is affected less by the increase in P_3. Sector 2 has a larger nontraded component; therefore an increase in public expenditures also raises the demand for these goods and increases their prices.

Fiscal Deficit Financed by Borrowing (f)

This effect is negative in both sectors. This means that increased deficits financed by borrowing will dampen price incentives in the private sector. This effect is stronger in the case of sector 2 and suggests that the rise in interest rates provoked by larger debt-financed deficits has a stronger effect on nonagriculture. This is consistent with the fact that this sector has relied on credit more extensively than agriculture, even though agriculture is thought to be more capital-intensive.

Monetary Expansion and Exchange Rate Management (μ)

This effect is positive for both sectors. When the rate of monetary expansion exceeds the rate of devaluation, there is a real balance effect because prices lag behind the monetary shock. Whether monetary expansion over and above the rate of devaluation, foreign inflation, and real growth will exert positive or negative effects on relative sectoral prices will depend on the propensity of private agents to spend on traded or nontraded goods. The results for Argentina imply that the propensity to spend on traded goods is higher.

5

SIMULATING THE EFFECT OF POLICY CHANGES ON THE REAL RATE OF EXCHANGE AND SECTORAL PRICES

How foreign prices and economic policies affect the real rate of exchange and sectoral prices was discussed in Chapters 3 and 4. In both cases, it was clear that the degree of openness of the economy is a crucial "state variable," influencing the values of the elasticities of the different determinants of relative prices. The degree of openness reflects government decisions and world market conditions, and therefore it is exogenous within the framework. However, the measurement of openness itself involves endogenous variables, and this should be allowed for in the empirical analysis. Having done this, a complete price system for the economy is written. The system contains an equation to explain the degree of commercial openness, an equation to explain the real rate of exchange, and two equations for sectoral prices. This system is estimated using a simultaneous estimation technique (3SLS), and the quality of the fit is analyzed by comparing a static simulation of the four endogenous variables with the actual values for the period 1913-84. Finally, the system is used to examine how alternative economic policies would have affected the real rate of exchange and sectoral prices.

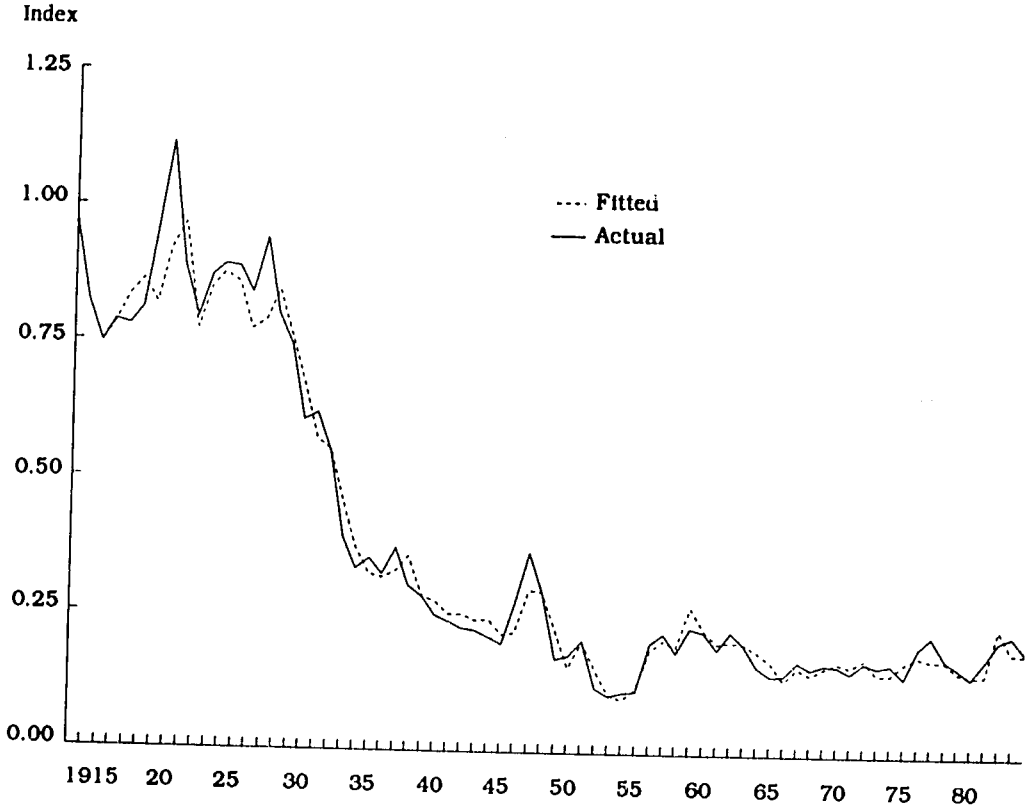
The Degree of Commercial Openness

The commercial openness of the economy is measured as the share of total trade in total income. This indicator is plotted in Figure 16. Note the significant reduction in trade that took place after the Great Depression. This was the natural outcome of adopting high taxes on foreign trade, imposing quantitative restrictions on imports and controls on foreign exchange, and increasing government expenditures and fiscal deficits. These government policies were implemented to attenuate the effects of the world depression and were similar to policies adopted by most other countries. However, this declining trend in trade continued up to 1955, except for a short interregnum in 1946-47, when high world demand for Argentine exports increased the value of trade to about 40 percent of total income. During subsequent postwar years, there was a revival of world trade, but Argentina deepened its restrictions on trade. This is reflected in the historical minimum of the value of trade of 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. Intense restrictions on financial transactions with the rest of the world were imposed. Trade policy used quantitative restrictions more than taxation of imports and exports, the form of instrumentation that had prevailed during the prewar period.[6]

[6] See Fernández, Mondolfo, and Rodríguez 1985; Humphrey 1969; Schwartz 1968; and Sturzenneger and Mosquera 1985.

Figure 16—Actual and fitted values of the degree of commercial openness, 1913-84



Notes: This is the ratio of total trade to income. Fitted values result from regression (1) in Table 10.

In accordance with this description of the trend in the degree of commercial openness, it is postulated that the degree of commercial openness depends on trade policy, on the degree of financial openness, DO_f, and perhaps on other determinants. More formally:

$$DO_c = f\,(\text{trade policy}, DO_f, \ldots). \tag{5.1}$$

An estimatable version of equation (5.1) first requires distinguishing between the two forms used for instrumenting trade policy in Argentina: export and import taxes and quantitative restrictions. No annual data are available for the quantitative restrictions. Therefore, macro policy indicators are introduced in the empirical equation to capture the effects of trade policies other than those represented by $1 - t_x$ and $1 + t_m$. The degree of financial openness is measured, as before, as the inverse of the black market premium on foreign exchange. Estimates of a log-linear form of equation (5.1) for different choices of explanatory variables are reported in Table 9.

Table 9—Degree of commercial openness, 1916-84

Variable	Dependent Variable: $\log DO_c$		
	Regression 1	Regression 2	Regression 3
$\bar{R}^2$	0.97	0.97	0.94
D.W.	1.96	1.97	1.73
Constant	−0.505 (−3.2)	−0.017 (−0.5)	−0.013 (−0.3)
$\log[(1-t_x)/(1+t_m)]_{t-1}$	1.00 (5.0)	0.857 (4.0)	1.16 (4.1)
$\log(E/F^b)_{t-1}$	0.193 (4.3)	0.169 (3.5)	0.113 (1.8)
$\hat{\mu}$	−0.572 (−7.7)	−0.596 (−7.5)	...
g_{t-1}	−0.176 (−3.4)	...	...
$\log(DO_c)_{t-1}$	0.726 (13.7)	0.868 (25.6)	0.831 (18.2)

Notes: See the glossary of symbols for definitions of variables; t-statistics are in parentheses.

Simultaneous Estimation

It is now possible to assemble the equations for the degree of commercial openness, the real exchange rate, and the relative prices for agriculture and nonagriculture (excluding government), and thus to build a system that can be estimated simultaneously. This will take account of the fact that the real exchange rate and the degree of commercial openness are endogenous variables in the system, which simultaneously determine relative sectoral prices and improve the efficiency of the estimates by incorporating the information from the cross equations.

The four equations estimated simultaneously are regression 1 in Table 9 for the degree of commercial openness, the regression for the real rate of exchange reported in Table 6, the regression for the relative price of agriculture reported in Table 7, and the regression for the relative price of private nonagriculture reported in Table 8. The results reported in Table 10 are, in general, similar to the OLS estimates. The estimation procedure is summarized in Appendix 2.

Table 10—Simultaneous estimates of the price system, 1916-84

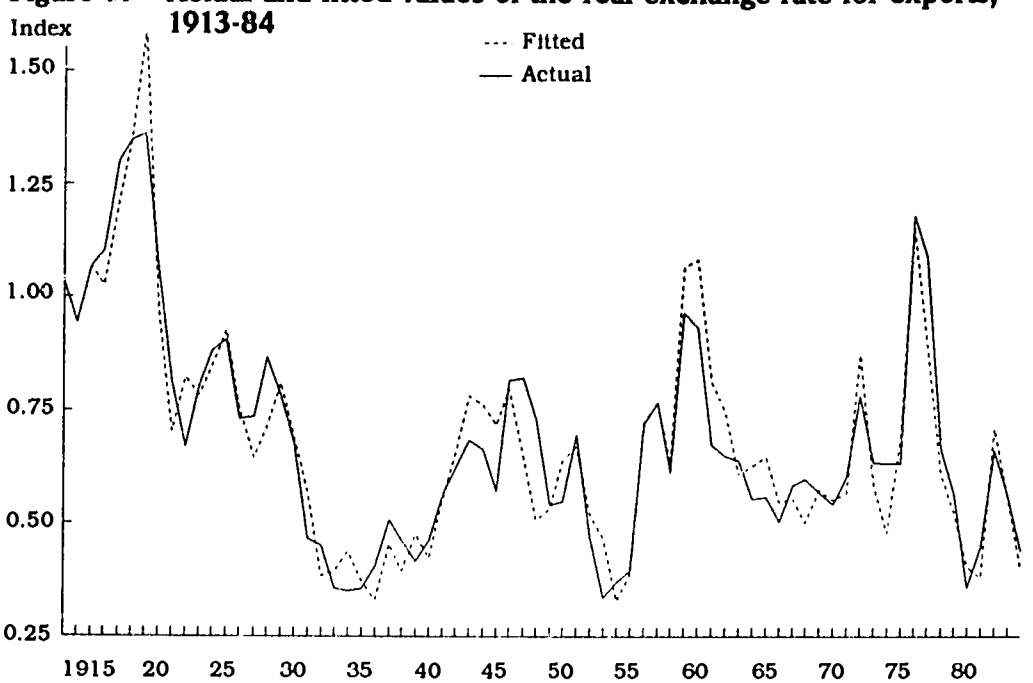
Equation Number	Equation
(1)	$\log DO_c = \underset{(-4.2)}{-0.516} + \underset{(4.0)}{0.648} \log[(1-t_x)/(1+t_m)] - \underset{(-4.2)}{0.170} \log g - \underset{(-8.3)}{0.590}\hat{\mu}$
	$+ \underset{(4.0)}{0.146} \log(DO_f) + \underset{(18.1)}{0.770} \log(DO_c)_{-1}$;
	$\bar{R}^2 = 0.97$; D.W. = 1.93.
(2)	$D[\log(P_x/P_3)] = \underset{(1.9)}{0.026} + \underset{(5.0)}{0.744} D[\log(P_x/P_m)] + \underset{(2.7)}{0.349} D[\log(P_x/P_m)\log DO_c]$
	$+ \underset{(1.6)}{0.194}\hat{Y} + \underset{(6.7)}{0.428} D(\log g \log DO_c) - \underset{(-2.5)}{1.12}f - \underset{(-1.4)}{1.31} f \log DO_f - \underset{(-1.2)}{0.130}\hat{\mu}$
	$+ \underset{(2.1)}{0.022} D[\log\mu \log DO_f] + \underset{(9.5)}{1.88} D\hat{O}_c$;
	$\bar{R}^2 = 0.89$; D.W. = 1.59.
(3)	$D[\log(P_1/P_3)] = \underset{(2.5)}{0.029} + \underset{(6.0)}{0.596} D[\log(P_x/P_3)] + \underset{(2.6)}{0.219} D\{\log(P_x/P_3)[\log DO_c + \log(PY/P_1Y_1)]\}$
	$- \underset{(-5.5)}{0.756}\hat{g} - \underset{(-1.2)}{0.360}f + \underset{(1.8)}{0.174}\hat{\mu}$;
	$\bar{R}^2 = 0.88$; D.W. = 1.97.
(4)	$D[\log(P_2/P_3)] = \underset{(2.7)}{0.023} + \underset{(3.9)}{0.355} D[\log(P_x/P_3) + \log(P_m/P_x)]$
	$+ \underset{(1.9)}{0.052} D\{[\log(P_x/P_3) + \log(P_m/P_x)][\log DO_c + \log(PY/P_2Y_2)]\}$
	$- \underset{(-7.2)}{0.630}\hat{g} - \underset{(-2.2)}{0.499}f + \underset{(1.2)}{0.080}\hat{\mu}$;
	$\bar{R}^2 = 0.85$; D.W. = 2.13.

Notes: D[x] is the first-difference operator; t-statistics are in parentheses. See the glossary of symbols for definitions of variables.

The fit of the system, as determined by static simulation, is presented in Figures 16-19. Clearly, the simulated values fit the data closely. The results of the static simulation are presented because agents in time t have all the information that was accumulated to that time, including lagged prices and the state of commercial openness. Static simulations cannot, however, be used for policy simulations because the introduction of policy shocks changes the dynamic paths of calculated prices and commercial openness. Hence, in evaluating policy changes, dynamic simulations are used.

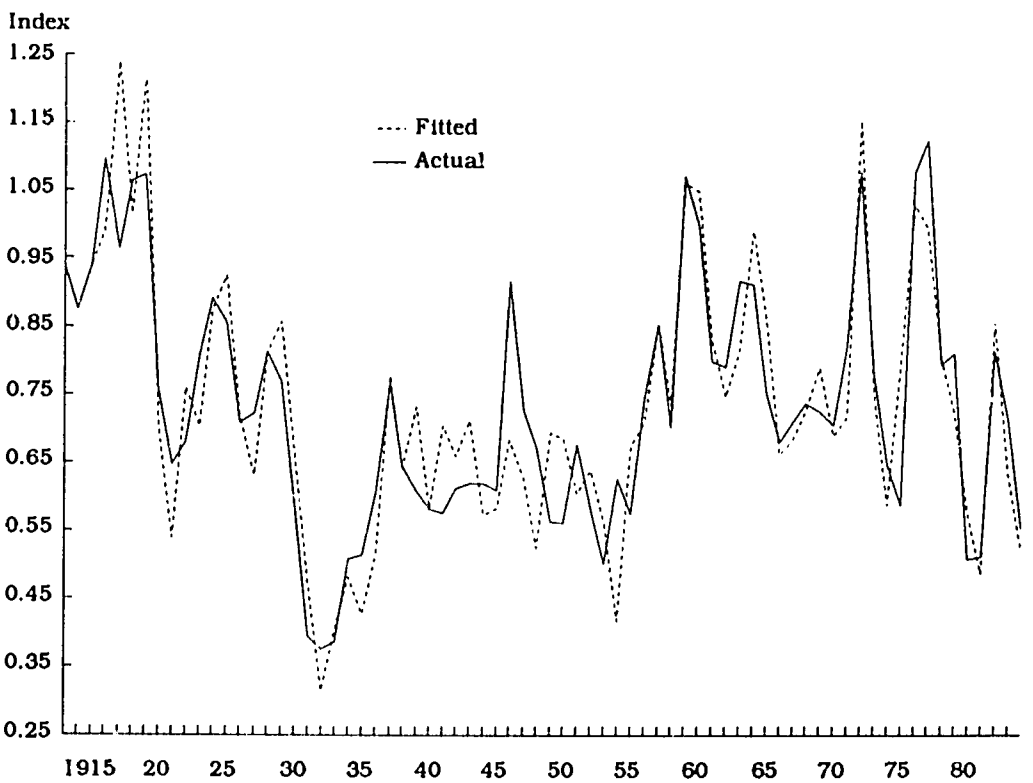
More specifically, note that equations (2)-(4) in Table 10 explain rates of change of prices. These rates of change are then integrated to obtain the level of the real exchange rate and real sectoral prices. This integration uses only computed values. In such computation, a small shock in the system tends to build up. This, however, does

Figure 17—Actual and fitted values of the real exchange rate for exports, 1913-84



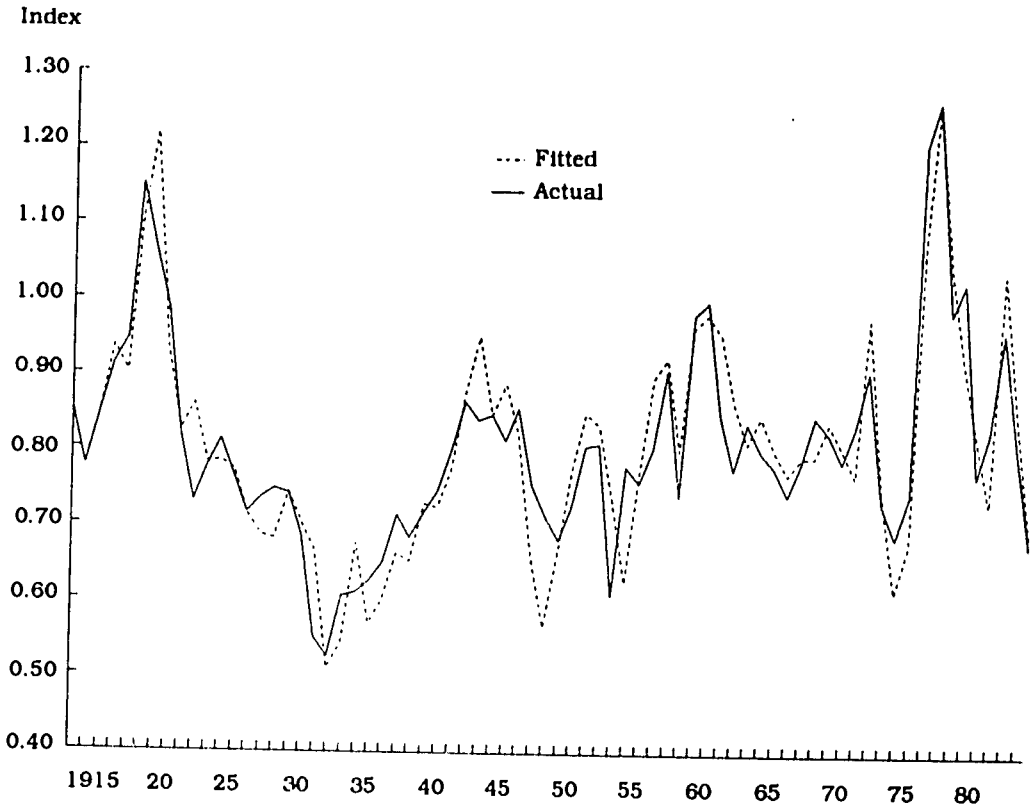
Note: Fitted values result from regression (2) in Table 10.

Figure 18—Actual and fitted values of the relative price of agriculture, 1913-84



Note: Fitted values result from regression (3) in Table 10.

Figure 19—Actual and fitted values of the relative price of nonagriculture, 1913-84



Note: Fitted values result from regression (4) in Table 10.

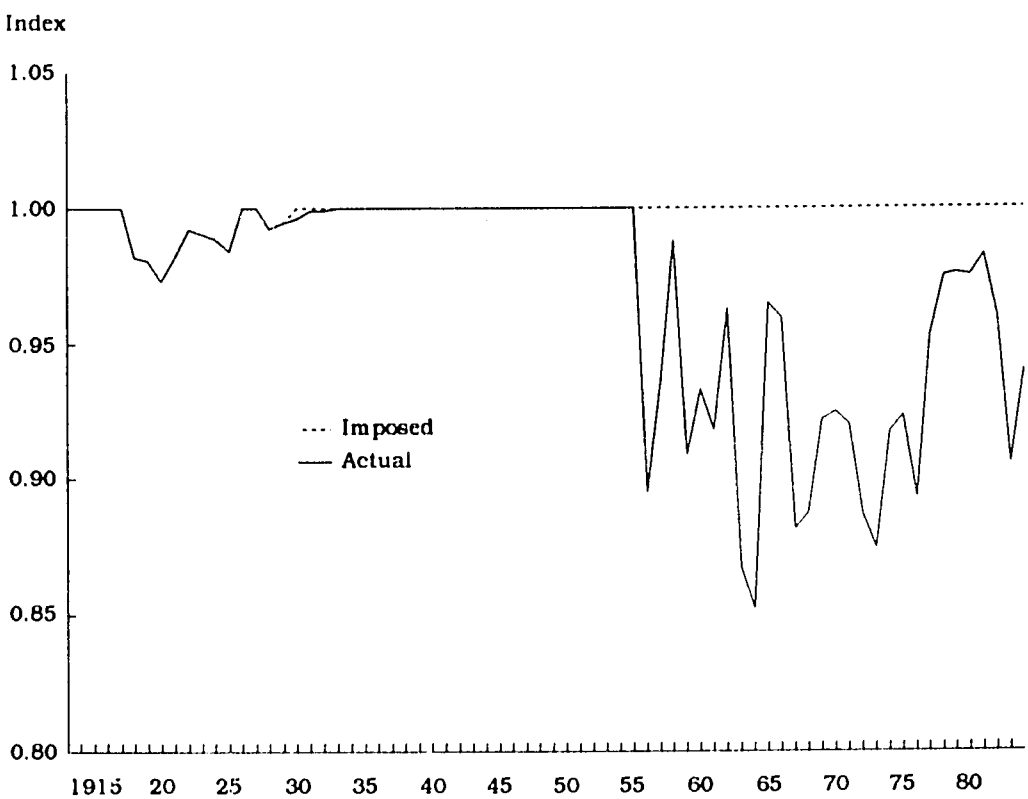
not affect agents' behavior because they have information about the actual values of lagged prices and do not need to use the values obtained from the dynamic simulation. The same applies to the degree of commercial openness, which is an endogenous variable in the system [illegible] cting all equations. The actual level of this variable depends on its lag values. Therefore, a small shock tends to build up. Nevertheless, the dynamic simulations capture well the main cycles of the variables, even though their fit is not as good as that of the static simulation for the reasons explained. But it should be emphasized that the only reason for doing the dynamic simulation is to produce a consistent system that permits the evaluation of a change in policy.

Simulating the Response of Relative Prices to Trade Liberalization

The system given in Table 10 is then used to simulate the response of the endogenous variables to a program of trade liberalization that is implemented together with consistent macroeconomic policies. The timing and sequencing of changes in trade policies, combined with the consistency of accompanying macroeconomic policies, are of crucial importance for the success of a trade liberalization program. Cavallo and Cottani (1986) show that the attempt to open the Argentine economy in the late 1970s failed mostly as the result of the inconsistent and inappropiate policies that were followed.

Before presenting the simulation results, it is necessary to be more specific about the set of trade and macroeconomic policies that are assumed for the trade liberalization exercise. These policy modifications are plotted in Figures 20-25 where their actual and "free trade" imposed values are compared. The policy changes include the following:

Figure 20—Actual and imposed values of taxes on exports, 1913-84

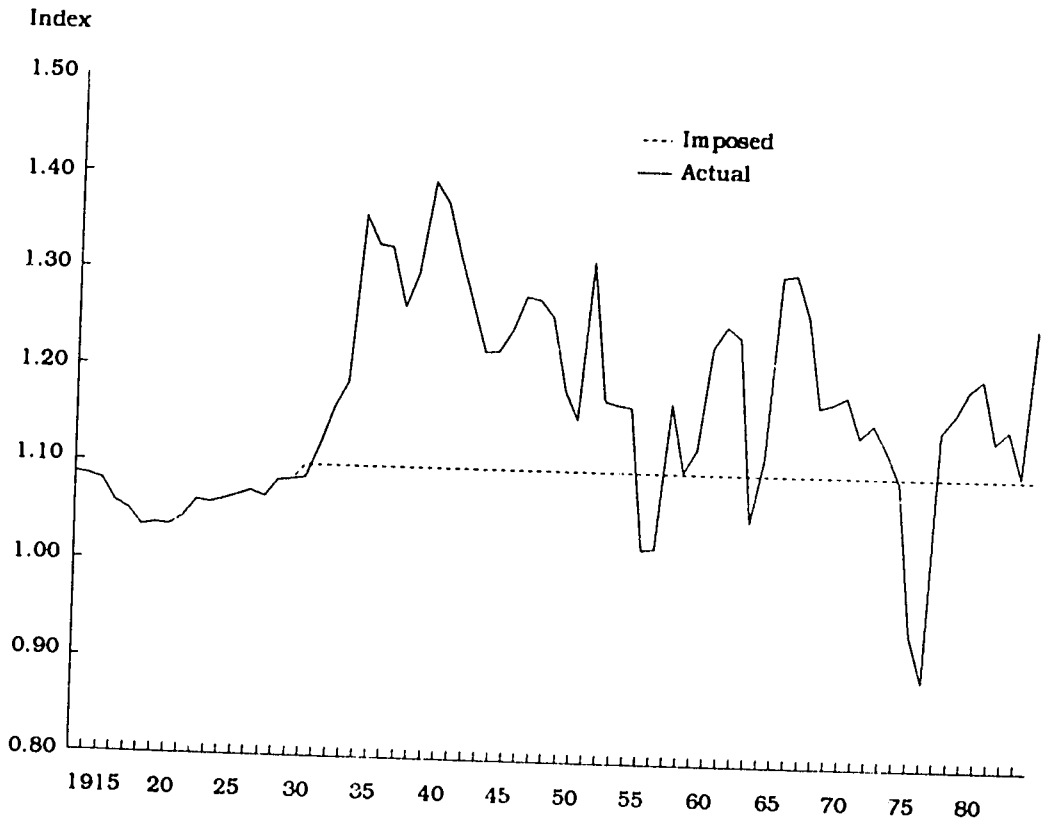


Note: This is one plus taxes on exports as a proportion of the value of exports ($1 - t_x$).

Trade Policy

Modifications in trade policy were introduced in the year 1930. They consisted of completely eliminating taxes on exports and setting a uniform tariff on imports of 10 percent. The actual and free-trade imposed values for $1 - t_x$ and for $1 + t_m$ are plotted in Figures 20 and 21, respectively.

Figure 21—Actual and imposed values of taxes on imports, 1913-84

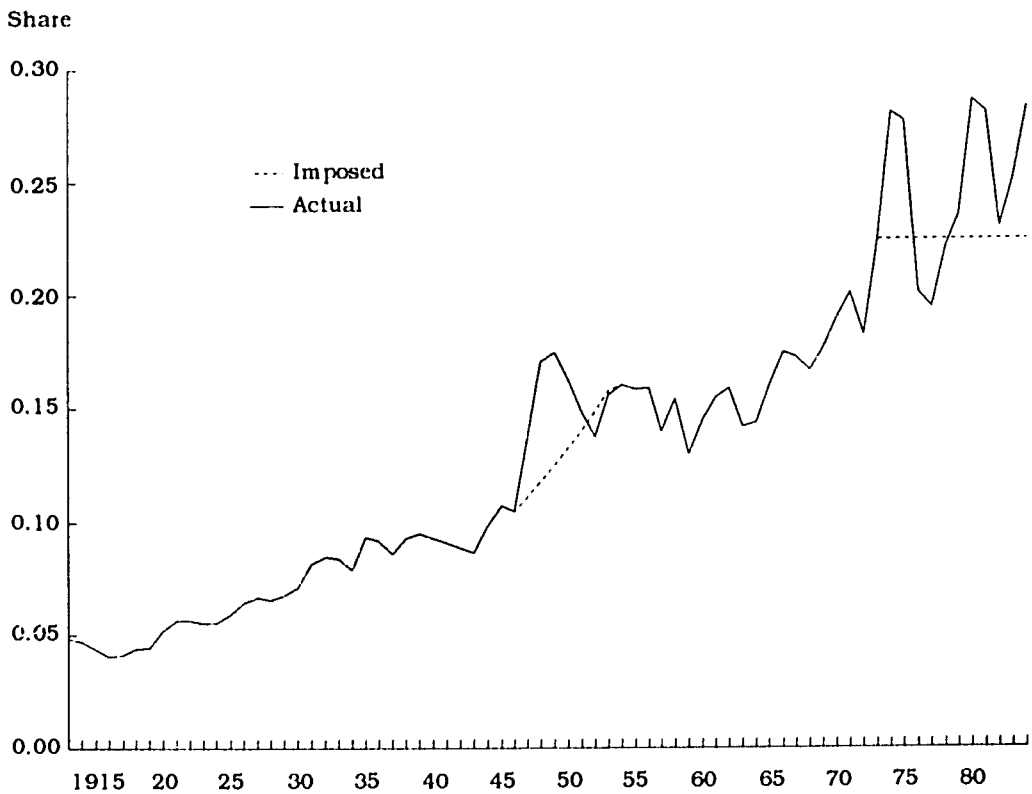


Notes: This is one plus taxes on imports adjusted by the exchange rate differential $(1 + t_m) E^m/E$. t_m was calculated as the proportion of taxes collected on imports over the value of imports; E^m is the nominal exchange rate for imports, and E is the nominal exchange rate for exports.

Macroeconomic Policy

Figure 22 plots the free-trade values imposed for public expenditures as a proportion of total income. It is assumed that public expenditures were at the historical levels except in two periods in which drastic jumps took place. These jumps were modified in the simulation. Thus, between 1946 and 1953 public expenditures are assumed to grow smoothly, and between 1974 and 1984 it is assumed that they remained at the level of 1973.

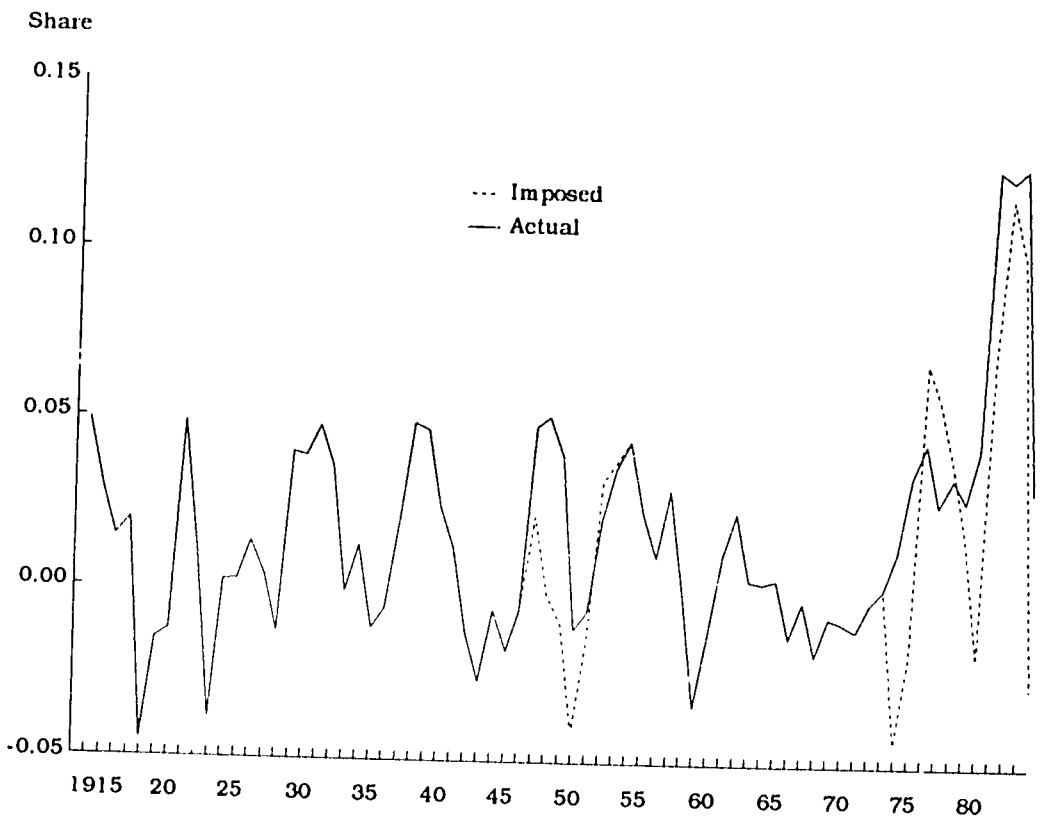
Figure 22—Actual and imposed values of government expenditures, 1913-84



Note: This is government consumption as a proportion of total income ($g = P_g C^g/PY$).

Figure 23 plots the imposed values for fiscal deficits financed by borrowing and the actual levels. The imposed free-trade values are calculated under the following assumptions: first, the deficit declines by the same amount as the reduction in government expenditures, and second, the level financed by monetization remains unchanged. Therefore, borrowing also declines by the same amount as government expenditures.

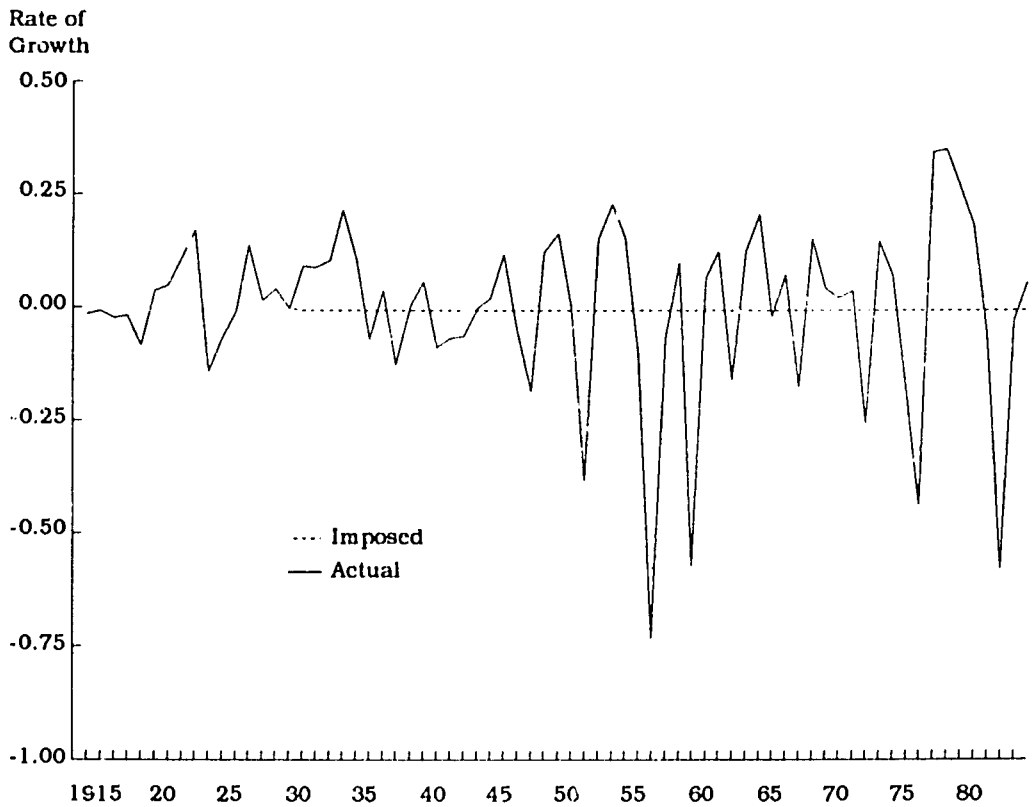
Figure 23—Actual and imposed values of debt-financed fiscal deficits, 1914-84



Note: This is the fiscal deficit financed by borrowing as a proportion of income ($f = F^b/PY$).

Figure 24 plots the actual and free-trade values imposed for the rate of μ. In this case, it is assumed that this control variable is stabilized during the period 1930-84, taking its average value for that period of −0.008.

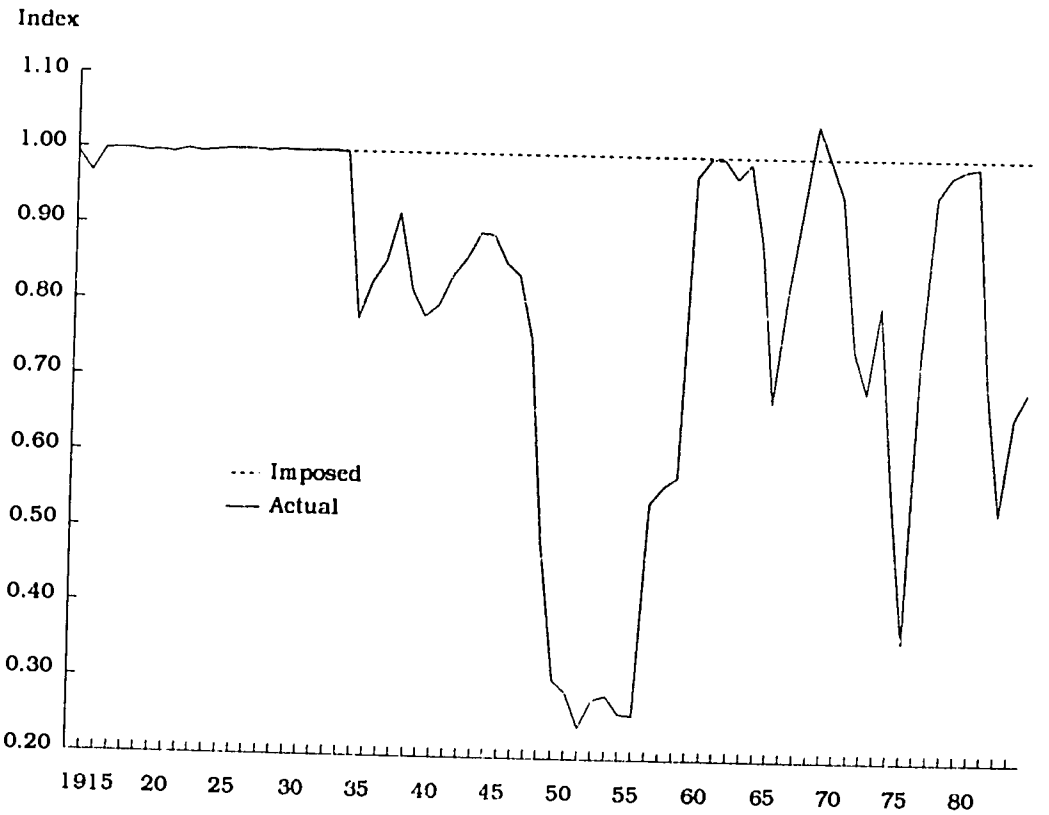
Figure 24—Actual and imposed values of monetary expansion over nominal devaluation, foreign inflation, and real growth, 1914-84



Note: This is computed as $\hat{\mu} = \hat{M} - \hat{E} - \hat{P}^* - \hat{Y}$ where M is the stock of money supply, P^* is the foreign price level, E is the nominal exchange rate, Y is real income, and hats indicate rates of change.

Finally, Figure 25 compares degrees of financial openness as measured by the inverse of one plus the black market premium for foreign exchange, with a regime of no restrictions on international financial transactions, which would be implied by the absence of a black market premium. This change is also imposed for the period 1930-84.

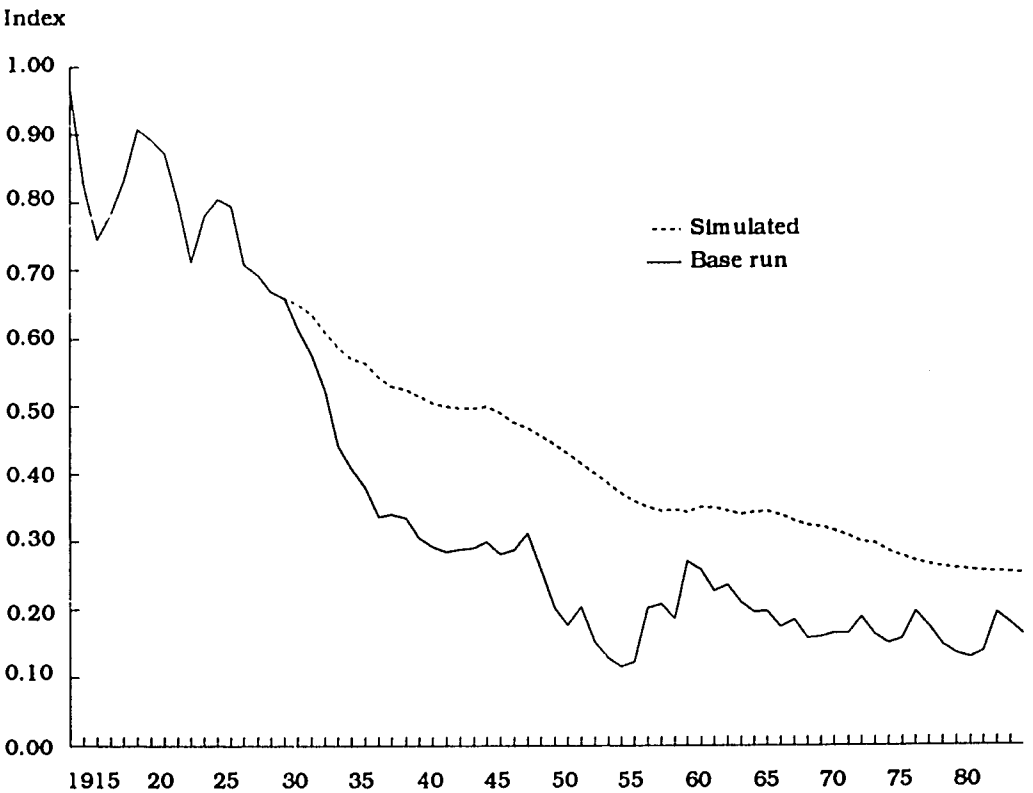
Figure 25—Actual and imposed values of degree of financial openness, 1913-84



Note: This is the ratio of the official to the black market exchange rate.

Figures 26-29 compare the simulated values of the endogenous variables with the base-run values. As can be seen by inspecting these plots, relative prices respond strongly to trade liberalization. This response is quantified in Table 11 where the percentage increases in the free-trade values relative to the actual values are reported for the endogenous variables.

Figure 26—Simulated values for the degree of commercial openness, 1913-84



These results imply that if the Argentine economy had been more integrated with the world economy after 1929, the volume of trade would have been almost 70 percent higher than its actual level. Moreover, Argentina would have had an economy where relative prices would have been more in line with international prices. This implies that price incentives for both agriculture and nonagriculture would have been much greater relative to the expansion of government services. Therefore, 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. In the two cases the sectoral prices are relative to the price of government services. Of course, a greater supply of agricultural and nonagricultural goods (excluding government) could have caused the changes in relative prices to be of a lesser magnitude.

Figure 27—Simulated values for the real exchange rate, 1913-84

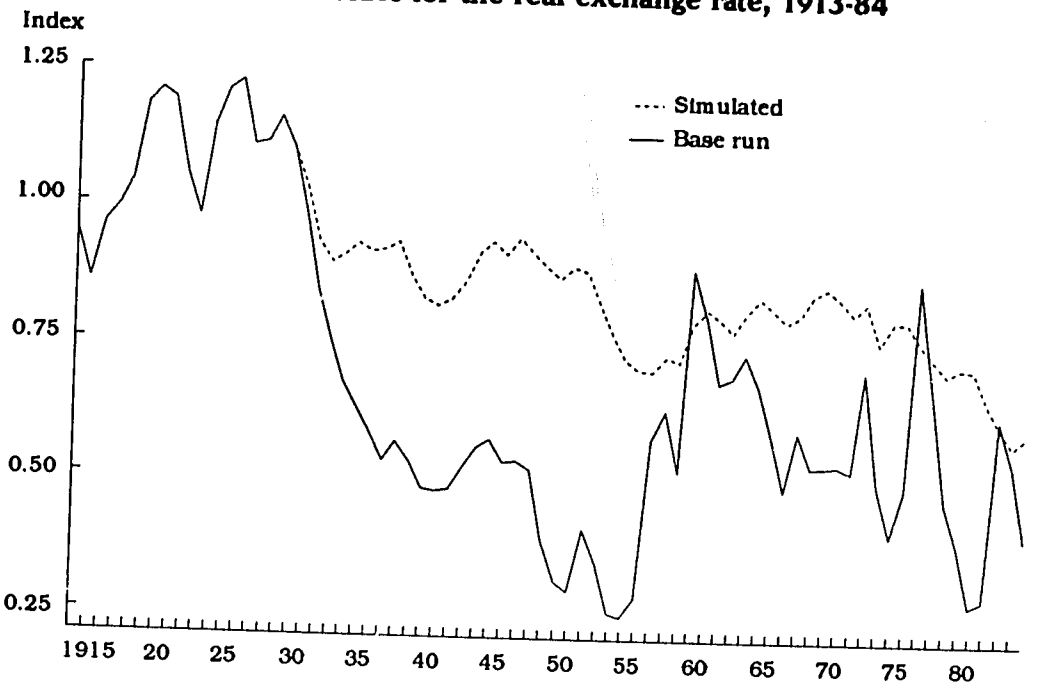


Figure 28—Simulated values for the relative price of agriculture, 1913-84

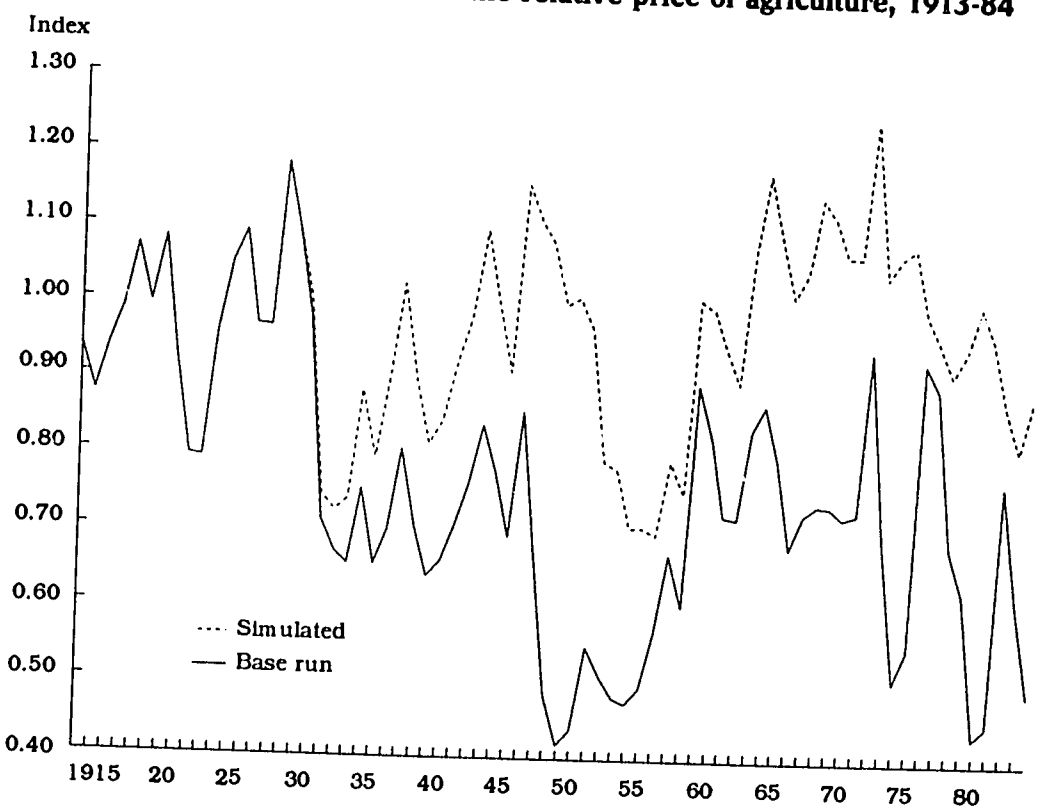


Figure 29—Simulated values for the relative price of nonagriculture, 1913-84

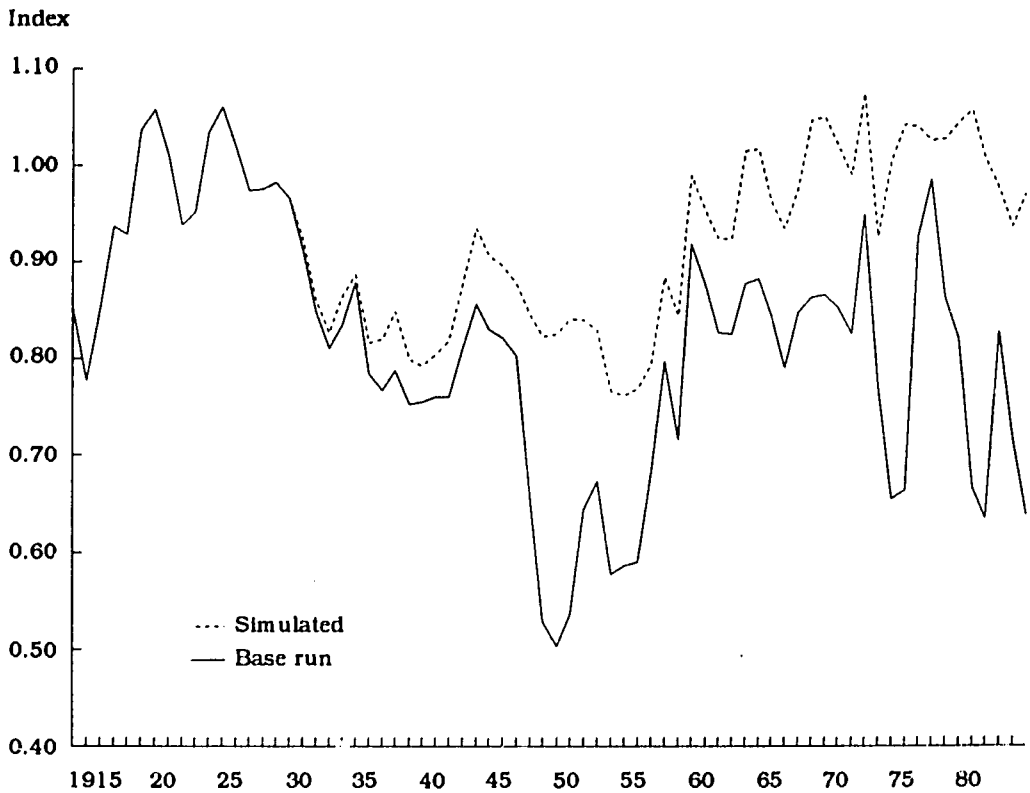


Table 11—Response of relative prices to trade liberalization, average 1930-84

Variable	Base Run (1)	Simulation (2)	Percentage Increase
Degree of commercial openness (DO_c)	0.24	0.40	67
Real rate of exchange (e)	0.54	0.82	52
Relative price of agriculture (P_1/P_3)	0.68	0.95	40
Relative price of nonagriculture (P_2/P_3)	0.77	0.91	18

Note: The last column is obtained by [(2)/(1) − 1]100, where (2) and (1) represent entries in these columns, respectively.

6

PRODUCTION, WAGES, AND RENTALS

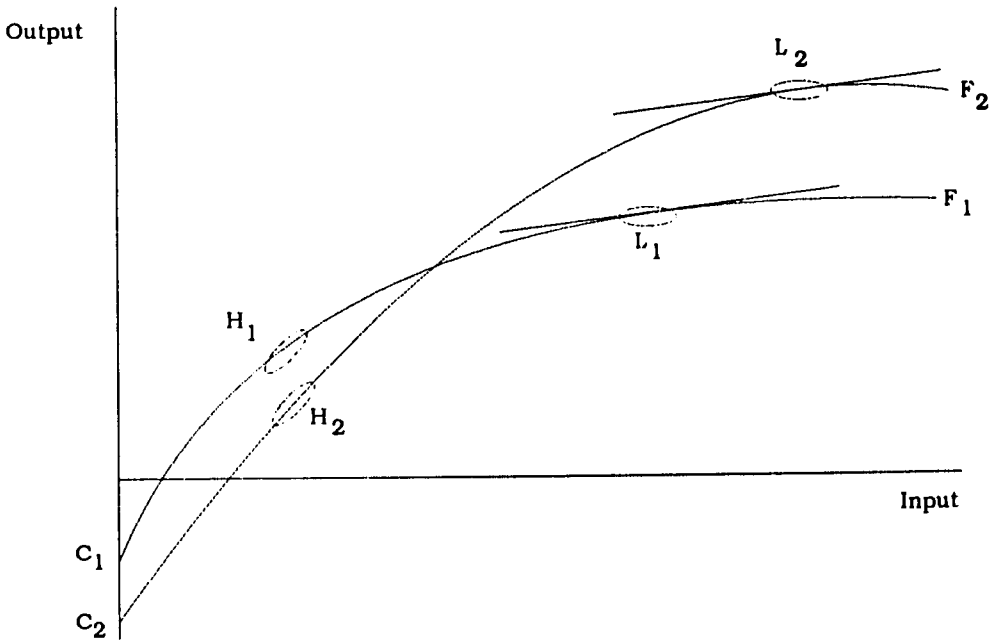
Technology is a key for evaluating the changes that an economy is undergoing in both the short and long runs. In most economic analyses, it is assumed that the economy has at any time a single production function: technical change is perceived as a change of this function. But clearly, looking at any sector of the economy, one can find numerous ways of producing a given product. Neglecting this simple fact leads to a distorted view of the world. This distortion arises from ignoring the fact that the set of techniques that are implemented at any time reflects the economic environment at that time. How does this approach differ from the standard? The standard approach assumes that economic conditions determine only the location of producers on a given production function, whereas here this assumption is extended to allow for a choice of the technique to be implemented. Thus, market conditions have a much stronger influence on the economy. This is relevant not only for explaining the past but also for understanding how a change in economic environment is likely to affect the future development of the economy.

This view was also pursued in previous analyses (Cavallo and Mundlak 1982; Mundlak, Cavallo, and Domenech 1987; Coeymans and Mundlak 1987), and it plays a key role in the present work. Although the theoretical and technical details have already been discussed (Mundlak 1987, 1988, 1989), the choice of technique plays a more central role in this analysis, and, therefore, it is reviewed here before going into the empirical results.

The Choice of Technique and Its Implications

Consider a single-output, single-input production function. Two such functions are presented in Figure 30. In this framework, there is only one relevant price; the real wage (factor price divided by product price). At first, assume that only F_1 is available. Then, if there is no constraint on the input, the selection of the optimal point will depend on the price. At a low real wage, the firm will be at L_1, whereas at a high wage the firm will be at H_1. Note that the production function does not begin at the origin because there is a cost of adjustment or implementation, c_1. This can be considered as the (fixed) cost associated with production. More generally, it can be thought of as the cost of adjustment or transformation of changing from one method of production to another. In this case, the cost will depend on the technique actually used and on the new technique contemplated by the firm. To simplify, initially this cost is made independent of the level of activity. Now, while the firm is producing with technique F_1, a new technique, F_2, becomes available. F_2 is more productive than F_1, but it requires more resources to implement it, and therefore it is more profitable at larger outputs, which correspond to low real wages. Thus, at a low real wage, the firm is now located at L_2 on F_2 rather than at L_1 on F_1. This makes the transfer from F_1 to F_2 profitable. This does not hold true when real wages are high, however, where being at H_1 on F_1 is preferable to being at H_2 on F_2. As a result, the distribution of prices affects not only the location of the firm on a given function but also determines the choice of the implemented technique.

Figure 30—Representation of technology



The collection of all the techniques available is referred to as the available technology. In the case of Figure 30, the available technology consists of the techniques described by the functions F_1 and F_2. The subset of techniques that are actually implemented is referred to as the implemented technology. It is important to note that the data are restricted to observations collected on the implemented technology. The foregoing discussion points to the dependence of the implemented technology on (1) the available technology, (2) on prices, and (3) on the cost of adjustment. Furthermore, it has been shown that a change in price simultaneously affects the choice of the implemented technology and the position on it. Consequently, in general, the production function is not identified by price variations (Mundlak 1987, 1989).

The next step is to extend the formulation to bring in additional determinants of productivity. In a world of uncertainty, prices are unknown at the time decisions are made. Firms act on the basis of a price forecast and are guided by their attitude toward risk. Hence, other things being equal, firms may vary in their position on the production function as a result of their differences in these two attributes. The same holds true for production uncertainty. In this sense, changes in risk act similarly to changes in prices; therefore they affect the choice of technique as well as the level of its implementation.

The choice of a technique is also affected by constraints. The most immediate one is the size of the capital stock. Thus, if the input in Figure 30 is capital, the firm may be restricted to the available quantity. The firm may acquire more capital and thereby affect its future but not its present production. In this sense, the constraint is tradable at the firm level. Some constraints, such as the ability or productivity of the entrepeneur, are not tradable. Thus, the production functions in Figure 30 can be thought of as representing two different firms. The functions differ because the firms have a specific input, entrepeneurial ability, that cannot be changed. Another example of a nontradable constraint is weather.

This simple model provides the framework for the analysis. Before it is extended further, it is useful to summarize the discussion up to this point. The output and input are determined by available technology (T), constraints (k), expected prices (p^e), risk (σ), and cost of adjustment (c).

All of these are considered to be state variables in the sense that they are given exogenously to the firm. The state variables are denoted by a vector $z = (p^e, m, c, k, T)$. Changing z changes both output (x_0) and input (x_1). Thus, the relationship between output and input, or simply the observed production function, depends on z. It cannot be overemphasized that it is the function itself that depends on z. The reason is that by changing z, the firm may move from one function to another, or combine several functions. This holds true regardless of the algebraic forms of the underlying production functions. Thus, the empirical production function is affected by the values of z. As such, the empirical production function is an estimate of the efficiency frontier of the implemented technology. As shown in Mundlak 1987, the production function can be approximated by a function that has a Cobb-Douglas form but the intercept, $\Gamma(z)$, and the slope, $\beta(z)$, are functions of the state variables. That is,

$$\log x_0 = \Gamma(z) + \beta(z) \log x_1. \tag{6.1}$$

This is the conceptual framework used in the analysis. It can easily be generalized to include several inputs. Specifically, in most of the subsequent discussion, x_0 and x_1 are the average labor productivity and the capital-labor ratio, respectively.

The discussion of the state variables will center around the equation that is actually estimated, where sectoral output is expressed as a function of sectoral labor, capital, and the state variables. In principle, the same framework applies to the analysis at the macro level where sectoral outputs are dealt with. The difference, and it is a substantial one, is related to the selection of the pertinent state variables of the economy or of a sector.

Technology and Capital Constraint

In the previous example, the available technology consisted of two techniques. In reality, any given sector contains many techniques. The concept of a technique is broad in scope. Techniques are identified with a method of production of a given product. Different methods of production are described by different techniques. It immediately follows that techniques differ by products or by firms. Hence, there is no simple way to represent the technology of the economy or of a sector. In fact, by its very nature, technology is an abstract concept, and at the macro level it cannot be observed. The evidence of it is primarily circumstantial. The same difficulty applies to a complete description of technical change. Conceptually, technical change is achieved by a change in the set of available techniques, which implies that new techniques have appeared. It has been generally observed, however, that, on the whole, the development of new techniques requires resources, and therefore the level of production is directly related to the availability of resources, or simply to the capital stock, broadly defined, including human capital.

This describes the supply side of new techniques. Turning to the demand side, it must be recognized that, on the whole, new techniques are capital-intensive; therefore, their implementation is paced by the availability of capital. Thus, implemented technology is expected to be directly related to the capital stock in the country. The essence of this discussion is that countries with larger capital stocks are expected to be more

productive than countries with low capital stocks because they are able to produce and implement more productive techniques. The same relationship is expected to hold over time for a given country.

This discussion calls for a measure of capital as a state variable. This, however, is not an easy variable to measure either conceptually or practically because it requires the measurement of all forms of human capital that affect technology, and it can be referred to as comprehensive capital. However, such a variable is not available. As a proxy, it is possible to use per capita stock of capital (Cavallo and Mundlak 1982). This variable will serve the purpose if the various components of human capital are positively correlated with the stock of physical capital. In any case, this is a rough measure.

Alternatively, an indirect measure of the comprehensive capital stock can be derived on the basis of the foregoing discussion. When the production function is linear homogeneous in labor and all components of capital, the average labor productivity serves as a natural measure of all the components of capital; therefore it can be used to represent technology (Mundlak and Hellinghausen 1982).

This variable is a reduced-form presentation of the implemented technology, and available technology and capital constraint are embedded in it. It is introduced as a state variable into the production function, where a measure of the physical capital-labor ratio is also introduced explicitly. In interpreting the results, it should be noted that regression coefficients are "net" in the sense that they represent the effect of a variable net of the linear contribution of the other variables in the regression. Consequently, the coefficient of average labor productivity represents the effect of this variable net of the effects of the capital items that are introduced explicitly into the regression. Therefore, it measures the net effect of the various forms of human capital, as well as the institutions that affect technology and that are not measured directly. For any year t, the peak of this variable for years up to t−1 inclusive is employed.

In the case of agriculture, a partial measure of available technology is constructed by taking a ratio of the Divisia index of yields in Argentina and the United States, with weights obtained from the crop composition in Argentina.

Profitability

The expected profitability depends on the demand conditions. For simplicity, sectoral demands are not explicitly formulated. The repercussions of this are not the same for the two sectors. As shown in Chapter 4, agricultural price has a large tradable component, therefore, agricultural price or a measure of the real rate of exchange can be used to represent demand. On the other hand, the tradable component in the output of sector 2 is smaller than in agriculture; therefore, the price itself is insufficient to represent demand. Specifically, demand for nonagriculture is affected by government expenditures. This effect is introduced into the analysis through a measure of government's share of total output. In both sectors demand is affected by overall macro shocks, which are discussed below.

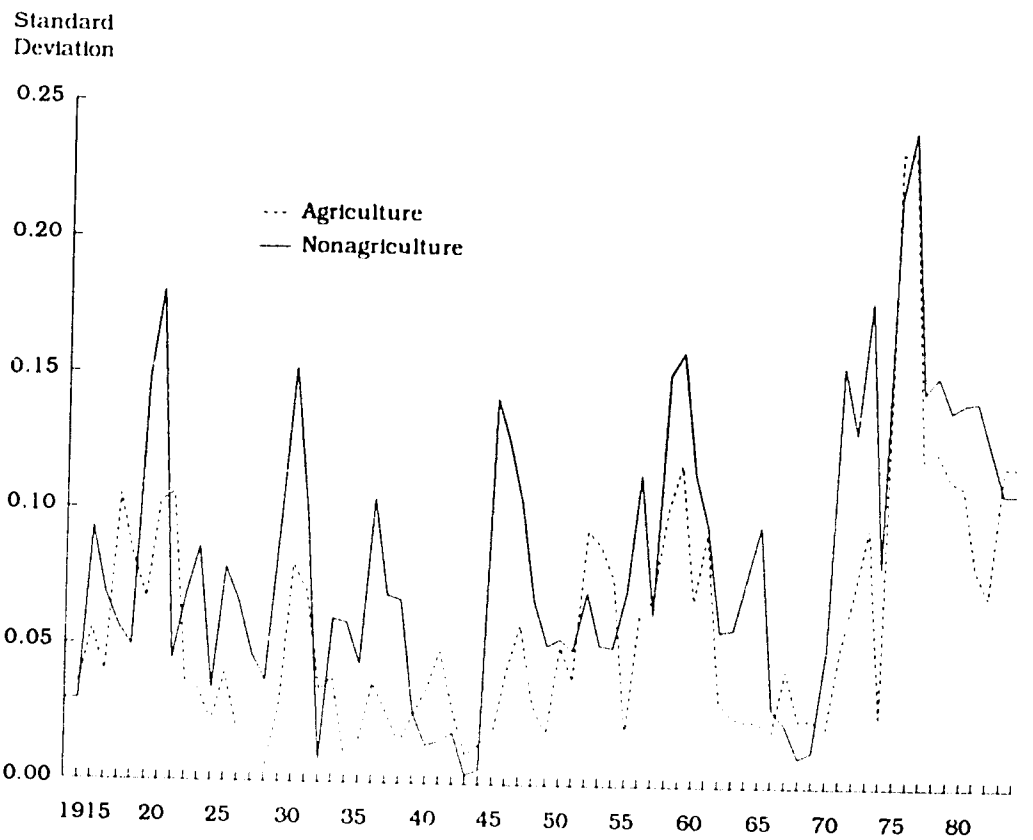
The analysis is conducted at a rather high level of aggregation, and no explicit account is taken of intermediate products. This is an important source of demand, which affects production. Thus, a good agricultural year has a positive effect on nonagriculture. To capture these cross effects, the output of sector 1 is introduced as a state variable in sector 2 and vice versa.

As an alternative to prices, the rates of return on capital were also used. The rate of return variable meaningfully summarizes the economic environment faced by the firms. The variable was also used in the earlier work (Cavallo and Mundlak 1982). In

either case, the problem is to capture in a practical way the expectations of prices or the rates of return. One possibility is to combine the price block of the model with the production block and to estimate them simultaneously, thereby allowing the price block to generate the expected prices. But the results are not satisfactory in that the estimated output did not reproduce the various cycles with sufficient detail. This shortfall is attributed to the large fluctuations that the economy has undergone over the entire period.

Such fluctuations generate uncertainty about future conditions, which affects the cost and the accuracy of forecasting. Furthermore, since investment is made for a long period of time, its efficiency tends to decline with fluctuations in the economy because more versatile techniques are required to cope with extreme market conditions. To allow for all of these problems, the actual fluctuations in prices are introduced here directly by the standard deviation of sectoral prices in the past three years (σ). This variable is plotted for the agricultural and nonagricultural prices in Figure 31. It is seen that this variable is subject to wide variations that are related to the main cycles in the economy.

Figure 31—Relative price variability, 1913-84



Note: Computed as the moving standard deviation of three periods for the prices of agriculture and nonagriculture relative to the price of government services.

For reasons indicated above, measures of expected prices or rates of return were insufficient to describe well the main cyclical variations in output. Apparently, the process through which such fluctuations affect output is more complex. Therefore, an alternative to the recursive structure is sought whereby first expectations are formed and second outputs are determined conditional on such expectations. This is done by introducing variables that represent the overall economic environment, and this introduces demand shocks into the production function. Basically, the macro variables discussed in Chapters 3 to 5 have been used. The set is narrowed down to the degree of commercial openness (DO_c) and to variables that represent inflation and recession, and these are described later with the results.

The foregoing discussion provides a rich set of possibilities. The choice among them is largely empirical, but there is no single set of variables that dominates the others over the entire period. Comparing the various possibilities is not easy because each alternative contains a large number of variables. Moreover, the estimates of the coefficient in a given equation are not independent, and there is compensation in the size of the empirical coefficients. A more meaningful test of the various alternatives is to simulate the response of the model to hypothetical changes in some variables. It is interesting to note that the various alternatives show similar qualitative properties, although they differ somewhat in the quantitative response.

Estimation

The statistical procedure calls for estimating the system:

$$\beta_j = z \cdot \pi_{1j} + e_1, \quad j = 1, 2; \tag{6.2}$$

$$\Gamma_j = z \cdot \pi_{0j} + e_0; \text{ and} \tag{6.3}$$

$$y_j = \Gamma_j + k_j \beta_j, \tag{6.4}$$

where z is a vector of state variables, π's are parameters to be estimated, e_0 and e_1 are disturbances, $z \cdot \pi$ implies an (inner) vector product, y_j is the log of the output-labor ratio in sector j, and k_j is the log of the capital-labor ratio in sector j.

No direct observations are available on β and Γ; their values are inferred. The factor share of capital replaces β. This assumes that the discrepancy between the two is uncorrelated with the capital-labor ratio. If this is not the case, such correlation can be taken into account in the estimation.

Γ_j is derived from the production function identity (6.4) as a residual where β_j is replaced by the factor share or by its estimate.

Four general alternative procedures are used to estimate the system: (1) ordinary least squares (OLS), (2) simultaneous estimation of the system for the two sectors (using nonlinear 3SLS), (3) simultaneous estimation of the system and the block of price equations, and (4) simultaneous estimation extended to include the equations describing resource allocation and expenditures discussed in Chapters 7 and 8.

OLS was initially used to screen specifications for the more complex techniques. The estimates obtained jointly with other blocks as explained in (3) and (4) above were deficient either in their simulation of the model or in their consistency with the theory. The results presented below are satisfactory; therefore, at this point it is not prudent to continue with the additional work necessary to estimate the complete system simul-

taneously. Thus, the results to be presented are obtained by joint estimation of the system equations (6.2) and (6.3), subject to (6.4) for the two sectors simultaneously, altogether a system of four equations and two identities.

Results

There is no easy way to present and compare results of alternative specifications for several reasons. First, each state variable appears in two equations, one for the slope and one for the intercept. Second, and more important, the model is both joint and dynamic and the response of output to a change in a state variable is a sum of several effects. Not all state variables are independent. Thus, a change of an exogenous state variable may affect the values of other state variables. Such changes also affect the value of the capital-labor ratio. This can be seen by evaluating the elasticity of average labor productivity with respect to a given state variable (say z_i):

$$\partial y_j/\partial z_i = \sum_h \{\partial \Gamma_j(z)/\partial z_h + k_j[\partial \beta_j(z)/\partial z_h] + \beta_j(z)(\partial k_j/\partial z_h)\}\partial z_h/\partial z_i. \qquad (6.5)$$

The first two terms in the brackets show the response of the implemented technology to a change in the state variables, whereas the last term shows the response under constant technology. A full evaluation of equation (6.5) requires a solution of the model. This is done in Chapter 9, where the complete model is put together for the particular specification that is used for the policy simulation. The innovation in the present formulation, however, lies in the response of the implemented technology. This is evaluated here under the assumption that $\partial z_h/\partial z_i$ is equal to zero for $h \neq i$. Thus, estimates can be presented for

$$E_{ij} = \partial \Gamma_j(z)/\partial z_i + k_j[\partial \beta_j(z)/\partial z_i]. \qquad (6.6)$$

Table 12 presents results for three alternative specifications. Detailed results of the first two are presented in Appendix 3 and those of the third are presented in Table 13. The estimates for each specification are used to compute the output. Then output (y) is regressed on the fitted output ($\hat{y}$) to obtain the degree of the fit (R^2) and to determine if there is any systematic bias in the estimates. This is done by computing $y = a + b\hat{y}$. The top part of the table presents the values of R^2 of these regressions as well as t-ratios for the null hypotheses that $a = 0$ and $b = 1$. It shows that all these specifications fit the data well, and none of them show any systematic discrepancy from actual output.

The first two specifications use the past peak of average labor productivity as a carrier of technology, but they differ in the demand specification. Starting with the presentation of the technology, the elasticities with respect to the peak are positive in the first specification and negative in the second. However, the peak is not the sole representative of the technology. Technology is also embedded in the lagged output and in the cross effects of output. Thus, the cross effects represent technology in addition to demand. The effect of the lagged dependent variable is rather strong, but it is not presented in the table. Note that the cross output effects are stronger in the second model.

Turning to prices, in specification 1, the same price (P/P_3) appears for both sectors. This is a measure of the real exchange rate. It appears in current and lagged form, and

Table 12—Short-run production elasticity and related statistics

Variable	Regression 1		Regression 2		Regression 3	
	y_1	y_2	y_1	y_2	y_1	y_2
Fit of the model						
R^2	0.963	0.978	0.933	0.997	0.934	0.988
t-ratio for a = 0	0.48	0.83	0.24	0.13	0.72	0.50
t-ratio for b = 1	0.38	1.60	0.17	0.21	0.76	0.77
Elasticities with respect to state variables						
Peak	0.25	0.23	−0.43	−0.007	...	...
Per capita capital	...	...	...	...	0.17	−0.54
Output of other sector	0.02	0.19	0.20	0.31	0.19	0.33
P_1/P_3	...	...	0.05[e]	...	0.02	...
P_2/P_3	...	...	...	0.005[e]	...	0.03
P/P_3	0.10	0.33	...	...	...	...
Government consumption	...	0.34	...	0.61	...	0.51
Standard deviation	−0.03	−0.02	−0.03	0.009	−0.05	−0.003
Openness	0.02	0.15	0.10[e]	0.09[e]	0.11	0.06
High inflation	...	...	0.001	−0.017	−0.002	−0.01
Deflation	...	...	...	0.002	...	0.002
Bank failures	...	...	..	−0.007	...	−0.006

Notes: Ellipses indicate that the variable does not appear in the equation. y_i is sectoral output. e indicates that the state variable was computed from the price block. t-ratios are absolute values.

the elasticities in the table are the sum of the two terms. They are positive as expected. The standard deviation of sectoral prices is negative, and this is generally true for the various specifications, indicating that volatility in prices had a negative effect on output. The degree of openness had a positive effect on productivity. This result is also quite robust in the various alternative specifications. This is also true for the effect of the share of government expenditure in total output on the productivity in nonagriculture.

The second specification replaces the actual prices and the degree of openness with the values obtained from the price block. For this reason, the prices are sectoral prices. The elasticities are positive. In addition, this specification includes three macro shocks as state variables. These are, first, a measure of high inflation, which is equal to the inflation rate whenever the inflation is above 50 percent and zero otherwise; second, a measure of deflation, which is equal to the rate of price decline and equal to zero when prices do not decline. Over the whole period, prices declined in seven years. In addition, there is a dummy variable for years of bank crises (1931-32, 1981-82). It cannot be overemphasized that it is not meaningful to think of an isolated change in any one of these variables—one without repercussions on the other state variables. With this qualification, it appears that inflation had a negative effect on nonagriculture, whereas deflation had a positive effect. However, when the negative effect of the years of bank crises are taken into account, the average effect of deflation is negative.

A solution of the model with the peak variable endogenized is somewhat complex. For this reason, the second specification is changed by replacing the peak with the overall per capita stock of capital as the carrier of technology. The numerator of this variable includes the capital stock of the private and public sectors combined, whereas the denominator is the total population. As such, it is different from the capital-labor ratio in either sector, but it nevertheless is correlated with the capital-labor ratio in nonagriculture. Thus, it is somewhat artificial to evaluate a change in this variable, keeping the sectoral capital-labor ratios constant. The elasticity of this variable is negative

Table 13—Production functions, 1916-84

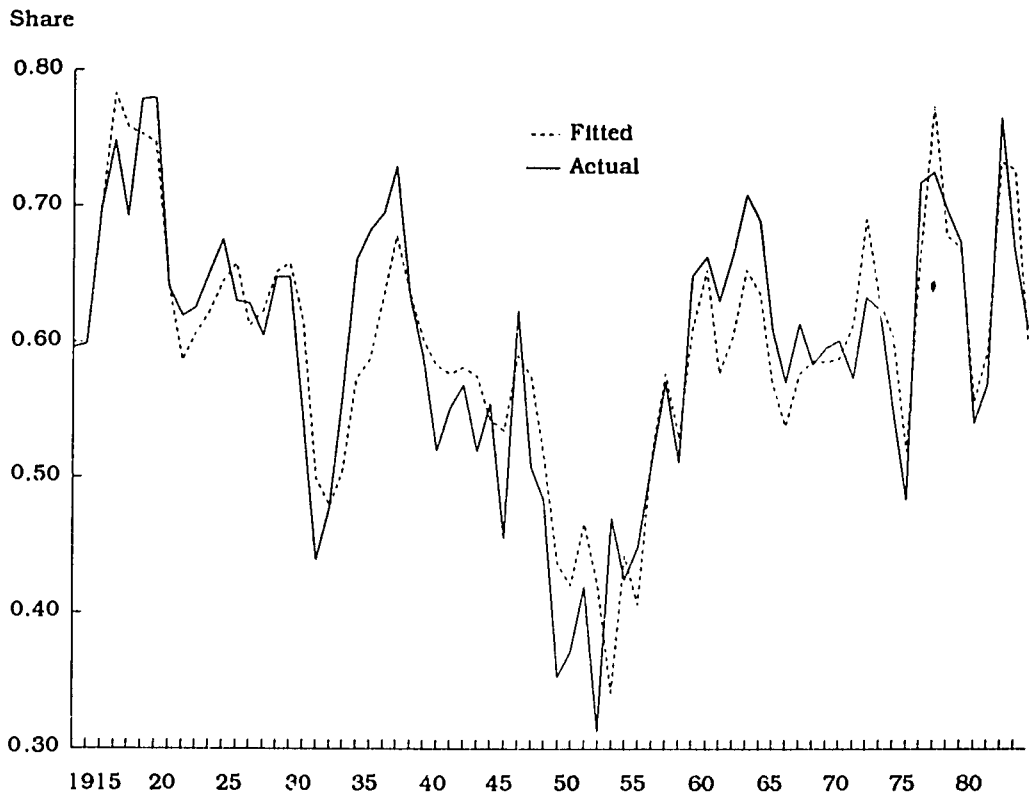
Variable	Agriculture: Share of Capital (β_1)	Agriculture: Intercept (Γ_1)	Nonagriculture: Share of Capital (β_2)	Nonagriculture: Intercept (Γ_2)
R^2	0.77	0.81	0.85	0.83
D.W.	1.52	1.37	1.3	1.4
Constant	−2.678 (5.3)	19.20 (6.3)	0.176 (0.3)	6.22 (2.1)
Logarithms				
K/N	0.541 (6.2)	−3.326 (6.4)	0.211 (3.4)	−1.730 (5.3)
P_1/P_3	0.236 (8.9)	−1.504 (9.5)	0.347 (8.9)	−1.935 (9.2)
$\sigma_{1,3}$	0.123 (1.0)	0.234 (0.3)	0.249 (1.8)	−1.505 (2.0)
DO_c	−0.833 (5.1)	5.612 (5.8)	0.453 (1.7)	−2.369 (1.7)
Cross effects	0.117 (3.5)	−0.583 (3.0)	−0.092 (1.4)	0.785 (2.2)
	$0.146DO_c$ (5.3)	$-0.967DO_c$ (5.9)	$-0.064DO_c$ (1.3)	$0.315DO_c$ (3.3)
g	...	...	0.129 (2.8)	−0.253 (1.0)
			$+0.075DO_c$ (2.8)	$-0.457DO_c$ (3.3)
Lagged dependent variables	0.291 (3.4)	0.236 (4.0)	...	...
High inflation	−0.049 (2.2)	0.320 (2.5)	−0.043 (2.2)	0.211 (2.1)
Deflation	...	...	0.780 (2.8)	−4.434 (3.0)
Bank failures	...	...	0.011 (0.5)	−0.166 (1.3)

Notes: Absolute values of t-ratios appear in parentheses. Variables are defined in the glossary of symbols.

in nonagriculture and it is positive in agriculture. The elasticities of the other variables are quite similar to those discussed above. This specification gives a good fit to the data and is chosen for the continuation of the analysis. The coefficients of the fitted functions are given in Table 13.

The fitted values of these equations are shown in Figures 32-37. The first thing to note is the great volatility of the capital shares. There are two approaches to account for such volatility. One is to attribute the variations in the share of capital to the changes in factor proportions. This is the approach taken by extending the Cobb-Douglas function to include interaction terms, such as the translog function. This approach was not helpful in this particular case. The second approach is the one taken here; it attributes the variations in the share to variations in the state variables. The two, of course, are not mutually exclusive, in that it is possible that the shares depend on factor proportions as well as on the state variables. Again, this is unnecessary here.

Figure 32—Actual and fitted values of capital shares in agriculture, 1913-84

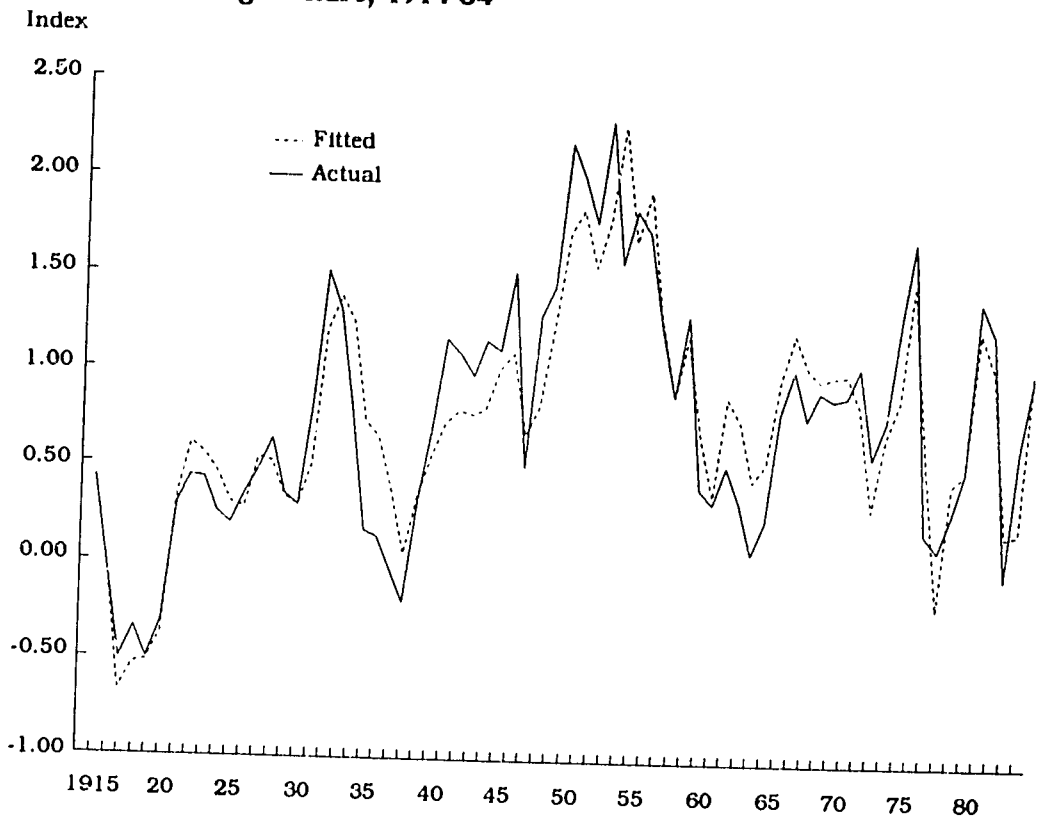


Note: Fitted values result from the regression for β_1 and Γ_1 reported in Table 13.

The sign of a coefficient in the share equation indicates the partial effect of a state variable on the share of capital in total output. Most of the coefficients are positive, which implies that the corresponding variables are capital-using or laborsaving. Specifically, the effect of K/N on the share of capital is positive. This is also true for the peak variable and for lagged output. Thus, on the whole, the message is that technical change as perceived here is laborsaving. Similarly, prices have positive signs in the share equation. This is consistent with the argument illustrated in Figure 30 that favorable prices are conducive to the implementation of more advanced techniques and that those are laborsaving. The effect of government expenditure on the share of capital in nonagriculture depends on the degree of openness, and it is not robust. Table 13 shows that this effect becomes more labor-using as the degree of openness increases. However, the results in Appendix 3 are somewhat different. One possible explanation for this mixed message is that this variable has two contradictory effects. It leads to higher aggregate demand, and therefore, it generates an expansion effect that is capital-intensive, like the effect of the other expansionary variables. On the other hand, government demand is biased toward labor-intensive products.

The partial effect of the degree of openness is not immediately apparent because this variable interacts with several other variables.

Figure 33—Actual and fitted values of the intercept of the production function in agriculture, 1914-84



Note: Fitted values result from the regression for β_1 and Γ_1 in Table 13.

The Determination of Sectoral Wages and Rentals

The production functions presented in Table 13 are used to determine the output of each sector and to estimate the factor shares. In turn, the factor shares are used to determine factor prices.

Under the assumption of homogeneity, sectoral output is exhausted by factor incomes.

$$P_j Y_j = W_j L_j + r_j K_j, \tag{6.7}$$

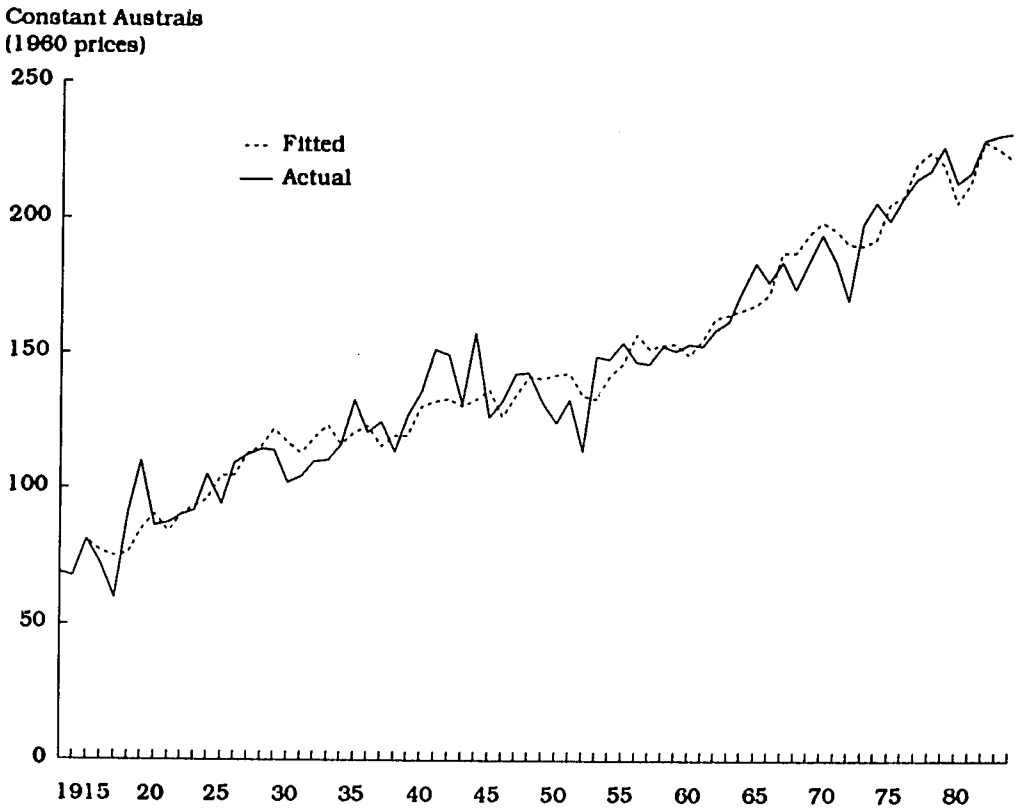
where r_j is the return to capital. Alternatively,

$$1 = S_{Lj} + S_{Kj}, \tag{6.8}$$

where S_{Lj} and S_{Kj} are, respectively, the shares of labor and capital in sector j. Recall that S_{Kj} is identified with β_j. Therefore, once the function $\beta_j(z)$ is determined, the use of expressions (6.7) and (6.8) allows the determination of sectoral wages. The wage of sector j is given by

$$W_j = (1 - \beta_j) P_j Y_j / L_j. \tag{6.9}$$

Figure 34—Actual and fitted values of agricultural output, 1913-84



Note: Fitted values result from the regression for β_i and Γ_i reported in Table 13.

Similarly, the rate of return to capital is given by

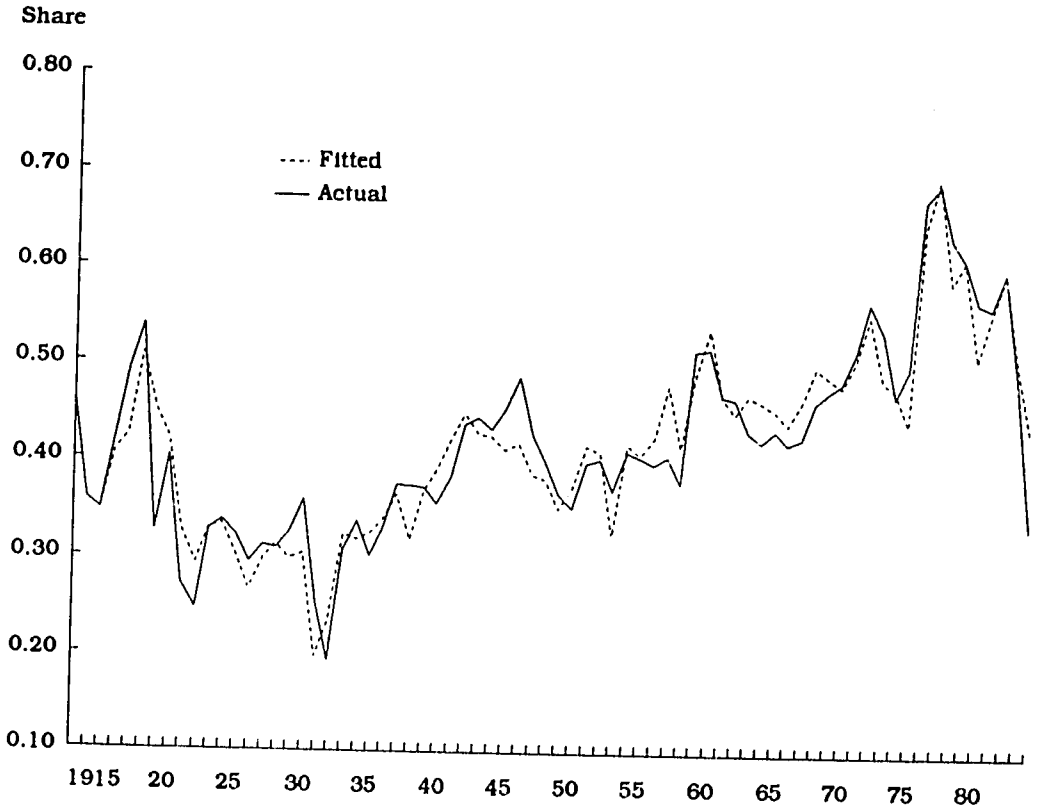
$$r_i = \beta_i P_i Y_i / K_i. \tag{6.10}$$

It is clear from equations (6.9) and (6.10) that as β increases, wages decline and the return to capital increases. Thus, the substitution effect of laborsaving technical change is to reduce the demand for labor, thereby having a depressing effect on wages. The formulation does not take into account the changes in the quality of labor that are required to implement the more advanced techniques. To the extent that labor has undergone quality appreciation, it should be reflected in wages. It is impossible to assess the quantitative importance of such a change without studying it. Nevertheless, it is important to bring out this caveat at this point because it has an important effect on the policy simulations carried out in Chapters 9 and 10.

The Price of Land

In agriculture, the capital stock, K_1, is an aggregate of physical capital and land. The rate of return to capital, r_1, determined in the previous section, is the rate of

Figure 35—Actual and fitted values of capital shares in nonagriculture excluding government, 1913-84



Note: Fitted values result from the regression for β_2 and Γ_2 in Table 13.

return of the aggregate capital, K_1. In order to determine the price of land, P_a, it is useful to write the identity,

$$r_1 P K_1 = r_{1c} P_1 K_{1f} + r_a P_a A, \tag{6.11}$$

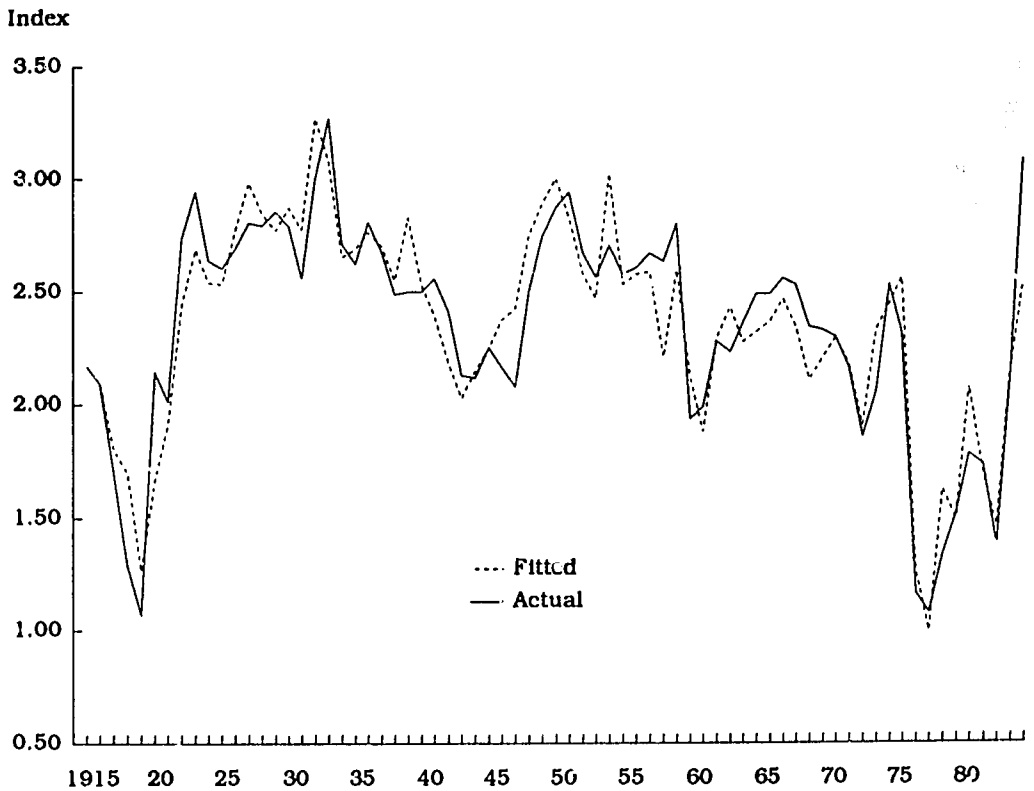
where P_1 is the price of physical capital. This identity indicates that the return on overall capital at current prices is divided into the return on the value of physical capital, $r_{1c} P_1 K_{1f}$, and the return to land $r_a P_a A$. It is assumed that agents invest in land until its rate of return equals that of physical capital (r_{1c}) adjusted for its depreciation at rate δ_1 and for the expected appreciation of land $E(\hat{P}_a - \hat{P})$. Formally,

$$r_a = r_{1c} - \delta_1 - E(\hat{P}_a - \hat{P}). \tag{6.12}$$

Assume also that the return to physical capital in sector 1 is equal to the return on total capital, that is $r_1 P = r_{1c} P_1$. Then

$$r_{1c} = r_1 P / P_1 . \tag{6.13}$$

Figure 36—Actual and fitted values of the intercept of the production function in nonagriculture excluding government, 1914-84



Note: Fitted values result from the regression for β_2 and Γ_2 in Table 13.

Substituting equations (6.12) and (6.13) into equation (6.11), obtains

$$r_1 PK_1 = r_1 P\, K_{1f} + [r_1 P/P_l - \delta_1 - E(\hat{P}_a - \hat{P})]P_a A, \tag{6.14}$$

and, therefore,

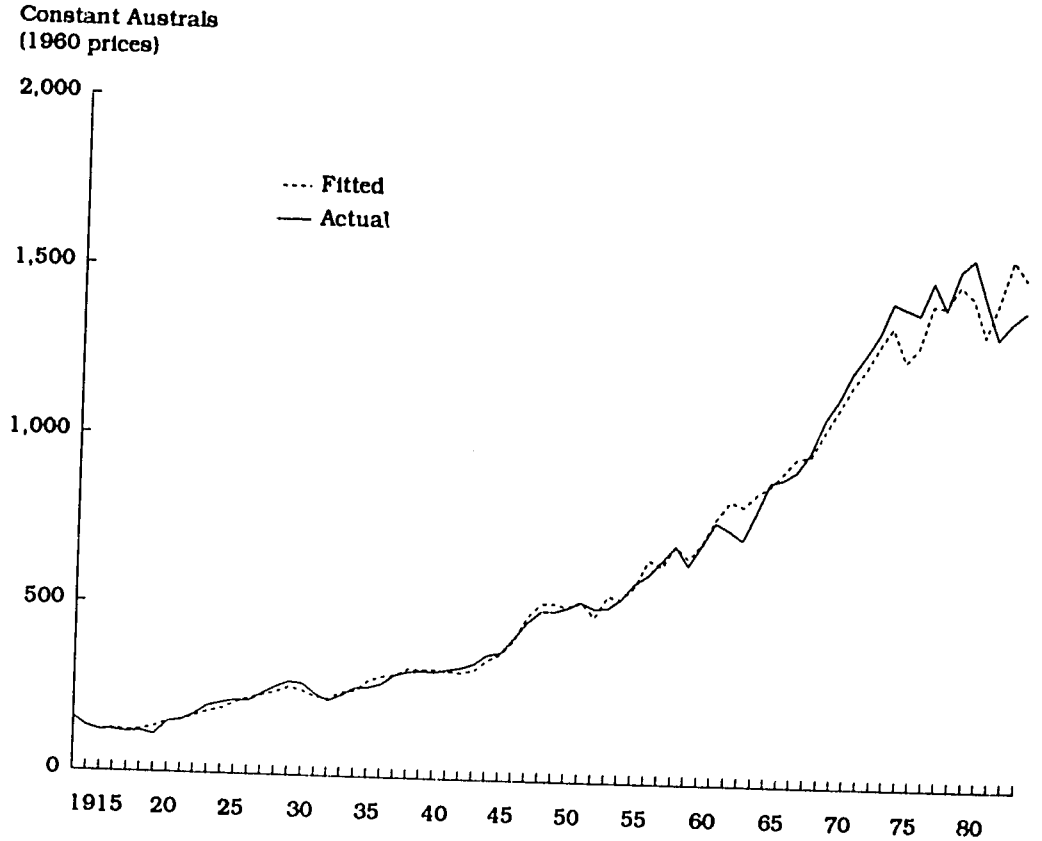
$$\frac{P_a}{P} = \frac{r_1(K_1 - K_{1f})}{A[r_1(P/P_l) - \delta_1 - E(\hat{P}_a - \hat{P})]} = \frac{R_a}{r_1(P/P_l) - \delta_1 - E(\hat{P}_a - \hat{P})}, \tag{6.15}$$

where R_a is the rent on a unit of land computed as $r_1(K_1 - K_{1f})/A$. The only variable that is unobserved in expression (6.15) is $E(\hat{P}_a - \hat{P})$. Thus, it is possible to derive $E(\hat{P}_a - \hat{P})$ from (6.15):

$$E(\hat{P}_a - \hat{P}) = r_1(P/P_l) - \delta_1 - R_a P/P_a. \tag{6.16}$$

This relation can be turned around in order to forecast land prices, if $E(\hat{P}_a - \hat{P})$ is known.

Figure 37—Actual and fitted values of nonagricultural output excluding government, 1913-84



Note: Fitted values result from the regression for β_2 and Γ_2 in Table 13.

For that purpose, an effort is made to determine $E(\hat{P}_a - \hat{P})$ under the assumption that it behaves as a polynomial distributed lag on $\hat{P}_a - \hat{P}$. This is done by computing

$$r_1(P/P_i) - \delta_1 - R_a P/P_a = PDL(\hat{P}_a - \hat{P}), \tag{6.17}$$

and estimates of the parameters involved are obtained. The results for alternative lag structures are reported in Table 14. Finally, to obtain the price of land, regression (1) of Table 14 is used to write:

$$\frac{P_a}{P} = \frac{R_a}{r_1(P/P_i) - \delta_1 - PDL(\hat{P}_a - \hat{P})}. \tag{6.18}$$

Alternatively, it is possible to estimate an equation for the price of land that does not explicitly use all of the above restrictions. This equation is

Table 14—Expected real appreciation of land, 1916-84

Independent Variable	Dependent Variable: $E(\hat{P}_a - \hat{P})$			
	1	2	3	4
$\bar{R}^2$	0.05	0.60	0.02	0.57
D.W.	0.50	2.14	0.55	2.14
Constant	0.066 (14.2)	0.063 (5.2)	0.066 (14.0)	0.063 (5.0)
$D[\log(P_a/P)] - 1$	0.025 (1.2)	0.006 (0.5)	0.019 (0.9)	-0.003 (-0.3)
$D[\log(P_a/P)] - 2$	0.27 (1.3)	0.019 (1.4)	0.031 (1.5)	0.005 (0.4)
$D[\log(P_a/P)] - 3$	0.038 (1.8)	0.032 (2.4)	...	...
ρ	...	0.753 (2.4)	...	0.752 (9.6)

Note: D [.] is the first-difference operator; t-statistics are in parentheses. $D[\log(P_a/P)] - j$ is the rate of change of the real price of land lagged j years.

$$\log(P_a/P) = \underset{(1.9)}{0.4093} + \underset{(2.1)}{0.1760}\log(r_1) + \underset{(8.2)}{0.9635}\log(P_a/P)(t-1)$$

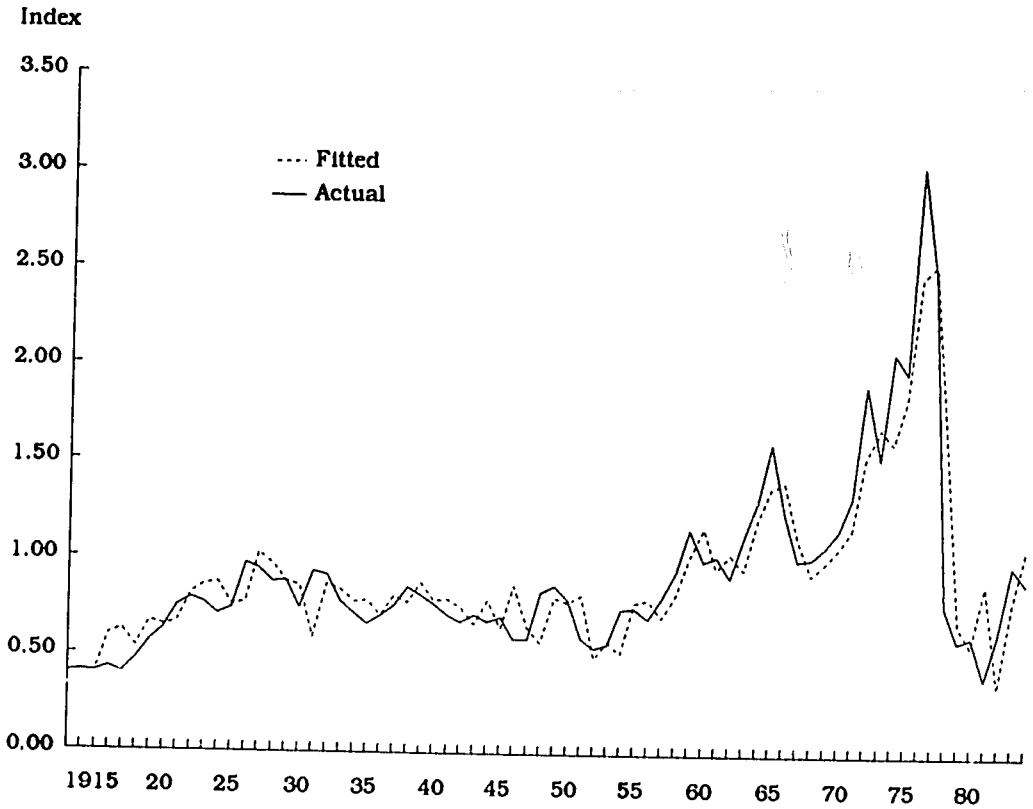
$$\underset{(-1.8)}{-0.2075}\log(P_a/P)(t-2), \qquad (6.19)$$

$\bar{R}^2 = 0.72$; D.W. = 1.96;

where r_1 is the rate of return on capital in agriculture.

In simulating the model, the price of land is taken to be exogenous. However, in the policy simulation the price of land deflated by the overall price level (P_a/P) is endogenized by using equation (6.19). The actual and fitted values of P_a/P are plotted in Figure 38.

Figure 38—Price of land, 1913-84



Notes: This is the price of land deflated by the GDP deflator. Fitted values result from regression (6.19) in the text.

7

CONSUMPTION, INVESTMENT, EXPORTS, AND IMPORTS

The purpose of this chapter is to show how the components of national expenditure are calculated to arrive at numerical values needed for simulating the economy.

Total output, valued at market prices, is allocated to three alternative expenditure components: consumption (private and public), investment (private and public), and net exports (exports minus imports). Consumption and investment by the government are taken to be exogenous. Private consumption and investment are modeled very simply. Net exports are obtained here as the difference between output and the sum of consumption and investment all valued at market prices. From net exports and the equation that explains the degree of commercial openness (defined as the sum of exports and imports divided by total output) discussed in Chapter 5, it is possible to obtain exports and imports separately. In what follows, the estimates of each of these functions are discussed. A summary of the estimation procedure is included in Appendix 2.

Consumption

The consumption function to be estimated is written as

$$c^p = c^p(y^p), \tag{7.1}$$

where c^p is private per capita consumption and y^p is per capita personal income.

Data on personal income are not available but can be derived from the national account series. Personal income in nominal terms is written as

$$PY^p = PY - D - (T^p + T^d - T^r), \tag{7.2}$$

where PY^p is value of personal income, PY is value of output, D is investment for the replacement of capital (total depreciation), T^p is the inflation tax, T^d is direct taxes, and T^r is net transfer payments to families. Using the budget constraint of the government, the sum of the last three terms in equation (7.2) must equal the difference between total government outlays, consumption (C^g) and investment (I_3), and resources coming from indirect taxes and the increase in the stock of public debt:

$$T^p + T^d - T^r = P_g C^g + P_i I_3 - T^i - F^b, \tag{7.3}$$

where P_g is the price of government consumption, P_i is the price of investment, T^i is indirect taxes, and F^b is the fiscal deficit financed by borrowing. The depreciation of the capital stock, D, can be computed as

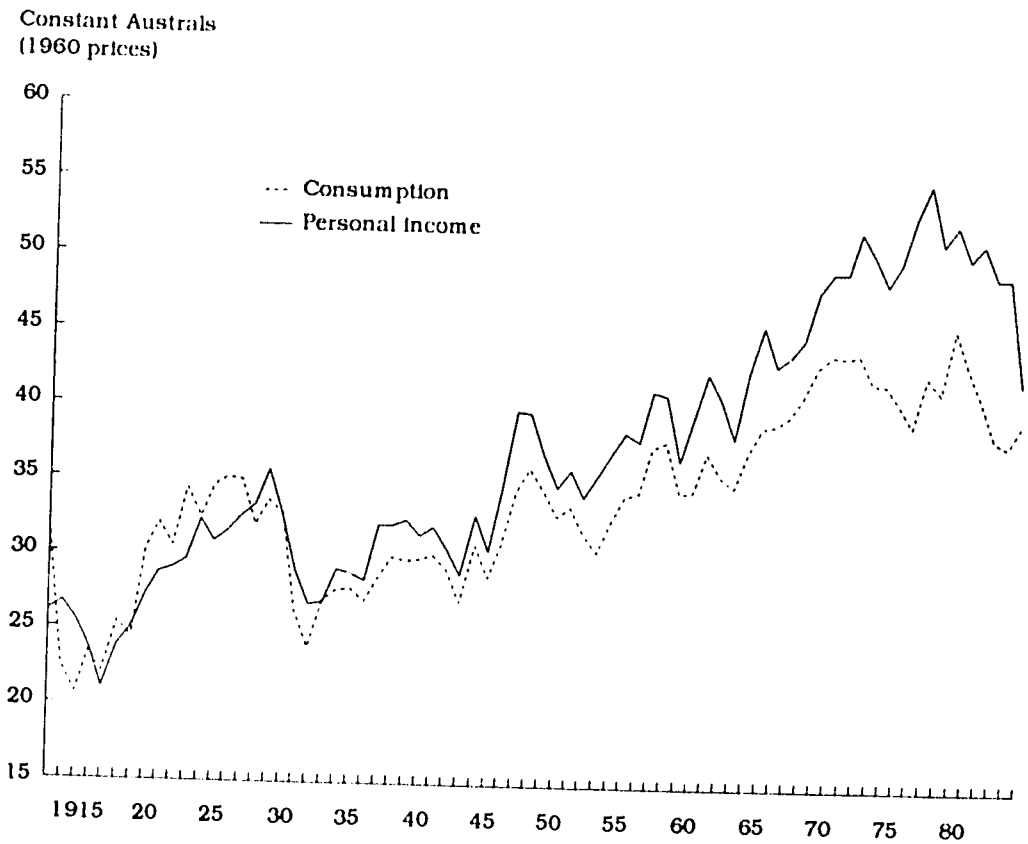
$$D = \delta_1 P_i K_1 + \delta_2 P_i K_2, \tag{7.4}$$

where δ_1 and δ_2 are the depreciation rates of the capital stocks (K_1 and K_2) in sectors 1 and 2, respectively. Substituting equations (7.3) and (7.4) in (7.2) obtains the personal income in nominal terms. Dividing this result by the price level and population obtains per capita personal income, y^p. This is plotted in Figure 39 together with private consumption per capita.

The estimation of the consumption function allows the propensity to consume out of personal income to vary with the share of labor and the share of public consumption in total income. The empirical results are reported in Table 15, assuming a linear form of the consumption function. This table also reports a regression that includes a wealth variable measured as the economy's per capita stock of capital, $k = K/N$, and also the same function estimated simultaneously with the investment, intersectoral capital allocation, and land equations discussed in Chapter 8. The plots of actual and fitted values are presented in Chapter 9. In all cases, the dependent variable lagged one and two periods is included to allow for partial adjustment.

The empirical results show that the propensity to consume out of personal income varies positively with the share of labor income and inversely with the share of govern-

Figure 39—Personal income and private consumption per capita in 1960 prices, 1913-84



Sources: Derived from Instituto de Estudios Económicos sobre la Realidad Argentina y Latinoamericana, "Estadísticas de la Evolución Económica de Argentina, 1913-1984" *Estudios* (No. 39, 1986). For data on private consumption, see Tables 4 and 15 of the data supplement to this report.

Table 15—Private consumption per capita, 1916-84

Independent Variable	Dependent Variable: $c^p = P_p C^p/PN$		
	1	2	3
$\bar{R}^2$	0.92	0.92	0.93
D.W.	1.93	1.98	1.97
y^p	$0.52 + 0.18S_L - 0.48g$ (6.7) (2.1) (−5.0)	$0.50 + 0.23S_L - 0.49g$ (6.4) (2.5) (−5.2)	$0.48 + 0.28S_L - 0.53g$ (6.7) (3.4) (−6.0)
K/N	...	0.014 (1.5)	0.22 (2.4)
c^p_{-1}	0.532 (5.2)	0.518 (5.1)	0.403 (4.1)
c^p_{-2}	−0.131 (1.5)	−0.180 (−2.0)	−0.092 (1.0)
Average propensity to consume	0.92	0.85	0.81

Notes: y^p is per capita personal income; K/N is the economy's total capital stock per capita; c^p is private per capita consumption; S_L is the labor share in total income, WL/PY; and g is the share of government consumption in total income, $P_g C^g/PY$. t-statistics are in parentheses. The last row is the average propensity to consume out of personal income.

ment consumption. The mean value of the average propensity to consume out of personal income for the entire period is 0.92. When the wealth variable is included in the regression, this value declines somewhat. These results reflect that consumption is computed here as a residual, and as such it has an important transitory component.[7]

Investment Function

The treatment of investment determines to a large extent how the model is closed. Here, as in the previous work, foreign savings (or net exports) are allowed to be a residual, and an autonomous investment function for the aggregate private sector, agriculture, and nonagriculture (excluding government) combined is introduced.

In differentiating between private and government investment, the two types of investment are determined by different criteria. The present analysis deals with private investment, taking government investment to be exogenous.

Private investment is assumed to depend on the expected rate of return to capital in the private sector and on the change in output (acceleration). In addition, it is allowed to be affected by government investment. To the extent that government investment expands infrastructure, it increases the productivity of private investment. In this case, government investment is expected to have a positive effect on private investment.

There is no time series for the rate of interest over the entire or even a large part of the period. Thus, the fiscal deficit is the focus of attention. When the government

[7] Estimation of the consumption function was also carried out by assuming that private consumption depends on transitory and permanent income. The two components of income were obtained by assuming that permanent income is an autoregressive process and, alternatively, a moving average of past income. In both cases, the results were not satisfactory.

runs a deficit and finances it by borrowing, the rate of interest will tend to increase and crowd out private investment. This is a well-known effect, which applies to a closed economy. An open economy can borrow from abroad, but as the stock of government debt, either domestic or foreign, increases, the government's need to borrow in order to meet interest payments increases, and that in turn increases interest. Thus, ultimately, the effect of crowding-out can be observed in open economies as well.

The preceding discussion is summarized in the form of a functional relationship for the private investment flow. In symbols,

$$I_{1,2}/N = I[\underset{+}{r^e_{1,2}}, \underset{+}{D(Y_{1,2})/N}, \underset{?}{I_3/N}, \underset{-}{f^b/N}], \tag{7.5}$$

where $I_{1,2}$ combines the investment of sector 1 (agriculture) and sector 2 (nonagriculture excluding government), $r^e_{1,2}$ is the expected rate of return of sectors 1 and 2 combined, $D(Y_{1,2})$ is the first difference of gross factor income in sectors 1 and 2 combined, I_3 is government investment, f^b is the fiscal deficit financed by borrowing at constant prices, and N is population.

In the empirical analysis, equation (7.5) is formulated to be linear in its arguments. No direct measurements of expected rates of return are available. The variable $r^e_{1,2}$ is computed as the fitted value of a three-stage autoregressive process, AR(3), for a measure of observed rate of return, $r_{1,2}$. The rate of return is computed as the nonwage income in sectors 1 and 2 combined, divided by the stock of capital of these two sectors.

Table 16 reports the regression estimates for the investment function. The empirical results show that the expected rate of return and the accelerator variable have positive and significant effects. Government investment is entered in alternative ways. In regression (1), the variable is lagged one period, whereas regression (2) contains the expected level of government investment obtained from the fitted values of an AR(3) process for I_3. Regression (3) is obtained from a simultaneous estimation together with the consumption, capital allocation, and land equations. The plots of actual and fitted values are presented in Chapter 9.

The results show that the effect of government investment is positive and statistically significant, which suggests that government investment encourages capital accumulation in the private sector. This is consistent with a view that expansion of infrastructure increases productivity. However, there is a counterpart to this positive effect of government investment. The fiscal deficit financed by borrowing exerts a negative effect on private investment and gives empirical support to the assertion of the existence of a crowding-out effect. Finally, the lagged dependent variable is included in all regressions to allow for partial adjustment.

Exports and Imports

Net exports—exports less imports—can be obtained as a residual from the product-expenditure identity:

$$PY_{mp} = PY(1 + t_i) = P_pC^g + P_iI_{1,2} + P_iI_3 + P_{ex}X^x - P_{im}M^m, \tag{7.6}$$

where Y_{mp} is gross domestic product at market prices, and P_p, P_g, P_i, P_{ex}, and P_{im} are the prices of private consumption, public consumption, investment, exports, and imports.

Table 16—Private investment per capita, 1916-84

Independent Variable	Dependent Variable: $I_{1,2}/N$		
	1	2	3
$\bar{R}^2$	0.94	0.94	0.95
D.W.	2.07	2.10	2.02
Constant	-1.12 (-2.4)	-1.29 (-2.7)	-1.06 (-2.2)
$r^e_{1,2}$	18.9 (3.7)	19.4 (3.6)	17.8 (3.7)
$D(Y_{1,2}/N)$	0.349 (6.7)	0.346 (6.4)	0.372 (7.8)
$(I_3/N)_{-1}$	0.630 (2.9)	...	0.591 (3.0)
I^e_3/N	...	0.633 (2.2)	...
f^b/N	-0.150 (-2.5)	-0.162 (-2.5)	-0.110 (-2.0)
$(I_{1,2}/N)_{-1}$	0.683 (11.1)	0.695 (10.9)	0.693 (12.8)

Notes: All variables except $r^e_{1,2}$ are in per capita terms; the dependent variable, $I_{1,2}$ is the sum of investment in sector 1 (agriculture), I_1, and sector 2 (nonagriculture, government excluded), I_2; $r^e_{1,2}$ is a measure of the expected rate of return in sectors 1 and 2 combined obtained from the fitted values of an AR(3) process of nonwage income divided by the capital stock in sectors 1 and 2 combined; $D(Y_{1,2})$ is the first difference of gross domestic income in sectors 1 and 2 combined. $(I_3)_{-1}$ is government investment lagged one period; I^e_3 is the fitted value of an AR(3) process for I_3; f^b is the fiscal deficit financed by borrowing deflated by the price level, P; and $(I_{1,2})_{-1}$ is the dependent variable lagged one period. t-statistics are in parentheses. See the glossary of symbols for the definition of other variables.

Government consumption, C^g, government investment, I_3, and the indirect tax rate, t_i, are taken to be exogenous. The determination of private consumption and investment was discussed in the previous sections. Therefore, net exports are simply

$$NX = P_{ex}X^x - P_{im}M^m = PY(1 + t_i) - P_pC^p - P_gC^g - P_iI_{1,2} - P_iI_3. \tag{7.7}$$

The actual and fitted values of net exports in per capita terms are presented in Chapter 9. The difference between the actual and the fitted values comes from the errors in the estimation of Y_1, Y_2, C^p, and $I_{1,2}$ because all the other terms in (7.7), namely, t_i, C^g, and I_3, are assumed to be exogenous, and consequently their actual values are entered into expression (7.7).

In order to decompose net export to its components, the equation that explains the degree of commercial openness, DO_c, is used. Recall that

$$DO_c = \frac{P_{ex}X^x + P_{im}M^m}{PY}. \tag{7.8}$$

Therefore, exports are given as

$$P_{ex}X^x = (NX + DO_cPY)/2, \tag{7.9}$$

and imports as

$$P_{im}M^m = P_{ex}X^x - NX. \tag{7.10}$$

8

RESOURCE GROWTH AND ALLOCATION

The preceding chapters analyzed how prices and quantities are determined at time t. This chapter turns to the analysis of the process of factor growth and its sectoral allocation. This will make it possible to determine how the economy moves from time t to t + 1. To simplify the analysis, the rate of growth and the age composition of the population are taken to be exogenous. The model includes an employment function that explains the outcome of the interaction of labor supply and demand. Total employment is allocated between the sectors in response to the intersectoral income differential. Capital accumulation is obtained as the yearly addition of net investment to the stock of capital in the previous period. Its allocation to the sectors is accomplished through the allocation of new investment. Finally, an equation is introduced to explain the size of cultivated land. A summary of this estimation procedure is also included in Appendix 2.

The Dynamics of Sectoral Employment

As a matter of definition, the labor force in sector 1 at time t, $L_1(t)$, is obtained from the labor force at time t − 1 increased by the rate of growth of the labor force and decreased by the rate of migration from agriculture. Two assumptions are made: (1) there is no unemployment in agriculture; hence, employment is equal to the labor force, (2) the rate of population growth replaces the rate of growth of the labor force. In symbols:

$$L_1(t) = L_1(t-1)[1 + n(t) - m(t)], \tag{8.1}$$

where n, the rate of population growth, is taken to be exogenous, and m, the rate of migration, is an endogenous variable, which will be discussed later.

Unless stated otherwise, employment in sector 2 is proportional to the labor force in that sector; it is determined as the difference between total employment and employment in sectors 1 and 3. The latter, L_3, is taken to be exogenous. Therefore,

$$L_2(t) = L(t) - L_1(t) - L_3(t). \tag{8.2}$$

As total population is assumed to grow at the exogenous rate n(t), $N(t) = N(t-1)[1 + n(t)]$. The only element that needs to be explained in equation (8.2) is the rate of employment, L(t).

Equations (8.1) and (8.2), together with the migration and employment equations, complete the description of the dynamics of sectoral employment.

Labor Migration

The intersectoral labor allocation can be analyzed within the framework of occupational choice. However, in the case of agriculture, a choice of a nonagricultural occupation often implies geographical mobility and, as such, entails a cost of migration.

It is assumed that a person chooses to migrate if his expected income in alternative occupations, properly computed, minus the cost of migration is higher than in agriculture. A distinction is made between landless labor and farm operators. The latter are assumed to take the future profitability of agriculture into consideration. This should be captured by the price of land. For both groups, the expected return in nonagriculture depends not only on wages, but also on the probability of finding a job (Todaro 1969). Such a probability is inversely related to the degree of unemployment.

The empirical formulation of the migration equation is explained in Mundlak 1979. The basic form is

$$\log(m + c_0) = \beta_0 + \beta_1 \log(\delta - c_1) + \beta_2 \log(L_1/L_2) + \beta_3 \log(z), \qquad (8.3)$$

where δ is a measure of the intersectoral wage or income differential, L_1/L_2 is the ratio of the labor force in the two sectors, and z stands for other variables that might enter the equation. The βs are the coefficients to be estimated; c_0 is a nonnegative constant. When there is negative migration, c_0 becomes positive. The second constant, c_1, determines the value of at which migration becomes zero. In this study, it is set at zero for computational convenience, but the analysis could be extended to search for other values of c_1.

Although there is no time series for labor for the whole period, there is information from various sources that has to be integrated. This integration is carried out as part of the empirical analysis. Hence, the empirical analysis serves two purposes: first, to estimate a migration equation, and second, to use the estimated results to construct a series on employment in sector 1. The estimation methodology and data sources are detailed in the data supplement.

Using expression (8.1), the available data permit a computation of intercensus migration rates for the periods 1914-47, 1947-60, 1960-70, and 1970-80, and annual rates for the period 1951-73. The best fit for expression (8.3) is reproduced below (t-ratios are in parentheses):

$$\log m(t) = \underset{(-6.6)}{-10.1} + \underset{(2.8)}{5.58} \log(W_2/W_1)_{t-1} - \underset{(-2.2)}{1.29} \log(P_a)_{t-1} - \underset{(-2.1)}{0.83} \log(U)_{t-2}; \qquad (8.4)$$

$R^2 = 0.95$.

The income differential is measured as the wage ratio in nonagriculture, excluding government, to that in agriculture, lagged one year $(W_2/W_1)_{t-1}$. As expected, an increase in the income differential in favor of nonagriculture increases the off-farm migration. The price of land (P_a) lagged one period has a negative effect on migration. This implies that better prospects for profitability manifested by a rise in the price of land decrease the migration rate. The ratio of the labor force in agriculture to that in nonagriculture turns out to be statistically insignificant, and it is dropped from the regression. Instead, migration is affected by the level of activity in sector 2. This variable is measured as the ratio of the actual to the historical peak of output in sector 2. It is introduced with a two-year lag, $U_{(t-2)}$. For convenience, it is referred to as urban unemployment, although the two are not the same. The negative sign indicates that the decline in the level of activity in nonagriculture is associated with a decline in migration.

Employment

The level of employment is determined by labor supply and demand, and possibly, by some institutional arrangements. It is postulated that labor supply is positively related to the real wage and to the size of the population in the relevant age group, assumed here to be ages 20-59. Supply is assumed to depend not only on the wage but also on the cost of finding employment, and this is assumed to be negatively related to the level of economic activity. Finally, the influence of the government on employment is allowed for in terms of the wage rate in the public sector relative to the size of the economy. Thus, this relationship can be formalized in symbols:

$$L = L(\underset{+}{w^p}, \underset{+}{P^r}, \underset{-}{U}, \underset{-}{w^g}), \tag{8.5}$$

where w^p is an average wage appropriately weighted in sectors 1 and 2, P^r is the proportion of the population ages 20-59, U is the measure of unemployment described above, and w^g is an index of government wages divided by per capita income.

According to equation (8.5), higher wages in the private sector and a higher participation rate have positive effects on total employment. This is intuitively clear. The unemployment variable serves as a measure of the probability of finding employment. Higher unemployment decreases such probability or increases the cost of the search, and therefore it shifts the supply downward.

The negative effect of the government wage stems from the fact that this rate may be exogenously set above the levels justified by productivity. In this case, the government wage acts as a floor for the cost of labor in the rest of the economy, thereby pushing up the economy-wide wage rate. If the government does not absorb labor to mitigate the excess supply created by a higher wage rate, given the labor demand, the total level of employment will fall.

The first issue to address in the empirical analysis is the problem of data availability. This is similar to that discussed in the previous section. Available annual data on total employment cover only the period 1950-73. In addition, there are census data for the years 1914, 1947, 1960, 1970, and 1980. The empirical analysis of employment also serves two purposes: first, to estimate an equation for the level of employment, and second, to use the estimated results to generate an annual series for the whole period. The details of the estimation are contained in the data supplement together with the estimation of the series on sectoral employment. The regression is run assuming a linear dependence of total employment normalized by population, L/N, on the determinants given in equation (8.5). Only the wage rate, w^p, and the index of government wages, w^g, turn out to be statistically significant and, consequently, the other two variables are dropped. The best fit is reproduced below:

$$L/N = \underset{(8.7)}{0.278} + \underset{(2.3)}{0.165}\, w^p_{-1} - \underset{(-2.1)}{0.031}\, w^g_{-1} + \underset{(10.0)}{0.104}\, DC; \tag{8.6}$$

$R^2 = 0.84,$

where DC is a dummy variable that takes a value of one for census data and zero for annual data. The estimated series for total employment is reported in the data supplement.

The Dynamics of Sectoral Capital Accumulation

Sectoral capital (K) varies from time t to time t + 1 according to the addition of the part of total investment that is allocated to the sector after depreciation has been subtracted. In symbols, the stock of capital in sector 1 (land excluded) is determined as

$$K_{1f}(t) = K_{1f}(t-1)[1-\delta_1(t)] + \theta(t)[I_{1,2}(t) + I_3(t)], \tag{8.7}$$

where δ_1 is the rate of depreciation, θ is the proportion of investment that goes to agriculture, and $I_{1,2}$ and I_3 are private investment and government investment, respectively. Similarly, the stock of capital in sector 2 at time t is

$$K_2(t) = K_2(t-1)[1-\delta_2(t)] + I_{1,2} - \theta(t)[I_{1,2}(t) + I_3(t)]. \tag{8.8}$$

The depreciation rates, δ_1 and δ_2, and government investment are taken to be exogenous, and the determination of private investment, $I_{1,2}$, is discussed in Chapter 7. Therefore, in order to obtain a complete description of the dynamics of capital accumulation, it is necessary to discuss how θ is determined.

Intersectoral Allocation of Investment

The intersectoral allocation of capital is primarily made through the allocation of gross investment. The share of agriculture in total investment, $\theta = I_1/I$, and the share of agriculture in the capital stock, $\theta^k = K_{1f}/K_f$, are plotted in Figure 40. It can be seen that the share of agriculture in the capital stock reached its peak in the early 1920s, when it amounted to more than 30 percent, and it has declined since then to a level of 10 percent. This followed a decline in the share of agriculture in investment, which was subject to volatility.

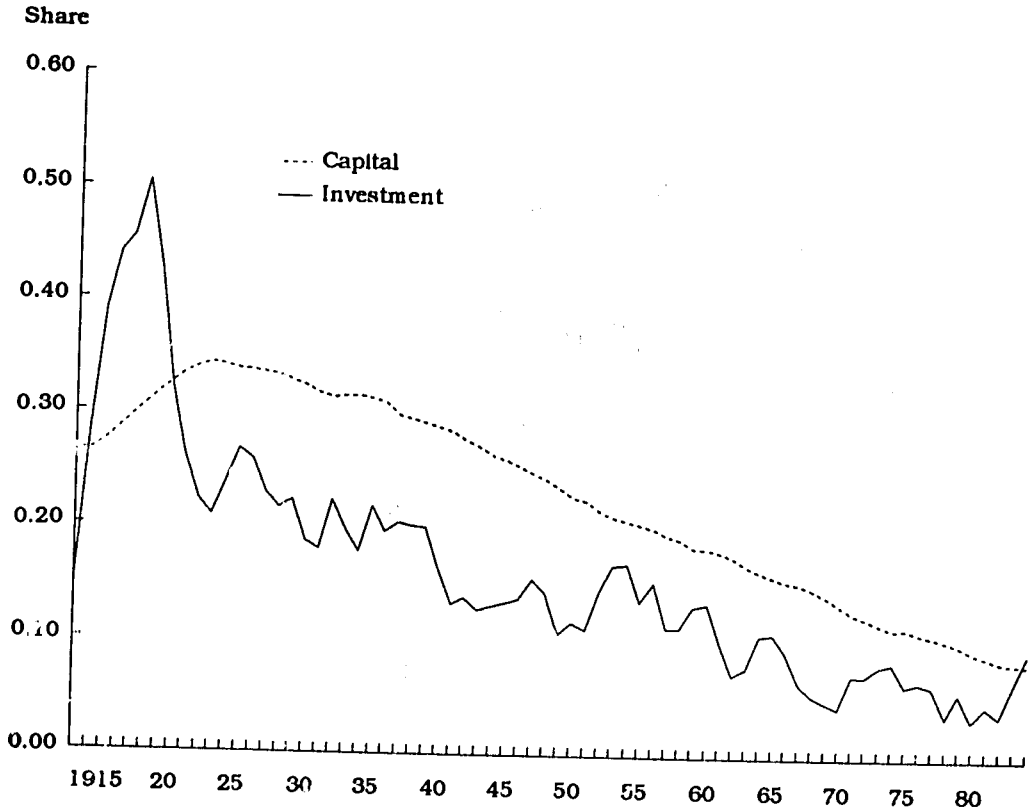
The sectoral rate of return is computed as nonwage income divided by the capital stock, where in this case, agricultural capital stock includes land. The inclusion of land accounts for part of the differential rate of return in that the aggregation depends on the price of land relative to that of capital goods.

Given total investment, the allocation to the various sectors depends on the sectoral rates of return. This relationship can be derived from an intertemporal optimization process with an external cost of adjustment (Mundlak 1986a; Cavallo and Mundlak 1989).

If resources move freely and the sectoral composition of capital adjusts in response to the differential rates of return, changes in the share of agriculture in investment should be reflected in the sectoral composition of capital. In other words, the more the economy relies on price signals to adjust the composition of capital to its equilibrium level, the closer to unity should be the elasticity of θ with respect to θ^k.

The empirical analysis regressed the logarithm of the share of agriculture in total investment on two variables: the share of agriculture in the capital stock and the differential rate of return, r_2/r_1. The latter is decomposed into an anticipated part, $(r_2/r_1)^e$, which is obtained from an AR(2) process, and an unanticipated part, $(r_2/r_1)^u$, which results from the difference between the actual and the anticipated ratio. The regression also includes the dependent variable lagged one year. The results are reported in Table 17, which also includes a simultaneous estimate of the θ function with the equations for investment, consumption, and cultivated land.

Figure 40—Shares of agriculture in investment and capital stock, 1913-84



Sources: Derived from Instituto de Estudios Económicos sobre la Realidad Argentina y Latinoamericana, "Estadísticas de la Evolución Económica de Argentina, 1913-1984" *Estudios* (No. 39, 1986). The series are reported in Tables 5 and 7 of the data supplement to this report.

Notes: The share of agricultural investment is computed as I_1/I, where I_1 and I are agricultural and total investment, respectively. The share of agriculture in the capital stock is computed as K_{1t}/K_t, where K_{1t} and K are respectively the physical stock of capital in agriculture and the total stock of physical capital (excluding land in both cases).

The most important result is the strong effect of the differential rate of return on the allocation of investment. The share of agriculture in the capital stock is introduced here to scale the investment. As argued in Cavallo and Mundlak (1982), in the absence of price signals, the elasticity of θ with respect to θ^k should be unity. The actual result appears on the last line of Table 17. The numbers are not different from one. Thus, the decline of θ is attributed to the differential profitability of agriculture.

Cultivated Area

The stock of capital that enters into the production function for sector 1 includes land. It is computed as a Divisia index of the stock of physical capital, K_{1t}, and the cultivated area, A, weighted by the price of investment goods, P_I, and the price of land, P_a. In symbols,

Table 17—Intersectoral allocation of investment, 1915-84

Independent Variable	Dependent Variable: θ		
	1	2	3
$\bar{R}^2$	0.90	0.90	0.90
D.W.	1.92	2.13	2.02
Constant	−0.039 (−0.5)	−0.045 (−0.5)	−0.058 (−0.6)
$\log \theta^k$	0.264 (2.1)	0.256 (2.0)	0.255 (1.9)
$\log r_2/r_1$	−0.175 (−2.9)	...	...
$\log(r_2/r_1)^e$	...	−0.140 (−1.6)	−0.140 (−1.9)
$\log(r_2/r_1)^u$	...	−0.203 (−2.5)	−0.170 (−1.7)
$\log(\theta)_{-1}$	0.720 (7.7)	0.735 (7.4)	0.732 (7.6)
$\epsilon(\theta,\theta^k)$	0.94	0.97	0.95

Notes: The dependent variable, θ, is the share of agricultural investment; θ^k is the share of agriculture in the capital stock excluding land; r_2/r_1 is the ratio of the rate of return in nonagriculture (government excluded) to that of agriculture; $(r_2/r_1)^e$ is the expected value from an AR(2) process for r_2/r_1; $(r_2/r_1)^u$ are the residuals from this autoregression. In the case of the simultaneous estimate, regression (3), the autoregressive process also includes a set of other relevant variables known at time t. Subscripts indicate lags in the variables, and t-statistics are in parentheses. $\epsilon(\theta, \theta^k)$ is the elasticity of θ with respect to θ^k.

$$K_1(t) = K_1(t-1)\{1 + [1 - S_a(t)]\hat{K}_{1f} + S_a(t)\hat{A}\}, \tag{8.9}$$

where $\hat{K}_{1f}$ is the rate of growth of K_{1f} implicitly given by expression (8.7) in the previous section, $\hat{A}$ is the rate of growth of cultivated land, and S_a is the share of the value of land in the value of total capital in agriculture. That is,

$$S_a(t) = \frac{P_a(t-1)A(t-1)}{P_a(t-1)A(t-1) + P_1(t-1)K_{1f}(t-1)}. \tag{8.10}$$

Therefore, to obtain $K_1(t)$ it is necessary to explain how the cultivated area is determined.

The size of the cultivated area is postulated to be positively affected by the real price of land, P_a/P, by the terms of trade of agriculture, measured here by the intersectoral differential rate of return to capital, r_1/r_2, and negatively by credit restrictions on agriculture, CR. Cultivated land does not include pasture, which constitutes an alternative use of land for livestock raising. Therefore, the use of land should also be negatively affected by the price ratio of livestock to crops, P_1/P_c. More formally, it can be written:

$$A = A(\underset{+}{P_a/P}, \underset{+}{r_1/r_2}, \underset{-}{CR}, \underset{-}{P_1/P_c}), \tag{8.11}$$

where A is the size of cultivated area defined as a weighted average of the areas assigned to the different crops, and the weights are given by the value of production of each crop.

The empirical analysis consists of fitting a log linear version of expression (8.11). The results are reported in Table 18, which also includes the result obtained from a simultaneous equation estimation explained in the previous section.

With the exception of the differential rate of return, the variables have the expected sign and are significant. Thus, it appears that the price of land and the price ratio of livestock to crops contain all the same relevant information that the rates of returns include for determining the size of the cultivated land.

Table 18—Cultivated area, 1916-84

Independent Variable	Dependent Variable: Log(A)		
	1	2	3
$\bar{R}^2$	0.97	0.97	0.97
D.W.	1.99	2.02	2.01
Constant	0.090 (0.3)	0.369 (1.0)	−0.035 (−0.1)
$\log P_a/P$	0.030 (2.3)	...	0.033 (2.7)
$\log(r_2/r_1)^e$	...	0.029 (4.6)	...
$\log(r_2/r_1)^u$	...	−0.014 (−0.9)	...
$\log(CR)_{-1}$	−0.054 (−2.6)	−0.058 (−2.9)	−0.053 (−2.9)
$\log(P_l/P_c)$	−0.047 (−2.1)	−0.044 (−2.0)	−0.063 (−3.0)
$\log(A)_{-1}$	0.722 (6.2)	0.691 (6.0)	0.784 (7.2)
$\log(A)_{-2}$	0.269 (2.3)	0.271 (2.3)	0.220 (2.0)

Notes: A, the dependent variable, is cultivated land adjusted for quality by the value of crops grown. P_a is an index of the price of land divided by the GDP deflator, P; r_1 and r_2 are the rates of return to capital in agriculture and nonagriculture (government excluded), respectively. The superscripts e and u denote expected and unexpected values, respectively; the expected differential rate of return is obtained from an AR(3) process for r_2/r_1, and the unexpected differential rate of return is the residual of this autoregression. P_l/P_c is the ratio of the prices of livestock to crops; CR is a dummy variable that measures the credit restrictions on agriculture, taking the value of the share of this sector in total credit when this share is above the trend line and the value zero otherwise; t-ratios are in parentheses; subscripts indicate lags in the variables. Column (3) reports the results from the simultaneous equation estimation discussed in the text.

9

SIMULATING THE EFFECT OF POLICY CHANGES ON PRODUCTION, EXPENDITURES, AND RESOURCE ALLOCATION

Policy changes that affect economic incentives cause changes in the pace of resource growth and allocation. Chapters 3, 4, and 5 established the relationship between policy changes and economic incentives, modeling the mechanism by which such changes are transmitted to sectoral prices. The pertinent empirical results are summarized in Table 10. Chapters 6, 7, and 8 dealt with sectoral and aggregate supply, the expenditure system, and resource growth and allocation.

The first part of this chapter builds on these results to assemble a sectoral growth model of the Argentine economy. The construction of a complete model requires that the number of independent equations and identities be equal to the number of endogenous variables. The description of the complete model below includes an explicit statement of the identities. The model is confronted with the data and the results are summarized in Figures 43-46. A summary of the estimation procedure for the entire system is included in Appendix 2. In order to explore dynamic properties of the model, supply response experiments are conducted using dynamic simulation. The choice of a supply response is not accidental. This is an extremely important subject on its own and it is also crucial for understanding the policy discussion in Chapter 10.

The System

The growth model of the Argentine economy is formed by five blocks: prices, labor, output and factor prices, expenditures, and capital growth and allocation. The relationships included in each of these blocks are as follows:

Prices

This block includes four equations and five identities that permit the determination of relative and absolute sectoral prices:

1. The function that explains the degree of commercial openness (regression 1, Table 10);
2. The equation for the real exchange rate (regression 2, Table 10);
3. The equation for the relative price of agriculture (regression 3, Table 10);
4. The equation for the relative price of nonagriculture excluding government (regression 4, Table 10);
5. The identity to obtain the absolute price of sector 3,

$$P_3 = \frac{PY}{Y_3 + Y(P_1/P_3) + Y_2(P_2/P_3)};$$

6. The identity to obtain the absolute price of sector 1,

$$P_1 = (P_1/P_3)P_3;$$

7. The identity to obtain the absolute price of sector 2,

$$P_2 = (P_2/P_3)P_3;$$

8. The identity to obtain the standard deviation of the relative price of agriculture,

$$3\sigma_{1,3} = \{\sum_{i=0}^{2}(P_1/P_3)^2(t-i) - (1/3)[\sum_{i=0}^{2}(P_1/P_3)(t-i)]^2\}^{1/2},$$

used as an indicator of price volatility in the production function of sector 1; and

9. The identity to obtain the standard deviation of the relative price of nonagriculture (excluding government), $\sigma_{2,3}$, is the same as (8) with P_2 replacing P_1; it is used as an indicator of price volatility in the production function of sector 2.

Labor

This block includes two functions and three identities that permit the determination of total and sectoral employment:

10. The employment function (regression 8.6);
11. A migration function (regression 8.4);
12. The identity to compute employment in sector 1,

$$L_1(t) = [N(t)/N(t-1) - m(t)]L_1(t-1),$$

where m(t) is the rate of migration out of agriculture;

13. The identity to compute employment in sector 3,

$$L_3(t) = Y_3(t)/AP(t-1),$$

where AP is the average labor productivity of sectors 1 and 2 combined (see the data supplement); and

14. The identity to compute employment in sector 2,

$$L_2(t) = L(t) - L_1(t) - L_3(t).$$

Figure 41 shows how these five equations reproduce the evolution of employment and its sectoral allocation.

Output and Factor Prices

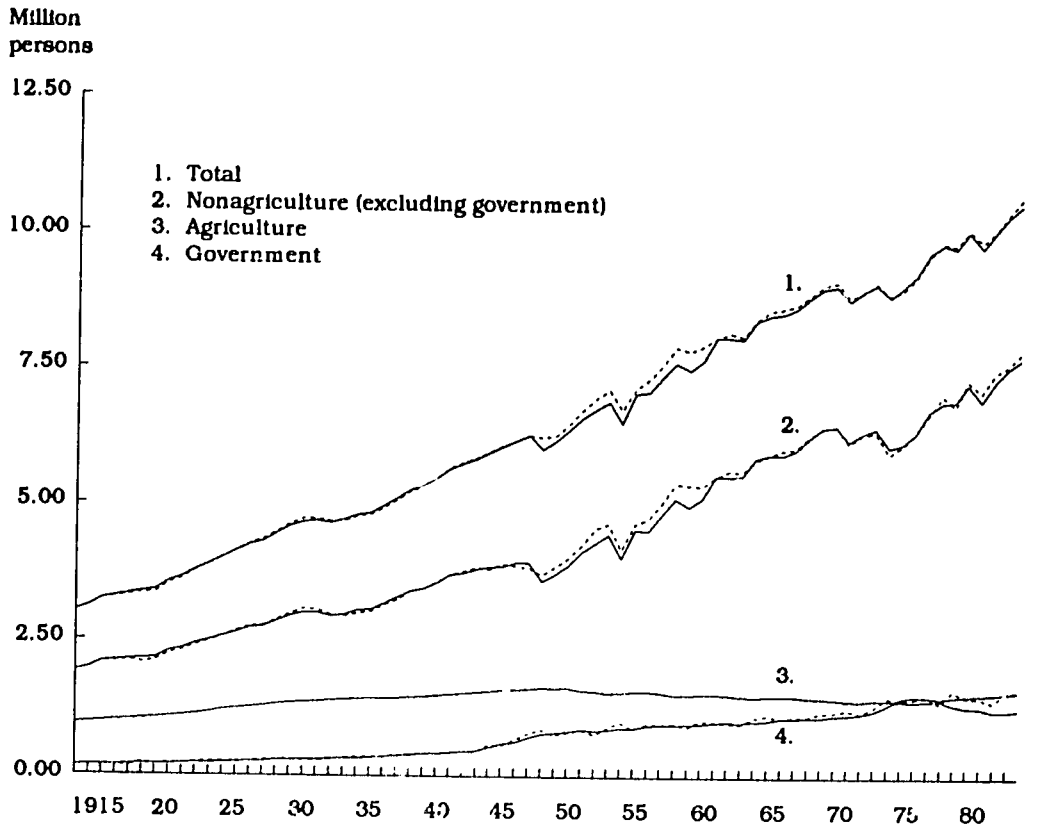
The five equations and the nine identities of this block allow the computation of total output, its sectoral composition, wages, and rates of return. They include:

15. The equation for the share of capital in sector 1, $\beta_1(t)$, (Table 13);
16. The equation for the level of productivity in sector 1, $\Gamma_1(t)$, (Table 13);
17. The identity to compute output in sector 1;

$$Y_1(t) = \exp\{\Gamma_1(t) + [1 - \beta_1(t)]\log L_1(t) + \beta_1(t)\log K_1(t)\};$$

18. The equation for the share of capital in sector 2, $\beta_2(t)$ (Table 13);

Figure 41—Actual and fitted values of employment and sectoral disaggregation, 1913-84



Note: Solid lines are actual values and broken lines are fitted values.

19. The equation for the intercept of the production function in sector 2, $\Gamma_2(t)$ (Table 13);

20. The identity to compute output of sector 2,

$$Y_2(t) = \exp\{\Gamma_2(t) + [1 - \beta_2(t)]\log L_2(t) + \beta_2 \log K_2(t)\};$$

21. The identity to compute total output,

$$Y(t) = Y_1(t) + Y_2(t) + Y_3(t),$$

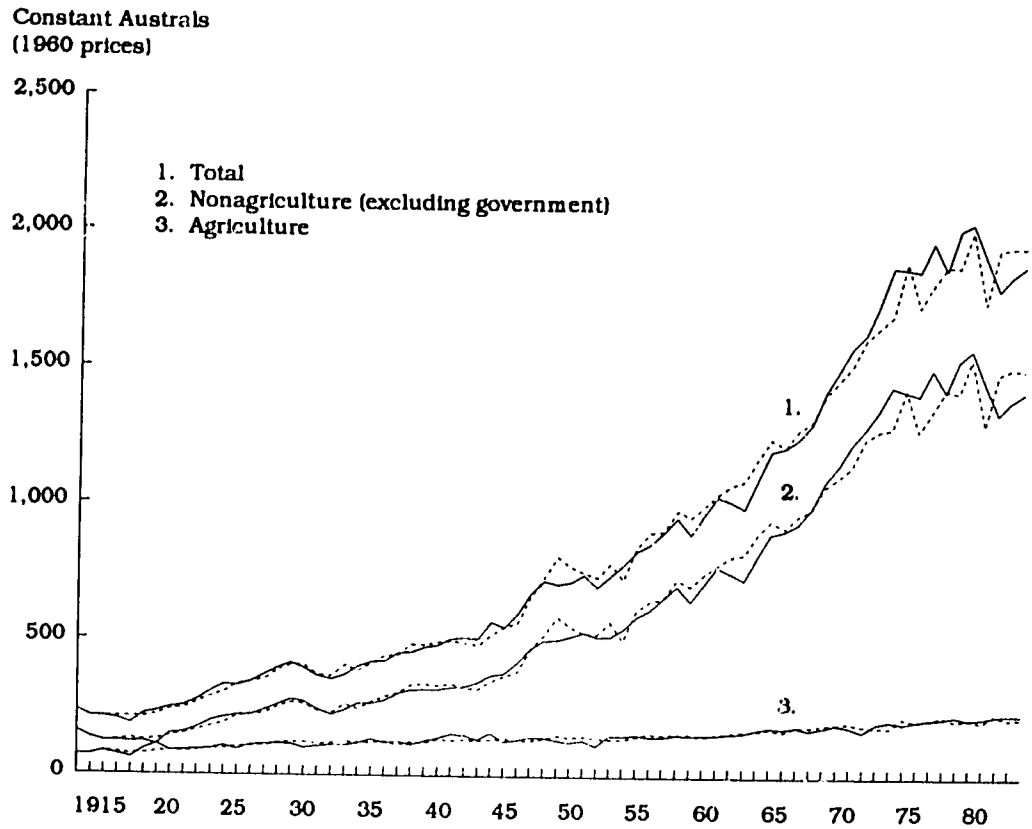
where $Y_3(t)$, output of sector 3, is assumed to be exogenous;

22. The determination of wages in sector 1,

$$W_1(t) = [1 - \beta_1(t)][Y_1(t)P_1(t)/L_1(t)];$$

23. The determination of wages in sector 2,

Figure 42—Actual and fitted values of output and sectoral disaggregation, 1913-84



Note: Solid lines are actual values and broken lines are fitted values.

$$W_2(t) = [1 - \beta_2(t)][Y_2(t)P_2(t)/L_2(t)];$$

24. The determination of nominal wages in sector 3,

$$W_3^n(t) = P_3(t)Y_3(t)/L_3(t);$$

25. The determination of the rate of return on capital in sector 1,

$$r_1(t) = [P_1(t)Y_1(t) - W_1(t)L_1(t)]/[P(t)K_1(t)];$$

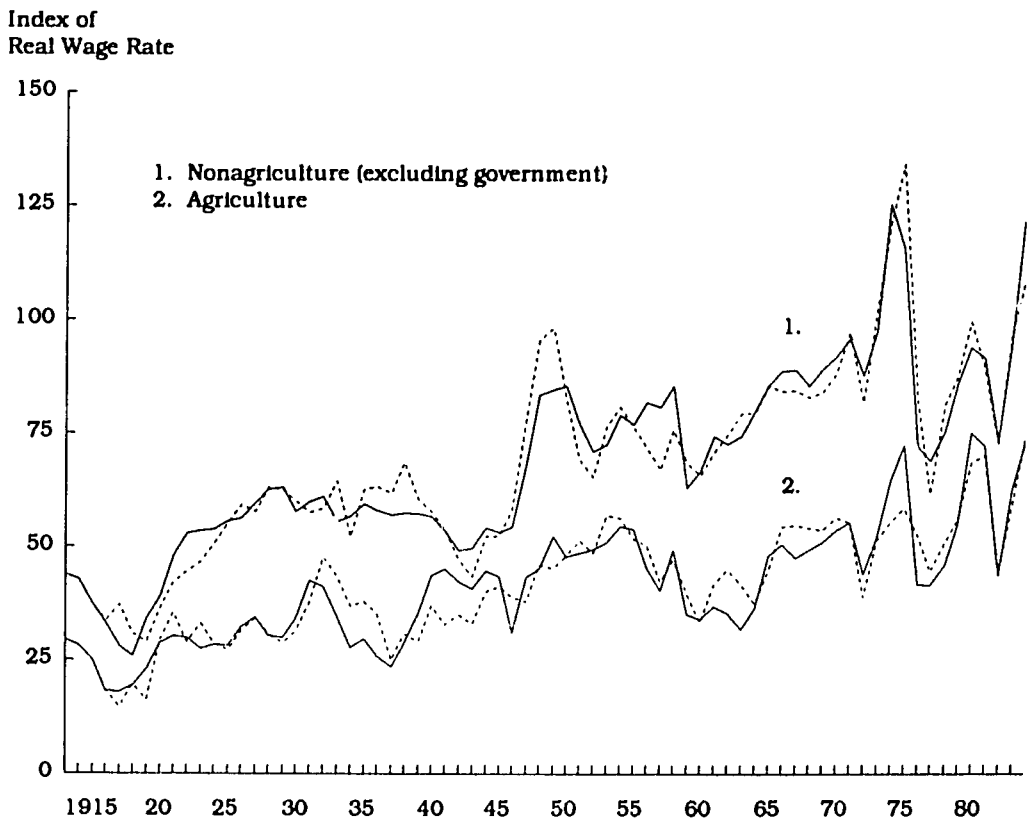
26. The determination of the rate of return on capital in sector 2,

$$r_2(t) = [P_2(t)Y_2(t) - W_2(t)L_2(t)]/[P(t)K_2(t)];$$

27. The determination of the rate of return on capital in the private sector, sectors 1 and 2 combined, used in the investment equation:

$$r_{1,2}(t) = [P_1(t)Y_1(t) + P_2(t)Y_2(t) - W_1(t)L_1(t) - W_2(t)L_2(t)]/[P(t)K_1(t) + K_2(t)];$$

Figure 43—Actual and fitted values of sectoral wages, 1913-84



Note: These are nominal wages deflated by sectoral prices.

and

28. A function for the real price of land (regression 6.19).

Figure 42 plots the actual and fitted values of total output and its sectoral composition. Figure 43 shows the fit for sectoral wages and Figure 44 shows the fitted values for the sectoral rates of return.

Expenditures

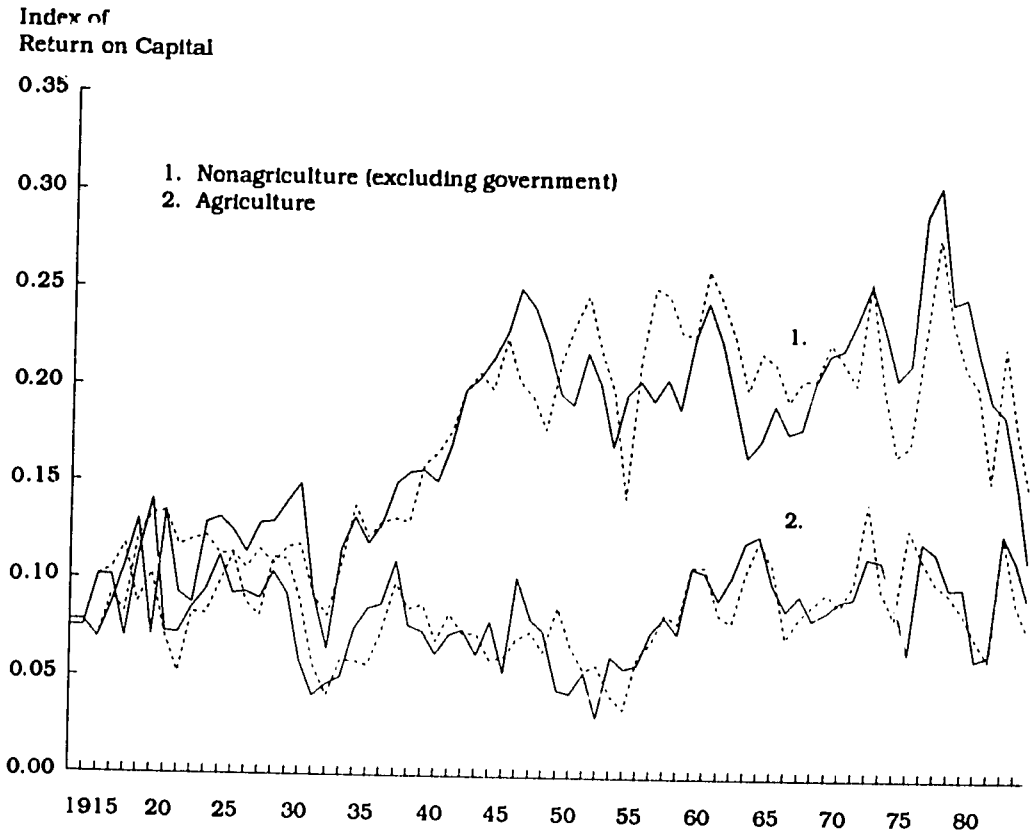
This block determines the components of total expenditures: investment, consumption, exports, and imports. The six equations are as follows:

29. A function explaining investment in the private sector, $I_{1,2}$, (Table 16, regression 3);
30. The determination of total investment,

$$I(t) = I_{1,2}(t) + I_3(t),$$

where I_3 is investment in sector 3, and it is assumed to be exogenous;

Figure 44—Actual and fitted values of sectoral rates of return, 1913-84



Note: Ratio of nonwage income to capital in each sector. Solid lines are actual values and broken lines are fitted values.

31. A function to explain private consumption per capita, $c^p(t)$ (Table 15, regression 3).

32. An identity for the determination of net exports,

$$NX(t) = [1 + t_i(t)]Y(t) - c^p(t)N(t) - [P_g(t)C^g(t)/P(t)] - I(t),$$

where government consumption, $P_g(t)C^g(t)/P(t)$, the rate of indirect taxes, t_i, and population, $N(t)$, are assumed to be exogenous;

33. The determination of exports,

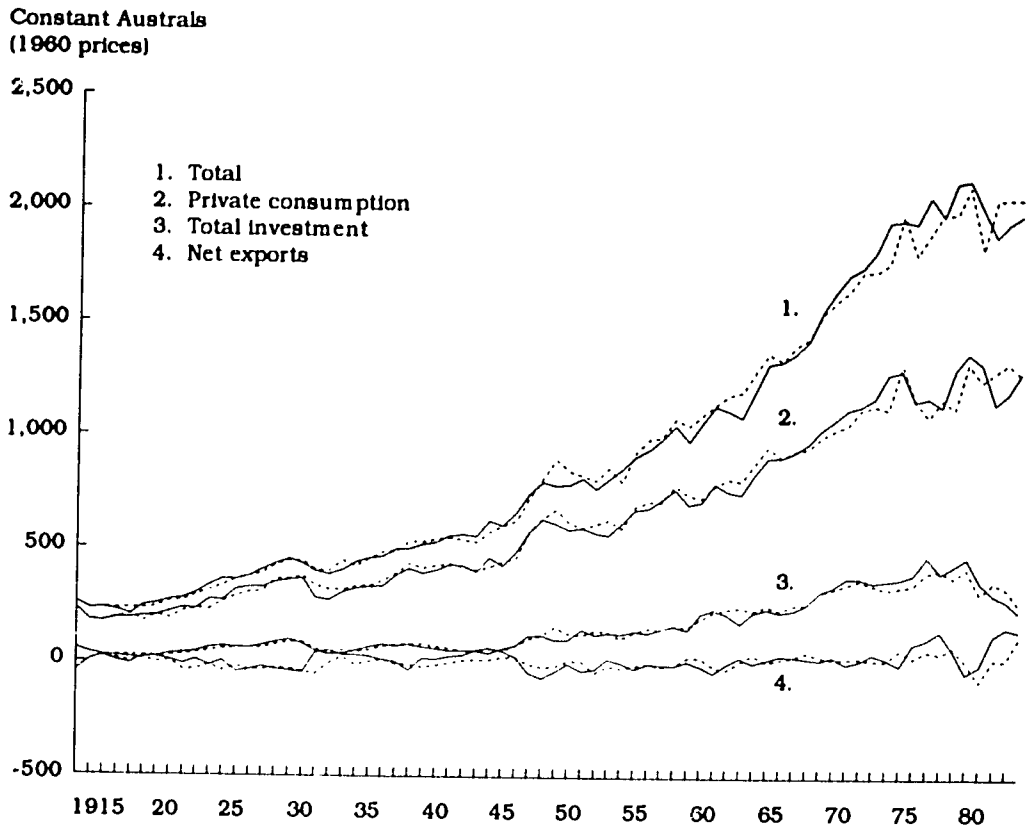
$$P_{ex}(t)X^x(t)/P(t) = [NX(t) + DO_c(t)Y(t)]/2,$$

where $DO_c(t)$ is the degree of openness; and

34. The determination of imports,

$$P_{im}(t)M^m(t)/P(t) = P_{ex}(t)X^x(t)/P(t) - NX(t).$$

Figure 45—Actual and fitted values of total expenditures and their components, 1913-84



Note: Solid lines are actual values and broken lines are fitted values.

Figure 45 reproduces actual and fitted values of the aggregate expenditure and its components.

Resource Growth and Allocation

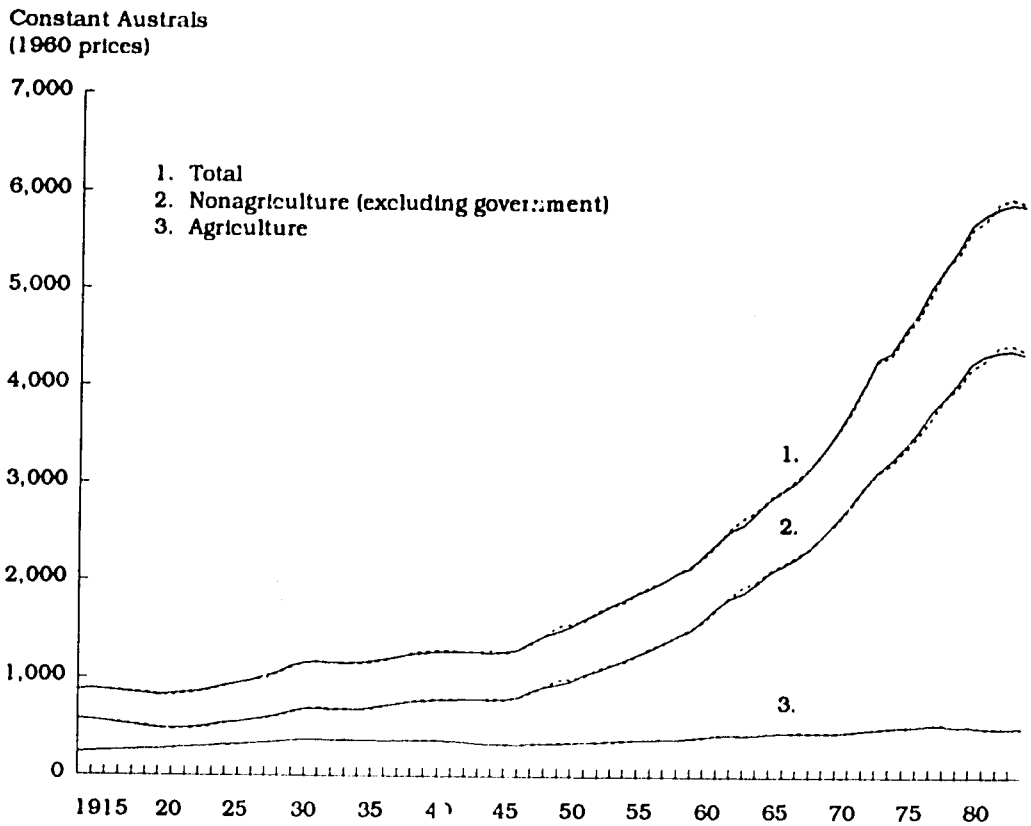
This block describes the process of capital accumulation. First, the sectoral allocation of new investment permits the computation of the accumulation of physical capital. Second, it deals with cultivated area and its aggregation to agricultural physical capital. The 10 equations are

35. A function to allocate the fraction of total investment that goes to sector 1, $\theta(t)$ (Table 17, regression 3);

36. The determination of investment in sector 1,

$$I_1(t) = \theta(t)I(t);$$

Figure 46—Actual and fitted values of the capital stock, and its sectoral composition, 1913-84



Notes: Solid lines are actual values and broken lines are fitted values. In this figure, actual and fitted values are virtually the same.

37. The determination of investment in sector 2,

$$I_2(t) = I(t) - I_1(t) - I_3(t);$$

38. An identity to determine the stock of physical capital in sector 1,

$$K_{1f}(t+1) = K_{1f}(t)[1 - \delta_1(t)] + I_1(t),$$

where δ_1 is the rate of depreciation of $K_{1f}(t)$, and it is predetermined in year t;

39. An identity to determine the capital stock in sector 2,

$$K_2(t+1) = K_1(t)[1 - \delta_2(t)] + I_2(t),$$

where δ_2 is the rate of depreciation of $K_2(t)$, and it is predetermined;

40. The determination of the economy's aggregate stock of physical capital,

$$K_f(t) = K_{1f}(t) + K_2(t) + K_3(t),$$

where K_3 is the stock of capital in sector 3, and it is assumed to be exogenous;

41. A function to explain cultivated land, A(t), (Table 18, regression 3);

42. The determination of the share of land in the total value of land and capital in sector 1, used in the computation of a Divisia index of the aggregated capital stock in agriculture,

$$S_a(t) = P_a(t-1)A(t-1)/\{P_a(t-1)A(t-1) + P_i(t-1)K_{1f}(t-1)\},$$

where P_i is the implicit price deflator of physcial capital;

43. The determination of the aggregate capital stock in sector 1,

$$K_1(t) = K_1(t-1)\{1 + [1 - S_a(t)]\hat{K}_{1f} + S_a(t)\hat{A}\},$$

where the hat (^) denotes rate of growth;

44. The determination of the economy's aggregate stock of capital,

$$K(t) = K_1(t) + K_2(t) + K_3(t).$$

Figure 46 reproduces the actual and fitted values of the aggregate capital stock and its sectoral disaggregation.

As can be seen in Figures 41-46, the model, made up of 44 equations (functions and identities) and 44 endogenous variables, permits close replication of the behavior of the Argentine economy in the period 1916-84.

Supply Response

Next the dynamic properties of the model described in the previous section are analyzed. For this purpose, two exercises that assume exogenous changes in prices are carried out and the price elasticities of the endogenous variables are computed. In the first place, a permanent 10 percent increase in agricultural prices, P_1, is assumed. This increase in P_1 is matched by the necessary adjustment in the price of government services, P_3, in order to keep the economy's price level, P, at its historical levels. On average, P_3 was reduced by 11 percent. The price of land was increased by the same proportion as P_1.

The computed elasticities of some of the endogenous variables are reported in Tables 19 and 20 for selected periods, and plotted in Figures 47, 48, and 49 for a time span of 20 years. The results indicate clearly that agriculture responds to prices, but that it takes time for the response to build up. In 3 years output moved up by 30 percent of the price change, and after 15 years the increase exceeded 70 percent. Over a 20-year time span, the response converges to 99 percent of the price change. This is equivalent to an elasticity of 0.99. The response results mainly from capital accumulation (see Table 19 and Figure 47) and from an increase in productivity.

An important result is that changes in agricultural prices also have a strong positive effect on nonagricultural output (see Table 20 and Figure 48). It is a known phenomenon

Table 19—Price elasticities of output, labor, capital, and land in agriculture, experiment 1

Period	Output	Labor	Physical Capital	Land
1	0.19	0.00	0.05	0.03
2	0.24	0.06	0.12	0.06
3	0.31	0.14	0.19	0.08
4	0.38	0.19	0.24	0.11
5	0.43	0.21	0.30	0.14
10	0.51	0.26	0.65	0.27
15	0.73	0.15	1.07	0.41
20	0.99	0.02	1.45	0.56

Notes: The elasticities are computed by imposing a 10 percent increase in the price of agriculture, compensated by a decline of the price of government services, in order to keep the general price level constant. The price of land is increased in the same proportion as the agricultural price.

Figure 47—Price elasticities of output, labor, capital, and land in agriculture

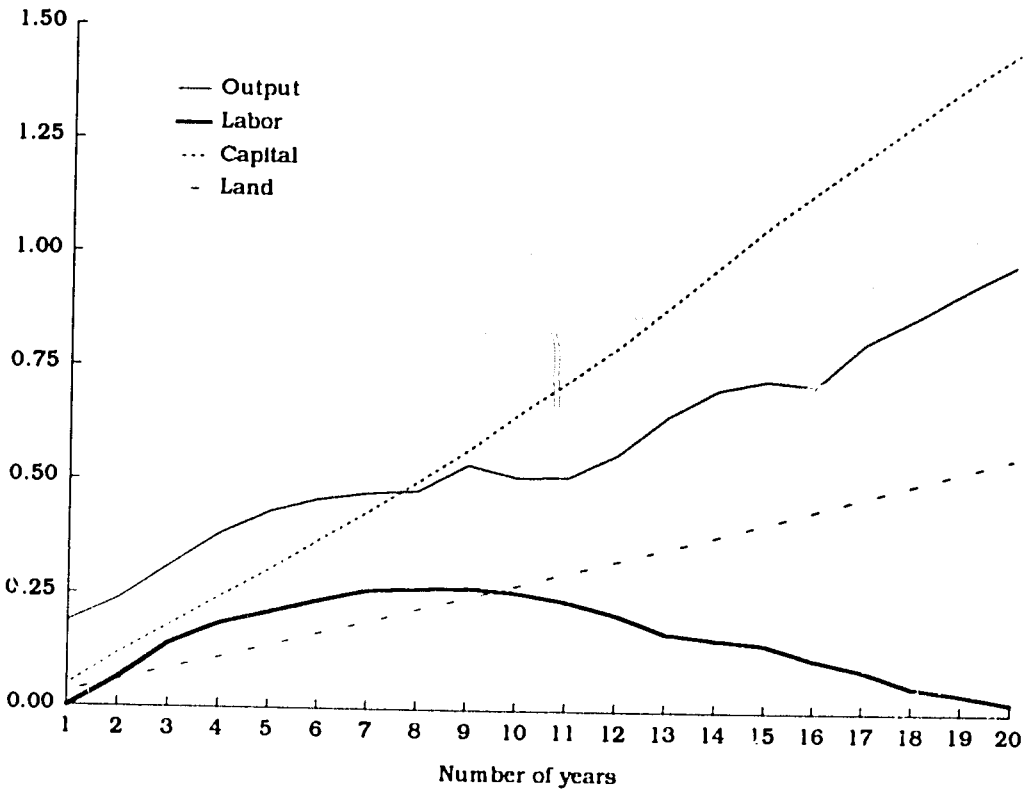


Table 20—Price elasticities of output, labor, and capital in private nonagriculture, and in the aggregated economy, experiment 1

Period	Private Nonagriculture			Aggregate Economy		
	Output	Labor	Capital	Output	Labor	Capital
1	0.42	0.00	0.09	0.33	0.00	0.06
2	0.72	0.43	0.24	0.55	0.26	0.15
3	0.75	0.35	0.37	0.60	0.22	0.23
4	0.79	0.38	0.49	0.63	0.24	0.31
5	0.74	0.29	0.60	0.61	0.19	0.39
10	0.64	0.06	1.01	0.56	0.02	0.72
15	0.83	0.02	1.24	0.73	-0.05	0.95
20	1.08	0.06	1.34	0.96	-0.07	1.08

Notes: The elasticities are computed by imposing a 10 percent increase in the price of agriculture, compensated by a decline of the price of government services, in order to keep the general price level constant. The price of land is increased in the same proportion as the agricultural price.

Figure 48—Price elasticities of output, labor, and capital in nonagriculture (excluding government)

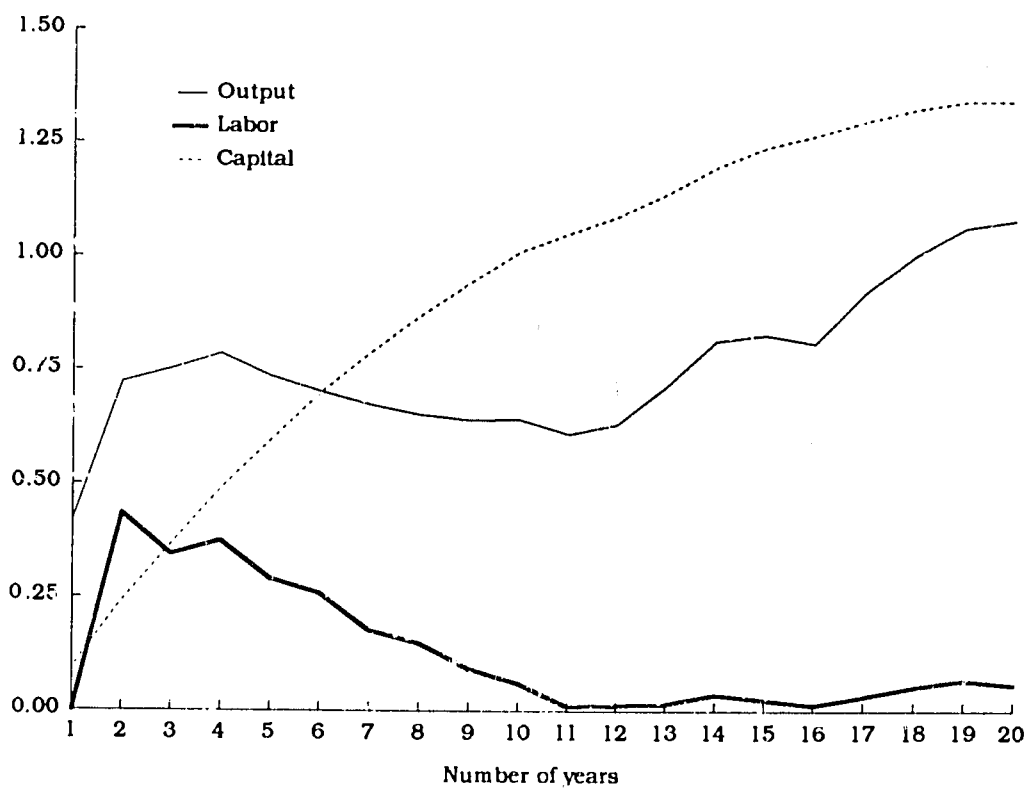
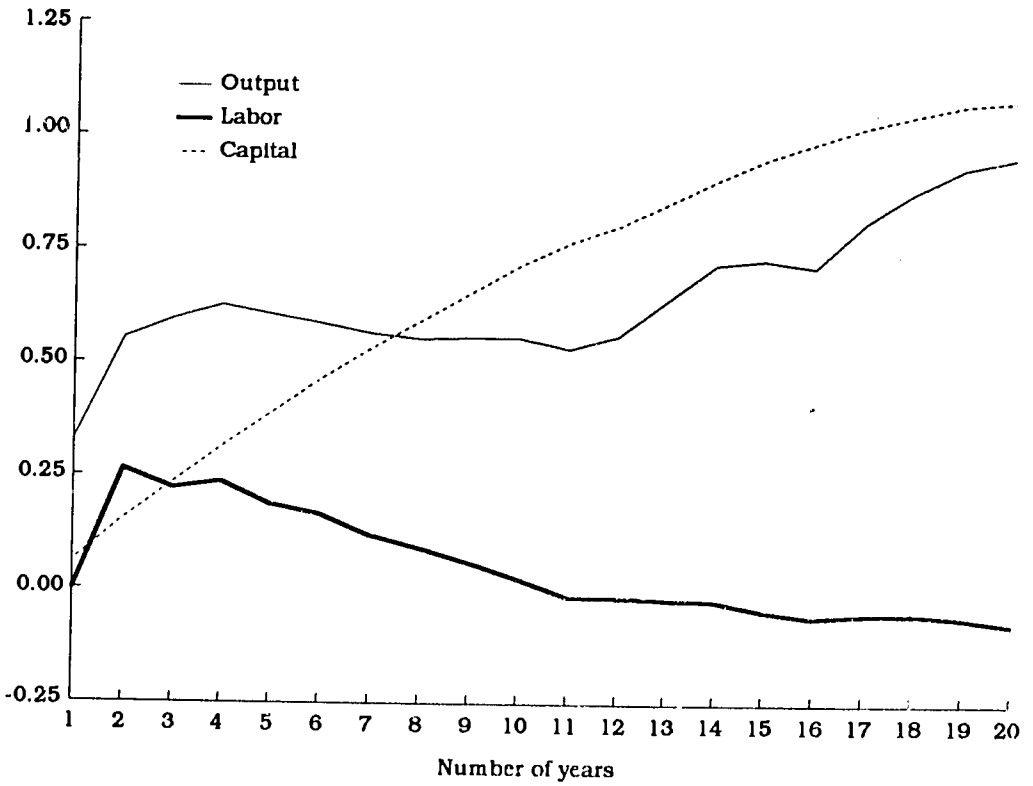


Figure 49—Price elasticities of output, labor, and capital in the aggregate economy



in Argentina that when agriculture prospers, so does the rest of the economy. In terms of the present model, there are several reasons for this strong effect. First, the improvement in agricultural prices increases the rate of return in agriculture, and this in turn leads to higher investment in the private sector, which is shared by nonagriculture. Second, this particular experiment results in an increase of P_2/P_3, which in turn supplements the effect of the price increase in agriculture. Finally, due to the cross effects on output in the production function, the increase in agricultural output has a favorable effect on nonagricultural output. The response of total output in the economy reflects the strong response of the two sectors as can be seen in Table 20 and Figure 49.

In the foregoing experiment, increases in agricultural price and to a lesser degree in nonagricultural price relative to the price of government services are imposed. As a result, there is an expansionary effect in investment that benefits both private sectors and initially, for the first few years of the experiment, increases employment in sector 2, part of which is at the expense of employment in the public sector.

In order to obtain a sharper view of the linkage between agriculture and nonagriculture, a second experiment is conducted whereby the 10 percent increase in P_1 is associated with an average reduction of 2 percent in P_2 in order to restrict both P and P_3 to remain unchanged. The results of this experiment are reported in Tables 21 and 22.

The response of agriculture, summarized in Table 21, is weaker than in the first experiment. This indicates that there are positive intersectoral externalities. A decline

Table 21—Price elasticities of output, labor, capital, and land in agriculture, experiment 2

Period	Output	Labor	Physical Capital	Land
1	0.07	0.00	0.03	0.03
2	0.11	0.06	0.07	0.06
3	0.15	0.12	0.11	0.08
4	0.19	0.15	0.17	0.11
5	0.21	0.17	0.18	0.14
10	0.31	0.23	0.39	0.27
15	0.45	0.23	0.65	0.41
20	0.61	0.23	0.91	0.56

Notes: Elasticities are computed with respect to a 10 percent increase in the price of agriculture, with the price of nonagriculture (excluding government) adjusted in order to keep the general price level and the price of government services at historical levels The price of land is increased in the same proportion as the price of agriculture.

in the profitability of nonagriculture reduces the level of total investment and thereby sectoral investment. Although, the profitability of nonagriculture declines relative to that of agriculture and to the public sector, nonagricultural output responds favorably to the price change. As can be seen in Table 22, nonagricultural output increases more than capital, whereas the response of labor is largely negative. Thus, there is an obvious increase in productivity, which comes from the cross-productivity effects of sectoral outputs. An expansion of agricultural output in sector 1 generates demand for the output of sector 2, which compensates for the decline in P_2/P_3. This, in turn, increases the rate of return in sector 2 and contributes to the expansion of investment, part of which is shared by nonagriculture.

There is no question that the response of sectoral output to changes in prices depends on the specification of the model and that different specifications give different

Table 22—Price elasticities of output, labor, and capital in private nonagriculture excluding government and in the aggregated economy, experiment 2

	Private Nonagriculture			Aggregate Economy		
Period	Output	Labor	Capital	Output	Labor	Capital
1	0.34	0.00	0.04	0.25	0.00	0.03
2	0.48	0.14	0.10	0.36	0.07	0.07
3	0.45	0.05	0.14	0.35	0.02	0.10
4	0.44	0.02	0.17	0.35	0.00	0.13
5	0.41	−0.01	0.19	0.33	−0.02	0.16
10	0.39	−0.04	0.25	0.33	−0.03	0.26
15	0.40	−0.06	0.25	0.37	−0.05	0.31
20	0.48	−0.05	0.25	0.45	−0.05	0.34

Notes: Elasticities are computed with respect to a 10 percent increase in the price of agriculture, with the price of nonagriculture (excluding government) adjusted in order to keep the general price level and the price of government services at historical levels. The price of land is increased in the same proportion as the price of agriculture.

results. In an earlier paper (Mundlak, Cavallo, and Domenech 1987), a simulation with a somewhat different specification was reported. The technology shifter was the cumulated sectoral returns, and no cross-sectoral effects of outputs on productivities were included. The response with this specification was stronger than the one observed here. Qualitatively, however, it was in the same direction. Thus, the qualitative properties are related to the basic features of the model. That is, resource use, both at the aggregate and sectoral levels, depends on the returns, and productivity also depends on profitability, both directly and indirectly, through the implementation of more advanced technology, which is related to capital accumulation.

10

MACROECONOMIC FLUCTUATIONS, ECONOMIC POLICY, AND GROWTH

In this chapter, three important periods in Argentine economic history are analyzed, mainly to evaluate the cost in long-term growth of economic policies applied to cope with external shocks or short-term economic goals. In general, studies by economic historians suggest that policies different from those actually applied would have performed better (Díaz Alejandro 1970, 1984; Mallon and Sourrouille 1975; Cavallo and Mundlak 1982).[8] To address these issues, the model discussed in Chapter 9 is used to compare the trajectories the economy could have attained under alternative economic policies. The costs of the policies applied are evaluated by separating the effects of macroeconomic policy from those that can be attributed to trade policies.

The first episode begins in 1929 and goes through the end of the 1930s. Here the reaction of economic policy to the drastic disruption in world trade caused by the Great Depression is examined.

The second episode extends from 1946 to the mid-1950s. Here attention is paid to the income distribution program implemented by President Juan Perón during his first and second administrations.

Finally, the third episode, 1970 to the mid-1980s, covers a period of contradictory policies. These policies first were aimed at deepening the import substitution process and redistributing income in favor of labor, but they were reversed later when extreme macroeconomic instability and excess liquidity prevailed in world financial markets.

From 1930 on, the trade policy applied in Argentina was characterized by strong restrictions on trade and frequent limitations on capital movements. In the last part of this chapter, the model is used to simulate the trajectory of the economy under a more internationally open regime, similar to the one that prevailed during the first three decades of the century. These long-term policies are accompanied by the alternative macro policies examined in each of the three episodes previously discussed. The simulated results of the model show—not surprisingly—that under appropriate economic policy, the growth performance of Argentina after 1929 would have been similar to those of Australia and Canada.

Policy Response to the Great Depression

The Great Depression that began in October 1929 affected the Argentine economy in the same way as it did all other national economies that were integrated into the world commercial and financial system. The reduction of international prices provoked a sharp fall in national income and tax revenues. The economic authorities reacted by trying to limit the devaluation of the peso and by financing the fiscal deficit through domestic borrowing rather than issuing money. This policy response was in line with

[8] See also Cavallo 1982; de Pablo 1982; Diamand 1969, 1973; Dieguez 1968; Di Tella and Zymelman 1967; Felix 1971; Ferrer 1979; Ferrer and Wheelwright 1966; Frigerio 1977; Frigerio 1961; Gerchunoff and Llach 1979; and Llach 1987.

the economic ideas prevailing at that time. To limit the devaluation, foreign reserves were sold, import duties were increased, and later, exchange controls were imposed.

Foreign reserves, which amounted to more than US$1 billion in 1928, declined to roughly US$400 million during the period 1933-34. Import duties, including those from differential exchange rates, increased from less than 10 percent in the late 1920s to more than 30 percent in the mid-1930s. The nonexisting premium on the black market increased to about 20 percent by 1934, reflecting the imposition of exchange controls.

The sale of foreign exchange facilitated domestic monetary contraction. The stock of money supply, M3, that had grown by 19 percent during the quinquennium previous to the Great Depression went down by 13 percent during the subsequent five years. In spite of price deflation, domestic interest rates declined only slightly because government became an important borrower to finance its deficits. The fiscal deficit financed by borrowing, which had been negligible in the quinquennium prior to 1930, reached 4 percent during the recession years. This trend was reversed by 1933 when new taxes on domestic revenues were created to make up for the revenue loss of taxes on foreign trade.

Farmers and urban businesses were debtors of the banking system as a consequence of investments undertaken during the expansion of the 1920s. The reduction in domestic prices and the fall in nominal income produced high real interest rates, adding to the burden of debt. During 1931-32 many private firms defaulted, causing bankruptcies during a financial crisis that, in turn, had disruptive effects on the productive process.

At the time of the Great Depression, in a world disciplined by the gold standard regime, the adoption of economic policies that could have avoided deflation and financial crisis might not have been considered sound economic management. Also, the institutions for controlling the money supply did not exist. Still, it is important to examine a set of alternative policies that could have avoided most of the negative consequences on the Argentine economy. This serves to demonstrate the broad scope of the model.

In light of the economic experiences after the 1930s, the stabilization of nominal income emerges as a clearly desirable short-term target. In the early 1930s, this target could have been achieved by devaluing the peso more and by avoiding monetary contraction. The devaluation of the peso would have been greater if the government had reduced sales of foreign exchange, had not increased import duties, and had not imposed exchange controls. Monetary contraction could have been avoided by just printing money to finance the fiscal deficit.

In the model, monetary and exchange-rate policies are described by the ratio of the money stock to the income valued at the price of traded goods ($\mu = M3/P^*EY$), and fiscal policy is mainly described by the fiscal deficit financed by borrowing as a proportion of income (f). Under the actual policies, μ increased significantly after 1929, reflecting the absolute reduction in nominal income of the most dynamic sectors of the economy during the 1920s. This increase took place despite the absolute reduction of the stock of money supply. Under alternative policies considered here the level of μ would have remained roughly constant because the price of foreign exchange (E) would have exceeded the historical level and thereby would have offset the contemplated increase in M3. At the same time, the deficit financed by borrowing would have been much lower because part of it could have been financed by printing money. Had monetary and fiscal policy been managed along these lines, deflation and financial crisis could have been avoided.

The changes in the simulator are introduced by keeping the ratio of μ at the level of 1929 and eliminating the deficit financed by borrowing during the period 1930-34.

As it is assumed that these policies would have avoided deflation, this is introduced into the simulator by imposing a constant price level during 1929-35 and setting the variables that capture banking failures and deflation at zero.

As indicated, the alternative policies would have avoided exchange controls and the increases in import duties. This is introduced into the simulator by keeping the tariff level at 10 percent and assuming no premium in the black market.

The results of the simulation under the alternative policies described above are summarized in Table 23. Figures 50, 51, and 52 show the behavior of sectoral and total outputs. The table presents the average percentage change for the simulation period (1930-39) and for the year 1939, that is, after 10 years of application of the set of alternative policies. In each case the first column reports the effects of the monetary, exchange, and fiscal policies, whereas the second column also includes the effects of trade policies.

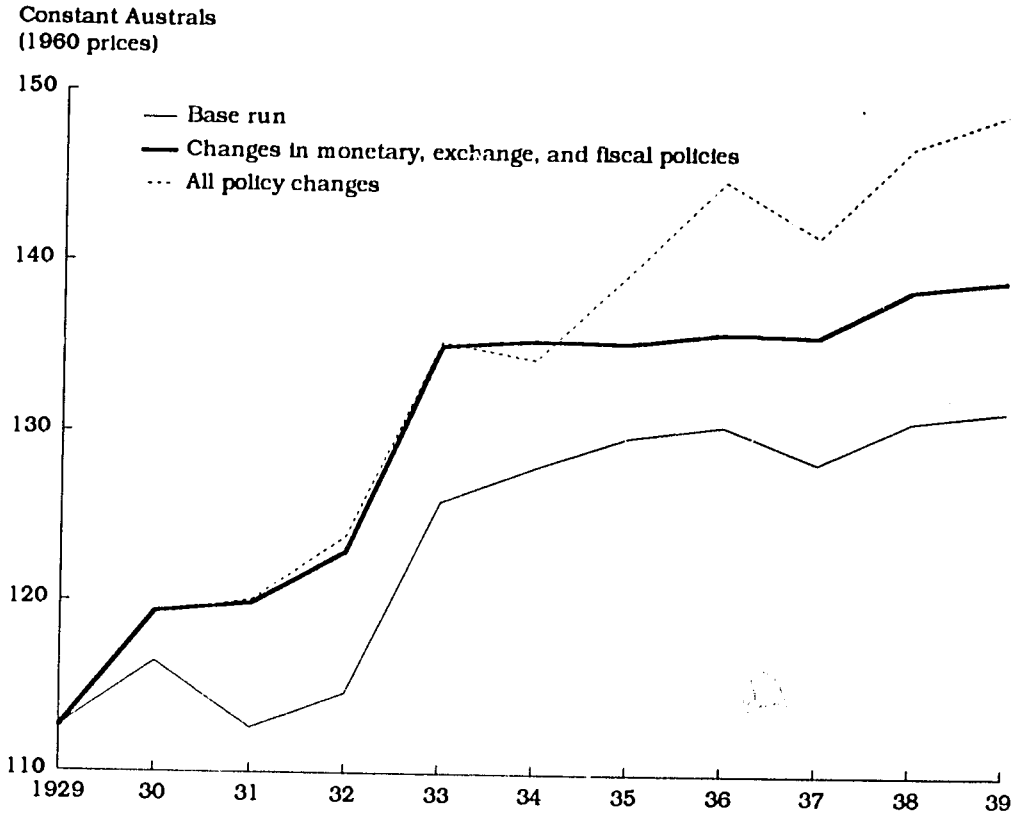
It is seen that the management of monetary, exchange, and fiscal policies would have avoided the recession, whereas adding the alternative trade policies would have resulted in growth.

Table 23—Effects of alternative economic policies, 1930-39

Endogenous Variables	Average Annual Response		Response in Year 1939	
	Changes in Monetary, Exchange, and Fiscal Policies	All Policy Changes	Changes in Monetary, Exchange, and Fiscal Policies	All Policy Changes
	(percent of base-run values)			
Relative prices				
Price of land	28	38	25	51
Degree of openness	12	38	5	66
Real exchange rate	31	64	29	96
Agriculture (P_1/P_3)	17	36	13	49
Nonagriculture (P_2/P_3)	12	15	11	18
Agricultural sector				
Labor	-4	-7	-4	-19
Physical capital	3	6	6	13
Cultivated land	3	4	7	9
Output	6	8	6	13
Wage	-15	-24	-18	-32
Rate of return	17	38	14	60
Nonagricultural sector (excluding government)				
Labor	9	11	-5	13
Capital	7	9	10	16
Output	5	12	2	17
Wage	-6	-4	-6	-5
Rate of return	15	16	6	11
Government sector				
Labor	-6	-9	-7	-15
Wage	-5	-7	-3	-5
Aggregated economy				
Labor	3	4	1	2
Total capital	5	6	8	13
Output	5	10	3	15
Private consumption	17	21	7	18
Investment	18	29	14	42
Exports	47	90	16	124
Imports	25	57	11	83
Wage	-7	-7	-7	-6

Notes: The computation of percentage changes for labor compares simulated and actual values.

Figure 50—Response of agricultural output to changes in macroeconomic and trade policies, 1929-39



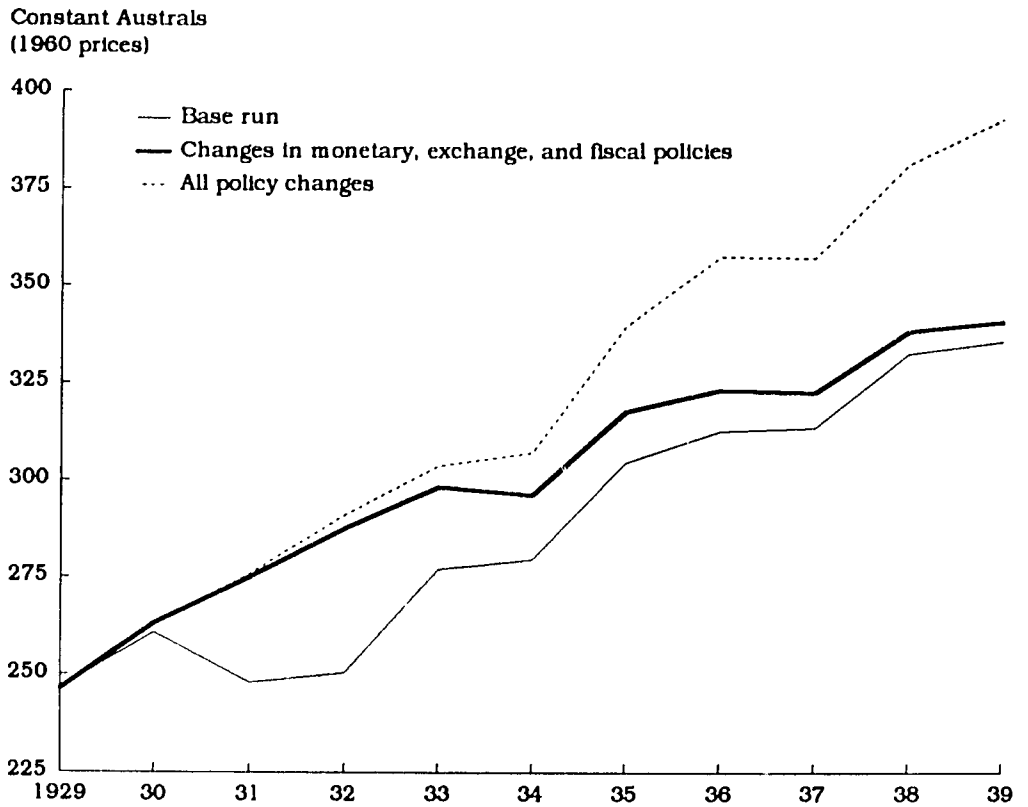
The real exchange rate and sectoral relative prices would have had favorable trends under these policies. In the simulation, the average increases for the period are 64 percent for the real exchange rate and 36 and 15 percent for agricultural and nonagricultural prices, respectively. This response in prices is similar to that described in Chapter 5.

Note that the relative price of agriculture increases by much more than that of nonagriculture (excluding government). This is associated with a fall in agricultural wages, and, because the allocation of labor depends on wage differentials, agricultural employment also declines. However, the increase in employment in nonagriculture (excluding government) more than compensates for this decline, thereby increasing the aggregate level of employment by 2 percent on average for the period.

The rate of return increases in both sectors, accelerating capital accumulation. This results in higher capital stocks. The rate of return in agriculture also influences expected profitability in this sector through the price of land, which increases by 38 percent on average for the period. The higher profitability in agriculture explains the 9 percent increase in cultivated area.

The results show that the alternative set of policies would have avoided the deflation and recession observed after the Great Depression. These policies would have resulted in a reallocation of labor from government to the private sector. In fact, they would have maintained government employment at the level that existed in 1929 and avoided the 8 percent increase observed during 1930-33. However, this would have been

Figure 51—Response of nonagricultural output (excluding government) to changes in macroeconomic and trade policies, 1929-39



associated with a decline in wages. This problem is common to other periods, and it is discussed further below.

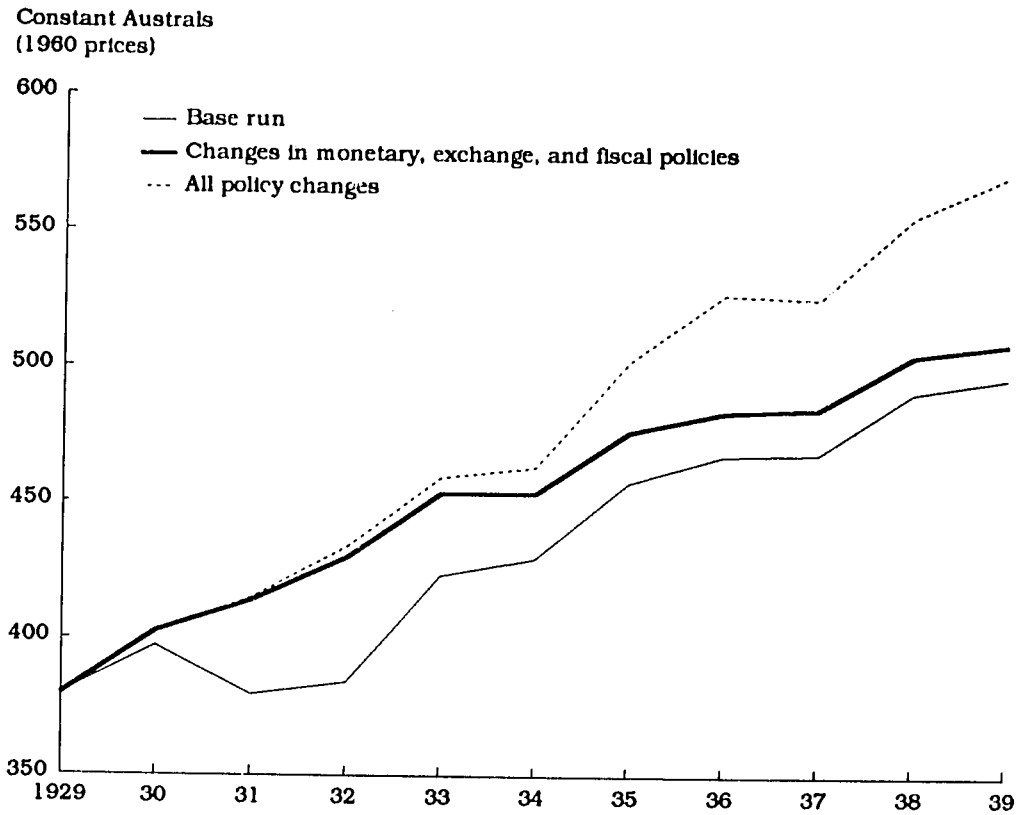
The fall in real wages also occurs in nonagriculture and in the total economy. This is caused, in part, by the explicit objective of the alternative policies of avoiding a decline in the price level. In this respect, the fall in real wages becomes a necessary outcome of permitting lower real interest rates to encourage the recovery of the economy. Nonetheless, the global evaluation of the effects under the alternative policies indicates a positive outcome in that these policies would have allowed significant increases in sectoral and total outputs. This, in turn, would have permitted private consumption to increase by 21 percent, investment by 29 percent (with a substantive expansion in trade), exports by 90 percent, and imports by 57 percent.

It is clear that adding the alternative trade policies would have fostered growth substantially.

President Perón's Income Redistribution Program

The disruption of world markets in the 1930s and the shortages in the supply of imports during World War II support the claim that expansion of domestic protected markets could be a substitute for Argentine exports as the engine of growth. Nevertheless, during the years when Juan Perón emerged as a strong leader, the foreign terms of

Figure 52—Response of total output to changes in macroeconomic and trade policies, 1929-39



trade were favorable to Argentine traditional exports and, under these favorable circumstances, it could be expected that the country would resume export-led growth.

Besides the then-dominant views in support of an inward-looking growth strategy, one of Perón's main concerns was income redistribution to labor, which was the basis of his political support. As manufacturing and urban services were more labor-intensive than export-oriented agriculture, the economic policies implemented by Perón continued and even deepened the import substitution growth strategy that had spontaneously developed during the Great Depression and continued throughout World War II. The instruments used to turn relative prices in favor of manufacturing and urban services were mainly the enforcement of expansionary fiscal policies and, not independently, an overvalued domestic currency.

Active use of foreign exchange reserve stocks that had been built up during the war, strong quantitative export restrictions, and exchange controls were the means for producing and maintaining the peso overvaluation. The relevance of exchange controls is reflected in the size of the black market premium, which averaged 200 percent during the period 1946-55.

Regarding fiscal policy, government expenditures as a proportion of income jumped from around 10 percent in the mid-1940s to more than 17 percent in 1949. During the 1947-49 period, the fiscal deficit financed by borrowing jumped from zero to about 5 percent of national income.

By the early 1950s, a combination of foreign shocks and domestic problems forced a change in fiscal policies. In 1949, the foreign terms of trade reversed the upward trend. Inflation jumped to 40 percent a year in 1951 when a severe drought brought the ongoing agricultural crisis to an extreme situation. In order to deal with macroeconomic instability, Perón decided to reduce government expenditures and the fiscal deficit, with no major changes in the trade and exchange rate policies. By 1954, inflation had receded to a rate of 2 percent a year, but, on average, growth slowed during 1949-54, compared with the first three years of Perón's administration.

Critics of Perón's economic policies point out that, as a consequence of the inward-looking strategy, Argentina failed to take advantage of the world trade expansion that occurred during the 1950s and 1960s. They also argue that the expansionary fiscal policies and the increases in nominal wages fueled inflationary pressures that since then have become a common feature of the Argentine economy.

The model describes what would have been the performance of the Argentine economy if Perón had followed a different strategy, more in line with what the critics consider sound policies. This exercise in counterfactual history is undertaken by introducing changes in five key policy instruments.

First, tariffs on imports are adjusted downward to a constant level of 10 percent beginning in 1946. Second, quantitative export restrictions and exchange controls are eliminated, and consequently, the black market premium is assumed to disappear during the whole period. Third, government expenditures as a proportion of national income are allowed to grow *gradually* from 10.7 percent in 1945 to the actual 14.8 percent in 1951, thus avoiding the sharp and unsustainable increases that took place during 1947-50. Fourth, the fiscal deficit financed by borrowing is adjusted downward in the same proportion as the reduction in government expenditures. Fifth, μ is assumed to be constant at the average level that prevailed in the years before 1946, thus reflecting a scenario of a more stable monetary and exchange rate policy.

The results of the policy simulation experiments are reported in Table 24. In line with the claims of advocators of alternative policies, by the end of the period, the economy could have attained a 20 percent higher level of real income; exports would have almost tripled, and imports quadrupled. The economy would have been much more integrated with world markets, as indicated by the degree of openness, which would have increased from 7 percent to 20 percent. This impressive growth would have been achieved mostly through the accumulation of capital and productivity growth.

The results are positive for the private sector: on average for the period, agricultural output would have increased by 15 percent and nonagriculture (excluding government) by 17 percent. As discussed in Chapter 6, public expenditures have a positive effect on the expansion of sector 2. However, the performance of this sector improves even though the fiscal policy imposed in the simulation is more restrictive than the one actually applied. This is a result of the faster accumulation of capital and the increase in productivity. These, in turn, are explained by a higher price of agriculture relative to that of nontraded goods, as measured by the price of government services.

The data reported in Table 24 also suggest why these policies were not attractive to Perón: a significant fall in real wages is associated with this impressive growth performance, whereas the level of employment remains mostly unchanged. In some years, the decline in real wages would have reached 37 percent in government, 30 percent in agriculture, and 18 percent in nonagriculture. On average, over the 10-year period, the economy-wide real wage would have been 9 percent lower than actual levels, ranging from a 21 percent decline in agriculture to a 6 percent decline in nonagriculture.

Table 24—Effects of alternative economic policies, 1946-55

Endogenous Variables	Average Annual Response: Changes in Monetary, Exchange, and Fiscal Policies	Average Annual Response: All Policy Changes	Response in Year 1955: Changes in Monetary, Exchange, and Fiscal Policies	Response in Year 1955: All Policy Changes
	(percent of base-run values)			
Relative prices				
Price of land	25	57	-5	45
Degree of openness	24	118	17	188
Real exchange rate	46	134	31	151
Agriculture (P_1/P_3)	29	67	5	40
Nonagriculture (P_2/P_3)	21	33	9	30
Agricultural sector				
Labor	4	-2	5	-5
Physical capital	5	13	10	28
Cultivated land	4	6	6	13
Output	6	15	10	26
Wage	-12	-21	-10	-30
Rate of return	35	112	24	126
Nonagricultural sector (excluding government)				
Labor	4	9	1	7
Capital	8	16	15	35
Output	3	17	4	22
Wage	-8	-6	-3	-4
Rate of return	19	38	9	40
Government sector				
Labor	1	-7	-5	-16
Wage	-15	-17	-1	-4
Aggregated economy				
Labor	3	5	1	1
Total capital	5	11	10	24
Output	3	15	5	20
Private consumption	4	15	5	21
Private investment	27	62	19	68
Exports	9	123	9	189
Imports	50	200	42	330
Wage	-9	-9	-4	-7

This striking behavior of real wages is related in part to the fact that export-oriented agriculture is more capital-intensive than the rest of the economy, an issue discussed earlier. But, it is mostly related to the response of technology to most of the state variables, including measures indicating that comprehensive capital is laborsaving. In addition to their direct effect on factor intensity, the set of contemplated policies also results in output growth, which in turn increases investment and generates technical change. Recall that labor is measured in terms of physical units and not in terms of efficiency units. Therefore, the return to human capital is embedded in the return to capital. This exercise indicates the worsening of the terms of trade of physical labor. Because, however, the human capital embedded in physical labor increases with other forms of capital, the total return to labor is expected to increase as well.

The question that naturally emerges from this counterfactual history experiment is the following: Is it possible to introduce additional economic instruments to achieve the redistribution goals Perón pursued, while preserving most of the growth that an open and fiscally disciplined economy would have attained, as shown by the exercise just described?

To answer this important question, another exercise is designed that uses a combination of taxes and subsidies to transfer income from rent to wage earners. This is simulated via the following procedure. Whenever the policy changes yield a sectoral wage below the actual historical level, nonwage income is taxed in the exact amount needed to replenish the wage bill. This mechanism of taxes and transfers only applies to the private sector. Wages in the government sector are determined according to changes in productivity, as explained in Chapter 9.

The results of this exercise are reported in Table 25. Figures 53, 54, and 55 show the alternative paths of sectoral and total outputs. On the whole, these results show that Perón's redistribution goals could have been attained, preserving the gains in growth associated with a more open and fiscally disciplined economy.

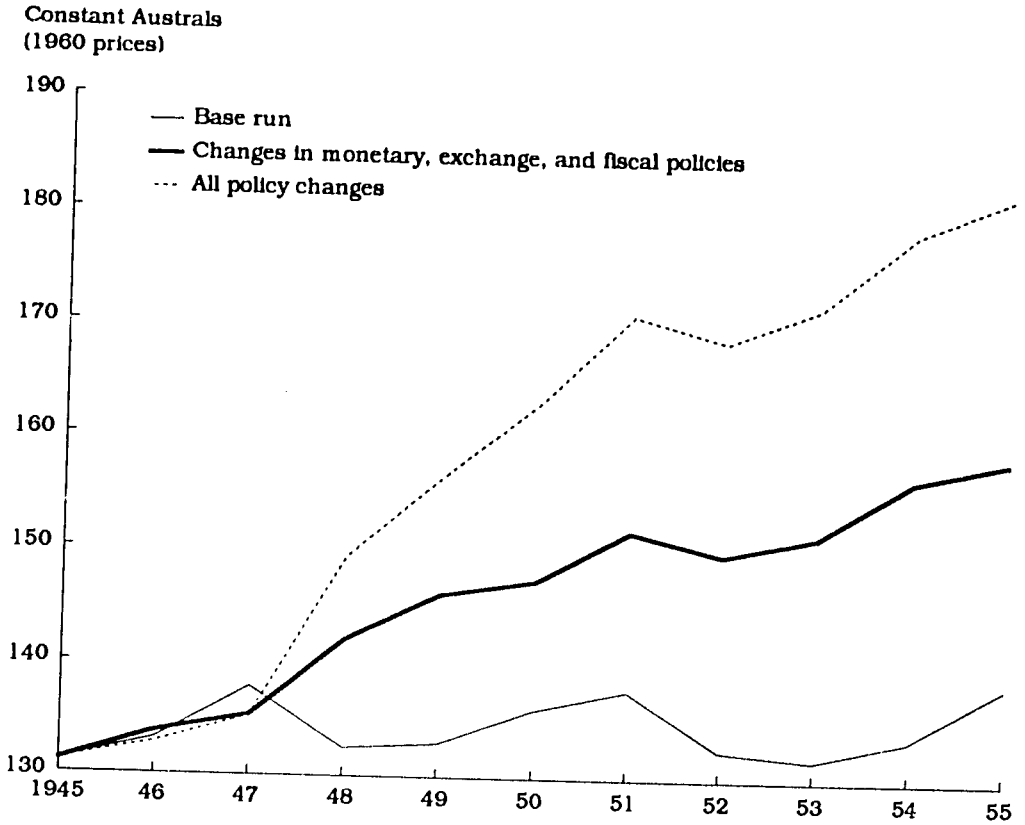
Although growth in nonagriculture (excluding government) would have been slightly lower, compared with that of the previous exercise, growth in agriculture would have been much higher. This is precisely the sector in which the tax-transfer mechanism produces an important improvement in real wages and attracts employment. As a result, a lower accumulation of capital produced by a lower rate of return is more than offset

Table 25—Effects of alternative economic policies with redistribution, 1946-55

Endogenous Variables	Average Annual Response: Changes in Monetary, Exchange, and Fiscal Policies	Average Annual Response: All Policy Changes	Response in Year 1955: Changes in Monetary, Exchange, and Fiscal Policies	Response in Year 1955: All Policy Changes
	(percent of base-run values)			
Relative prices				
Price of land	15	32	−12	11
Degree of openness	24	118	17	188
Real exchange rate	46	134	31	151
Agriculture (P_1/P_3)	29	67	5	40
Nonagriculture (P_2/P_3)	21	33	9	30
Agricultural sector				
Labor	9	14	13	25
Physical capital	5	10	8	19
Cultivated land	3	4	4	8
Output	9	19	14	31
Wage	8	26	0	12
Rate of return	16	51	10	44
Nonagricultural sector (excluding government)				
Labor	10	11	1	3
Capital	4	13	6	25
Output	7	19	5	20
Wage	3	2	3	4
Rate of return	−3	22	9	35
Government sector				
Labor	3	−5	−4	−14
Wage	−15	−19	−2	−7
Aggregated economy				
Labor	8	9	3	5
Total capital	3	9	5	17
Output	6	17	6	20
Private consumption	8	19	7	22
Private investment	13	45	2	42
Exports	24	138	24	203
Imports	40	191	23	309
Wage	0	2	0	2

Note: Results reported in this table assume a tax-subsidy mechanism to transfer income from nonwage to wage earners.

Figure 53—Response of agricultural output to changes in macroeconomic and trade policies, 1945-55



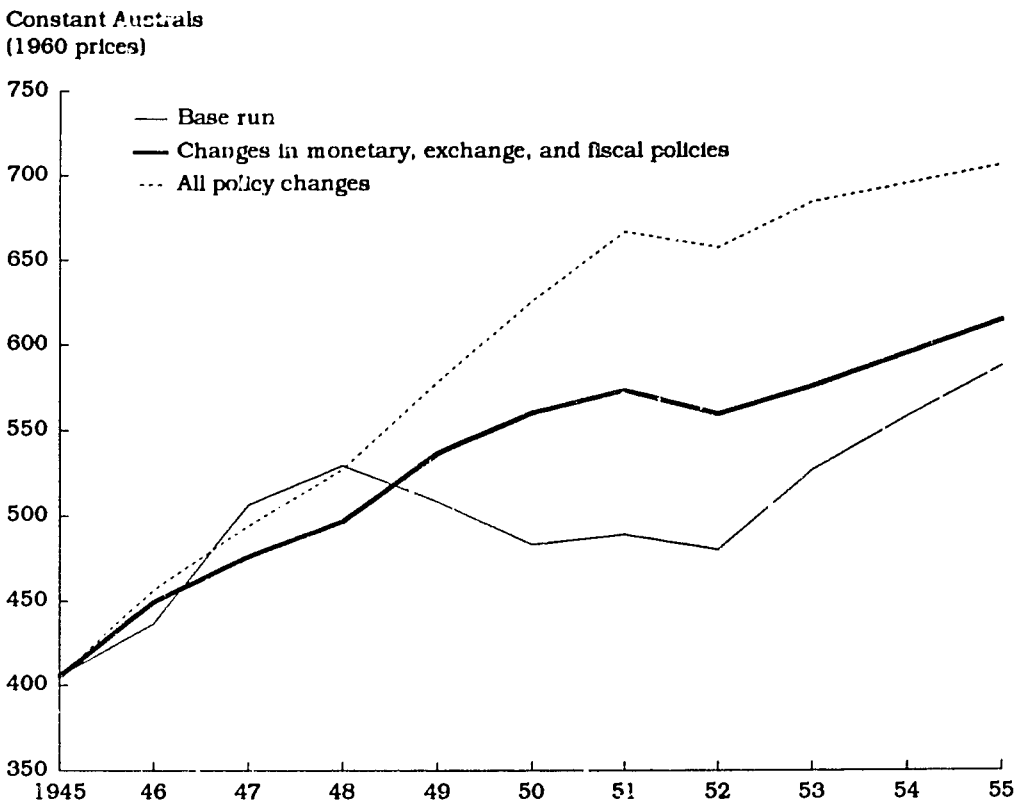
by the contribution of higher employment. This decline in profitability is a consequence of the tax-transfer mechanism designed to redistribute income.

Unfortunately, the institutional arrangements needed to produce these results were mostly absent in Argentine economic history: market prices, as signals for efficient resource allocation, and fiscal policy, as an instrument of distribution goals, were lacking. The opposite combination was commonplace in Argentine economic history: prices were distorted to achieve income redistribution goals, while fiscal policy was mostly aimed at influencing resource allocation.

The 1970s and 1980s: Extreme Instability and Stagnation

Political historians find it difficult to explain the source of the ideological and factual trends that developed during the 1960s, when the economy was fairly successful. By 1960, President Arturo Frondizi's growth and stabilization plan was producing both record investment levels and the lowest inflation rate in many years. These signals of a healthy economy prevailed throughout the 1960s in spite of the deep recession of 1962-63 and some inflation acceleration in 1965-66. By 1969, Minister of Finance Adalberto Krieger-Vasena's stabilization plan was delivering growth and low inflation. However, in 1970, many of the phenomena that characterized the complicated political

Figure 54—Response of nonagricultural output (excluding government) to changes in macroeconomic and trade policies, 1945-55



scenario of the 1970s were already present: the emergence of terrorism and guerrillas, a rebirth of extreme economic nationalism comparable only to that of the 1940s, and great confidence in the role of the government to promote growth through deep involvement in the investment and production processes.

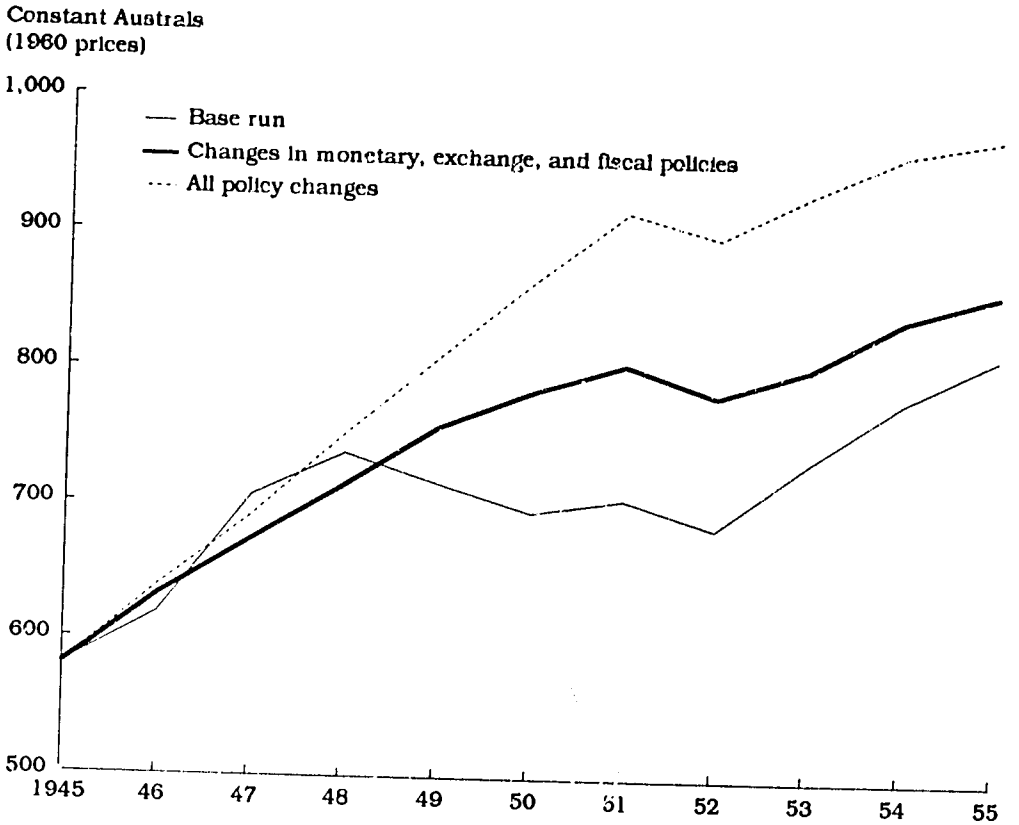
By 1976, the guerrillas had been defeated, but militarism had replaced democracy. There was a drastic change in economic ideology toward market-oriented policies in the context of a greater integration with international trade and finance. This was associated, however, with an increase in the size of government, and government intervention continued to be extended and inefficient. At the same time, the composition of government expenditures shifted from social services toward defense and security.

In terms of specific policy measures, the most striking phenomena were the increased government expenditures and fiscal deficits; the drastic changes in trade policies, aimed first at closing the economy and later at liberalizing trade; and the extreme variability of monetary and exchange rate management.

Government expenditures, which represented 19 percent of income in 1970, jumped to 28 percent in 1974, and, in spite of some reductions in the following years, were still as high as 28 percent in 1984.

The overall fiscal deficit, which stood at about 10 percent of national income averaged for the period as a whole, was mostly financed by printing money in the early 1970s; after 1975, it shifted to domestic and foreign borrowing.

Figure 55—Response of total output to changes in macroeconomic and trade policies, 1945-55



Taxes on exports varied from 2 to 13 percent, and restrictions on imports and exchange controls shifted from extremely high levels in 1975 to almost complete elimination by 1980. This is mainly reflected in the black market premium, which was as high as 200 percent in 1975 and nonexistent in 1980. Tariffs on permitted imports varied in an opposite direction from the quantitative restrictions and the exchange controls, moving from a subsidy (negative tariff) of 6 percent in 1975 to an actual tariff of 26 percent in 1984.

Monetary and exchange rate policy was characterized by extreme cyclical variations. This is reflected in the behavior of the monetary and exchange policy indicator, μ. Whereas during 1970-71 money supply expanded in relation to nominal income valued at the price of traded goods, in 1972 sharp devaluations produced the opposite phenomenon. During 1973-74 monetary policy was again expansionary, while the domestic currency was overvalued. This was followed by two years of sharp devaluations that reversed the situation. A plan devised by the Minister of Finance José Martínez de Hoz was implemented at a time of excess liquidity in world financial markets. The peso continued to be overvalued during the next four years. This trend was reversed during 1981-82 when economic authorities were forced to devalue the peso drastically.

As a consequence of the policies implemented during the period 1970-84, the rate of inflation rose to historical high levels, becoming volatile while the economy stagnated, except for a short-lived boom during the the world commodity crisis in 1973-74.

Economic analysts of the 1970s and 1980s have pointed out that the source of the extreme instability and stagnation must be found in expansionary fiscal policies, whereas the stabilization attempts relied mainly on price controls or heavy borrowing to finance the fiscal deficits.

Extensive and high protection during the first half of the 1970s and opening up during the second half enabled Argentina to deal with deficit financing. Thus, when capital markets were restricted and borrowing was not readily available, deficits were mainly financed by money printing, whereas import restrictions and exchange controls were needed to stabilize the commercial exchange rate. Later, capital markets were deregulated, the source of deficit financing shifted to borrowing, and the overvaluation of the peso was engineered by means of capital inflows, instead of import restrictions and exchange controls as before.

The model simulates the working of the economy under alternative policies resembling the economic analysts' retrospective views on what could have avoided the extreme instability and persistent stagnation during this period. The policy experiment includes changes in macro policies and also in the trade regime.

Regarding fiscal policy, government expenditures are left unchanged until 1973, when they reached 22 percent of national income, and they are assumed to remain constant thereafter. The fiscal deficit financed by borrowing is adjusted accordingly. This is a significant change from the fiscal policy actually followed.

Monetary and exchange rate policies are stabilized to avoid the high variability observed in the period. This is done by restricting μ to a constant level at the average for the period.

Trade and financial policy changes are directed to open up the economy, that is, to follow the trend observed in the late 1960s. More specifically, this means imposing an average tariff for imports of 10 percent, no taxes on exports, and the elimination of quantitative restrictions and exchange controls. The latter is done by imposing a zero premium in the black market for foreign exchange. The changes in trade and financial policies apply to the whole period.

Finally, it is assumed that the set of alternative policies would have avoided the financial crises of 1981-82 and inflation rates above 50 percent. Consequently, a value of zero is imposed on the variable that represents the financial crisis, and a value of 50 percent is imposed on the variable that captures the effects of high inflation on productivity.

The results of this exercise are reported in Table 26 and Figures 56, 57, and 58. As can be seen, the performance of the economy would have improved significantly. After 15 years of applying the alternative set of policies, the economy's output would have increased by 33 percent and exports would have doubled.

As in the previous exercise for the period 1946-55, growth in Argentina proves to be a laborsaving process, and real wages do not show improvement. Therefore, the same redistributive fiscal policy used in the simulation for the period 1946-55 is assumed here to avoid declines of real wages in some years.

Real wages increase by 16 percent in agriculture and 5 percent in nonagriculture (excluding government). Real wages and employment in government fall, but the economy's wage rate goes up by 3 percent, and the level of total employment increases slightly. It is interesting to note the significant reallocation of labor from agriculture and, even more intensely, from government toward private nonagriculture. This happens even though wages increase more in agriculture. However, the price of land also has a positive and direct influence on agricultural employment because it is used as an indicator of expected profitability for landowners. The price of land falls significantly

Table 26—Effects of alternative economic policies with redistribution, 1970-84

Endogenous Variables	Average Annual Response: Changes in Monetary, Exchange, and Fiscal Policies	Average Annual Response: All Policy Changes	Response in Year 1984: Changes in Monetary, Exchange, and Fiscal Policies	Response in Year 1984: All Policy Changes
	(percent of base-run values)			
Relative prices				
Price of land	6	35	25	62
Degree of openness	8	47	−2	52
Real exchange rate	5	48	15	61
Agriculture (P_1/P_3)	0	24	29	58
Nonagriculture (P_2/P_3)	10	18	38	43
Agricultural sector				
Labor	−12	−4	−16	−3
Physical capital	−1	7	2	19
Cultivated land	−4	−1	−3	6
Output	5	23	12	49
Wage	3	7	−1	16
Rate of return	7	50	37	105
Nonagricultural sector (excluding government)				
Labor	7	7	9	5
Capital	1	11	8	26
Output	3	19	14	36
Wage	4	5	6	5
Rate of return	2	23	21	56
Government sector				
Labor	2	−9	−4	−18
Wage	−7	−2	−20	−11
Aggregated economy				
Labor	3	3	4	1
Total capital	0	7	5	19
Output	3	17	12	33
Private consumption	3	20	14	35
Private investment	9	30	36	75
Exports	9	69	9	104
Imports	14	81	13	99
Wage	3	3	2	3

Note: Results reported in this table assume a tax-subsidy mechanism to transfer income from nonwage to wage earners.

during 1970-77, which has a depressing effect on agricultural employment. This trend is reversed by the end of the 1970s, producing an increase in employment in this sector.

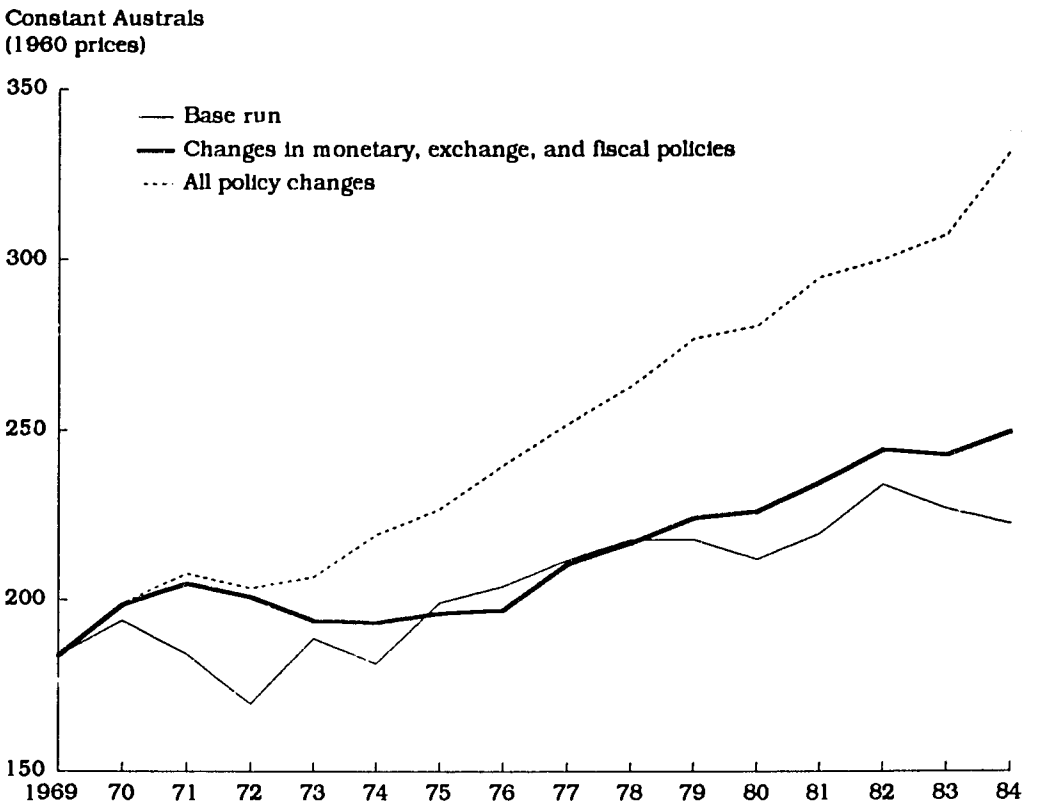
Most impressive, however, is the finding that the higher growth of the economy would have increased consumption by 35 percent and investment by 75 percent.

Integrating Argentina into the World Economy

The single most striking characteristic of Argentine economic history is the long-lasting reversal in its once-substantial share in world trade and finance. For several decades prior to the Great Depression, Argentina's growth was tightly integrated into the world economy. Due to a combination of external shocks and internal decisions, the economy has turned inward since 1929, and it has become less and less integrated with world trade and capital markets.

The costs in long-term growth of the inward-looking strategy followed after 1929 have been the subject of heated debates and discussions among students of the Argentine

Figure 56—Response of agricultural output to changes in macroeconomic and trade policies, 1969-84



economy[9] Two antagonistic positions have emerged: one view supports the strategy actually followed, and the other claims that it was detrimental. To address this controversial issue, the model is used to simulate the trajectory of the economy under a set of policies designed to preserve the outward-looking strategy that prevailed before 1930. The results are then compared with the actual trends.

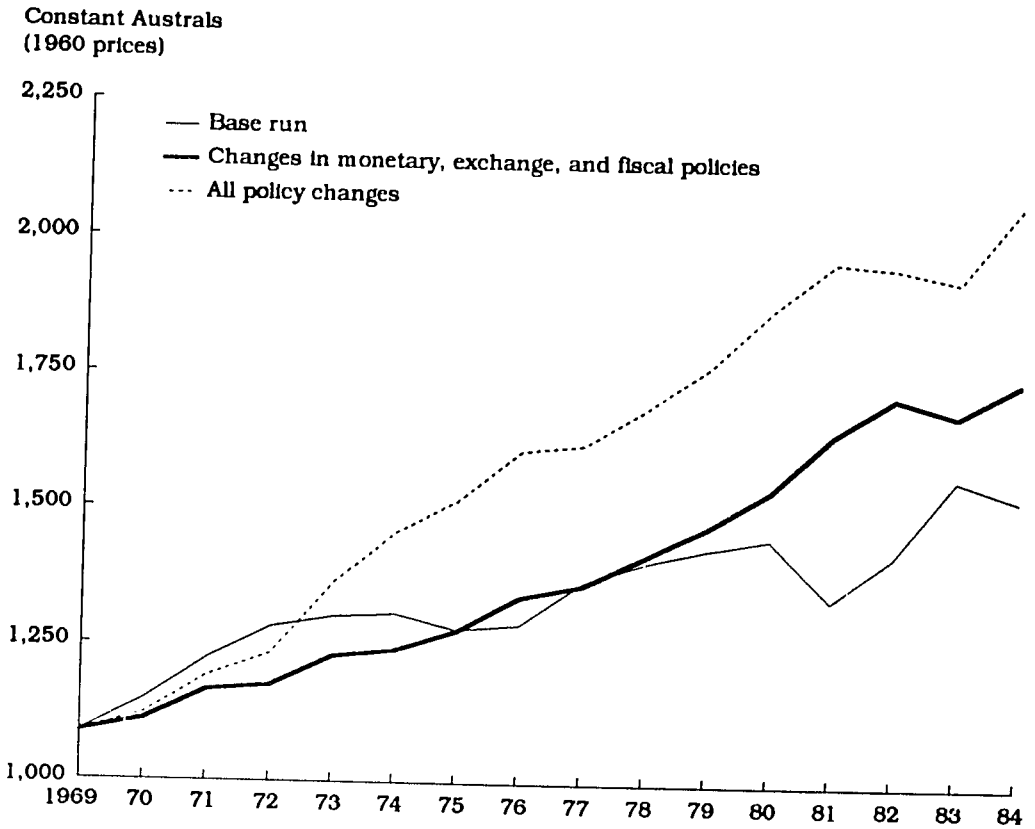
Regarding fiscal policy, public expenditures are adjusted in the same way described in the exercises for 1946-55 and 1970-84, that is, sharp increases that are not sustainable in the longer run are avoided. Reducing public expenditures was shown to reduce the need for borrowing; therefore, in this simulation the fiscal deficit financed by borrowing is adjusted accordingly.

The monetary exchange rate policy is designed so that the growth of money supply in excess of nominal devaluation, foreign inflation, and real growth is stabilized at the average level actually observed during the period 1930-84.

The structural scenario of an open economy is simulated, imposing a uniform and constant tariff on imports of 10 percent and no taxes on exports, and eliminating

[9] See Díaz Alejandro 1984; Ferrer 1979; Mallon and Sourrouille 1975; Cavallo 1986; de Pablo 1982; Llach 1987; Diamand 1973; and Frigerio 1977.

Figure 57—Response of nonagricultural output (excluding government) to changes in macroeconomic and trade policies, 1969-84

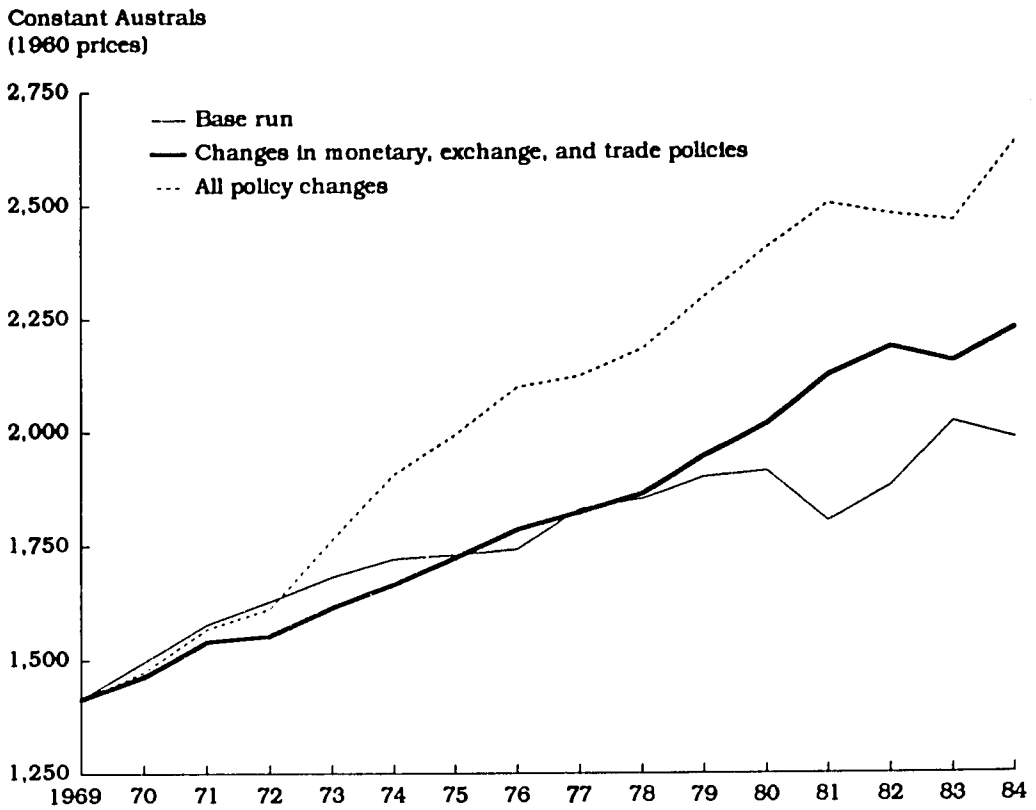


quantitative restrictions and exchange controls. This amounts to having no premium on the black market for foreign exchange. Finally, it is assumed that bankruptcies that occurred during 1931-32 and 1981-82 were nonexistent, whereas the shocks of deflation and inflation are given a value of zero.

The results of this simulation exercise are shown in Table 27. As can be seen, relative prices strongly respond to the policy changes. On average, over the 55-year period, agricultural prices would have been 45 percent higher and nonagricultural prices 20 percent higher, relative to the price of government services. By the end of the period, agricultural output would have more than doubled its historical level as a consequence of both input expansion and productivity growth. Employment in agriculture would have increased by 64 percent, physical capital by 59 percent, and cultivated land by 37 percent. In private nonagriculture, output would have increased by 65 percent, with a small decline in employment, and the stock of capital would have increased by 50 percent.

To allow this resource growth and reallocation in the private sector of the economy, employment in the government sector would have been 35 percent lower. This decline in government employment is consistent with the same level of government services, because the model assumes that labor productivity in this sector increases at the same rate as in the rest of the economy. The figures for the overall economy are quite

Figure 58—Response of total output to changes in macroeconomic and trade policies, 1969-84



impressive. Total output would have been 63 percent higher, investment would have doubled, and exports almost tripled.

The only result that does not seem to agree with this favorable performance is urban wages. While wages in agriculture increase by 26 percent by the end of the period, wages in nonagriculture and government are 6 percent above the historical levels. This problem has already been discussed, where it is indicated that these simulated wages do not capture the returns to human capital, which are captured instead by the returns to capital.

In any case, where well-developed economic institutions exist, the achievement of income redistribution goals should not be a difficult task, especially in an economy with such impressive growth potentials.

As econometricians are well aware, these results have all the limitations inherent in working with simulations involving large policy changes. With this caveat, the results can be put into a perspective that allows the reader to judge their relevance. Figure 59 plots the actual trajectories of total output in Argentina, Australia, and Canada, together with the trajectory of the output that the model predicts for Argentina under free trade and macroeconomic disciplines. The outcome of the more appropriate policies is that Argentina's performance could have been close to that of these similarly endowed countries, which continued to take advantage of opportunities offered by the world

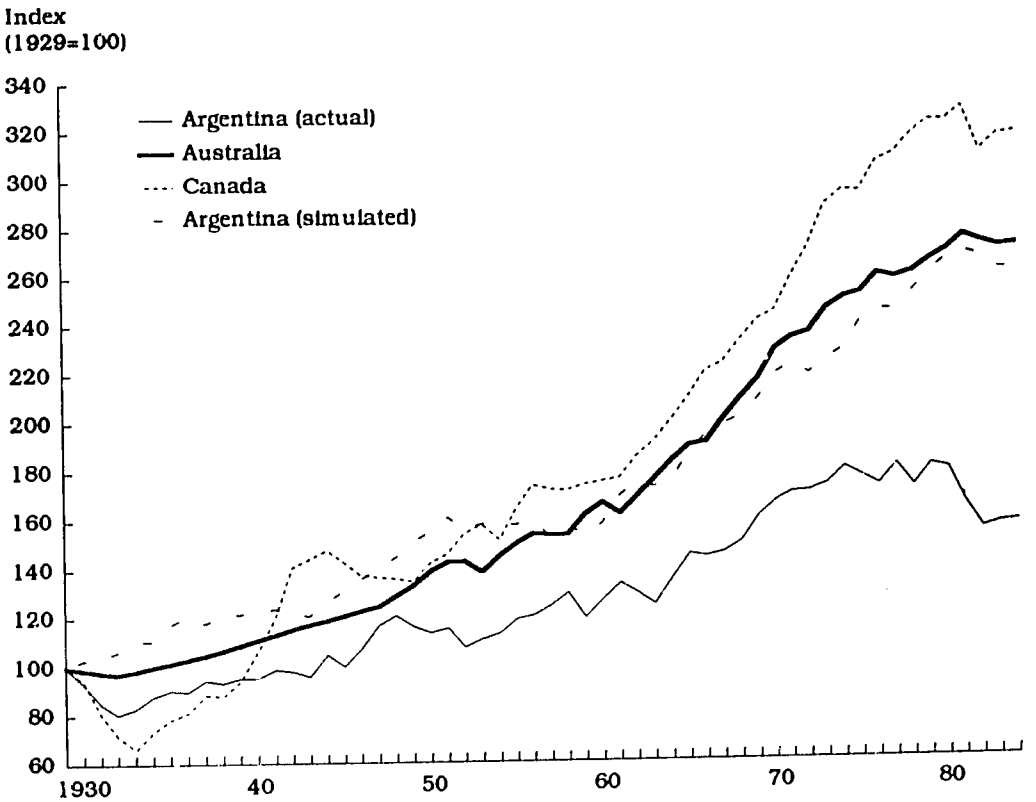
Table 27—Effects of alternative economic policies with redistribution, 1930-84

Endogenous Variables	Average Annual Response: Changes in Monetary, Exchange, and Fiscal Policies	Average Annual Response: All Policy Changes	Response in Year 1984: Changes in Monetary, Exchange, and Fiscal Policies	Response in Year 1984: All Policy Changes
	(percent of base-run values)			
Relative prices				
Price of land	9	29	32	46
Degree of openness	4	77	1	57
Real exchange rate	12	70	72	59
Agriculture (P_1/P_3)	12	45	72	81
Nonagriculture (P_2/P_3)	11	20	56	53
Agricultural sector				
Labor	5	31	0	64
Physical capital	5	26	20	59
Cultivated land	7	22	2	37
Output	12	42	41	115
Wage	3	18	18	26
Rate of return	15	47	104	140
Nonagricultural sector (excluding government)				
Labor	2	-1	7	-8
Capital	5	20	33	50
Output	8	23	47	65
Wage	2	5	6	6
Rate of return	10	23	74	106
Government sector				
Labor	-4	-15	-24	-35
Wage	-5	-2	-11	6
Aggregated economy				
Labor	2	2	1	-3
Total capital	5	19	23	41
Output	8	24	40	63
Private consumption	10	27	46	70
Private investment	12	32	92	112
Exports	12	124	53	187
Imports	13	118	24	114
Wage	0	3	4	3

Note: Results reported in this table assume a tax-subsidy mechanism to transfer income from nonwage to wage earners.

markets. The only purpose of this comparison is to put Argentina's policies in perspective. It should not be interpreted that the policies adopted by the other countries were ideal, or that they would have been more conducive to growth in Argentina. But relative to Argentina, their economies were oriented outward. Therefore, instead of exploiting their agricultural bases, they used them to expand their economies.

Figure 59—Growth trends in Argentina, Australia, and Canada, 1929-84



Sources: Richard Bird, *The Growth of Government Spending in Canada* (Toronto: Canadian Tax Foundation, 1970); Noel Butlin, *Some Perspectives of Australian Economic Development, 1860-1965* (New Haven, Conn., U.S.A.: Yale University, Economic Growth Center, 1971); Hector L. Dieguez, *Argentina y Australia: Algunos Aspectos de su Desarrollo Económico Comparado* (Buenos Aires: Instituto Torcuato Di Tella, 1968); O. Firestone, *Canada's Economic Development, 1867-1953*, Income and Wealth Series (London: Bowes and Bowes, 1958); International Monetary Fund, *International Financial Statistics* (Washington, D.C.: IMF, 1987); and Arthur Smithies, "Economic Growth: International Comparisons, Argentina and Australia," *American Economic Review*, Paper Proceedings 55 (1st part), 1965.

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CONCLUSIONS

This study provides a comprehensive and formal analysis of the causes behind the poor performance of the Argentine economy during most of this century. The main conclusion that emerges from the analysis is that wrong economic policies led Argentina to lag behind the trend growth of countries with similar potential. Explaining why wrong economic policies were actually applied is beyond the scope of this study and in part beyond the present scope of economics. Yet economic analysis can show why these policies were inferior to feasible alternatives that could have yielded a better performance.

This task is performed by constructing a model where the economy is disaggregated into three sectors: agriculture, nonagriculture, and government. The model embraces the basic idea that economic incentives are closely related to the economic environment in which decisions are made. The economic environment is largely defined by relevant indicators of the state of the economy, such as relative prices and government policies. The latter, which play an important role, are explicitly considered in the analytical framework.

The study finds that trade and macroeconomic policies affect economic sectors with different intensity, depending on the degree of sectoral openness and factor intensity. It shows that agriculture has been a more open sector and has used capital more intensively than nonagriculture. These are the two main reasons for the differential effects of economic policies.

The explicit introduction of government as a nontraded sector in the analysis permits discussion of the determinants of the real exchange rate. In addition to the conventional effects of trade policies, macroeconomic policies also exert important influences on the real exchange rate, which in turn affects relative sectoral prices and, therefore, sectoral output, resource growth, and allocation. This addition to the original framework introduces explicitly the channels by which the economic environment and government policies (in particular) affect economic decisions.

This, however, is not the only way in which the economic environment influences economic decisions. The study also finds that government actions have more direct effects. First, the size of government, measured by its consumption share of income, has a positive effect on the productivity of nonagriculture. Because it improves profitability through higher demand in a sector that is relatively closed, it also tends to decrease private consumption, which indicates substitutability between private and public consumption. Second, government investment has a positive effect on private investment, but the method used to finance government expenditures matters. In particular, government borrowing causes higher interest rates, which decrease private investment. Third, government wages exert a negative influence on employment.

Aside from government actions, other indicators of the economic environment affect the productivity of resources. Among these, the volatility of relative prices and macroeconomic shocks in periods of deflation or high inflation are found to have a negative effect.

The estimation of the model shows results that are consistent with conventional theory. Thus, employment responds to wages, capital accumulation to the rate of return,

and the expansion of the cultivated area to the price of land. The allocation of resources between agriculture and nonagriculture responds to differential incomes in the case of employment and to the differential rate of return in the case of capital. Private consumption grows with increases in personal income and wealth.

The estimated model is used for policy simulations. Policy changes are decomposed into two parts: *macroeconomic* and *trade policies.* Within *trade policies* three indicators are considered: taxes on exports, taxes on imports, and quantitative restrictions, measured by the premium in the black market for foreign exchange. Regarding *macroeconomic policies,* three indicators are used: the share of government expenditures in total income, the ratio of the debt-financed fiscal deficit to total income, and the ratio of the stock of money supply to income valued at foreign prices.

The analysis of three episodes of Argentine economic history aims to evaluate the cost in terms of growth of the policies applied. In all cases it finds that alternative policies would have yielded a considerably better performance of the economy.

For the period 1930-39, the effects of the Great Depression are examined. The policy simulation exercise is designed in such a way that deflation and high real interest rates are avoided by printing money to finance the fiscal deficit. At the same time, restrictions on trade are only allowed at the level that prevailed before 1930. Results show that output for the period would have been, on average, 10 percent higher. The fall in employment would have been avoided, although some reallocation of labor would have been required.

The analysis of the second episode focuses on the income redistribution program implemented during the Peronist administrations of [illegible]-55. The policy simulation in this case is designed to open up the economy and [illegible]oid the large increases in public expenditure and fiscal deficit that took place. It indicates that income redistribution goals could have been attained without damaging the growth trends in agriculture and nonagriculture, as actually happened.

The third episode deals with the 1970s and 1980s, a period of economic instability that led the economy to the highest rate of inflation during the analyzed period. Frequent shifts in macroeconomic and trade policies characterized the period. The policy simulation in this case is designed to avoid unsustainable jumps in public expenditure and fiscal deficit, while monetary expansion is stabilized. Within this macroeconomic context, trade policy is aimed at opening up the economy to an inflow of capital at a time when macroeconomic instability was costly to Argentina.

Finally, the model is used to simulate the economy's trajectory under the assumption that, after 1930, Argentina should not have chosen to base its growth on an inward strategy. Results show that on average for the period of 55 years, Argentina could have attained levels of income, consumption, and investment that would have been 63 percent, 70 percent, and 112 percent higher, respectively. This implies a growth performance close to those of Australia and Canada, countries with similar resource endowments.

The simulation results lead to two additional conclusions. First, policy actions have failed in their orientation. The price system has been distorted in order to redistribute income, while fiscal policy has been aimed at direct resource allocation. This reversal of economic principles has been costly in terms of growth and welfare. Second, well-designed macroeconomic and trade policies would have produced, qualitatively and quantitatively, different effects. While macroeconomic policies would have tended mainly to stabilize the shorter-run fluctuations, the trade policies would have produced a stronger effect on growth.

In conclusion, much of the pessimism concerning market-oriented policies is based

on two premises. First, it is claimed that a declining trend in foreign terms of trade badly affects exporting countries. The statement is empirically correct, but the conclusion is wrong. The reason that foreign terms of trade deteriorate is that technical change in world agriculture generates an excess supply, in spite of the continuous growth of demand caused by growing population and income. This technical change more than offsets the decline in terms of trade. This is basically the reason that supply—worldwide—increases in spite of the real price decline.

The second premise is that agricultural output does not respond to price. The empirical base for this premise is derived from inappropriate methodology. The present study provides an alternative methodology, which shows that agriculture does respond to price, and this methodology provides the structure of the dynamics of supply response.

APPENDIX 1: GLOSSARY OF SYMBOLS OF VARIABLES USED IN THE EMPIRICAL ANALYSIS

This glossary of symbols provides a short definition of the variables used in the text and, in the case of transformed variables, the formulas involved. The unit of measurement and the variables involved in the computation are provided when applicable. The reader should recall that sector 1 is agriculture, sector 2 is nonagriculture excluding government, and sector 3 is government.

Commodity Flows

Y_1 = Agricultural gross domestic product (GDP), 1960 prices.

Y_2 = Nonagricultural GDP excluding government, 1960 prices.

$Y_{1,2}$ = $Y_1 + Y_2$.

Y_3 = Government GDP, 1960 prices.

Y = Total GDP, factor costs, 1960 prices.

X_3 = Government GDP, 1960 prices, original series not adjusted by productivity growth in sector 3.

X = Total GDP, factor costs, 1960 prices, original series not adjusted by productivity growth in sector 3.

C^p = Private consumption in australs, 1960 prices.

C^g = Public consumption in australs, 1960 prices.

I_1 = Gross investment in agriculture in australs, 1960 prices.

I_2 = Gross investment in nonagriculture excluding government, in australs, 1960 prices.

$I_{1,2}$ = Gross investment in sectors 1 and 2 combined, in australs, 1960 prices, computed as $I_1 + I_2$.

I_3 = Gross investment in the government sector, in australs, 1960 prices.

I = Gross investment in australs, 1960 prices.

I_3^e = Expected investment of sector 3, obtained as a forecast of an AR(3) process for I_3.

X^x = Exports in australs, 1960 prices.

M^m = Imports in australs, 1960 prices.

NX = Net exports, 1960 prices, computed as $X^x - M^m$.

Y_{mp} = GDP in australs, 1960 market prices.

Y^p = Personal income, in 1960 australs.

$C^{u,g}$ = Public consumption, original series not adjusted for productivity in australs, 1960 prices.

X_{mp} = GDP in australs, 1960 market prices, original series not adjusted for productivity growth in sector 3.

c^p = Private consumption per capita, 1960 prices, computed as P_pC^p/PN.

y^p = Personal income per capita, constant 1960 prices.

y^m = Maximum of per capita GDP, Y/N, up to the current period, in 1960 australs.

Prices, Wages, and Rates of Return

P_1 = Implicit price deflator in GDP (factor costs) of sector 1, index 1960 = 1.

P_{1T} = Domestic price of traded goods in sector 1, computed as $P_x^* (1 - t_x) E/82.7$, where 82.7 is E for the year 1960.

P_{1h} = Domestic price of nontraded goods in sector 1.

P_2 = Implicit price deflator in GDP (factor costs) of sector 2, index 1960 = 1.

P_{2T} = Domestic price of traded goods in sector 2, computed as $P_m^* (1 + t_m) E/82.7$, where 82.7 is E for year 1960.

P_{2h} = Domestic price of nontraded goods in sector 2.

P_3 = Implicit price deflator in GDP (factor costs) of sector 3, index 1960 = 1.

P_h = Prices of the home good.

P = Implicit price deflator in GDP, index 1960 = 1, computed as $P = (Y_1 P_1 + Y_2 P_2 + Y_3 P_3)/Y$.

P_p = Implicit price deflator in private consumption, index 1960 = 1.

P_g = Implicit price deflator in public consumption, index 1960 = 1.

P_i = Implicit price deflator in total gross domestic investment, index 1960 = 1.

P_{ex} = Implicit price deflator in exports of goods and services, index 1960 = 1, computed as $P_x^* E/82.7$, where 82.7 is E for the year 1960.

P_{im} = Implicit price deflator in imports of goods and services, index 1960 = 1, computed as $P_m^* E^m/82.7$, where 82.7 is E^m for the year 1960.

P_x^* = Foreign price of exports (in dollars), index 1960 = 1.

P_x = Domestic price of exported goods, computed as $P_x^* (1 - t_x) E$, index 1960 = 1.

p_x = Real exchange rate of exports, computed as P_x/P_h.

P_m^* = Foreign price of imports (in dollars), index 1960 = 1.

P_m = Domestic price of imported goods, computed as $P_m^* (1 + t_m) E$, index 1960 = 1.

p_m = Real exchange rate of imports, computed as P_m/P_h.

P^* = Average foreign price of traded goods (imports and exports), index 1960 = 1, computed as $P^* = (P_x^*)^{1/2} (P_m^*)^{1/2}$.

P_a = Price of land, index 1960 = 1.

P_l = Price of livestock, index 1960 = 1.

P_c = Price of crops, index 1960 = 1.

CPI = Consumer price index, 1960 = 1.

WPI = Wholesale price index 1960 = 1.

E = Nominal exchange rate for exports, pesos moneda nacional per U.S. dollar (or 10^{-9} australs per U.S. dollar).

E^m = Nominal exchange rate for imports, pesos moneda nacional per U.S. dollar (or 10^{-9} australs per U.S. dollar).

E^b = Nominal exchange rate on black market, pesos moneda nacional per U.S. dollar (or 10^{-9} australs per U.S. dollar).

W_1 = Nominal wage rate of sector 1, in 10^{-6} australs per year per person.

w_1 = Sectoral real wage rate of sector 1, computed as W_1/P_1.

W_2 = Nominal wage rate of sector 2, in 10^{-6} australs per year per person.

w_2 = Sectoral real wage rate of sector 2, computed as W_2/P_2.

W_3^n = Nominal wage rate of sector 3, in 10^{-6} australs per year per person.

W = Average wage rate, in 10^{-6} australs per year per person, computed as $W = (L_1W_1 + L_2W_2 + L_3W_3)/L$.

w^g = Index of government wages per capita, computed as $(W_3^n/CPI)/(Y/N)$, where CPI is the consumer price index.

w^p = Index of wages in the private sector computed as a weighted average of wages in sectors 1 and 2.

r_1 = Rate of return on capital of sector 1, computed as $(P_1Y_1 - W_1L_1)/(PK_1)$.

r_{1c} = Rate of return on physical capital of sector 1, computed as $(P_1Y_1 - W_1L_1)/(PK_{1f})$.

r_2 = Rate of return on capital of sector 2, computed as $(P_2Y_2 - W_2L_2)/(PK_2)$.

$r_{1,2}$ = Rate of return on capital of sectors 1 and 2 combined, computed as $(P_1Y_1 + P_2Y_2 - W_1L_1 - W_2L_2)/[P(K_1 + K_2)]$.

$r_{1,2}^e$ = Expected return of sectors 1 and 2 combined, obtained as the forecast of an AR(3) process for $r_{1,2}$.

$(r_2/r_1)^e$ = Expected differential return between sectors 2 and 1.

$(r_2/r_1)^u$ = Unexpected differential return between sectors 2 and 1.

r_a = Rate of return on land.

R_a = Rent on a unit of land, computed as $r_1(K_1 - K_{1f})/A$.

Resources

N = Total population, in million persons.

L_1 = Labor force of sector 1, in million persons.

L_2 = Labor force of sector 2, in million persons.

L_3 = Labor force of sector 3, in million persons.

L = Total labor force, in million persons.

A = Weighted average of cultivated area in thousands of hectares. The weights are the values of production of each crop.

K_{1f} = Stock of physical capital of sector 1, excluding land, in australs, 1960 prices.

K_1 = Total capital used in agriculture, Divisia index that aggregates physical capital, K_{1f}, and land, A, in australs, 1960 prices.

K_2 = Stock of capital of sector 2, in australs, 1960 prices.

K_3 = Stock of capital of sector 3, in australs, 1960 prices.

K_f = Total stock of physical capital, excluding land, computed as $K_{1f} + K_2 + K_3$, in australs, 1960 prices.

K = Total stock of capital, including land, computed as $K_1 + K_2 + K_3$, in australs, 1960 prices.

Derived Variables and Ratios

DO_1 = Degree of openness, sector 1, computed as $(P_{ex}X^x + P_{im}M^m)/(P_1Y_1)$.

DO_2 = Degree of openness, sector 2, computed as $(P_{ex}X^x + P_{im}M^m)/(P_2Y_2)$.

DO_c = Degree of commercial openness, computed as $(P_{ex}X^x + P_{im}M^m)/(PY)$.

DO_f = Degree of financial openness, computed as E/E^b.

α_1 = Share of traded output in agriculture.

α_2 = Share of traded output in nonagriculture, excluding government.

S_{K1} = Share of capital in sector 1, computed as $1 - (W_1 L_1)/(P_1 Y_1)$.

S_{K2} = Share of capital in sector 2, computed as $1 - (W_2 L_2)/(P_2 Y_2)$.

$\sigma_{j,3}$ = Measure of relative price variability in sector j. Computed as the moving standard deviation of P_j/P_3 over the last three periods, where $j = 1, 2$ stands for the sectors.

Γ_1 = Productivity level in sector 1, computed as $\log(Y_1/L_1) - S_{K1}\log(K_1/L_1)$.

Γ_2 = Productivity level in sector 2, computed as $\log(Y_2/L_2) - S_{K2}\log(K_2/L_2)$.

m = Migration rate out of agriculture, computed as $N(t)/N(t-1) - L_1(t)/L_1(t-1)$.

U = Unemployment gap estimated as the relative difference of potential and actual nonagricultural output.

θ = Share of agricultural investment, I_1/I.

θ^k = Share of agricultural capital, K_{1f}/K_f.

δ = Differential income, nonagriculture, excluding government, relative to agriculture.

g = Share of government consumption in total income, computed as $P_g C^g/PY$.

$\hat{g}$ = $\log[g/g(-1)]$.

S_L = Share of labor income, computed as WL/PY.

S_a = Share of the value of land in the total value of capital in agriculture.

k = Total capital per capita, computed as K/N.

AP = Average productivity in sectors 1 and 2 combined, computed as $[(Y_1 + Y_2)/(Y_1^o + Y_2^o)]/[(L_1 + L_2)/(L_1^o + L_2^o)]$, where the superscript indicates the year 1913.

$\hat{E}$ = Rate of growth of the nominal exchange rate, computed as $\log[E(t)/E(t-1)]$.

$\hat{M}$ = Rate of growth of money supply, computed as $\log[M(t)/M(t-1)]$.

$\hat{P}$ = Rate of inflation, computed as $\log[P(t)/P(t-1)]$.

$\hat{Y}$ = Rate of growth, computed as $\log[Y(t)/Y(t-1)]$.

$\hat{P}^*$ = Foreign inflation, computed as $\log[P^*/P^*(t-1)]$.

$\hat{\mu}$ = $\hat{M} - \hat{E} - \hat{P}^* - \hat{Y}$.

e = Real exchange rate, EP^*/P_3, index 1960 = 1.

Fiscal and Monetary Variables

F = Total fiscal deficit, in australs.

F^b = Total fiscal deficit financed by borrowing, in australs.

T^i = $(Y_{mp} - Y)P$, indirect taxes in australs.

f^b = Fiscal deficit financed by borrowing, 1960 prices, computed as F^b/P.

f = Fiscal deficit financed by borrowing as a proportion of total income, computed as F^b/PY.

t_i = Average rate of indirect taxes, computed as Y_{mp}/Y.

T^x = Tax revenue from exports in australs, current prices.

t_x = Average tax rate on exports, collected taxes divided by the value of exports, computed as $T^x/P_{ex}X^x$.

T^m = Tax revenues from imports in australs, current prices.

t_m = Average tax rate on imports, collected taxes divided by the value of imports, computed as $T^m/P_{im}M^m$.

M = Stock of money supply M_3, end of period figures in australs.

Other Variables

δ_1 = Rate of depreciation of K_{1f}.

δ_2 = Rate of depreciation of K_2.

P^r = Population between 20 and 59 years of age.

CL = Measurement of climatic conditions, estimated as the area not harvested, filtered by changes in relative prices and credit conditions.

CR = Credit restrictions on agriculture.

WPI_a = Agricultural wholesale price index, 1960 = 1.

WPI_n = Nonagricultural wholesale price index, 1960 = 1.

WPI_{us} = Wholesale price index of the United States, 1960 = 1.

HI = High inflation, dichotomic variable that takes the value of the rate of inflation when this is more than 50 percent and zero otherwise.

DL = Deflation, dichotomic variable that takes the value of the rate of price change when this is negative and zero otherwise.

BC = Bank crisis, dichotomic variable that takes the value 1 for years 1931-32 and 1981-82 and zero for the rest of the period.

APPENDIX 2: SUMMARY OF ESTIMATION PROCEDURE

The system was estimated by blocks. For convenience, the equations are listed below by blocks with supplementary notes.

Price Block

Degree of openness:

$$\log DO_c = \underset{(-4.2)}{-0.516} + \underset{(4.0)}{0.648}\log[(1-t_x)/(1+t_m)] - \underset{(-4.2)}{0.170}\log g - \underset{(-8.3)}{0.590}\hat{\mu}$$

$$+ \underset{(4.0)}{0.146}\log DO_f + \underset{(18.1)}{0.770}\log(DO_c)_{-1};$$

$\bar{R}^2 = 0.97$; D.W. = 1.93.

Real rate of exchange for exports:

$$D[\log(P_x/P_3)] = \underset{(1.9)}{0.026} + \underset{(5.0)}{0.744}D[\log(P_x/P_m)] + \underset{(2.7)}{0.349}D[\log(P_x/P_m)\log DO_c]$$

$$+ \underset{(1.6)}{0.194}\hat{Y} + \underset{(6.7)}{0.428}D(\log g \log DO_c) - \underset{(-2.5)}{1.12}f - \underset{(-1.4)}{1.31}f\log DO_f$$

$$- \underset{(-1.2)}{0.130}\hat{\mu} + \underset{(2.1)}{0.022}D(\log\mu \log DO_f) + \underset{(9.5)}{1.88}D(\log D\hat{O}_c;$$

$\bar{R}^2 = 0.89$; D.W. = 1.59.

Real price of agriculture:

$$D[\log(P_1/P_3)] = \underset{(2.5)}{0.029} + \underset{(6.0)}{0.596}D[\log(P_x/P_3)] + \underset{(2.6)}{0.219}\{D\log(P_x/P_3)$$

$$[\log DO_c + \log(PY/P_1Y_1)]\} - \underset{(-5.5)}{0.756}\hat{g} - \underset{(-1.2)}{0.360}f + \underset{(1.8)}{0.174}\hat{\mu};$$

$\bar{R}^2 = 0.88$; D.W. = 1.97.

Real price of nonagriculture:

$$D[\log(P_2/P_3)] = \underset{(2.7)}{0.023} + \underset{(3.9)}{0.355}D[\log(P_x/P_3) + \log(P_m/P_x)]$$

$$+ \underset{(1.0)}{0.052} D\{[\log(P_x/P_3) + \log(P_m/P_x)][\log DO_c + \log(PY/P_2Y_2)]\}$$

$$\underset{(-7.2)}{-0.630\hat{g}} \underset{(-2.2)}{-0.499f} + \underset{(1.2)}{0.080\hat{\mu}};$$

$\bar{R}^2 = 0.85$; D.W. = 2.13.

The block has four endogenous variables, which are the variables on the left-hand side in the equations. The four equations are estimated by nonlinear 3SLS. The exogenous variables are g, μ, DO_f, P_x^*/P_m^*, $\hat{Y}$, and f. Note that the system has a recursive structure. DO_c is determined only by predetermined variables; P_x/P_3 is determined by DO_c and predetermined variables. Finally, sectoral prices are determined by DO_c, P_x, P_3, and exogenous variables.

Expenditures and Resources

Private consumption:

$$c^p = P_p C^p/PN = (\underset{(6.7)}{0.48} + \underset{(3.4)}{0.28} S_L \underset{(-6.0)}{-0.53} g) y^p + \underset{(2.4)}{0.22} k$$

$$+ \underset{(4.1)}{0.403} c^p_{-1} - \underset{(1.0)}{0.092} c^p_{-2};$$

$\bar{R}^2 = 0.93$; D.W. = 1.97.

Private investment:

$$I_{1,2}/N = \underset{(-2.2)}{-1.06} + \underset{(3.7)}{17.8}(\hat{I}_{1,2})^e + \underset{(7.8)}{0.372} D(Y_{1,2}/N) + \underset{(3.0)}{0.591} (I_3/N)_{-1}$$

$$- \underset{(-2.0)}{0.110} f^b/N + \underset{(12.8)}{0.693} (I_{1,2}/N)_{-1};$$

$\bar{R}^2 = 0.95$; D.W. = 2.07.

Intersectoral allocation of investment:

$$\log\theta = \underset{(-0.6)}{-0.058} + \underset{(1.9)}{0.255} \log\theta^k - \underset{(-1.9)}{0.140} \log(r_2/r_1)^e - \underset{(-1.7)}{0.170} \log(r_2/r_1)^u$$

$$+ \underset{(7.6)}{0.732} \log(\theta)_{-1};$$

$\bar{R}^2 = 0.90$; D.W. = 2.02.

Cultivated area:

$$\log(A) = \underset{(-0.1)}{-0.035} + \underset{(2.7)}{0.033}\log(P_a/P) - \underset{(-2.6)}{0.053}\log(CR)_{-1} - \underset{(-3.0)}{0.063}\log(P_l/P_c)$$

$$+ \underset{(7.2)}{0.784}\log(A)_{-1} + \underset{(2.0)}{0.220}\log(A)_{-1};$$

$\bar{R}^2 = 0.97$; D.W. = 2.01.

This block contains four equations explaining the variables on the left-hand side. In addition, there are two variables derived from total income: y^p in the consumption function and $D(Y_{1,2}/N)$ in the investment function. The exogenous variables are K, $r^e_{1,2}$, I_3, f^b, N, θ^k, P_a/P, CR, and P_l/P_c.

Labor

Total employment:

$$L/N = \underset{(8.7)}{0.278} + \underset{(2.3)}{0.165}w^p_{-1} - \underset{(-2.1)}{0.031}w^g_{-1} + \underset{(10.0)}{0.104}DC;$$

$R^2 = 0.97$.

Migrations:

$$\log m_t = \underset{(-6.6)}{-10.1} + \underset{(-2.8)}{5.58}\log(W_2/W_1)_{-1} - \underset{(-2.2)}{1.29}\log(P_a/P)_{-1}$$

$$- \underset{(2.1)}{0.83}\log(U)_{-2};$$

$R^2 = 0.95$.

The data were generated by using the total employment and migration equations. The two equations were estimated from the available data and were constrained to go through the census points. It was therefore unnecessary to reestimate these equations.

Production Functions

Agriculture:

$$\beta_1 = \underset{(-5.3)}{-2.67} + \underset{(6.2)}{0.541}\log(k)_{-1} + \underset{(8.9)}{0.236}\log(P_1/P_3)^e + \underset{(1.0)}{0.123}\log\sigma_{1,3}$$

$$+ (\underset{(3.5)}{0.117} + \underset{(5.3)}{0.146}\log DO_c)\log(P_2Y_2/P) - \underset{(-5.1)}{0.833}\log(DO_c)$$

$$- \underset{(-2.2)}{0.049}\,HI + \underset{(3.4)}{0.201}\,(\beta_1)_{-1};$$

$\bar{R}^2 = 0.77$; D.W. = 1.52.

$$\Gamma_1 = \underset{(6.3)}{19.2} - \underset{(-6.4)}{3.33}\log(k)_{-1} - \underset{(-9.5)}{1.50}\log(P_1/P_3)^e + \underset{(0.3)}{0.234}\log\sigma_{1,3}$$

$$- \underset{(-3.0)}{(0.583} + \underset{(-5.9)}{0.967}\log DO_c)\log(P_2Y_2/P) + \underset{(5.8)}{5.61}\log(DO_c)$$

$$+ \underset{(2.5)}{0.320}HI + \underset{(4.0)}{0.236}(\Gamma_1)_{-1};$$

$\bar{R}^2 = 0.81$; D.W. = 1.37.

$$Y_1 = \exp[\Gamma_1 + \beta_1\log(K_1/L_1) + \log(L_1)].$$

Nonagriculture:

$$\beta_2 = \underset{(0.3)}{0.176} + \underset{(3.4)}{0.211}\log(k)_{-1} + \underset{(8.9)}{0.347}\log(P_2/P_3)^e + \underset{(1.8)}{0.249}\log\sigma_{2,3}$$

$$- \underset{(-1.4)}{(0.092} + \underset{(-1.3)}{0.064}\log DO_c)\log(P_1Y_1/P) + \underset{(1.7)}{0.453}\log(DO_c)$$

$$- \underset{(-2.2)}{0.043}HI + \underset{(2.8)}{0.780}DL + \underset{(0.5)}{0.011}BC + \underset{(2.8)}{(0.129} + \underset{(2.8)}{0.075}DO_c)\log g;$$

$\bar{R}^2 = 0.85$; D.W. = 1.3.

$$\Gamma_2 = \underset{(2.1)}{6.22} - \underset{(-5.3)}{1.73}\log(k)_{-1} - \underset{(-9.2)}{1.93}\log(P_2/P_3)^e - \underset{(-2.0)}{1.51}\log\sigma_{2,3}$$

$$+ \underset{(2.2)}{(0.785} + \underset{(3.3)}{0.315}\log DO_c)\log(P_1Y_1/P) - \underset{(-1.7)}{2.37}\log(DO_c)$$

$$+ \underset{(2.1)}{0.211}HI - \underset{(3.0)}{4.43}DL - \underset{(-1.3)}{0.166}BC - \underset{(-1.0)}{(0.253} + \underset{(-3.3)}{0.457}DO_c)\log g;$$

$\bar{R}^2 = 0.83$; D.W. = 1.4.

$$Y_2 = \exp[(\Gamma_2 + \beta_2\log(K_2/L_2) + \log(L_2)].$$

This block contains four empirical equations and two identities, which explain the production elasticities (β), levels (Γ), and outputs (Y). The exogenous variables are $\sigma_{1,3}$, $\sigma_{2,3}$, HI, k_{-1}, DL, BC, and g. In addition, $(P_1/P_3)^e$, $(P_2/P_3)^e$, and DO_c are determined in the price block and considered here to be exogenous.

Price of Land

$$\log(P_a/P) = \underset{(1.9)}{0.409} + \underset{(2.1)}{0.176}\log r_1 + \underset{(8.2)}{0.963}\log(P_a/P)_{-1} - \underset{(1.8)}{0.207}\log(P_a/P)_{-2};$$

$\bar{R}^2 = 0.72$; D.W. = 1.96.

This equation is needed for the policy simulation. As explained in the text, an equation based on appreciation of land failed to give sensible results. Thus, the above equation, which is a modified AR(2), was used for the simulation.

See the glossary of symbols (Appendix 1) for definitions of the variables. Note that D(x) is the first-difference operator; t-statistics are in parentheses. DC is a dummy variable that takes the value one for census data and zero for annual data. DL is a dummy variable that equals the negative rates of change in the price level and zero otherwise. HI is a dummy variable that equals the inflation rate when its level is more than 50 percent and zero otherwise. BC is a dummy variable that takes the value one in years of bank failures (1931-32 and 1981-82) and zero otherwise.

APPENDIX 3: ESTIMATES OF PRODUCTION FUNCTIONS

This appendix reports two additional estimates of the production functions discussed in Chapter 6 (see Tables 28 and 29).

Table 28—Production functions, estimate 1, 1916-84

Variable	Agriculture		Nonagriculture	
	β_1	Γ_1	β_2	Γ_2
$\bar{R}^2$	0.68	0.73	0.88	0.85
D.W.	1.89	1.74	1.63	1.72
Constant	−1.780 (0.7)	2.486 (1.5)	0.780 (2.0)	0.055 (0)
$\log(y^m)_{-1}$	0.154 (1.8)	−0.743 (1.5)	0.182 (3.9)	−1.232 (5.0)
Output of other sector	0.001 (0)	0.002 (0)	−0.194 (3.5)	1.164 (4.1)
	+ 0.028 $\log DO_c$ (1.1)	−0.194 $\log DO_c$ (1.2)	−0.072 $\log DO_c$ (2.0)	+ 0.319 $\log DO_c$ (1.7)
$\log(P/P_3)$	0.367 (6.4)	−2.323 (7.0)	0.423 (9.9)	−2.311 (10.1)
$\log(P/P_3)_{-1}$	−0.216 (3.2)	1.449 (3.7)	−0.086 (1.8)	0.726 (3.1)
$(\sigma_{1,3})_{-1}$	0.023 (0.2)	−0.490 (0.6)	−0.074 (0.7)	0.061 (0.1)
$\log(DO_c)$	−0.123 (0.8)	0.878 (1.0)	0.477 (2.4)	−2.103 (0.1)
$\log(g)$	...	...	0.080 (1.9)	−0.019 (0.1)
			+ 0.072 $\log DO_c$ (3.2)	−0.334 $\log DO_c$ (2.8)
$D[\log(y^m_{-1})]$	...	−0.011 $\log(L_1)$ (0)	...	0.309 $\log(L_2)$ (1.3)
Lagged dependent variables	0.510 (7.4)	0.533 (8.4)	0.307 (4.4)	0.730 (8.0)

Note: Absolute values of t-ratios are in parentheses.

Table 29—Production functions, estimate 2, 1916-84

Variable	Agriculture		Nonagriculture	
	β_1	Γ_1	β_2	Γ_2
$\bar{R}^2$	0.70	0.75	0.70	0.63
D.W.	1.24	1.10	1.33	1.26
Constant	0.269 (0.8)	0.774 (0.4)	−0.186 (0.2)	6.362 (1.5)
$\log(y^m)_{-1}$	0.174 (1.6)	−1.025 (1.6)	0.222 (2.0)	−1.582 (2.6)
Output of other sector	−0.077 (1.9)	0.613 (2.5)	−0.089 (1.0)	0.955 (1.9)
	$-0.001 \log DO_c^e$ (0.1)	$-0.056 \log DO_c^e$ (0.4)	$-0.121 \log DO_c^e$ (1.8)	$+0.811 \log DO_c^e$ (2.2)
$\log(P_1/P_3)^e$	0.301 (7.8)	−1.900 (8.2)	0.072 (0.9)	−0.402 (0.9)
$(\sigma_{1,3})_{-1}$	0.293 (2.4)	−2.214 (2.9)	0.919 (5.1)	−5.176 (5.1)
$\log(DO_c^e)$	−0.051 (0.4)	0.824 (1.0)	0.598 (1.6)	−3.843 (1.9)
log(g)	...	...	−0.055 (0.7)	0.944 (2.3)
			$+0.031 \log DO_c^e$ (0.8)	$-0.159 \log DO_c^e$ (0.8)
High inflation	0.020 (0.8)	−0.129 (0.9)	−0.047 (1.7)	0.194 (1.3)
Deflation	...	...	1.893 (5.6)	−10.46 (5.5)
Bank failures	...	...	0.025 (0.8)	−0.276 (1.6)
$D[\log(y^m_{-1})]$	...	$-1.609 \log(L_1)$ (1.0)	...	$0.228 \log(L_2)$ (0.7)
Lagged dependent variables	0.240 (4.6)	0.285 (5.3)	...	...

Notes: Absolute values of t-ratios are in parentheses. The superscript e indicates that the variable is computed from the price block.

BIBLIOGRAPHY

Ballesteros, Mario A. 1958. Argentine agriculture, 1908-1954: A study in growth and decline. University of Chicago, Chicago. Mimeo.

Beker, Victor A. 1969. Elasticidades de oferta de la producción agropecuaria: trigo, maiz y carne. *Económica* 15 (May-August): 145-181.

Binswanger, Hans, Yair Mundlak, M.C. Yang, and Alan Bowers. 1985. *Estimation of aggregate agricultural response.* ARU 48. Washington, D.C.: World Bank.

Bird, Richard. 1970. *The growth of government spending in Canada.* Toronto: Canadian Tax Foundation.

Bolsa de Cereales de Buenos Aires. Various years. *Boletín anual.* Buenos Aires: Bolsa de Cereales de Buenos Aires.

Butlin, Noel. 1971. *Some perspectives of Australian economic development, 1860-1965.* New Haven, Conn., U.S.A.: Yale University, Economic Growth Center.

Cavallo, Domingo. 1982. *Volver a crecer.* Buenos Aires: Sudamericana-Planeta.

_____. 1986. Exchange rate overvaluation and agriculture: The case of Argentina. Background paper for *World Development Report, 1986.* New York: Oxford University Press for the World Bank.

_____. 1988. Argentina. In *The open economy: Tools for policymakers in developing countries,* ed. Rudiger Dornbusch and F. Leslie C. H. Helmers. EDI Series in Economic Development. New York: Oxford University Press for the World Bank, 267-284.

Cavallo, Domingo, and Joaquin Cottani. 1986. *The timing and sequencing of trade liberalization policies: The case of Argentina.* Washington D.C.: World Bank.

Cavallo, Domingo, and Raul García. 1985. Políticas macroeconómicas y tipo de cambio real. Paper presented at the Jornadas sobre Economía Monetaria y Sector Externo, Buenos Aires, Banco Central de la República Argentina, July.

Cavallo, Domingo, and Yair Mundlak. 1982. *Agriculture and economic growth: The case of Argentina.* Research Report 36. Washington, D.C.: International Food Policy Research Institute.

_____. 1989. On the nature and implications of factor adjustment—Argentina, 1913-1984. In *Agriculture industry interactions: Social considerations,* ed. I. Adelman and S. Lane. New York: Macmillan.

Coeymans, Juan, and Yair Mundlak. 1987. Agricultural and economic growth: The case of Chile, 1960-1982. International Food Policy Research Institute, Washington, D.C. Mimeo.

de Pablo, Juan C. 1982. Inflation and growth: Lessons from the Argentine experience. In *Trade, stability, technology, and equity in Latin America,* ed. Moshe Syrquin and S. Teitel, 33-49. New York: Academic Press.

Diamand, Marcelo. 1969. Bases para una politica industrial argentina. *Cuadernos del Centro de Estudios Industriales,* 1: 4-9.

———. 1973. *Doctrinas económicas e independencia.* Buenos Aires: Paidos.

Díaz Alejandro, Carlos F. 1965. *Exchange rate devaluation in a semi-industrialized country: The experience of Argentina, 1955-1961.* Cambridge, Mass., U.S.A.: MIT Press.

———. 1970. *Essays on the economic history of the Argentine Republic.* New Haven, Conn., U.S.A.: Yale University Press.

———. 1984. No less than one hundred years of Argentine economic history, plus some comparisons. In *Comparative development perspectives: Essays in honor of Lloyd G. Reynolds,* ed. Gustav Ranis, Robert L. West, M. W. Leiserson, and C. Taft Morris, 328-361. Boulder, Colo., U.S.A.: Westview Press.

Dieguez, Hector L. 1969. *Argentina y Australia: Algunos aspectos de su desarrollo económico comparado.* Buenos Aires: Centro de Investigaciones Económicas, Instituto Torcuato Di Tella.

Di Tella, Guido, and Manuel Zymelman. 1967. *Las etapas del desarrollo económico argentino.* Buenos Aires: European Development Bank.

Dornbusch, Rudiger. 1974. Tariffs and nontraded goods. *Journal of International Economics* 4: 177-185.

———. 1987. Exchange rate economics. *Economic Journal* (97): 1-18.

Edwards, Sebastian. 1988. Real monetary determinants of real exchange rate behavior: Theory and evidence from developing countries. *Journal of Economic Development* (29): 311-342.

Felix, David. 1971. Import substitution and industrial exporting: An analysis of recent Argentine experience. Paper presented at the 21st Conferencia Anual Latinoamericana, University of Florida, February 1971.

Fernández, Roque, F. Mondolfo, and Carlos Rodríguez. 1985. Un panorama de la política comercial argentina. Working Paper 47. Centro de Estudios Macroeconómicos de Argentina, Buenos Aires.

Ferrer, Aldo. 1963. *La economía argentina: Las etapas de su desarrollo y problemas actuales.* Mexico City: Fondo de Cultura Económica.

———. 1979. *Crisis y alternativas de la política económica argentina.* Mexico City: Fondo de Cultura Económica.

Ferrer, Aldo, and E. L. Wheelwright. 1966. *Industrialización en la Argentina y Australia: Estudio comparativo.* Buenos Aires: Instituto Torcuato Di Tella.

Fienup, Darrel F., Russell H. Brannon, and Fender A. Fender. 1967. *Argentina: The sleeping giant. A study of the problems and opportunities of its agriculture.* New York: The Ford Foundation.

———. 1969. *The agricultural development of Argentina: A policy and development perspective.* New York: Praeger.

Firestone, O. J. 1958. *Canada's economic development, 1867-1953.* Vol.7, *Income and wealth* series. London: Bowes and Bowes.

Freire, Remy. 1966. *Price incentives in Argentine agriculture.* Cambridge, Mass., U.S.A.: Harvard Development Advisory Service.

Frigerio, Octavio. 1977. *Opulencia y subdesarrollo: Antagonismo y superacion.* Buenos Aires: Editorial Crisol.

Frigerio, Rogelio. 1961. *Nacionalismo, potencias industriales y subdesarrollo.* Buenos Aires: Editorial Concordia.

Gerchunoff, Pablo, and Juan J. Llach. 1979. La polémica sobre la industrialización argentina. *Criterio* 1807, March 8.

Gluck, Susana. 1979. Reseña de estimaciones de oferta agrícola pampeana. *Ensayos Económicos, Banco Central de la República Argentina* (No. 10): 35-84.

Humphrey, David B. 1969. Changes in protection and inflation in Argentina, 1953-1966. *Oxford Economic Papers* 21 (July).

IEERAL (Instituto de Estudios Economicos sobre la Realidad Argentina y Latinoamericana). 1986. Estadísticas de la evolución económica de Argentina, 1913-1984. *Estudios* (No. 39).

IMF (International Monetary Fund). 1987. *International financial statistics.* Washington D.C.: IMF.

Jarvis, Lovell S. 1968. The sources of manufacturing growth in Australia and Argentina in the period 1946-1960. *Economic Record* 44.

———. 1969. Supply response in the cattle industry: The Argentine case, 1937-38/1966-67. Ph.D. diss., Massachusetts Institute of Technology, Cambridge, Mass., U.S.A.

Llach, Juan J. 1987. Reconstrucción o estancamiento. Editorial thesis, Buenos Aires.

Mallon, Richard, and Juan Sourrouille. 1975. *Economic policymaking in a conflict society.* Cambridge, Mass., U.S.A.: Harvard University Press.

Martínez de Hoz, José A. 1967. *La agricultura y la ganadería argentina en el periodo 1930-1960.* Buenos Aires: Sudamericana.

Mundlak, Yair. 1979. *Intersectoral factor mobility and agricultural growth.* Research Report 6. Washington, D.C.: International Food Policy Research Institute.

———. 1986a. Agriculture and economic growth: Theory and measurement. Lecture notes. University of Chicago, Chicago. Mimeo.

———. 1986b. Agricultural growth and the price of food. In *Agriculture in a turbulent world economy,* ed. Allen Maunder and U. Renborg. Aldershot, England: Gower Publishing Co.

———. 1987. Endogenous technology and the measurement of productivity. In *Agricultural productivity: Measurement and explanation,* ed. S. M. Capalbo and J. M. Antle. Washington, D.C.: Resources for the Future.

———. 1988. Capital accumulation, the choice of techniques and agricultural output. In *Agricultural Price Policy for Developing Countries,* ed. John W. Mellor and

Raisuddin Ahmed, 171-189. Baltimore, Md., U.S.A.: Johns Hopkins University Press for the International Food Policy Research Institute.

_____. 1989. *Sources of input variations and the (in)efficiency of dual empirical production functions.* Rehovot, Israel: Center for Agricultural Economic Research.

Mundlak, Yair, and Rene Hellinghausen. 1982. The intercountry agricultural production function: Another view. *American Journal of Agricultural Economics* 64 (November): 664-672.

Mundlak, Yair, Domingo Cavallo, and Roberto Domenech. 1987. Effects of trade and macroeconomic policies in agriculture and economic growth: Argentina, 1913-84. Paper presented at the International Food Policy Research Institute Workshop on "Trade and Macroeconomic Policies: Impact on Agricultural Growth," Annapolis, Md., U.S.A., May 1987, and at the Econometric Society meeting in São Paulo, August 1987.

Nogues, Julio. 1988. La economía politica del proteccionismo y la liberalización en la Argentina. *Desarrollo Económico* 28 (No. 110): 159-182.

Otrera, Wylian T. 1966. Un modelo econométrico para analizar las exportaciones potenciales de carne argentina. Ph.D. diss., Texas A & M University, College Station, Texas, U.S.A.

Pinedo, Federico. 1961. *Siglo y medio de economía argentina.* Mexico City: Centro de Estudios Monetarios Latino-Americanos.

Piñeiro, M. E. 1968. Argentine agriculture: Past and potential contributions to countrywide economic growth Ph.D. diss., University of California, Davis, Calif., U.S.A.

Reca, Lucio G. 1967. The price and production duality within Argentine agriculture, 1923-1965. Ph.D. diss., University of Chicago, Chicago.

_____. 1969. Determinantes de la oferta agropecuaria en la Argentina, 1934-1935/1966-1967. *Instituto de Investigaciones Económicas y Financieras, Confederación General Económica: Estudios sobre la economía argentina* 5 (August).

Rodríguez, Carlos, and Larry Sjaastad. 1979. *El atraso cambiario en Argentina: Mito o realidad?* Buenos Aires: Centro de Estudios Macroeconómicos de Argentina.

Schwartz, Hugh H. 1968. The Argentine experience with industrial credit and protection incentives, 1943-1958. *Yale Economic Essays* 8.

Sigaut, Lorenzo J. 1964. Desarrollo agropecuario y proceso de industrialización en la economía argentina. Oficina de Estudios para la Colaboración Económica Internacional, Buenos Aires.

Smithies, Arthur. 1965. Economic growth: International comparisons, Argentina and Australia. *American Economic Review, Paper Proceedings* 55 (1st part).

Snape, Richard H. 1989. Real exchange rates, real interest rates, and agriculture. In *Agriculture and governments in an interdependent world,* ed. Allen Maunder and Alberto Valdés. Proceedings of the Twentieth International Conference of Agricultural Economists. Aldershot, England: Gower Publishing Co.

Sturzenneger, Adolfo C., and Beatriz Martínez Mosquera. 1985. Tipo de cambio real de equilibrio, sesgo anticomercio y precios relativos, Argentina, 1960-1984. Paper presented at Jornadas de Economía Monetaria y Sector Externo, Banco Central de la República Argentina, November.

Todaro, Michael. 1969. A model of labor migration and urban unemployment in less developed countries. *American Economic Review* 59 (No. 1).

U. S. Bureau of the Census. 1960. *Historical statistics of the United States, colonial times to 1957.* Washington, D.C.: GPO.

U. S. Department of Agriculture. Various years. *Annual report.* Washington, D.C.: USDA.

Valdés, Alberto. 1986. Exchange rates and trade policy: Help or hindrance to agricultural growth? In *Agriculture in a turbulent world economy,* ed. Allen Maunder and U. Renborg, 624-632. Proceedings of the 19th International Conference of Agricultural Economists. Aldershot, England: Gower Publishing Co.

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