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RESEARCH REPORT

EFFECTS OF EXCHANGE RATE AND TRADE POLICIES ON AGRICULTURE IN PAKISTAN

Paul Dorosh
Alberto Valdés

December 1990

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CONTENTS

Foreword

1. Summary 9

2. Introduction 12

3. Trade Policy in Pakistan 15

4. Effective Exchange Rates for Imports and Exports 23

5. The Real Exchange Rate 30

6. Effects of Trade and Exchange Rate Policies on Agricultural Prices 44

7. Modeling the Real Effects of Price Changes 58

8. Real Effects of Changes in Price Incentives: Simulation Results 67

9. Conclusions 83

Appendix 1: Supplementary Tables 86

Appendix 2: Method for Calculating Nominal Rates of Protection of Agricultural Commodities in Pakistan 91

Appendix 3: Methodology for Effective Rates of Protection 97

Appendix 4: Modeling World Demand for Basmati Rice 100

Appendix 5: Simulation Results 102

References 111

Digitized by Google

TABLES

1. Importance of agriculture in Pakistan, selected years 12
2. Production of the main agricultural commodities and shares of agricultural value added, selected years 13
3. Effective protection rates on manufactured goods as estimated in three studies, selected years 19
4. Effective protection rates on individual products, selected years 20
5. Equivalent tariff calculations, 1980/81 25
6. Average import taxes and equivalent import tariffs, 1977-87 26
7. Real exchange rate regressions, full-period sample, quarterly data, 1960-87 35
8. Real exchange rate regressions, reduced sample, quarterly data, 1972-87 36
9. Calculation of the equilibrium real exchange rate using the omega approach, 1960-87 38
10. Equilibrium exchange rates using an elasticities approach, 1960-87 41
11. Equilibrium nominal exchange rates and purchasing power parity, 1960-87 42
12. Direct and total nominal protection rates to producers of agricultural commodities, 1961-87 47
13. Measures of direct and total effective rates of protection to agricultural producers, 1961-87 56
14. Coefficients of variation of producer prices, 1961-87 57
15. Direct and total effects of trade and exchange rate policies on agricultural production and consumption, 1961-71 and 1972-87 69
16. Direct and total effects of trade and exchange rate policies on agricultural trade, 1961-71 and 1972-87 70
17. Effects on agricultural income of simulated policy changes, 1961-87 71
18. Effects of simulated policy changes on the balance of trade and on world basmati rice prices, 1961-87 72
19. Net transfer to agriculture from direct price and nonprice-related transfers for five commodities, based on model simulations, 1973-87 74
20. Net transfer to agriculture from direct and indirect price and nonprice-related transfers, adapted from Nabi, Hamid, and Nasim (1987), 1973-87 75
21. Net transfer to agriculture from direct and indirect price and nonprice-related transfers, adapted from Qureshi (1988) for five commodities, 1973-87 76
22. Output price intervention effects based on three estimations, 1973-87 78
23. Net transfer to agriculture from direct and indirect price and nonprice-related transfers for five commodities, based on model simulations, 1973-87 79

Digitized by Google

ILLUSTRATIONS

24. Estimates of transfers into and out of agriculture, based on Nabi, Hamid, and Nasim (1988), 1960-87 80
25. Direct and total price and non-price-related transfers as a percentage of GDP, for five commodites, 1973-87 81
26. Tariffs and effective exchange rates, 1960-87 86
27. Equivalent tariff calculations, 1963/64 87
28. Equilibrium exchange rates using a modified elasticities approach, 1960-87 88
29. Domestic supply (area and yield) elasticities 89
30. Price and income elasticities of demand 90
31. Indices used in computing border prices for specific commodities, 1961-88 92
32. Indices of nonagricultural prices, 1961-87 99
33. Data used in the regression on world demand for basmati rice, 1972-87 101
34. Agricultural production (simulation 1) 102
35. Consumer prices, consumption, and trade (simulation 1) 104
36. Agricultural production (simulation 2) 106
37. Consumer prices, consumption, and trade (simulation 2) 108

1. Import quotas and equivalent import tariffs 24
2. Overall trade policy bias, 1960-87 27
3. Devaluation episodes and evolution of effective exchange rates, 1960-87 28
4. Real effective exchange rate indices, 1960-87 31
5. Nominal exchange rates, 1960-87 39
6. Equilibrium exchange rates, 1960-87 43
7. Wheat prices, 1961-87 48
8. Basmati rice (paddy) prices, 1961-87 49
9. Ordinary rice (paddy) prices, 1961-87 50
10. Seed cotton prices, 1961-87 51
11. Vegetable oil prices, 1961-87 52
12. Sugarcane prices, 1961-87 53
13. Maize prices, 1961-87 54
14. Fertilizer prices, 1961-87 55

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FOREWORD

This report on Pakistan is one of a series of country studies undertaken by the International Trade and Food Security Program at IFPRI on trade and macroeconomic policies. Other studies in this series include research reports on Colombia, Argentina, Nigeria, Zaire, and the Philippines, and collaborative work with the World Bank on this topic in several other countries in Asia, Africa, and Latin America.

The findings from this research have vividly shown the need to analyze the effects of policy interventions in agriculture in developing countries in an economy-wide framework. There is now an overwhelming body of evidence showing that trade and exchange rate policies have, in most countries, had a far greater impact, generally adverse, on agricultural incentives than policies that are specific to agriculture. Through their influence on incentives vis-à-vis the nonfarm sector, these indirect and usually implicit price interventions influence private investment and labor employment in agriculture and induce substantial income transfers from agriculture to the rest of the economy.

This research report examines the Pakistan experience from the early 1960s until 1987. It attempts to quantify the effects on the agricultural sector of both sectoral policy interventions and the indirect effect of economy-wide trade and macroeconomic policies. The empirical findings are analyzed in a broad policy context, and the authors draw some implications for development strategy in Pakistan.

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SUMMARY

Although price policies play an important role in determining returns to agriculture, trade and macroeconomic policies can also have a large impact on the agricultural sector. By changing the relative prices of importables, exportables, and home goods, trade and exchange rate policies alter the structure of incentives throughout the economy. The indirect effects on agriculture can be especially pronounced, since many major agricultural commodities are internationally tradable goods.

These issues are particularly important for Pakistan, where the share of agriculture in gross domestic product (GDP) remains high, and about half of the labor force is employed in agriculture. Further growth in the agricultural sector is crucial for overall economic development and to improve the welfare of many of the poorest people in Pakistan. Moreover, as the Pakistan government seeks new revenue sources to ease its budgetary problems, increased explicit taxation of the large agricultural sector has become a serious option.

This study, based on a framework devised for an earlier work, attempts to quantify both the "direct effects" of agricultural policy interventions (such as commodity-specific trade taxes, guaranteed producer prices, and input subsidies) and the indirect effects of economy-wide trade and macroeconomic policies (which influence the real exchange rate) on the agricultural sector.

From an examination of the goals and instruments of trade policies in Pakistan, it is evident that, for the most part, import quotas rather than import taxes have determined the structure of protection; the major purpose of tariffs, when these were applied, was to raise revenues. Measures of effective rates of protection (as constructed in other studies) show wide variance across industries, although in general trade policy has had a distinct import substitution bias. The antiexport bias was partially reduced for selected industries by granting export subsidies. Generally, export subsidies went to existing industries with strong lobbies, such as the textile industry. As a result, growth of nontraditional exports suffered.

Implicit import tariffs on the principal importables—manufactured goods, fertilizers, wheat, and vegetable oils (ghee)—were 130 to 220 percent in the 1960s and 40 to 55 percent from the mid-1970s to 1987. Implicit export subsidies—on raw cotton, cotton yarn, cotton textiles, basmati rice, and petroleum—have been 5 percent or less since the mid-1970s. Thus effective exchange rates for imports (equal to the official exchange rate adjusted for implicit import taxes) have consistently been 50 to 60 percent higher than effective exchange rates for exports.

A trade policy bias toward importables leads to an appreciation of the real exchange rate (that is, a decrease in the ratio of the domestic price of traded goods to nontradables). The real exchange rate appreciates because tariffs on imports raise the domestic prices of import goods so that demand shifts toward nontraded goods, raising their prices. Prices of goods for which there is no protection, such as exportables and many agricultural importables, remain unchanged. But relative to the prices of protected imports or nontraded goods, the prices of unprotected traded goods fall.

Regression analysis indicates that the trade policy bias toward importables has resulted in a real exchange rate appreciation of approximately 18 to 20 percent since the mid-1970s. Despite some depreciation of the nominal exchange rate since 1982,

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quantitative restrictions on imports have remained in place and in 1987 resulted in a high implicit tariff on imports of 47 percent and an appreciation of the real exchange rate of 26 percent. Thus border prices of traded goods were reduced by the same percentage.

Appreciation of the real exchange rate (the negative indirect effect of trade and macroeconomic policies) has reduced and sometimes reversed the protection provided by agricultural trade policies (positive direct effects) for some commodities. During the 1960s, the overvaluation of the rupee, which lowered the border prices of all traded goods, outweighed the protection provided by direct trade policies (calculated using the official exchange rate) for wheat, ordinary rice, and cotton and increased the taxation of basmati rice.

From 1972 to 1987, direct taxation of agricultural exportables (averaging −15 percent) was reinforced by indirect taxation (for a total of −38 percent). In contrast, the average for the direct and total protection of import-competing products was positive, although the indirect effects reduced this protection from 48 percent to 7 percent during 1972-87. However, this positive average for importables masks the difference between high protection of sugar and milk and considerable taxation of wheat and vegetable oil. Estimates of effective protection, which compare value added calculated using border and actual prices, indicate approximately the same patterns of protection as do the nominal measures, which compare border and actual output prices.

A model of the real effects of changes in agricultural prices is introduced, and results of two model simulations are given, with domestic prices of agricultural products determined using (1) border prices measured at the official exchange rate, and (2) border prices with an adjustment in the real exchange rates. The model simulations show that because Pakistan's major agricultural products (wheat, basmati and ordinary rice, cotton, and sugar) were consistently taxed between the 1960s and the early 1980s, production of these crops suffered. Due to the combined effect of trade and exchange rate policies and agricultural price policies, wheat production was 24 percent lower and basmati rice 52 percent lower in the 1983-87 period than they would have been with no government intervention. Without price interventions—either direct or indirect—farm incomes from these five major crops would have been 40 percent higher during the same period.

Transfers out of agriculture due to direct and indirect price policies averaged, for the five major crops, 25 billion rupees (Rs) per year during 1978-87, about 36 percent of agricultural value added. This implicit tax on agriculture was about nine times the actual net subsidies to producers (both budgetary and off-budget) and more than three times public expenditures on research, extension, and infrastructure for agriculture (about Rs 7 billion per year during 1978-87). Thus, the net effect of price- and nonprice-related income transfers for the five major crops is estimated to be a transfer out of agriculture of approximately 25 percent of agricultural GDP during that period.

Government intervention in agricultural markets also had some positive effects. Domestic producer prices of all major agricultural commodities except vegetable oil and fertilizer were less variable than border prices evaluated at either the official or the simulated free-trade equilibrium exchange rate. The large dairy sector greatly benefited from protection from milk imports, and all consumers faced more stable food prices.

Given the inherent limitations of most agricultural supply models, including this one, in capturing fully the interdependence between sectors (arising from investment behavior, labor and capital flows, and other factors), the output response predicted here should be considered very preliminary. Moreover, the model simulations assume no change in public investment in agriculture and rural infrastructure, compared with historical levels. Finally, the simulations in the scenario modeling free trade with and

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without real exchange rate adjustments are *not* meant to be taken as policy recommendations. They merely reflect the purpose of the study: to assess the effects on agriculture of government macroeconomic and sectoral price interventions, holding other factors (including public investment) constant.

There may be some scope for increasing the direct taxation of agriculture, particularly if indirect taxes on agriculture arising from trade and exchange rate policies are reduced (for example, by reducing import restrictions in the nonagricultural sector). The indirect taxes on agriculture computed in this study are not paid to the government but accrue mostly to other sectors of the economy and to consumers. In theory, it would be possible to levy direct taxes on agriculture in conjunction with changes in trade and exchange rate policies that reduce the indirect taxation of agriculture so that agricultural incomes would be unchanged. In practice, direct taxation of agriculture is made difficult by problems in measuring agricultural incomes, valuation of land, and tax avoidance.

Although this study is not meant to be an analysis of fiscal and trade policy options in Pakistan, it shows that the indirect effects of trade and exchange rate policies on agricultural producer prices are large and have persisted for more than two decades for several major commodities. These indirect effects are too large to be ignored and should be taken into account in the design of future agricultural pricing policy and taxation in Pakistan.

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INTRODUCTION

Agricultural price policies play an important role in determining prices, but a sectoral policy focus can miss important linkages between economy-wide policies (trade and macroeconomic policies) and the agricultural sector. By changing the relative prices of importables, exportables, and home goods, trade and exchange rate policies have effects far wider than the balance of trade or incomes for exporters and importers. The indirect effects on agriculture can be especially pronounced since many agricultural commodities are traded goods.

These issues are particularly important for Pakistan, a country of 104 million people in 1988, which has enjoyed steady economic growth for nearly three decades. From 1960 to 1988, the growth of real GDP averaged 6.0 percent per year, while agricultural GDP increased an average of 3.7 percent per year. Public investments in irrigation and the introduction of high-yielding varieties (HYVs) of wheat, rice, and cotton were major factors underlying the growth in agricultural output. Though the share of agriculture in GDP fell as the country's economy developed, agricultural value added still accounted for 23 percent of GDP in 1988 (down from 46 percent in 1960) (Table 1). Moreover, the share of the labor force employed in agriculture did not decline as precipitously, so that agriculture still employs more than half of the labor force.

Most of the major agricultural commodities in Pakistan are tradable goods. Wheat, a major staple food, accounted for about 20 percent of agricultural value added in 1987 (Table 2), with wheat imports supplying about 6 percent of total domestic availability from 1983 to 1987. Raw cotton, cotton yarn, and cotton cloth are Pakistan's leading exports; together they accounted for 35 percent of export earnings in 1987. Basmati rice (a high-valued aromatic rice) and other rice are important food staples; rice exports represented 8 percent of total export earnings in 1987. Sugar and milk are neither exported nor imported in large quantities by Pakistan, though both commodities are widely traded internationally. Milk is especially important in Pakistan's rural economy: the value of milk production was equal to 28 percent of agricultural GDP in 1987.

Table 1—Importance of agriculture in Pakistan, selected years

Year	Share of GDP	Share of Employment	Value of Agricultural Exports	Share of Agricultural Exports in Foreign Exchange Earnings	Share of Agricultural Exports in Total Exports	Value of Agricultural Imports
	(percent)		(US$ million)	(percent)		(US$ million)
1959/60	45.83	n.a.	71	44.38	44.38	102
1971/72	36.02	57.32	234	39.53	39.53	93
1979/80	29.57	52.67	775	18.30	33.12	433
1987/88	23.29	51.15	1,010	16.69	28.89	674

Source: Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).
Note: Exports include rice, hides and skins, raw cotton, and tobacco. n.a. means not available.

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Table 2—Production of the main agricultural commodities and shares of agricultural value added, selected years

Commodity	1960/61		1970/71		1979/80		1986/87	
	Production	Share	Production	Share	Production	Share	Production	Share
	(1,000 metric tons)	(percent)	(1,000 metric tons)	(percent)	(1,000 metric tons)	(percent)	(1,000 metric tons)	(percent)
Wheat	3,814	20.47	6,890	17.50	10,857	21.83	14,251	19.80
Basmati rice	284	1.07	371	1.00	887	2.29	1,056	1.87
Other rice	730	2.63	1,848	3.56	2,329	3.01	2,464	2.27
Cotton	301	3.26	707	5.10	728	4.33	1,327	4.26
Milk	6,410	39.80	7,800	30.66	9,075	29.53	12,198	27.97
Sugarcane	11,641	7.85	19,963	7.51	23,498	7.09	29,793	6.10

Source: Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).
Note: The percentages indicate the share of a commodity's production in agricultural value added.

Further growth in the agricultural sector is crucial for overall economic development and to improve the welfare of many of the poorest groups in Pakistan. Yet as the Pakistan government seeks new revenue sources to ease its budgetary problems, increased explicit taxation of the large agricultural sector has become a serious option. While this study is not meant as an analysis of fiscal policy, the actual level of indirect taxation of agriculture through appreciation of the real exchange rate should be considered an extremely relevant element for the policy debate.

This study examines the effects of trade and exchange rate policies on domestic relative prices and agricultural output, consumption, and income transfers in Pakistan. This is a first step toward analyzing the effects of agricultural and economy-wide policies on agricultural growth and rural income. Trade taxes and restrictions on agricultural goods directly affect the prices of these goods. What is less obvious is that import taxes and tariffs designed to protect other sectors of the economy have an effect on the equilibrium real exchange rate and thus affect the prices of all traded goods in the economy, including agricultural goods.

In Pakistan, the large depreciation of the rupee from Rs 9.90 to more than Rs 17.00 per US$1.00 between 1981 and 1987 and the absence of a sizable black market foreign exchange premium have led many observers to conclude that Pakistan's real exchange rate is at or near equilibrium. To the extent that other macroeconomic and trade policies, levels of capital inflow, and world market conditions are unchanged, this observation may be correct. In this report, however, it is argued that the removal of trade taxes and quantitative restrictions would result in a further depreciation of the real exchange rate; thus these trade restrictions (which for the most part result in protection of domestic industry) result in lower domestic prices for other traded goods and, in particular, for all exportables and for most agricultural commodities.

In addressing these issues, this study follows the framework of Krueger, Schiff, and Valdés (1988), and Valdés, Hurtado, and Muchnik (1989) in its approach to analyzing the effects of agricultural price policies (direct effects) and trade and exchange rate policies (indirect effects) on agriculture. Nabi, Hamid, and Nasim (1987) first applied the approach of Krueger, Schiff, and Valdés to Pakistan, and their work provides a valuable foundation for the empirical analysis. This study extends their work in several areas.

In estimating the levels of overall protection, price indices are used to construct a series of implicit import tariffs and export subsidies closer to Carlos Diaz-Alejandro's (1982) method of estimating the trade bias than to Sjaastad's (1980) approach, which

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estimates the uniform equivalent tariff used in several recent studies. Equilibrium real exchange rates are calculated using a reduced form real exchange rate regression, and these rates are then compared with results from calculating equilibrium exchange rates based on export supply and import demand elasticities and from the purchasing power parity approach.

The commodity coverage has also been extended in this study to include 12 subsectors of agriculture in Pakistan. Finally, the real effects of price policy are modeled in a more detailed manner. Prices of nontraded agricultural goods (such as pulses, meat, sorghum, and millet) are determined endogenously. The extent and direction of trade (imports, exports, or no trade) of other goods are also determined endogenously. Income effects on demand and world prices of basmati rice are incorporated in the analysis.

This report is structured into nine chapters. First, the goals and instruments of trade policy in Pakistan are examined in Chapter 3. This chapter is based on a background paper prepared for this project by Kemal (1988). Effects of trade policies in terms of effective rates of protection for broad categories of industry are also discussed. Chapter 4 focuses on the nominal exchange rate and trade policies in Pakistan and presents measures of overall trade bias (implicit import tariffs and export taxes) and effective exchange rates for imports and exports. Chapter 5 examines historical movements in Pakistan's real exchange rate. Determinants of the real exchange rate are discussed with particular attention paid to the influence of trade policies. Results of a regression analysis are used to construct a time series of equilibrium real exchange rates and the results compared with estimates using the elasticities approach and simple purchasing power parity. Chapter 6 presents calculations of nominal and effective rates of protection for agricultural commodities in Pakistan (the direct trade effects) and compares these with measures of the total effective rates of protection that incorporate the total effects of trade and exchange rate policies on output prices and value added.

In Chapter 7, a model of the effects of changes in prices on agricultural production, consumption, and trade is introduced. Results of two model simulations (free trade in agricultural products and free trade with an adjustment in the real exchange rate) are presented in Chapter 8. This section also includes estimates of the total net income transfers from agriculture due to exchange rate, trade, and pricing policies. Chapter 9 contains the conclusions of the study.

Details on the methodology used to estimate the border prices of agricultural commodities and the price indices for nonagricultural goods are presented in Appendixes 2 and 3 respectively. These appendixes, which supplement Chapter 4, calculate the nominal and effective rates of protection of major crops. Appendix 4 presents the results from a regression on the demand for basmati rice and Appendix 5 presents additional results of the simulations.

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3

TRADE POLICY IN PAKISTAN

Trade policy in Pakistan has been designed to achieve three sometimes conflicting objectives: to contain the trade deficit within manageable limits, to ensure adequate availability of essential goods, and to direct investment and production to the sectors that accord with national priorities.[1] In attempting to achieve the first objective (limiting the trade deficit), Pakistani governments have relied more on restriction of imports than on promotion of exports. The objective of providing adequate supplies of essential goods has been implemented by allocating import licenses, lowering import duties, and restricting exports of these goods. However, trade policy has failed to meet the third objective. Instead, the structure of protection resulting from trade policy discriminates against essential agricultural goods, while favoring certain nonessential manufactured goods.

In this chapter the objectives, instruments, and effects of trade policy in Pakistan are summarized. First, the history of Pakistan's trade policy is briefly described. Then effective rates of protection for agriculture and manufacturing industries are reported along with effective exchange rates for major importable and exportable subsectors. Finally, the interrelationship between policy objectives, policy instruments, and the results is examined.

An Historical Overview

Increasing Government Controls on Trade: 1952-59

Although Pakistan chose not to devalue the rupee in 1949 along with other countries in the sterling area, the country was able until 1952 to pursue a liberal import policy because the Korean war commodity boom resulted in a large increase in demand for Pakistan's major export commodities, cotton and jute. Under the Open General Licensing (OGL) System, import licenses could be obtained to import any product.

After the Korean war, however, demand for Pakistani products slumped, and foreign exchange earnings declined sharply. The government resorted to import controls but delayed the decision to devalue the rupee until 1956. Import licenses were awarded for imports of capital and intermediate goods to those who had obtained sanctions from the government for setting up industries. Import licenses also were distributed to "category holders" (traders who had imported under the OGL system) in the proportion of their imports in 1951/52. The latter licenses were used mainly for consumer goods. Since, at the prevailing prices, the demand for both consumer goods and intermediate goods far exceeded their supplies, a black market in licenses developed on a massive scale.

At the same time, cotton and jute exports were subjected to export duties, and there was a ban on exports of most other agricultural goods. Inadequate price incentives contributed to a decline in the real value of total exports from US$336 million in 1952/53 to US$95 million in 1958/59 (both in 1960 dollars).

[1] This chapter is based on a background working paper (Kemal 1988) written for this project.

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Beginnings of Liberalization through Multiple Exchange Rates: 1959-72

While various schemes were set up to restrict imports and allocate import licenses, export taxes were gradually reduced and eventually eliminated, and exports were encouraged through various incentives. Most important was the export bonus scheme, introduced in 1959, under which exporters of manufactured products were awarded export bonus vouchers at different rates (different percentages of f.o.b. values) depending on the stage of processing. These bonus vouchers could then be used to purchase otherwise restricted items from the import "bonus list." Bonus rates were 20 percent for intermediate goods and 30 percent for finished goods in the early 1960s. By the mid-1960s, the bonus rates were raised to 30 and 40 percent of the f.o.b. value.

The bonus export scheme brought about an effective devaluation of the exchange rate for exports receiving bonus vouchers and for imports purchased with bonus vouchers. The landed cost of some imported products (equal to the c.i.f. value plus the value of vouchers plus import taxes) reached four times the c.i.f. value.

Increased availability of foreign exchange through foreign aid and a greater willingness to rely on market mechanisms rather than administrative controls led to an easing of quantitative import restrictions during this period. The licensing system in place at the start of this period created substantial profits (economic rents) for both industrial and commercial license holders because demand for imports far exceeded the supply limited by licenses. Domestic prices of imported goods rose substantially above the cost of imports at the point of entry (Alamgir 1968; Pal 1964).

The OGL system was reintroduced in 1961 with the hope that it would break the monopoly on imports held by "category holders" (established traders). However, because total imports remained constrained and the share of licenses purchased by new importers was less than 10 percent of total imports, substantial profits for importers were only slightly less concentrated than under the old system (Naqvi 1964).

Later, in 1964, a "free list" of goods that could be imported without an import license was introduced, but after the 1965 war with India the number of commodities on the free list was drastically reduced.

Postdevaluation Period: 1972-76

By 1971 bonus vouchers issued against exports were as high as 35 percent of the export proceeds, and goods imported under bonus voucher schemes accounted for almost 40 percent of total imports. The bonus voucher scheme was finally abolished when the rupee was devalued by 131 percent in May 1972 from Rs 4.76 to US$1.00 to Rs 11.00 to US$1.00. (Subsequently, when the dollar was devalued against all other currencies, the new par value of the rupee was fixed at Rs 9.9 to US$1.00 in March 1973.)

Along with the devaluation of the rupee in 1972 and the end of the bonus export scheme, there were other major changes in import and export policies. Import licensing was simplified; all the permissible imports were placed on either the free list (which now consisted of goods that could be imported from any source once an import license was obtained) and the "tied list" (which consisted of goods that could be imported from specified countries or by the public sector only). Goods not on either list were banned. Import duties were also reduced on intermediate and capital goods. However, imports of consumer goods, especially certain luxury items, were either banned or taxed at high rates.

All export subsidies except tax rebates and export financing were withdrawn. Instead export duties were imposed on a number of products including raw cotton,

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cotton yarn, and cotton fabrics. Later in the period, the reduction and finally the elimination of export duties on various products helped to unify the exchange rate for exports.

Renewal of Balance-of-Trade Problems: 1978-82

Pakistan maintained a constant nominal exchange rate throughout the 1970s, while domestic inflation exceeded world price inflation and the rupee appreciated in real terms. Instead of devaluation of the rupee, the government resorted to export subsidies and quantitative restrictions on imports to manage the balance of trade. Although the number of products on the free list changed little, licensing procedures were tightened. Different duty rates were imposed for commercial and industrial users, and the Raw Material Replenishment Scheme (RMR) was introduced to provide exporters with access to raw materials, including some that were otherwise banned.

Subsidies on selected, mostly traditional exports also were provided through compensatory rebates. The rebates were provided on a number of products at rates ranging from 7.5 to 12.5 percent of f.o.b. value. The rebates were justified on the basis that exporters were allowed tax withdrawals on imported intermediate inputs, but they were not being compensated for duties on capital equipment, higher construction costs, and higher prices of other inputs that are import substitutes. However, the differences in compensatory rebates across commodities did not correspond to the weight of imported (or import substitute) inputs in value of output.

Managed Float of the Rupee: 1982-88

In January 1982, the rupee was delinked from the dollar and the Pakistani government adopted a managed float exchange rate policy. Along with the gradual depreciation of the rupee came a liberalization of imports. Import bans were lifted from 122 products in 1983, and in place of lists specifying which goods could be imported, a "negative list" (of banned imports) was introduced. A tied list of goods that could be imported only from specified countries or by specified users (the public sector) was also created. In 1987/88, 124 products and in 1988/89, 162 products were removed from the negative list.

In 1988/89, the negative list consisted of 1) items banned for religious or security reasons, 2) luxury consumer goods, and 3) items banned to protect selected industries. It should be noted that most of the items banned to protect domestic industries were already subject to prohibitive import duties so that the ban did not constitute an increase in industrial protection.

The Structure of Protection

Trade policy in Pakistan has had a distinct bias toward protecting manufactured goods in the domestic market and promoting them through export subsidies in external markets. Imports of manufactured goods have been restricted through tariffs, quotas, and bans, and exports of manufactured goods have been subsidized through various export promotion schemes. But exports of some agricultural goods (such as cotton and rice) have at times been explicitly taxed, while exports of other goods (such as wheat) have been banned.[2]

[2] Given Pakistan's monopoly on exports of basmati rice, an argument can be made for an optional export tax to maximize the value of exports.

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A number of studies have been done in Pakistan to determine effective rates of protection for manufacturing industries. Soligo and Stern (1965) measured effective rates of protection for 1963/64, but their estimates overstated true effective rates of protection for some industries for which tariffs were redundant. For certain other industries, for which quantitative restrictions were binding (so that domestic prices were higher than world prices adjusted for actual tariffs), their estimates of effective rates of protection were too low.

Lewis and Guisinger (1969) included the effects of quantitative restrictions in their calculations of effective rates of protection for 1963/64 by using comparisons of actual domestic and world prices instead of tariff rate schedules. Subsequent studies by Kemal (1978) for Punjab province alone in 1968/69 and Naqvi and Kemal (1983b) also used comparisons of actual prices in their estimates.

Table 3 presents the effective rates of protection for broad industrial categories from the Lewis and Guisinger (1969), Kemal (1978), and Naqvi and Kemal (1983b) studies. The studies are not strictly comparable because Lewis and Guisinger (1968) used aggregated input-output table data and the other two studies used disaggregated survey data from the Census of Manufacturing Industries (Kemal 1978) or their own survey (Naqvi and Kemal 1983b). The effective rates of protection shown therefore are only suggestive of the actual trends.

The estimates of average effective rates of protection in Table 3 show a sharp decline from 271 percent in 1963/64 to 66 percent in 1980/81. However, at least a part of the fall in protection rates is illusory because the protection rates in 1963/64 and 1968/69 are overstated, since no correction was made for the overvaluation of the exchange rate in the 1960s. If it is assumed that the equilibrium exchange rate was 50 percent higher than the official rate in 1963/64,[3] the corrected average effective rate of protection in 1963/64 would be about 150 percent. A similar adjustment for 1968/69 would yield average effective rates of protection not very different from those of 1980/81. This suggests that protection rates in the early sixties were significantly higher than those in the late sixties or early eighties.

The structure of protection has also changed over time. In the late 1960s, effective rates of protection were generally highest for finished goods, somewhat lower for intermediate goods, and lowest for capital goods. In 1980/81 no such cascading structure is found. Instead the average effective rate of protection on intermediate goods is much higher than that for capital or finished goods. For example, in 1980/81, cotton yarn was subsidized both through export subsidies on output and export duties on the major input (raw cotton). Similarly, leather and leather goods were subsidized, while hides and skins exports were taxed. Other intermediate inputs such as polyvinyl resins, synthetic fibers, synthetic yarn, and basic metal products were subject to high import duties. High import duties on intermediate goods also led to relatively lower effective rates of protection on finished products.

On average, there is an increase in the protection provided to capital goods between 1968/69 and 1980/81. However, the higher average effective rate of protection for capital goods in the 1960s is essentially due to a higher average effective rate of protection for industries producing construction materials. The average effective rate of protection in 1980/81 for capital goods apart from construction materials is only 10 percent.

[3] Pakistan had a multiple exchange rate system in the mid-1960s that included import taxes and export subsidies. As will be shown later, the effective exchange rate for exports in 1963 was 56 percent greater than the official exchange rate. The 50 percent figure assumed in the text is an approximation of the above figure.

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Table 3—Effective protection rates on manufactured goods as estimated in three studies, selected years

Type of Goods	1963/64	1968/69	1980/81
		(percent)	
Finished goods	883	179	26
Intermediate goods	88	61	235
Capital goods	155	58	69
Total	271	125	66

Sources: 1963/64: S. R. Lewis and S. Guisinger, "Protection in a Developing Country: Case of Pakistan," *Journal of Political Economy* (November-December 1968). 1968/69: A. R. Kemal, "An Analysis of Industrial Efficiency in Pakistan: 1959/69 to 1969/79" (Ph.D. diss., University of Manchester, Manchester, England, 1978). 1980/81: Sywed N. H. Naqvi and A. R. Kemal, *The Structure of Protection on Pakistan: 1980-81*, vol. 2 (Islamabad: Pakistan Institute of Development Economics, 1983).

As shown in Table 4, the averages mask great variations in effective rates of protection across individual manufacturing activities, and between these and other activities. Since the three studies have varying coverage, there are no estimates available for some activities in one or two of the periods. Effective rates of protection have declined sharply for food, cigarettes, textiles, footwear, chemicals, rubber and plastic products, cement, metal products, and machinery. On the other hand, protection seems to have increased for tea, jute textiles, leather and leather goods, paper and board, matches, rerolled iron and steel, and sports goods.

Protection in Key Manufacturing Sectors

Cotton Manufacturing

The cotton manufacturing sector, which comprises cotton gins (which separate seed cotton into cotton lint and cottonseed) and the textile industry (which transforms cotton lint into cotton yarn, cloth, and clothing), is Pakistan's most important industrial sector. Partition and independence separated Pakistan's cotton producers from the bulk of the cotton processing industry located in India. Establishment of a domestic textile industry became a top development priority for Pakistan, and trade policies were designed to protect the new industry by forcing down prices of raw materials (raw cotton) and taxing or banning imports of competing goods.

An overvalued exchange rate and export taxes kept domestic prices of raw cotton exports low in the 1960s, while export subsidies raised the export prices of cotton yarn and textiles. As a result, effective rates of protection for cotton yarn and cotton fabrics were 82 and 213 percent, respectively, in 1963/64 (Table 4).

From 1972/73 to 1976/77 exports of both cotton yarn and raw cotton were taxed. However, yarn production enjoyed protection because the rate of export duty on raw cotton was higher. By 1977/78, yarn was subsidized through compensatory rebates (7.5 percent of the f.o.b. price). These rebates, along with lower domestic prices of raw cotton relative to world market prices, provided very high protection for the spinning industry. The high subsidies enabled the industry to grow despite low export prices on yarn and obsolete technology, which caused the value added at world market prices during 1980/81 to be negative. Subsequently, under a program to balance prices, modernize the industry, replace outmoded equipment, and reduce duties on spinning machinery, the efficiency of the industry was increased. A sharp increase in the world

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Table 4—Effective protection rates on individual products, selected years

Product	1963/64	1968/69	1980/81
		(percent)	
Dairy products	...	...	-343
Canning of fruits and vegetables	...	...	-202
Fish and other seafood	...	...	-2
Edible oils	-189	-39	-43
Sugar	-329	-1,307	40
Tea	-6	...	93
Animal feeds	...	...	0
Cigarettes	...	...	38
Cotton ginning	...	...	-9
Cotton yarn	82	173	-431
Cotton fabric	213		157
Woolen textiles	...	116	68
Synthetic textiles	9,900	164	-3
Jute textiles	183	...	161
Carpets and rugs	...	...	3
Wearing apparel	1,900	...	33
Leather and leather goods	96	55	2,135
Leather footwear	59	110	52
Rubber footwear		203	53
Paper and board	144	...	492
Printing and publishing	16	...	-43
Drugs and pharmaceuticals	...	...	18
Cosmetics	...	...	362
Soaps and detergents	223	...	-37
Paints and varnishes	133	...	23
Fertilizers	186	7	32
Pesticides	...	...	-40
Chemicals	113	88	77
Matches	9	...	-314
Petroleum products	-5	...	-6
Tyres and tubes	...	...	159
Rubber manufactures	525	...	99
Plastic products	335	...	147
Nonmetallic mineral products	72	...	83
Cement	49	21	-3
Iron and steel rerolling	194	111	318
Metal products	270	...	39
Utensils	...	334	3,251
Agricultural machinery	...	42	-20
Textile machinery	170	83	15
Metal working machinery	...	113	14
Sewing machines	82	...	-766
Electric fans	...	96	98
Electric bulbs and tubes	...	...	37
Electrical machinery	72	...	16
Motor vehicles	-2,100	...	49
Cycles	...	144	28
Surgical instruments	...	...	13
Sports goods	75	...	392

Source: 1963/64: R. Soligo and J. Stern, "Tariff Protection Import Substitution and Investment Efficiency," *Pakistan Development Review* (Summer 1965); 1968/69: A. R. Kemal, "An Analysis of Industrial Efficiency in Pakistan: 1959/69 to 1969/79" (Ph.D. diss., University of Manchester, Manchester, England, 1978). 1980/81: Sywed N. H. Naqvi and A. R. Kemal, *The Structure of Protection in Pakistan: 1980-81*, vol. 2 (Islamabad: Pakistan Institute of Development Economics, 1983).

Note: Negative numbers indicate a tax instead of a subsidy.

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price of yarn in the 1980s led Pakistan first to withdraw subsidies on yarn exports and subsequently to impose an export duty of Rs 2.00 per kilogram in order to provide sufficient yarn for local fabric and ancillary industries.

Cotton fabrics enjoyed an effective rate of protection of 157 percent in 1980/81 because of compensatory rebates for yarn and fabrics and a small value-added component in the value of output at world prices. Garment industries also enjoyed protection in 1980/81 but at a lower rate of 33 percent. At present, the garment industry is allowed to import duty-free cloth for exports, but the industry does not receive any subsidies in the form of compensatory rebates. Effective rates of protection for the garment industry may have, therefore, remained roughly constant. The effective rate of protection for fabrics is likely to still be high because the fabric industry now enjoys a lower-than-world-market price on cotton yarn.

Iron and Steel

Pakistan produces pig iron and rolled and flat products of steel. The Pakistan Steel Factory only began production in the 1980s; prior to that only rolled products in the form of billets were produced in rerolling mills and by the shipbreaking industries.

Billets are the most protected steel activity. Rerolling mills enjoyed an effective rate of protection of 318 percent in 1980/81. Similarly, flat products are also protected although the degree of protection may decline following reductions in duties on imports of these goods in recent years. In 1980/81, except for utensils and sewing machines, other metal-based industries enjoyed only low levels of protection or were even taxed.

Chemicals

Pakistan produces various types of industrial chemical compounds manufactured from imported components. At present, the import duty on import substitutes is 80 percent; on noncompetitive chemicals the duty ranges from 0 to 40 percent. In 1980/81 the effective rate of protection on industrial chemicals was 77 percent.

Fertilizers and pesticides are the two main chemicals produced in Pakistan that are used in the agricultural sector. Even though fertilizer prices in the domestic market were no higher than world market prices in 1980/81, the industry enjoyed an effective rate of protection of 40 percent because of subsidized natural gas, a major input in the industry. However, protection of the fertilizer industry up to 1985 was only notional because the industry was assured a fixed return on equity. Higher returns were taxed through surcharges and lower returns enhanced through subsidies.

The pesticide industry was penalized in 1980/81: its effective rate of protection was −40 percent. Although the industry in Pakistan only consists of the mixing of imported basic chemicals, and there were no duties or taxes on the imports of finished pesticides, the basic chemicals were subjected to sales taxes.

Conclusions

The existing structure of protection in Pakistan is the result of various ad hoc measures initially undertaken by the government to restrict imports, boost exports, and raise revenues. In general, these policies have had a distinct bias toward import substitution—few policies have had an explicit export promotion orientation.

Between the 1960s and 1980s, import policy aimed to restrict luxury and nonessential imported goods and to enable liberal imports of essential consumer goods, intermediate goods, and capital goods. The structure of tariffs was similar, though tariffs

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did not determine the structure of protection because quotas were the binding constraint. Instead, the major purpose of tariffs was to raise revenues. The import policies thus favored establishment of industries producing luxury and nonessential goods and enabled some inefficient industries to survive because of high domestic prices supported by heavy protection.

In order to compensate for the overvaluation of the rupee, export subsidies have at times been granted to selected industries to boost exports. Generally, the subsidies have gone to existing industries with strong lobbies, such as the textile industry. As a result, growth of nontraditional exports has suffered.

Trade and tariff policies have not been formulated with a view to creating a structure of incentives consistent with a higher rate of growth in the production of tradables. Only in the mid-1980s has the government begun to make a conscious effort to reorient trade and tariff policies toward the realization of a more trade-oriented incentive structure.

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4

EFFECTIVE EXCHANGE RATES FOR IMPORTS AND EXPORTS

For most years since its independence in 1947, Pakistan has had a fixed official exchange rate. Until January 1982, the official exchange rate had changed only three times in 35 years—in 1955, 1972, and 1973. Khan (1986) suggests that the constant nominal exchange rate policy in the late 1970s might have been justified by the argument that the short-run costs of a depreciation of the rupee in terms of higher domestic inflation, reduced economic growth, and increased fiscal cost of subsidies on imported goods were likely to outweigh the short-run benefits of higher prices of traded goods (because import demand and export supply were assumed to be inelastic in the short run). Beginning in 1982, the government adopted an adjustable-peg exchange rate policy, with the rupee pegged to a basket of currencies of major trading partners during part of this period (Pakistan, Ministry of Finance 1987, 44).

For much of the sixties and seventies, Pakistani governments used trade policies rather than changes in nominal exchange rates to help bring about a sustainable current account position. Trade policy instruments included import tariffs, quotas, export taxes, and export bonuses. These trade policies served two other purposes as well. Trade taxes accounted for 38 percent of government revenues between 1976 and 1980, and the protection provided to domestic industry by tariffs and quotas was an integral part of an import substitution development strategy. Because of the sizable effects of trade policies, nominal exchange rates in Pakistan have not reflected the actual cost of foreign exchange to importers and exporters. Import tariffs and surcharges, export taxes, export bonuses, and multiple exchange rate schemes in place at various times have resulted in divergences between the actual costs of foreign exchange for some uses and the official exchange rate. For example, in 1979 a 60 percent tariff was placed on rubber, so that while the official exchange rate was Rs 9.9 to US$1.00, the effective exchange rate for importers of rubber was 15.8 ($= 9.9 \times 1.6$), according to data from Kemal, Burney, and Hameed (1981).

Effective exchange rates can differ by commodity when trade policy instruments are commodity specific. More generally, the effects of trade policies on the actual price of foreign exchange for exports (imports) taken as a whole can be given as the effective exchange rate for exports (imports) defined as

$$E_x = E \cdot (1 - t_x), \tag{1}$$

and

$$E_m = E \cdot (1 + t_m), \tag{2}$$

where

E = the official nominal exchange rate,
t_x = the implicit export tax, and
t_m = the implicit import tariff.

Both E, E_m, and E_x are expressed in rupees per unit of foreign currency.

Average import tariff or export tax rates calculated using actual tax revenues and

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trade values may be good measures of t_m and t_x in the absence of import or export quotas. In order to take into account the effects of binding quantitative restrictions, however, the implicit import tariff or export tax, calculated from the ratio of domestic to world prices of the import goods, is a more accurate measure of the direct effect of trade policies. The case of an import tariff is illustrated in Figure 1. With no quota or import tariff, import demand equals M_0 when the world price is P_0 ($= E_0P_m^w$), where P_m^w is the world price of imports. If imports are limited to M_1 by an import quota, then the domestic price of imports rises to P_1. The quota on total imports and the domestic price of imports has the same effect as a tariff of t_{m1} percent on imports.

In practice, calculating the implicit import tariff or export tax when quotas are binding and tax rates are not uniform across commodities requires detailed data on world and domestic prices of all traded goods. Estimates of the implicit import tariff and export tax for 1980/81, based on data from Naqvi and Kemal (1983a), are shown in Table 5. The implicit tariffs (taxes) on each category of imports (exports) were aggregated using import (export) value shares as weights in order to calculate the average implicit tariff (export tax).

Two major aspects of Pakistan's trade policy are highlighted. First, quantitative restrictions on imports have had a significant effect on domestic prices of imports. The implicit tariff on imports in 1981 was 54.8 percent, while the average import tax (calculated as total import revenues divided by total value of imports) was only 29.7 percent (Table 6). Thus import taxes captured only 54 percent of the economic rent

Figure 1—Import quotas and equivalent import tariffs

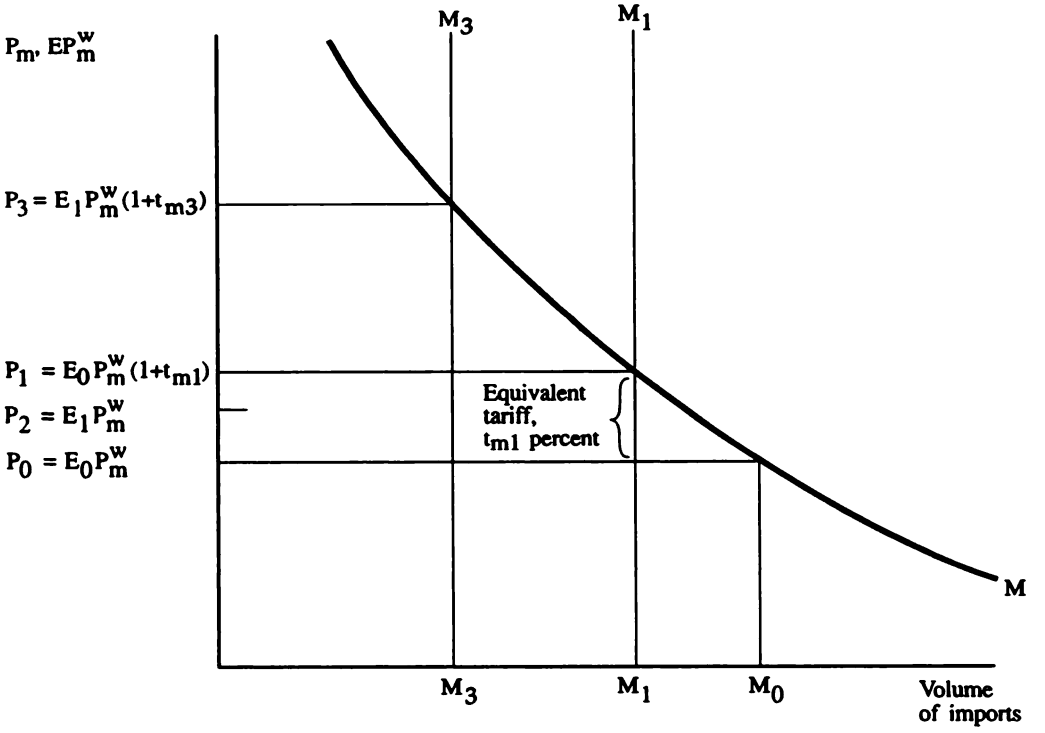

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Table 5—Equivalent tariff calculations, 1980/81

Exported Good	Export Tariff	Nominal Rate of Protection	Imported Good	Import Tariff	Nominal Rate of Protection
	(Rs million)	(percent)		(Rs million)	(percent)
Raw cotton	5,203.4	–24	Capital goods		
Cotton yarn	2,048.7	52	Iron, steel bars	76	116
Cotton cloth	2,389.6	61	Plates, sheets	1,512	116
Ordinary rice	2,730.6	–46	Hoop, strip iron	26	116
Basmati rice	2,871	–46	Rails, track	58	116
Fish	559.2	30	Iron, steel wire	50	106
Tanned leather	891.9	79	Tubes, pipes	281	58
Carpets, rugs	2,242.8	0[a]			
Petrol products	1,675.2	53	Machinery		
Sports goods	312.3	106	Power generation	560	12
Raw wool	80.2	0[a]	Agricultural	1,048	14
Others	8,273.6	0[a]	Textile, leather	739	32
			Specialized	828	12
Total	2,9278.5	2.7[b]	Electric power	742	12
			Motor vehicles	2,345	140
			Others	6,617	72[c]
			Consumer goods		
			Wheat	633	–41
			Other food	2,983	73[c]
			Petrol products	1,774	53
			Medicines, drugs	936	11
			Printed matter	100	–9
			Others	1,340	73[c]
			Raw materials		
			Crude petroleum	9,840	53
			Petrol products	3,585	53
			Edible oil	2,625	–11
			Chemicals	1,212	51
			Dyeing and tanning materials	462	51
			Fertilizers	3,537	0
			Other chemicals	550	51
			Pig iron	120	116
			Ingots	383	116
			Other nonferrous materials	5	65
			Iron, steel forging	20	116
			Copper	184	65
			Aluminum	234	65
			Others	8,130	72[c]
			Total	53,535	55.04[b]

Sources: World Bank, *Pakistan Sixth Plan Progress and Future Prospects*, Report No. 6533-PAK (Washington, D.C.: World Bank, 1988); and Sywed N. H. Naqvi and A. R. Kemal, *The Structure of Protection in Pakistan: 1980-81*, vol. 1 (Islamabad: Pakistan Institute of Development Economics, 1983).

[a]This figure is assumed to equal zero.

[b]This is the weighted average of the nominal rates of protection using trade weights.

[c]"Others" is assumed to equal the average level of protection for the subsector.

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Table 6—Average import taxes and equivalent import tariffs, 1977-87

Year	Sales Tax on Imports (1)	Import Duties (2)	Iqra (3)	Total Import Tax (4)	Value of Imports (5)	Average Tax (6)	Equivalent Tariff (7)
			(Rs million)			(percent)	
1977	1,124	4,426	...	5,550	23,012	24.12	52.88
1978	1,226	6,034	...	7,852	27,815	28.23	45.60
1979	1,566	8,045	...	10,225	36,388	28.10	50.60
1980	2,014	9,844	...	12,178	46,929	25.95	55.03
1981	2,537	12,126	...	15,913	53,544	29.72	54.82
1982	2,614	13,569	...	17,351	59,482	29.17	43.80
1983	2,791	17,295	...	22,208	68,151	32.59	42.06
1984	3,699	20,901	...	28,099	76,707	36.63	47.29
1985	3,739	22,282	...	26,021	89,778	28.98	45.59
1986	3,568	24,334	4,019	31,921	90,946	35.10	51.71
1987	4,564	24,649	4,397	33,610	90,077	37.31	46.99

Source: Pakistan, Ministry of Finance, *Economic Survey 1986-87* (Islamabad: Ministry of Finance, 1988) Tables 8.2, 8.4, and 10.3.

Notes: Data for 1987 are preliminary.
Iqra is a surcharge on internationally traded goods.
Total import tax = Sales tax on imports + Import duties + Iqra.
Average tax = Total import tax / Value of imports × 100.
The equivalent tariffs are given in Appendix 1, Table 26.
1977-87 average tax = 30.54; equivalent tariff = 48.76 percent.

accruing to holders of import licenses. Second, the implicit tariffs vary widely by commodity group, and this variance is even more pronounced for effective rates of protection (see the data in Table 4 from Naqvi and Kemal 1983b), which suggests that the quantitative effects may have had unintended effects on the structure of relative incentives to import-competing sectors.

Time series for t_m and t_x were constructed from the 1980/81 estimates from Table 5 and from price indices of import and export goods, using the following equations:

$$1 + t_m(t) = \frac{P_m^d(t)/E(t)P_m^w(t)}{[P_m^d(1981)/E(1981)P_m^w(1981)]} \cdot [1 + t_m(1981)], \quad (3)$$

$$1 - t_x(t) = \frac{P_x^d(t)/E(t)P_x^w(t)}{[P_x^d(1981)/E(1981)P_x^w(1981)]} \cdot [1 - t_x(1981)], \quad (4)$$

where the terms in parentheses indicate the year and

w = world prices,
P_m^w = index of the import unit value, and
P_x^w = index of the export unit value,

based on actual quantities and values of Pakistan's trade, and where

P_m^d = index of the domestic price of major imports, and

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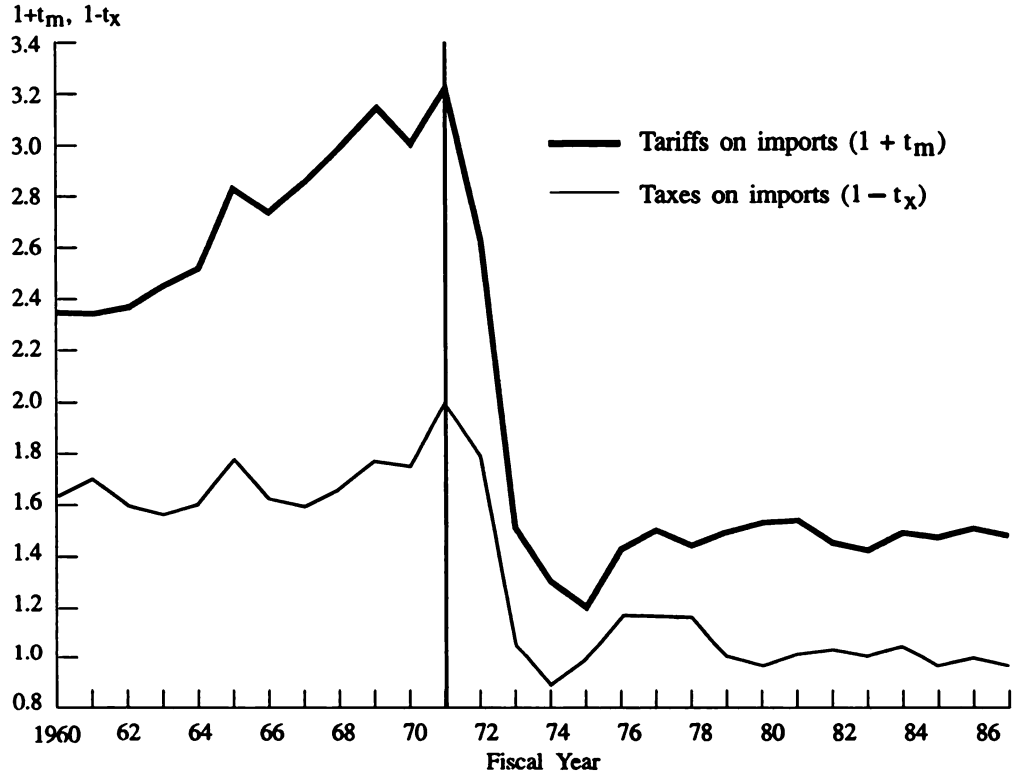
P_x^d = index of the domestic price of major exports.

Two sets of weights were used, for the pre- and post-1971 periods, based on value shares in total imports and exports (weight values and results are given in Appendix 1, Table 26). Appendix 1, Table 27 presents calculations of the implicit import tariff and export tax in 1963/64, which at 110 and −29 percent, respectively, are somewhat below the figures calculated using the price series (152 and −62 percent).

Figure 2 shows the pattern of $1 + t_m$ and $1 - t_x$ over time. From the early 1960s to 1971 the implicit tariff on imports rose from 130 percent to 220 percent. At the same time, the export subsidy (implicit in the system of multiple exchange rates) was between 60 and 80 percent in most years. Thus while the official exchange rate was fixed at Rs 4.78 to US$1.00, the effective exchange rate for imports rose from Rs 11.2 to Rs 15.4 to the dollar, and the effective exchange rate for exports varied from about Rs 7.5 to Rs 9.5 to the dollar (Figure 3 and Appendix 1, Table 26).

The 1972 devaluation of the nominal exchange rate from Rs 4.78 to Rs 11.00 to US$1.00 brought about a simplified exchange rate system, ending the bonus export

Figure 2 — Overall trade policy bias, 1960-87



Source: Derived from basic data in Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: The vertical line indicates the devaluation and unification of exchange rates. 1971 was the year East Pakistan seceded and Bangladesh was created. Zulfiqar Ali Bhutto governed during 1971-77 and Mohammad Zia ul-Haq during 1977-88.

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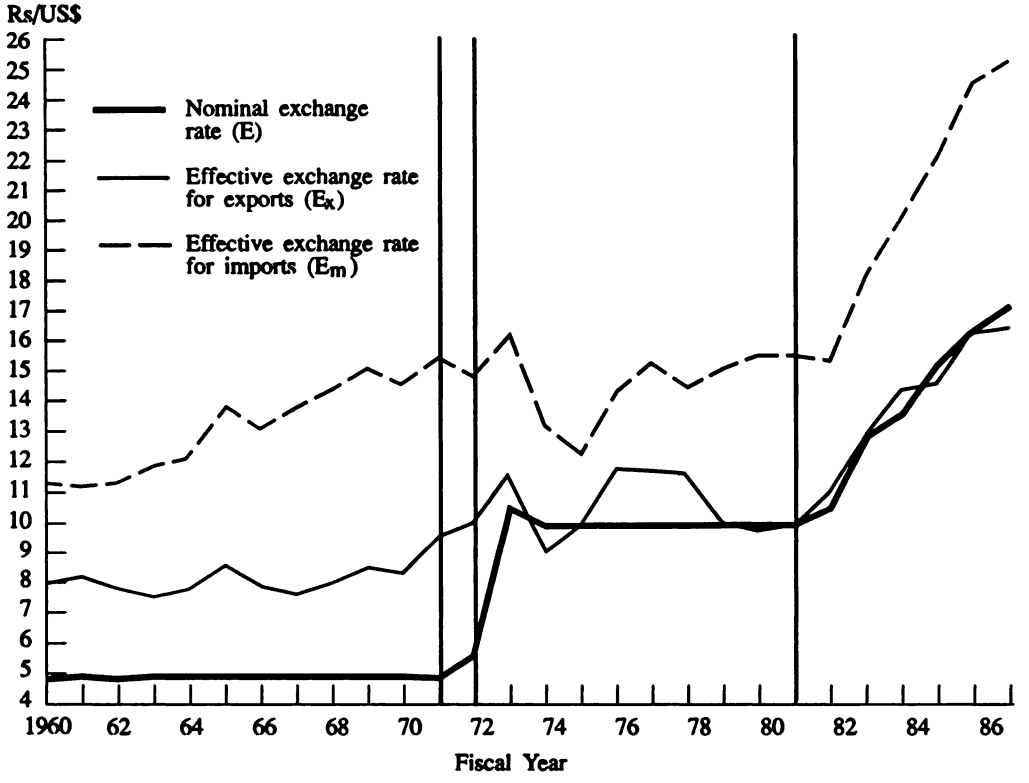
Figure 3 – Devaluation episodes and evolution of effective exchange rates, 1960-87



Source: Derived from basic data in Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: The vertical lines indicate the nominal devaluations. 1971 was the year East Pakistan seceded and Bangladesh was created. Zulfiqar Ali Bhutto governed during 1971-77 and Mohammad Zia ul-Haq during 1977-88.

scheme and greatly reducing the level of many nominal import tariffs. As a result, the implicit import tariffs and export subsidies were both significantly reduced. The effective exchange rate for imports increased by 5 percent and that for exports by 20 percent[4]—much less than the 121-percent devaluation of the official exchange rate (Figure 3).

The implicit import tariff declined further in 1974 and 1975, but from the mid-1970s to 1987, it remained at about 60 percent. Export taxes and subsidies were also kept small, beginning in the mid-1970s, and did not increase greatly even when the official exchange rate depreciated sharply in the 1970s. As a result, the effective exchange rate for exports approximated the official exchange rate during this period. Unlike the 1972 devaluation, the 73 percent depreciation of the official exchange rate (relative to the dollar) beginning in 1982 resulted in an approximately equal 61 percent depreciation of the effective exchange rate for exports between 1981 and 1987.

[4] These changes in effective exchange rates are calculated between fiscal years 1971 and 1973.

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The depreciation of the rupee in the 1980s also differed from the devaluation of 1972 in that it was not accompanied by a reduction in implicit import tariffs. This result is somewhat surprising since, all things being equal, the implicit import tariff is reduced by a nominal devaluation because the devaluation increases the world price of imports expressed in rupees, while leaving the domestic price unchanged (assuming the tariff is still binding):

$$(1 + t_m) = P_m^d/EP_m^w. \tag{5}$$

That the implicit tariff did not change significantly (and even increased slightly) indicates that quotas have been reduced (or that demand for the restricted import goods has increased).[5] Returning to Figure 1, with the world price of import goods at $P_0 = E_0P_m^w$, and the quantity of imports restricted to M_1 (determined in part by export earnings or foreign exchange reserves), the domestic price of imports rises to $P_1 = E_0P_m^w(1 + t_{m1})$ where t_{m1} is the implicit tariff. With a nominal devaluation, the world price expressed in rupees rises from $P_0 = E_0P_m^w$ to $P_2 = E_1P_m^w$. In this case, if total imports are still restricted to M_1, the domestic price of imports remains at P_1 and the implicit tariff is measured as $P_1/P_2 = 1 + t_{m2}$. In order for the nominal devaluation not to have an effect on the measured implicit import tariff, the quota on imports must actually be reduced. If foreign exchange earnings or reserves fall so that the import quota is reduced to M_3, the import price is raised to P_3 and the implicit tariff $(1 + t_{m3})$ increases to P_3/P_2.

[5] A third alternative, that import quotas are a relatively unimportant factor in determining the domestic price of importables in Pakistan, is not consistent with the Naqvi and Kemal (1983a) study.

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5

THE REAL EXCHANGE RATE

The previous analysis of effective exchange rates ignored changes in the domestic prices of nontraded goods and in world prices. While the effective exchange rates for imports and exports determine the nominal prices of traded goods in the domestic economy, another measure of price incentives, the real exchange rate (RER), is needed to reflect changes in the domestic price of traded goods relative to the price of home goods.[6]

RER is defined as the relative price of tradables to home goods. In this study, the actual RER is measured as

$$RER = E \cdot P_T^w / P_h, \tag{6}$$

where E is the nominal exchange rate and P_T^w and P_h are the world price of traded goods and the domestic price of home goods, respectively, and where the numerator represents a policy for the price of tradable goods, ignoring for the moment domestic taxes and quotas on imports and exports. A weighted average of the wholesale price indices of major trading partners of Pakistan is used to represent P_T^w:

$$in(P_T^w) = \Sigma(w_i \cdot WPI_i / E_i), \tag{7}$$

where w_i, WPI_i, and E_i are the weight, wholesale price index, and exchange rate (expressed in units of a country's own currency per dollar) of country i. The weights used are based on the average share of trade in nonpetroleum products (exports plus imports) of Pakistan's leading trading partners in Pakistan's trade from 1972 to 1986. The weights are as follows: United States, 0.278; Japan, 0.277; United Kingdom, 0.160; West Germany, 0.146; Italy, 0.080; and France, 0.059. These six countries accounted for almost half of Pakistan's trade during this period. An index of consumer prices in Pakistan is used as a proxy for the price of home goods, based on the argument that home goods weigh heavily in this price index.

Effective RER indices for imports (t_m) and exports (t_x) that take into account trade taxes and quotas are defined as

$$RER_x = RER \cdot (1 - t_x), \quad (1981 = 100), \text{ and} \tag{8}$$

$$RER_m = RER_x \cdot (1 + t_m)/(1 - t_x). \tag{9}$$

Figure 4 shows the level of the RER indices over time. The large nominal devaluation of the rupee (more than 100 percent) combined with changes in trade policies resulted in a much smaller depreciation of the RER (of about 20 percent) between 1971 and 1973. However, between 1981 and 1987, the 73 percent nominal devaluation of the rupee (relative to the dollar) resulted in a 43 percent depreciation of the effective RER for exports.

[6] "Home goods" and "nontraded goods" are used interchangeably in the following discussion.

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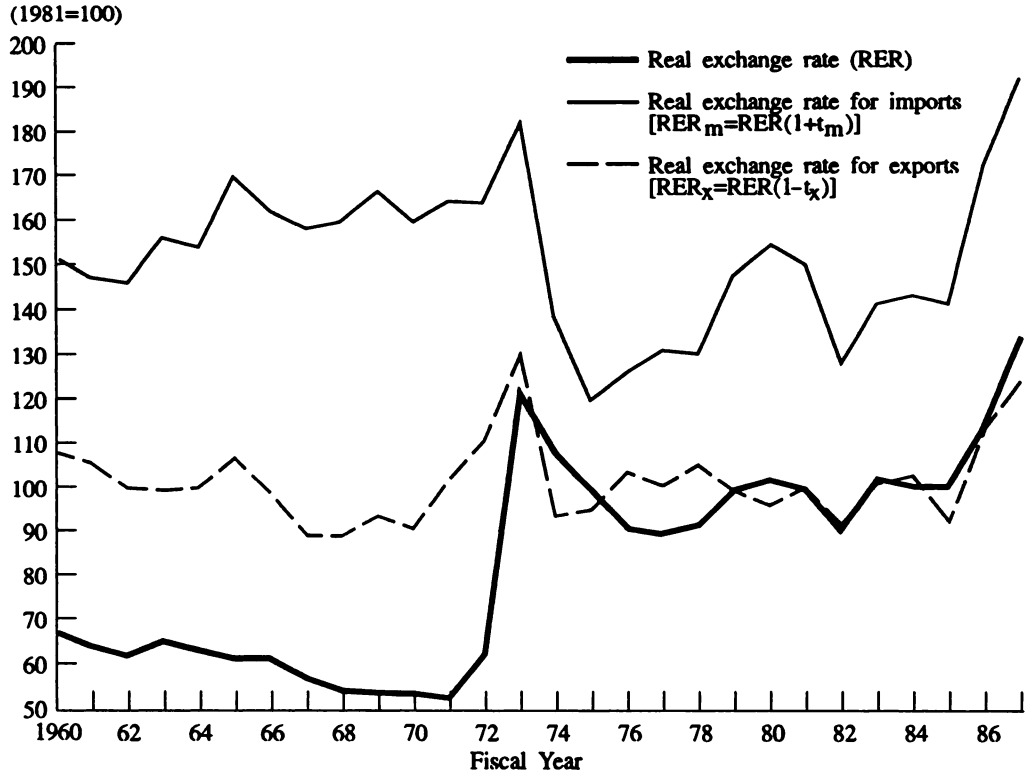
Figure 4—Real effective exchange rate indices, 1960-87



Source: Derived from basic data in Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Determinants of the Real Exchange Rate

Even when the nominal exchange rate is fixed for long periods of time, the effective RER can adjust to bring about equilibrium in the traded and home goods markets. These changes in the effective RER come about through changes in world prices and prices of home goods and changes in the implicit import tariff and export tax. Thus factors such as world prices and government trade policies, which influence supply and demand in these markets, affect the effective RER.

Import tariffs and export taxes affect the RER by changing domestic demand and supply for both tradable and nontradable goods.[7] For example, an increase in import tariffs raises the domestic price of importables relative to the domestic prices of exportables and home goods, thereby leading to increased demand for home goods. In order to restore equilibrium in the home goods market, the price of home goods must rise relative to the price of exportables and the new after-tariff price of importables. Thus the RER for exportables appreciates (P_x/P_h decreases). The imposition of an export

[7] The theoretical formulation of the effect of trade policy on the RER is credited to Dornbusch (1974). Sjaastad (1980) and Garcia (1981) give less abstract, though less elegant, presentations of the same concepts.

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subsidy has an analogous effect, shifting domestic demand away from exportable goods to importables and home goods.

The extent to which an increase in the domestic price of imports causes an increase in the demand for home goods (and an increase in their price) is measured by the incidence parameter, defined as the negative of the percentage change of the RER for exportables (P_x/P_h) for a given percentage change in the domestic price of importables relative to exportables (P_m/P_x) (Sjaastad 1980). This incidence parameter, here called omega (ω), is determined in part by the degree of substitutability between home goods and import goods in production and consumption. For example, if home goods are close substitutes for import goods in terms of demand, then an import tariff that raises the price of import goods will cause a large shift in demand toward home goods and a sizable increase in their price.[8]

The external terms of trade (expressed as the ratio of the world price of export goods to the world price of import goods) affects the relative prices of tradables to nontradables in two ways. Like trade policy, there is a direct effect on prices. A worsening of the terms of trade through an increase in the world price of importables, like an increase in the import tariff, raises the domestic price of importables, increases demand for home goods, and leads to an appreciation of the RER for exportables. There is also an income effect. An increased world price for importables reduces the purchasing power of export earnings and reduces real income. The effect on relative demand for tradables and home goods (and on their relative prices) depends on the income elasticities of demand for these goods. In general, a worsening of the terms of trade, that is, a reduction in income, might be expected to cause a decrease in demand for home goods and a depreciation of the RER for exportables. A priori, the net effect on the RER for exportables is indeterminate, although it is usually expected that the income effect will predominate, with a worsening terms of trade requiring a depreciation of the RER to restore external balance (see Edwards 1985).

In the case of Pakistan, workers' remittances (largely from Pakistani workers in the Middle East) are an important part of foreign exchange earnings. Remittances and other private, unrequited transfers are spent partly on home goods, thereby raising their prices and causing an appreciation of the RER. First, a slowing of the increase in workers' remittances and later an absolute decline were factors contributing to the government's decision to depreciate the rupee relative to trading partners' currencies in the 1980s.

Foreign grants and long-term borrowing can also lead to an appreciation of the RER. Because this inflow of foreign exchange accrues to the government rather than to the private sector (as do workers' remittances) the composition of spending on home goods versus tradables is likely to differ, so that the magnitude of the effect on the RER may be different.

The level of government expenditure may also affect the RER by altering the overall pattern of spending in the economy. Typically, government expenditures are concentrated on nontraded goods such as salary payments, various domestic subsidies, and investment in infrastructure. Increasing levels of government expenditure would then

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[8] Bautista (1987) derives an expression for omega as a function of the price elasticities of demand and supply for home goods:

$$x = em - nm/(em - nm + ex - nx),$$

where em and ex are the demand elasticities for home goods with respect to the relative prices of importables and exportables, and nm and nx are the corresponding supply elasticities.

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increase demand for nontraded goods relative to traded goods and lead to an appreciation of the RER.[9]

In the above discussion, trade policy and other variables are treated as exogenous, but in the case of Pakistan, some of the explanatory variables are not exogenous but are determined simultaneously with the RER.

In Pakistan, quantitative restrictions on imports have been widely used. Thus changes in the implicit tariff may result even when no changes in tariff rates have occurred, when the size of the quota is varied, or when domestic demand for imports changes. Factors that influence the government to change the import quota, such as foreign exchange earnings and the level of international reserves, and factors that influence domestic demand will thus cause changes in the implicit tariff.

Workers' remittances are largely determined by the price of oil (a major determinant of the level of incomes in the Middle Eastern countries that employ many Pakistani workers), but the RER may influence the amount of income remitted to Pakistan rather than spent or saved abroad. The supply of foreign aid may depend in part on income in developed countries, whereas Pakistan's "demand" for foreign aid may be influenced by its terms of trade, exchange reserves, and ultimately its RER.

Regression Results

Valdés (1986) summarizes the results of a number of studies that have estimated RER regressions for Latin American countries using either the domestic price ratio of exportables to home goods (P_x/P_h) or an RER constructed from wholesale prices of major trading partners as the dependent variable. Because export subsidies and taxes have been significant in Pakistan, the effective RER for exports is used as the dependent variable instead of an average RER index.[10] (See, for example, Valdés, Hurtado, and Muchnik [1989], where an average RER index similar to equation (6) is used without any adjustment for export taxes because export taxes and subsidies were insignificant.)

Expressing the RER as a function of trade policy, terms of trade, and other variables gives

$$\log RER_x = c + \beta 1 \cdot LTRPOL + \beta 2 \cdot LTT + \beta 3 \cdot RREMIT + \beta 4 \cdot RAID + \beta 5 \cdot RGOVT + e, \quad (10)$$

where

c = the unit constant,

LTRPOL = log of "trade policy", $\log[(1 + t_m)/(1 - t_x)]$,

LTT = log of the terms of trade, $\log(P_x^w/P_m^w)$,

[9] Valdés (1986) discusses other determinants of the RER that are important in the Latin American context, such as budget deficits, absorption (relative to GNP), and wage policy.

[10] Thus, the dependent variable in the regressions is the logarithm of $RER_x = E(P_T^w/P_h)(1 - t_x)$, where the term P_T^w in the numerator represents a price index of Pakistan's trading partners that includes both exportables and importables. Ideally, one would use the ratio of the domestic price of exportables to the domestic price of home goods (P_x^d/P_h) as the real exchange rate for exports. Unfortunately, little disaggregated price data are available with which to construct the price indices, and regressions using the above definition produced unsatisfactory results. A hybrid approach is taken in this study: price indices are used to estimate the equivalent tariff and export tax (Chapter 4), but a more general index of world prices is used [P_T^w in equation (6)] to construct the index of the real exchange rate for exportables.

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RREMIT = private transfers in dollars divided by P_T^W/real GDP index,

RAID = (sum of aid loans and grants to Pakistan measured in dollars divided by P_T^W)/real GDP index, lagged two quarters, and

RGOVT = (government expenditures)/real GDP index.

Tables 7 and 8 present the regression results for both the full sample (1960-87) and for a subsample (1972-87). The first regression in Table 7 is estimated using ordinary least squares for the full sample. A dummy variable (DBANG = 1 for quarters prior to the second quarter of 1972 [1972.2], 0 otherwise) is used to help capture the effects of the secession of East Pakistan in December 1971. In addition, the coefficients of each of the explanatory variables outlined above are allowed to vary between the pre- and post-1971 periods, using dummy variables DTRPOL, DLTT, and DRAID, where

DTRPOL = LTRPOL for 1960.3 to 1972.1,
= 0 for 1972.2 to 1987.1,

DLTT = LTT for 1960.3 to 1972.1,
= 0 for 1972.2 to 1987.1,

DRAID = RAID for 1960.3 to 1972.1, and
= 0 for 1972.2 to 1987.1.

For private transfers (RREMIT), comparable data were not available for most of the pre-1971 period (transfers were very small compared with those of the 1970s), so that no dummy variable for transfers is included.

The coefficient for LTRPOL, equal to $-\omega$ for the post-1971 period, indicates that a 1 percent increase in the ratio of $(1 + t_m)/(1 - t_x)$ will result in a 0.480 percent appreciation of the RER for exports.[11] The coefficients for DRAID and RAID are almost the same in absolute size but opposite in sign, indicating that aid flows were not a significant factor in determining the RER in Pakistan in the pre-1971 period. However, the sum of the coefficients of LTRPOL and DTRPOL, which gives the estimate of ω for the pre-1971 period, is implausibly high in absolute terms (–1.073), and coefficients on the terms of trade and remittances are insignificant.

As discussed above, some of the explanatory variables, notably the trade policy variables (LTRPOL and DTRPOL) are likely to be endogenously determined along with the RER. To correct for this problem, the equation was reestimated using two-stage

[11] The coefficient B1 differs slightly from the omega coefficient estimated in studies of other countries for which export taxes or subsidies were relatively small, since the dependent variable, log RER_x, is not identical to the real exchange rate used in these studies. For example, Valdés, Hurtado, and Muchnik (1989) estimate a regression of the form

$$\log RER = \alpha 1 + \beta 1 \cdot \log(1 + t_m) + \beta 2 \cdot \log(1 - t_x) + \beta 3 \cdot \log(x),$$

where x represents other variables in the equation. (Note that the term $\beta 2 \cdot \log(1 - t_x)$ was omitted in their regression because $\log(1 - t_x)$ was equal to zero in all years.) The regression used in this study is of the form

$$\log RER_x = A1 + B1 \cdot \log(1 + t_m) - B1 \cdot \log(1 - t_x) + B3 \cdot \log(x).$$

The two regressions can be shown to be equivalent if $\beta 1$ is constrained to equal $-\beta 2-1$.

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Table 7—Real exchange rate regressions, full-period sample, quarterly data, 1960-87

Regression Number/ Estimation Method	C	DBANG	LTRPOL	DTRPOL	LTT	DLTT	RREMIT (-2)	RAID	DRAID	ρ	Durbin Watson	R^2
1. OLS	2.738*	0.071	−0.480*	−0.593*	0.133	0.352	−62.4	−264.0*	264.5*	0.833*	2.015	0.804
	(29.717)	(0.453)	(−4.071)	(−2.340)	(1.219)	(1.333)	(−0.929)	(−4.372)	(3.992)	(12.830)		
2. 2SLS	2.710*	−0.223	−0.677*	0.408**	−0.293*	−0.357	−13.6	−148.1*	105.0*	0.834	1.882	0.747
	(30.070)	(−1.623)	(−5.092)	(1.674)	(−2.396)	(−1.419)	(−0.181)	(−2.987)	(1.969)	(12.617)		
3. OLS (first differences)	0.003	−0.001	−0.505*	−0.504**	0.169	0.322	−208.3	−165.8*	193.8*	. . .	1.249	0.386
	(0.460)	(−0.075)	(−4.045)	(−1.928)	(1.420)	(1.212)	(−1.479)	(−3.016)	(2.983)			

Notes: A sample period of 1960.3 (third quarter 1960) to 1987.1 (first quarter 1987) is used for all regressions. Data for all variables are smoothed using arithmetic moving averages. In Equation 2, LRERX(−1), C, DBANG, and current and lagged values of LTT, DLTT, LPOIL, and LWGDP are used as instrumental variables. The variables are defined as follows:

C = the unit constant,
DBANG = a dummy variable equal to 1 for quarters prior to the second quarter of 1972, 0 otherwise,
LTRPOL = log of $(1 + t_m)/(1 - t_x)$, where t_m is the implicit import tariff and t_x is the export tax,
LTT = log of the terms of trade,
RREMIT = private transfers divided by GDP,
RAID = sum of aid loans and grants to Pakistan divided by Pakistan's GDP,
LPOIL = log of the price of oil, deflated by a wholesale price index for major industrial countries,
LRERX = log of the real exchange rate for exports,
LWGDP = log of the index of the GDP's of major industrial countries,

DTRPOL = DBANG • LTRPOL,
DLTT = DBANG • LTT, and
DRAID = DBANG • RAID,

OLS is ordinary least squares and 2SLS is two-stage least squares.

* Significant at the 95 percent confidence level.
** Significant at the 90 percent confidence level.

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Table 8—Real exchange rate regressions, reduced sample, quarterly data, 1972-87

Regression Number/ Estimation Method	C	LTRPOL	LTT	RREMIT (-2)	RAID	RGOVT	ρ	Durbin Watson	R^2
4. OLS	2.895* (21.153)	-0.488* (-3.882)	0.125 (1.068)	-197.1** (-1.801)	-295.0* (-4.389)	...	0.866* (12.070)	1.698	0.808
5. 2SLS	2.808* (26.284)	-0.410* (-3.248)	0.072 (0.609)	-170.5** (-1.698)	-259.2* (-5.098)	...	0.848* (10.266)	1.632	0.806
6. OLS (first differences)	0.005 (0.816)	-0.544* -4.254)	0.180 (1.476)	-256.6 (-1.651)	-271.4* (-4.094)	...	...	1.830	0.430
7. OLS	3.237 (9.616)	-0.496* (-3.947)	0.132 (1.130)	-190.6** (-1.755)	-314.9* (-4.562)	-1.538 (-1.122)	0.861* (11.649)	1.704	0.812
8. 2SLS	3.498 (10.626)	-0.464* (-3.702)	0.083 (0.711)	-234.8* (-2.467)	-472.3* (-7.482)	-2.117 (-1.543)	0.823* (10.226)	1.652	0.793
9. OLS (first differences)	0.006 (1.006)	-0.563* (-4.377)	0.203* (1.646)	-280.7** (-1.794)	-286.4* (-4.248)	-1.788 (-1.136)	...	1.839	0.443

Note: The variables are defined as follows:

C = the unit constant,
LTRPOL = log of $(1 + t_m)/(1 - t_x)$, where t_m is the implicit import tariff and t_x is the export tax,
LTT = log of the terms of trade,
RREMIT = private transfers divided by GDP,
RAID = sum of aid loans and grants to Pakistan divided by Pakistan's GDP, and
RGOVT = government expenditures.

A sample period of 1972.2 (second quarter 1972) to 1987.1 (first quarter 1987) was used for all regressions. Data for all variables are smoothed using arithmetic moving averages. In estimations 5 and 8, LRERX(-1), C, LTT, LTT(-1), LPOIL, LPOIL(-1), LWGDP, and LWGDP(-1) are used as instrumental variables, where LRERX is the log of the real exchange rate for exports, LPOIL is the log of the price of oil deflated by a wholesale price index for major industrial countries, and LWGDP is the log of the index of the GDP's of major industrial countries. OLS is ordinary least squares and 2SLS is two-stage least squares.

* Significant at the 95 percent confidence level.
** Significant at the 90 percent confidence level.

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least squares with current and lagged values of an index of national income in developed countries and the deflated dollar price of oil as identifying instrumental variables (regression 2). Current and lagged values of the terms of trade (LTT and DLTT) were also used as instruments. Finally, because of autocorrelation of the residuals, the lagged value of the dependent variable (the RER for exports) was also used as an instrument. The resulting estimates for omega in the pre- and post-1971 periods, −0.677 and −0.269 (= −0.677 + 0.408), are more plausible than the results of regression 1. A positive relationship between the external terms of trade and the RER for exports is also found in both periods.

Results of a regression using the first differences (the arithmetic differences between the current and lagged values) of all variables to correct for the problem of the autocorrelation of the residuals (regression 3) were similar to those of the OLS estimation.

Table 8 presents results of regressions from a reduced sample covering only the post-1971 period. Regressions 4, 5, and 6 correspond to regressions 1, 2, and 3 for the full sample period. Results of all three regressions are similar, with estimates of omega ranging from −0.410 (regression 5) to −0.544 (regression 6). In all three regressions, the coefficient on the terms of trade is insignificant and coefficients on remittances and foreign aid flows are of the expected signs and similar magnitudes. Three other regressions (7, 8, and 9) include the ratio of government expenditures to GDP as an explanatory variable. In each of the regressions, the coefficient on RGOVT has the expected sign but is not statistically significant. In regression 9, the coefficient on the terms of trade (LTT) is positive and statistically significant; values for the estimates of the other coefficients are similar to those in regressions 4, 5, and 6.

Overall, the regressions give similar estimates for the omega coefficient, ranging from −0.410 to −0.677 for the post-1971 period. All of the estimates are biased toward −1, because the logarithm of $(1 - t_x)$ is a component of the numerator of the dependent variable LRERX and LTRPOL, so estimates at the lower end of the range may be closer to the true value of omega. Parameter estimates from regression 4, estimated using two-stage least squares for the post-1971 sample period, are used in the following calculations and the model simulations.

The high values for the autocorrelation coefficient (RHO) in all regressions not estimated using the first differences of the variables indicate that errors unexplained by the included variables have persistent effects. Slowness of the RER to adjust to changes in the explanatory variables and other shocks may be one explanation. One quarter is probably too short a period of time for complete adjustments in the RER to take place, especially when nominal exchange rates are fixed and overall domestic inflation is low. Further research might estimate a system of equations rather than a single reduced-form equation to capture the adjustment process and the effects of other variables on the RER in Pakistan.

Equilibrium Real Exchange Rates

The omega parameter estimated using the RER equations above can be used to estimate the equilibrium exchange rate under alternative trade policies.[12] In Table 9 the percentage

[12] The estimate from regression 5 is used for the calculations because the dummy variables used in the regressions over the entire sample period may not have adequately captured the massive structural changes in the economy resulting from the secession of Bangladesh. Equilibrium exchange rates calculated for the pre-1972 period thus are calculated using an out-of-sample estimate of omega.

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Table 9—Calculation of the equilibrium real exchange rate using the omega approach, 1960-87

Year	RER_x (1)	Equivalent Tariff (2)	$(1 + T)^{-\omega}$ (3)	Equilibrium RER_x (4)
Year				
1960	107.40	1.42	1.15	123.97
1961	106.08	1.38	1.14	121.07
1962	100.02	1.45	1.17	116.62
1963	99.87	1.57	1.20	120.15
1964	99.88	1.55	1.20	119.61
1965	105.84	1.61	1.22	128.74
1966	97.96	1.67	1.23	120.82
1967	88.12	1.79	1.27	111.98
1968	88.03	1.81	1.28	112.32
1969	93.84	1.78	1.27	118.73
1970	91.10	1.74	1.26	114.38
1971	102.31	1.62	1.22	124.55
1972	110.75	1.48	1.18	130.21
1973	129.78	1.41	1.15	149.27
1974	94.56	1.47	1.17	110.83
1975	95.72	1.25	1.10	104.99
1976	103.98	1.21	1.08	112.60
1977	101.36	1.30	1.11	112.70
1978	105.40	1.24	1.09	115.29
1979	99.00	1.49	1.18	116.62
1980	95.86	1.62	1.22	116.76
1981	100.00	1.51	1.18	118.32
1982	93.03	1.38	1.14	106.09
1983	100.73	1.41	1.15	115.92
1984	103.33	1.40	1.15	118.51
1985	93.51	1.53	1.19	111.23
1986	114.24	1.51	1.18	135.37
1987	125.38	1.54	1.19	149.78
Average				
1960-71	98.37	1.62	1.22	119.41
1972-77	106.03	1.35	1.13	120.10
1978-82	98.66	1.45	1.16	114.62
1983-87	107.44	1.48	1.17	126.16

Notes: (1) is the real exchange rate index for exports (1981 = 100).
(2) is equivalent tariff = $1 + T = (1 + t_m) / (1 - t_x)$, where t_m is the import tariff and t_x is the export tax .
(3) is misalignment in the real exchange rate ($\omega = -0.410$).
(4) is the equilibrium real exchange rate index = $RER_x \cdot (1 + T)^{-\omega}$.

change in the RER for exports is calculated under the assumption that the implicit import tariff and the implicit export tax are reduced to zero $[(1 + t_m)/(1 - t_x) = 1]$. For example, in 1981, removing all trade tariffs and taxes reduces $(1 + t_m)/(1 - t_x)$ from 1.51 percent to 1.00 (a reduction of 0.51/1.51 = 33.8 percent) and results in a depreciation of the RER by $-33.8 \cdot -0.410 = 13.86$ percent.

Reducing tariffs to zero in the pre-1972 period, when $(1 + t_m)/(1 - t_x)$ averaged 1.62, would have resulted in a 22 percent depreciation of the RER for exports, compared with historical levels (Table 9). As shown in Figure 5, the gap between the official exchange rate (which applied to some agricultural products) and the calculated equilibrium exchange rate is even larger. Under the government of Zulfiqar Ali Bhutto, $(1 + t_m)/(1 - t_x)$ averaged only 1.35, so that removal of all trade barriers would have resulted in a smaller depreciation (13 percent) of the RER. Implicit tariffs have changed little

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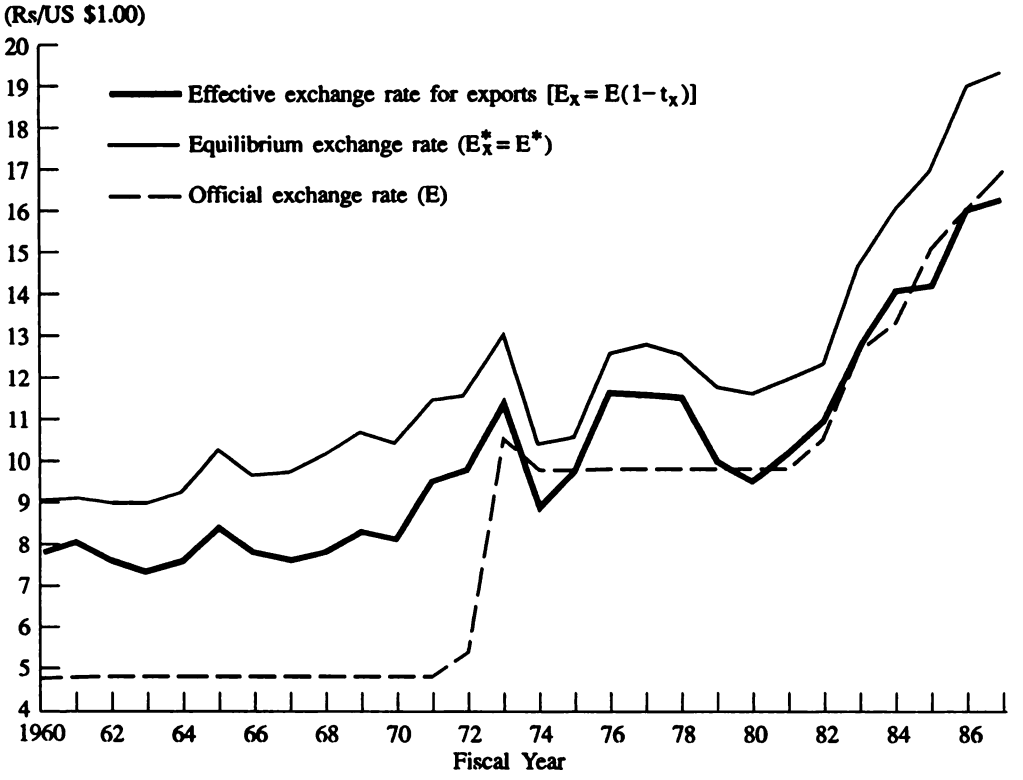
Figure 5—Nominal exchange rates, 1960-87



Source: Derived from basic data in Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

in the 1980s despite a large depreciation of the nominal (and real) exchange rates. Thus the overvaluation of the rupee caused by trade policy has persisted.

The role of reduced levels of workers' remittances in the 1980s on the RER can also be estimated from the RER equation parameters. Private transfers (mostly workers' remittances) rose sharply from the early 1970s to 1984, with the ratio of remittances to GDP increasing nearly fivefold over this period. Had remittances relative to real GDP remained at the 1973 level and implicit tariffs and taxes, terms of trade, and capital inflows remained unchanged, the equilibrium RER in 1984 would have been 20.1 percent higher. Similarly, if the ratio of remittances to real GDP had remained at the 1984 peak level, the equilibrium RER would have been 9 percent lower in 1987, all else remaining the same. Based on the 1987 level of workers' remittances of more than US$2.6 billion, each reduction of US$500 million in remittances would result in a 2.6 percent depreciation of the RER.

Elasticities Approach

An alternative method of determining the equilibrium RER is a variant of the elasticities approach, which is based on estimated import demand and export supply

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elasticities. The essence of the approach is to calculate the change in the RER required to eliminate the unsustainable part of the deficit in the current account and the elimination of trade interventions. Following Krueger, Schiff, and Valdés (1988),

$$E^* = E \cdot \frac{Q_0 + [t_m/(1 + t_m)] \cdot n_D Q_D - [t_x/(1 - t_x)] \cdot e_S Q_S}{(e_S Q_S + n_D Q_D)} + 1, \qquad (11)$$

where

E^* = the equilibrium real exchange rate,

E = the official nominal exchange rate,

Q_0 = unsustainable deficit in the current account = $Q_D - Q_S$,

n_D = the elasticity of demand for foreign exchange (the elasticity of demand for imports),

Q_D = the demand for foreign exchange (the level of imports),

e_S = the elasticity of supply of foreign exchange (the elasticity of supply of exports), and

Q_S = the supply of foreign exchange (the level of exports).

Two series of equilibrium exchange rates calculated using the elasticities approach are presented in Table 10.[13] In the first series (E_1^*), equilibrium is calculated with no tariffs and a balance of trade of zero (remittances are included as exports). The second series (E_2^*), which is more directly comparable to the series obtained using the RER regression, assumes zero tariffs and the same balance of trade as historically observed. For both series, the export supply elasticity is assumed to be 1.0 and the import demand elasticity is assumed to be −2.0.[14]

The elasticities approach ignores changes in the prices of home goods resulting from an exchange rate devaluation. Thus a given percentage change in the nominal exchange rate implies the same percentage change in the real exchange rate. In order to facilitate comparison with the equilibrium exchange rates calculated using the elasticities approach, the equilibrium real exchange rate calculated using the omega approach is expressed in Table 11 as a nominal exchange rate. Assuming that monetary policy is adjusted to keep the price of nontradables equal to its historical level, the calculated percentage change in the real exchange rate for exports is equal to the percentage change in the nominal exchange rate for exports.

Figure 6 compares the equilibrium exchange rates derived from the RER equation (Table 11) and from the elasticities approach (Table 10, E_1^*). A constant RER series

[13] For the years prior to 1973, when Pakistan had multiple exchange rates, the effective exchange rate for exports is used in place of the official nominal exchange rate as a base for the calculations. The ratio $(1 + t_m)/(1 - t_x)$ is used in place of the implicit import tariff, and the export tax (subsidy) is set to zero. Results of an alternative approach that uses the actual t_m and t_x values for all years of the series are shown in Appendix 1, Table 28.

[14] The calculations shown in Table 10 rely heavily on the estimates of the trade elasticities. Nabi, Hamid, and Nasim (1987) also used the elasticities approach (and the same parameter assumptions) to calculate the real exchange rage adjustment, but their results differ markedly for the early years of the period because of higher estimates of the equivalent tariff (calculated using Sjaastad's [1981] import regression residuals method).

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Table 10—Equilibrium exchange rates using an elasticities approach, 1960-87

Year	$1 + t_m$	$1 - t_x$	Q_1	E	E_1^*	E_2^*
			(Rs million)			
1960	2.34	1.65	2,360	4.78	8.54	7.37
1961	2.34	1.69	2,699	4.79	9.08	7.44
1962	2.36	1.62	2,775	4.77	9.07	7.42
1963	2.45	1.56	3,655	4.79	8.81	7.46
1964	2.52	1.62	3,995	4.79	8.85	7.52
1965	2.85	1.77	5,239	4.80	9.26	7.79
1966	2.73	1.64	4,100	4.79	8.83	7.64
1967	2.86	1.59	5,180	4.80	9.07	7.73
1968	3.01	1.66	5,088	4.79	8.73	7.74
1969	3.14	1.77	4,880	4.80	8.68	7.82
1970	3.02	1.73	5,075	4.79	8.74	7.76
1971	3.22	2.00	5,925	4.78	8.77	7.89
1972	2.65	1.78	5,873	5.56	8.70	8.69
1973	1.53	1.08	6,486	10.56	12.96	13.21
1974	1.33	0.90	5,491	9.90	12.05	11.34
1975	1.24	0.99	7,985	9.90	13.15	11.38
1976	1.44	1.19	14,781	9.90	13.67	12.55
1977	1.53	1.18	18,502	9.90	13.80	12.82
1978	1.46	1.17	21,177	9.90	12.83	12.50
1979	1.51	1.01	24,891	9.90	12.73	12.26
1980	1.55	0.96	31,567	9.90	12.59	12.21
1981	1.55	1.03	39,513	9.90	12.46	12.36
1982	1.44	1.04	38,335	10.55	13.41	12.92
1983	1.42	1.01	41,046	12.70	14.84	15.18
1984	1.47	1.05	52,714	13.48	16.55	16.56
1985	1.46	0.95	52,557	15.16	19.07	18.27
1986	1.52	1.00	62,226	16.13	19.81	19.81
1987	1.47	0.95	52,432	17.17	19.90	20.40

Notes: t_m is the implicit import tariff and t_x is the implicit export tax.

Q_1 = current account imbalance due to trade taxes and quotas.

$= [t_m/(1 + t_m] \cdot Q_D \cdot n_D [t_x/(1 - t_x) \cdot (Q_s + \text{Remit})] \cdot e_S$,

E = the actual nominal exchange rate,

$$E_1^* = E \cdot \left\{ \frac{(\text{Current account deficit} + Q_1)}{[Q_D \cdot n_D + (Q_S + \text{Remit}) \cdot e_S]} + 1, \right\}$$

$$E_2^* = E \cdot \{Q_1 \cdot / [Q_D \cdot n_D + (Q_S + \text{Remit}) \cdot e_S] + 1\},$$

Remit = workers' remittances,

Q_D = the demand for foreign exchange (the level of imports),

n_D = the elasticity of supply of foreign exchange (the elasticity of demand for imports),

Q_S = the supply of foreign exchange (the level of exports), and

e_S = the elasticity of supply of foreign exchange (the elasticity of supply of exports).

(purchasing power parity with the 1974 nominal exchange rate as a base) is also included (Table 11). The equilibrium exchange rates calculated using the ω parameter and those calculated using the elasticities approach follow approximately the same path except for the late 1960s and early 1970s. A rise in the export subsidy accounts for much of the divergence between the series in the late 1960s (because changes in the export subsidy directly affect the effective exchange rate for exports on which the ω exchange rate series is based, but indirectly affect the exchange rate series using the elasticities approach through changes in calculated export supply).

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Table 11—Equilibrium nominal exchange rates and purchasing power parity, 1960–87

Year	E (1)	E_x (2)	EPPP (3)	E_x^* (4)	E_x/EPPP (5)	E_x^*/EPPP (6)
		(Rs/US$)			(percent)	
1960	4.78	7.89	8.12	9.10	-2.93	12.05
1961	4.79	8.10	8.44	9.24	-4.02	9.55
1962	4.77	7.74	8.56	9.02	-9.63	5.37
1963	4.79	7.48	8.28	9.00	-9.65	8.70
1964	4.79	7.77	8.60	9.31	-9.63	8.22
1965	4.80	8.49	8.86	10.33	-4.13	16.62
1966	4.79	7.84	8.84	9.66	-11.34	9.34
1967	4.80	7.65	9.60	9.73	-20.24	1.36
1968	4.79	7.95	9.68	10.14	-17.88	4.78
1969	4.80	8.50	9.52	10.76	-10.66	13.03
1970	4.79	8.30	9.58	10.42	-13.37	8.77
1971	4.78	9.54	9.82	11.62	-2.79	18.34
1972	5.56	9.92	9.64	11.67	2.97	21.06
1973	10.56	11.45	9.34	13.17	22.69	41.11
1974	9.90	8.93	9.90	10.46	-9.81	5.71
1975	9.90	9.77	10.68	10.71	-8.53	0.34
1976	9.90	11.75	11.21	12.73	4.89	13.59
1977	9.90	11.68	10.89	12.99	7.32	19.33
1978	9.90	11.58	10.61	12.67	9.19	19.44
1979	9.90	10.00	10.03	11.78	-0.30	17.46
1980	9.90	9.49	10.17	11.56	-6.70	13.64
1981	9.90	10.17	10.56	12.03	-3.66	13.99
1982	10.55	11.01	11.43	12.56	-3.63	9.91
1983	12.70	12.81	11.79	14.74	8.68	25.06
1984	13.48	14.21	12.32	16.30	15.33	32.28
1985	15.16	14.46	13.09	17.19	10.42	31.34
1986	16.13	16.18	12.71	19.17	27.30	50.84
1987	17.17	16.35	11.88	19.53	37.64	64.42

Notes: (1) E = nominal exchange rate,

(2) E_x = nominal exchange rate (E) • $(1 - t_x)$, where t_x is the export tax,

(3) EPPP(t) = Purchasing power parity exchange rate = E (1974) • CPI(t) / WWPI(t),

where CPI is an index of consumer prices in Pakistan andWWPI is an index of wholesale prices of Pakistan's trading partners measured in U.S. dollars.

(4) E_x^* = equilibrium effective exchange rate for exports = equilibrium nominal exchange rate (t_x and $t_m = 0$),

where t_x is the export tax and t_m is the implicit import tariff.

(5) E_x/EPPP = percentage deviation of E_x from EPPP, and

(6) E_x^*/EPPP = percentage deviation of E_x^* from EPPP.

Both the elasticity and omega free-trade equilibrium exchange rate series fluctuate greatly from 1972 to 1974, a period during which the Pakistan economy was subject to a number of major shocks: war with India, the secession of East Pakistan (Bangladesh), a major devaluation and restructuring of the exchange rate system and later a revaluation of the exchange rate. One reason for the instability in the calculated free-trade equilibrium exchange rates may be the underlying disequilibrium in the actual exchange rates on which the calculated series are based. (Both approaches to calculating the free-trade equilibrium exchange rate are essentially comparative static approaches, which implicitly assume that the observed historical exchange rates, trade levels, and other macroeconomic variables are in equilibrium).

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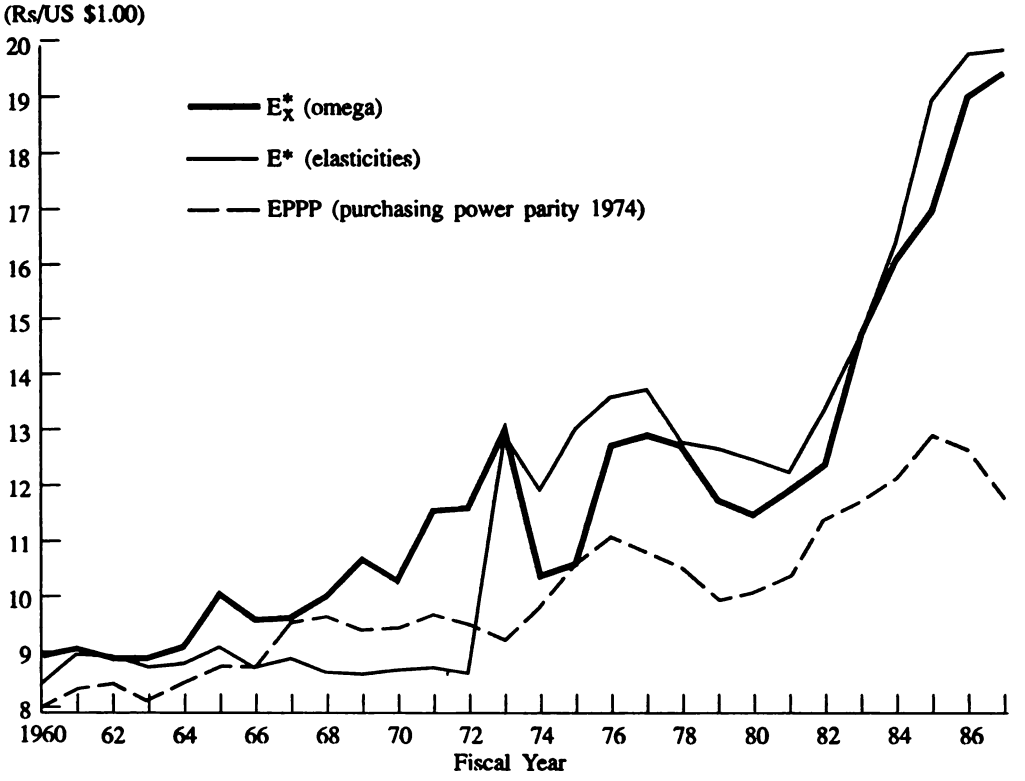
Figure 6—Equilibrium exchange rates, 1960-87



Source: Derived from basic data in Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

All three series are similar from 1974 to 1982. The sharp increase in the omega and elasticity approach series relative to the constant purchasing power parity series after 1982 reflects the underlying depreciation of the nominal exchange rate in the 1980s in response to changes in Pakistan's external environment (decreasing worker remittances), policy decisions (unwillingness to greatly increase foreign borrowing to compensate for lower foreign exchange earnings), and other factors.

In sum, Pakistan's trade policies have consistently favored import-competing sectors at the expense of the export sector over the last three decades. Tariffs and quotas on imports have not only raised the domestic price of importables relative to exportables, but by increasing the demand for home goods, have led to an increase in the price of home goods relative to export goods (an appreciation of the RER for exports). Calculations based on regression results show that a removal of trade taxes and quantitative restrictions would have resulted in an average RER depreciation of 17 percent relative to historical values from 1982 to 1987.

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6

EFFECTS OF TRADE AND EXCHANGE RATE POLICIES ON AGRICULTURAL PRICES

In Pakistan, a number of policy instruments, including export taxes, government monopolies on trade, producer support prices, and input subsidies, have been used in an attempt to influence agricultural output prices and the costs of production. The import substitution bias in industrial trade policy and the resulting appreciation of the real exchange rate (RER) discussed in the previous section have also indirectly affected the prices of agricultural commodities relative to nonagricultural goods.

In this section, the effects of government policies on agricultural price incentives are analyzed. Following the framework set forth in Krueger, Schiff, and Valdés (1988), the effects of agricultural trade and price policies (direct effects) are quantified in terms of nominal and effective rates of protection for major agricultural commodities, calculated using historical nominal exchange rates in determining border prices.[15] The indirect effects of overall trade policy and appreciation of the RER are then included in measures of the total effects on prices and value added by using the free-trade equilibrium RERs of the previous section.

Direct Effects on Output Prices: Nominal Rates of Protection

Agricultural trade and price policies (including trade taxes, quotas, government monopolies on trade, and marketing and processing subsidies) have a direct effect on output prices. Nominal rates of protection measure these direct effects on output prices by comparing actual domestic prices with free-trade prices that would prevail in the absence of government intervention.

$$NRP_i = (P_i - P_i')/P_i' = P_i/P_i' - 1, \qquad (12)$$

where NRP_i is the nominal rate of protection on good i, P_i is the domestic price of good i, and P_i' is the border or world price of good i adjusted for transport and other marketing costs.

In this section, nominal rates of protection are calculated for agricultural commodities based on prices received by farmers. P_i is measured as the support price of the commodity or the wholesale price less marketing costs from farmgate to wholesale market.

Defining the border price is somewhat more difficult because of differences in quality and degree of processing between commodities traded on the world market and the farmers' product. In general, for an exportable good, the border price measured at the farmgate is defined as the world price less the cost of export handling, transport,

[15] The Krueger, Schiff, and Valdés (1988) framework was also used by Nabi, Hamid, and Nasim (1987) in their estimations of effects of policies on agricultural prices.

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and marketing not only to the port but also between the farmgate and the local wholesale market (in order to make a comparison with farmgate prices). The world price is measured as the price in a major export market adjusted for transport and quality differences or as the actual average export price received for Pakistan's exports. For importable goods the border price is defined as the world price (equal to the c.i.f. import price) plus costs of unloading, transport to the wholesale market, and marketing less transport and marketing costs between the farmgate and the wholesale market.

Indirect and Total Effects

Nominal rates of protection, calculated using the official exchange rate, measure only the direct effects of trade policy. However, exchange rates as well as trade policies affect border prices and the opportunity costs of production and consumption. In order to capture the indirect effects of misalignment of the exchange rate, the indirect effects of trade on nonagriculture and of exchange rate policies on farm prices can be measured as

$$\frac{(P_i'/P_{na}) - (P_i^*/P_{na}^*)}{(P_i^*/P_{na}^*)} = \frac{(P_i'/P_{na})}{(P_i^*/P_{na}^*)} - 1$$

$$= \frac{(P_i'/P_{na})}{(E^*/E_0)(P_i'/P_{na}^*)} - 1 = \frac{(E_0/P_{na})}{(E^*/P_{na}^*)} - 1, \qquad (13)$$

where P_i' is the border price of a commodity evaluated at the official exchange rate and P_i^* at the equilibrium exchange rate; E^*/E_0 measures the exchange rate adjustment; P_{na} is the price index of nonagriculture; and P_{na}^* is the price index of nonagriculture with free trade and an equilibrium exchange rate.[16] These indirect effects are of course common to all tradable farm products.[17]

The above measures of indirect effects assume that the prices of nonagricultural goods and services remain unchanged. However, as argued by Valdés (1986), long-term investments in agriculture are a function of the relative prices of agricultural to nonagricultural goods (the domestic terms of trade of agriculture).[18] Thus the ratio of the output price of a commodity to the price of nonagricultural goods is the appropriate measure of the incentives. And because trade and exchange rate policies affect the prices of nonagricultural goods as well as agricultural goods, the total effect (direct plus indirect) of policy on agricultural relative prices is[19]

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[16] In this study, the equilibrium exchange rate, E_x^*, calculated using the omega approach (Table 11), is used as the estimate of the equilibrium exchange rate, E^*. The estimates E_1^* or E_2^*, calculated using the elasticities approach (Table 10), are presented for comparison purposes only.

[17] Whereas the indirect effect is common to all tradables, the estimates of the direct, indirect, and total price effects are done successively, so the numerical value of the indirect effect reported varies by commodity. Alternatively, the direct and indirect effects can be expressed as a percentage of the total effect, in which case the indirect effect is common to all tradables.

[18] See also Mundlak, Cavallo, and Domenech 1989a and 1989b.

[19] Note that the formula for the nominal rate of protection can also be written in this form but, since the calculation of direct effects assumes no changes in overall trade policy or exchange rates, $P_{na}' = P_{na}$, and $NRP_i = (P_i/P_{na} - P_i'/P_{na}')/(P_i'/P_{na}') = (P_i - P_i')/P_i'$. Estimated values of P_{na}, P_{na}', and P_{na}^* are reported in Appendix 3, Table 32, and the methodology is described in Appendix 4.

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$$[(P_i/P_{na}) - (P_i^*/P_{na}^*)]/(P_i^*/P_{na}^*) = (P_i/P_{na})/(P_i^*/P_{na}^*) - 1. \quad (14)$$

This equation measures the combined effects of sectoral and economy-wide price interventions on agricultural prices and is the measure of price incentives used in this study; the total effect on output prices can thus be interpreted as nominal rates of protection adjusted by sectoral and economy-wide policies.

Output Price Effects: Pakistan 1961-87

In estimating the nominal rates of the direct and total effects of government trade and exchange rate policies on output (producer) prices (Table 12), import parity prices are used as world prices for wheat, sugarcane, vegetable oil, maize, and fertilizer; for rice and cotton, export parity prices are used.[20] The producer prices are annual prices at harvest time. In the case of wheat, the producer price is used and is very close to the market price. Details of the calculations are given in Appendix 2.

Wheat

The direct effect of trade and agricultural price policies on wheat in the early 1960s was small, but from 1966 to 1971, domestic wheat prices were on average 28 percent higher than import parity prices when evaluated at the official exchange rate (see Table 12 and Figure 7).[21] Including the indirect effects of the appreciation of the RER, however, the total effect of government policy on farmgate prices of wheat averaged −46 percent in this period.

After the devaluation of 1972 and throughout most of the 1970s and 1980s, the farmgate support prices were kept below the import parity price measured using the official exchange rate. During Bhutto's administration (1972-77), world wheat prices were high, especially during 1972-74, but average domestic producer prices changed little in real terms compared with the 1966-71 period; as a result the nominal rate of protection fell to −38 percent. The border price of wheat measured in real terms (P_w^*/P_{na}^*) fell by 40 percent between the 1961-65 and 1983-87 periods (the 1972-74 rise in world prices was an exception to the overall trend), while farmer support prices declined by only 22 percent so that the total (direct plus indirect) effects of government policies decreased in absolute magnitude from −49 to −33 percent.

In recent years Pakistan has imported only small quantities of wheat for domestic purposes. (Significant quantities have been imported for use at Afghan refugee camps, however.) As shown in Figure 7, domestic procurement prices have been below or near export parity border prices evaluated at the official exchange rate in most years since 1977. In the 1983-87 period, farmgate prices were on average 15 percent above export parity prices using the official exchange rate, but 7 percent below export parity prices using an equilibrium exchange rate.

Basmati Rice

Trade policies have had large direct effects on basmati rice prices. Export taxes and profits to government trading corporations reduced farmgate prices to half or less

[20] Although Pakistan receives some food aid, these food aid flows are inframarginal, and thus the opportunity cost at the margin is still the border price.

[21] Nabi, Hamid, and Nasim (1987) include a detailed summary of the policy measures underlying the measured price effects for wheat, basmati rice, ordinary rice, cotton, and sugarcane.

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Table 12—Direct and total nominal protection rates to producers of agricultural commodities, 1961-87

Commodity/ NPR	Annual Average						
	1961-65	1966-71	1972-77	1978-82	Average 1983-87	Average 1961-71	1972-87
				(percent)			
Importables							
Wheat							
Direct effect	8	28	−38	−34	−19	19	−31
Total effect	−49	−46	−56	−48	−33	−48	−46
Maize							
Direct effect	23	37	−30	0	−1	30	−12
Total effect	−41	−41	−52	−20	−18	−41	−31
Vegetable oil							
Direct effect	4	42	−18	−36	−26	24	−26
Total effect	−40	−21	−37	−46	−35	−30	−40
Milk							
Direct effect	...	...	51	78	82	...	61
Total effect	...	...	18	51	53	...	35
Sugarcane							
Direct effect	538	−287	−22	30	628	88	197
Total effect	20	63	−50	−7	210	43	45
Sugar (ex-mill)							
Direct effect	97	154	−21	9	69	128	17
Total effect	3	26	−43	−11	43	16	−6
Total importables							
Direct effect	...	...	...	...	...	21	48
Total effect	...	...	...	...	...	−11	7
Exportables							
Basmati							
Direct effect	−37	−14	−50	−48	−57	−20	−52
Total effect	−76	−72	−67	−60	−65	−73	−65
Ordinary rice							
Direct effect	16	18	−34	−38	7	17	−23
Total effect	−53	−60	−61	−53	−17	−57	−44
Cotton							
Direct effect	34	76	−10	5	25	57	6
Total effect	−46	−41	−38	−20	−3	−43	−21
Total exportables							
Direct effect	...	...	...	...	...	28	−15
Total effect	...	...	...	...	...	−54	−38

Source: Author's calculations based on data from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: The total importable figures are a weighted average of nominal rates of protection of importables. The weights are the relative value shares of production of the selected products (wheat, 33 percent; maize, 2 percent; sugar, 15 percent; vegetable oil, 2 percent; and milk, 48 percent). Total exportables are a weighted average of nominal rates of protection of exportables. The weights are the relative value shares of production (basmati, 19 percent; other rice, 36 percent; and cotton, 45 percent).

The indirect effect is common to all tradable farm products: however, numerically the implicit indirect effect varies among commodities (see Chapter 6).

Sugar (ex-mill) is not included in the average since the protection is included in sugarcane figures.

of the border price each year from 1979 to 1987, whereas the farmgate prices for paddy were on average 41 percent lower than border prices during the period 1964 to 1987 (see Table 12 and Figure 8). The indirect effect of the appreciation of the RER augmented the direct effect of trade policy so that farmgate prices were on average only one-third the equilibrium exchange rate border prices from 1964 to 1987.

The total effect of government policy on farmgate prices of basmati rice has been remarkably stable, ranging between −60 and −76 percent except in 1977 and 1978

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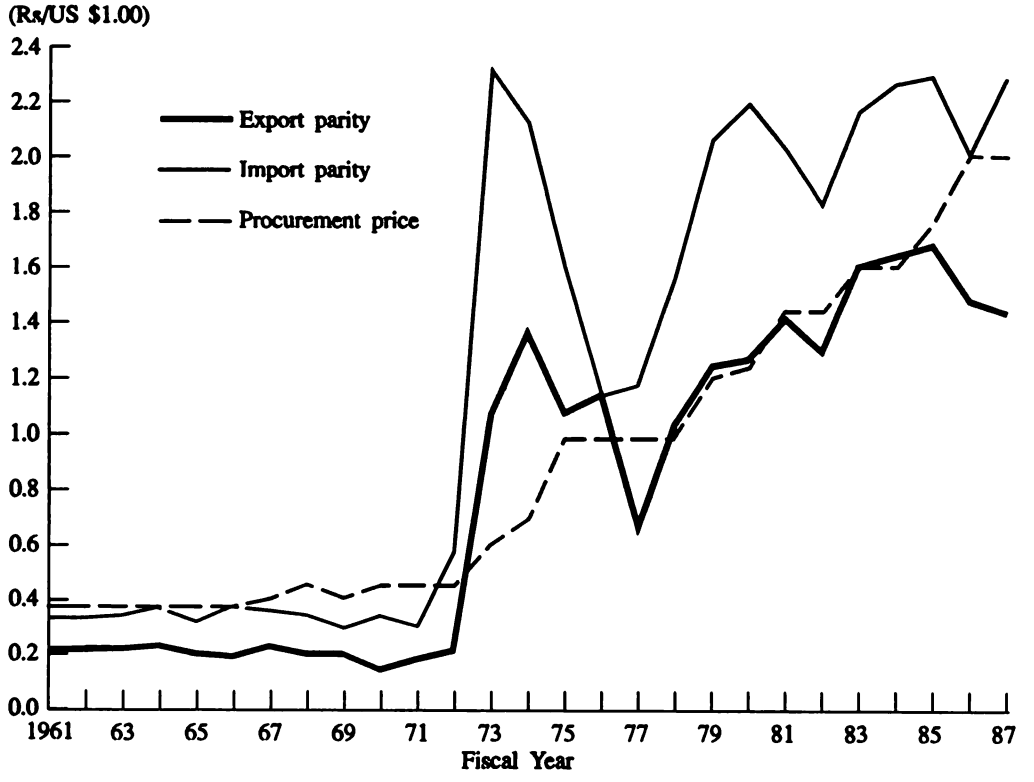
Figure 7—Wheat prices, 1961-87



Sources: Derived from basic data in Pakistan, Ministry of Food, Agriculture and Co-Operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years); and Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: These are annual prices at harvest time, when the procurement price of wheat is similar to the market price; see Appendix 2 for details.

when low world prices did not lead to a corresponding drop in producer support prices.

Although the tax rates on basmati rice have been very high, lower tax rates could result in substantial losses of revenue and foreign exchange if the quantity of exports were increased. Because Pakistan enjoys a virtual monopoly in basmati rice exports on the world market, an increase in farmer prices leading to greater production and increased export supplies would result in lower world rice prices. The same method of estimating rates of production could be extended to adjust to the change in world price resulting from larger basmati exports from Pakistan. This is done in the price model in Chapter 7. In any case, government policies have resulted in a substantial resource transfer from basmati rice farmers to the government.

Ordinary Rice

The direct and total effects of government policies on ordinary rice (including varieties developed by the International Rice Research Institute and other nonbasmati rice) are smaller than those on basmati rice. They have declined substantially since 1981 as world rice prices have fallen. Government purchase prices for paddy were on

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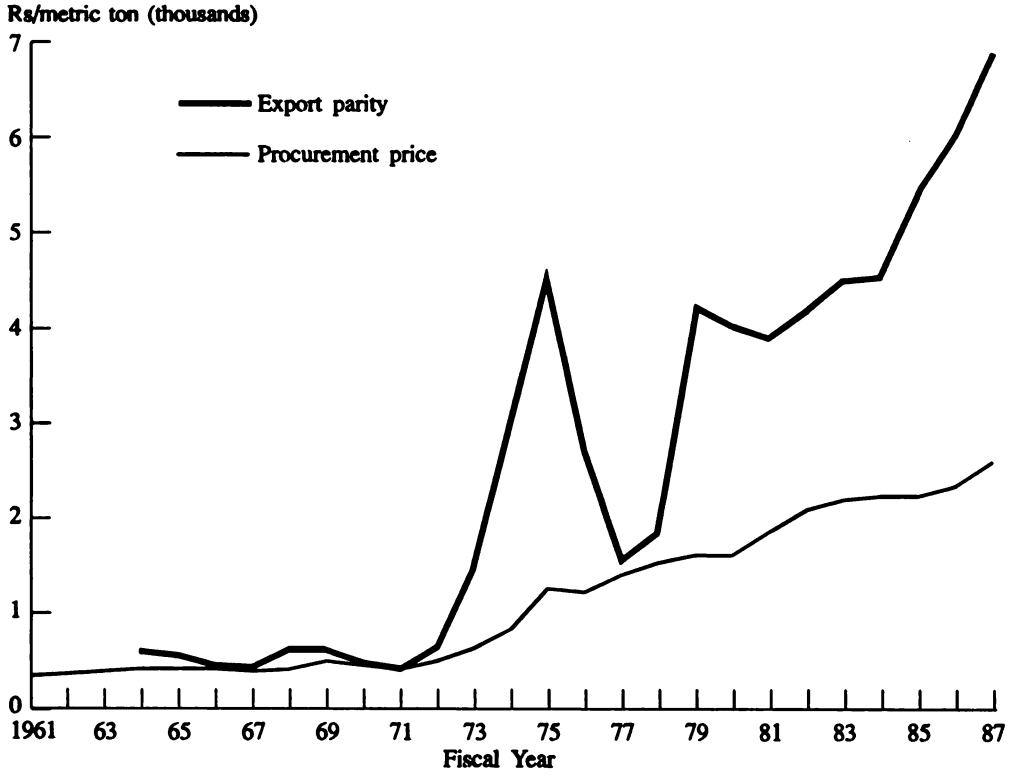
Figure 8—Basmati rice (paddy) prices, 1961-87



Sources: Derived from basic data in Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years); and Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: The border price of rice is converted to that of paddy by adjusting for processing and milling costs. If these processing activities are noncompetitive, the measured nominal rates of protection to producers would be understated. However, the difference in nominal rates of protection as a percentage of mean value would be very small.

average 17 percent higher than official exchange rate border prices from 1961 to 1971 (see Table 12 and Figure 9). After the devaluation in 1972, the direct effect of trade policies was negative until 1983. The total effect of trade and exchange rate policies, however, was approximately the same throughout the 1960s and 1970s, so that farmers received less than half the free-trade equilibrium border price in most years.

Domestic rice prices did not decline along with world rice prices beginning in 1983. As a result, from 1983 to 1987 border prices (using the official exchange rate) were approximately equal to farmgate prices, and the total effect of government policies on ordinary rice prices was only −17 percent.

Cotton

Border prices of seed cotton at the farmgate level were constructed using world (f.o.b.) prices of lint cotton and world (c.i.f.) prices of vegetable oil (soybean and palm oil) to derive a border price for cottonseed. Although cottonseed constitutes approximately two-thirds of the weight of cotton, 75-80 percent of the value of the cotton (in

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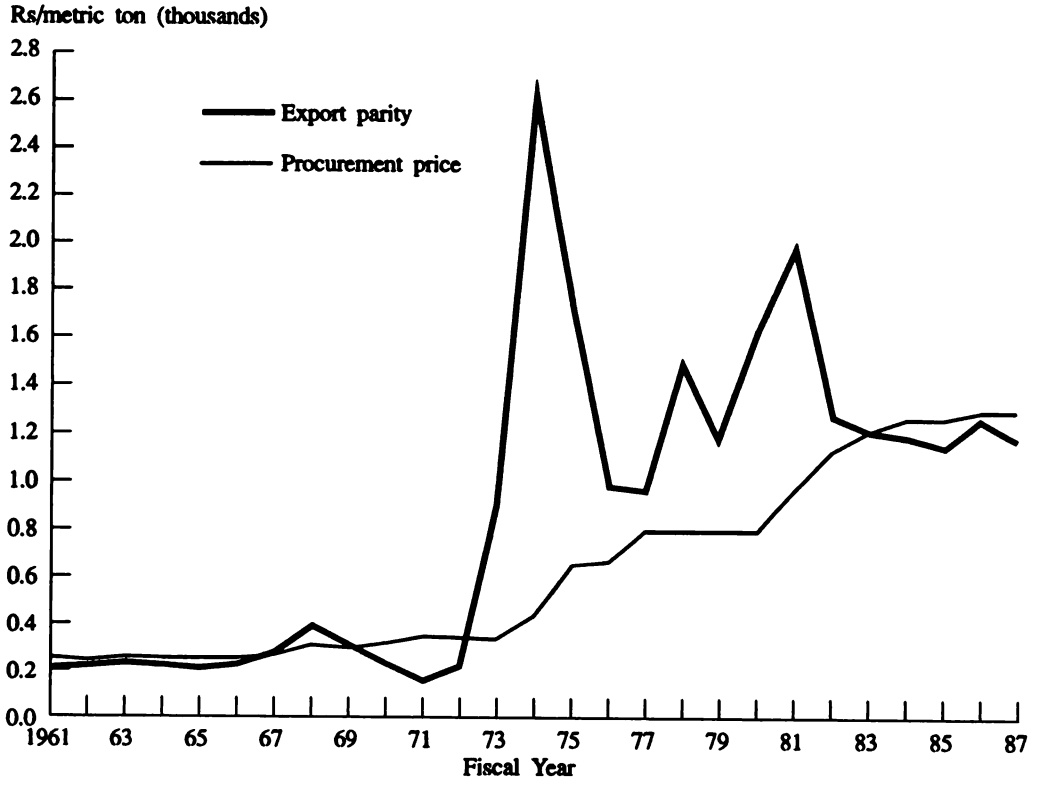
Figure 9—Ordinary rice (paddy) prices, 1961-87



Sources: Derived from basic data in Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years); and Pakistan, Ministry of Finance, *Economic Survey* (islamabad: Ministry of Finance, various years).

Notes: The border price of rice is converted to that of paddy by adjusting for processing and milling costs. Because these costs are protected, the tax is overstated, but the adjustment is very small compared with overall nominal rates of protection.

1987 world prices) derives from the cotton fibers (cotton lint). The implicit tax on cotton lint is thus the major factor in determining the rate of protection on cotton.

During the 1960s, domestic prices of cotton were higher than border prices evaluated at the official exchange rate (Figure 10). Protection provided by direct trade policies was outweighed by the implicit taxation resulting from exchange rate policies, so that the total effect of government policy was a farmgate price 30-52 percent lower than the border price. After the devaluation of 1972, direct taxes levied on raw cotton exports kept domestic raw cotton prices an average of 10 percent below border prices. From 1978 to 1985, the direct effect of trade policies on cotton prices was small in most years. Finally, the sharp reduction in world cotton prices in 1986 and 1987 eliminated the longstanding disprotection of lint cotton. Domestic support prices for cotton declined only slightly in real terms in 1986 and 1987 so that by 1987 real farmgate prices of cotton were 49 percent higher than real, free-trade equilibrium border prices. Thus, there was an implicit subsidy on exports of lint cotton in these years.

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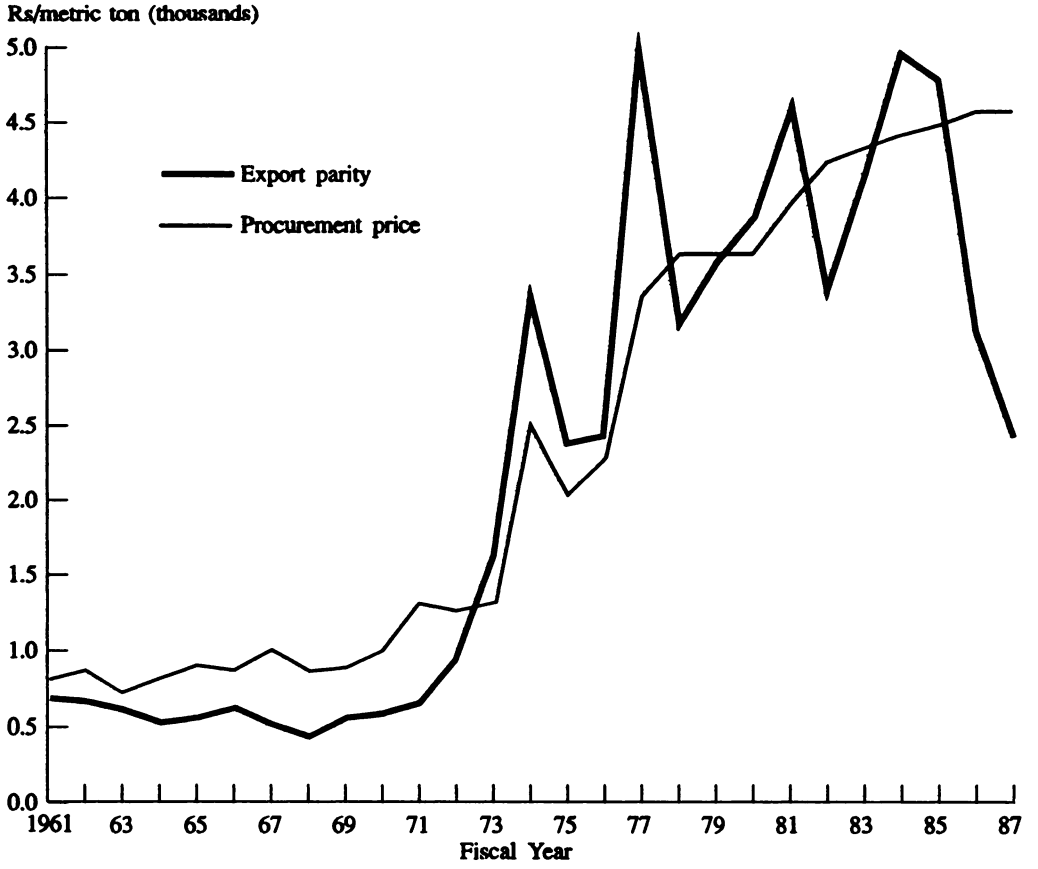
Figure 10—Seed cotton prices, 1961-87



Sources: Derived from basic data in Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years); and Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Vegetable Oil

In the calculations of direct and total effects for vegetable oil prices, the domestic wholesale price of cottonseed oil is compared with the average of the border prices of soybean and palm oils (edible oils imported by Pakistan). No quality adjustment is made in comparing the prices of the oils.

From 1965 until the devaluation of 1972, the domestic price of cottonseed oil was consistently above the border price of imported edible oils (converted to rupees at the official exchange rate). Since 1973, it has been below (see Figure 11). When indirect effects of exchange rate policies are considered, domestic prices were below border prices every year, averaging 36 percent below border prices of imported vegetable oils.

Sugarcane

World prices of refined sugar are extremely variable, which causes measures of protection provided by government policies to fluctuate wildly. The real border price (P_s^*/P_{na}^*) of refined sugar (ex-mill) varied from Rs 1,649 to Rs 14,077 per ton in 1981

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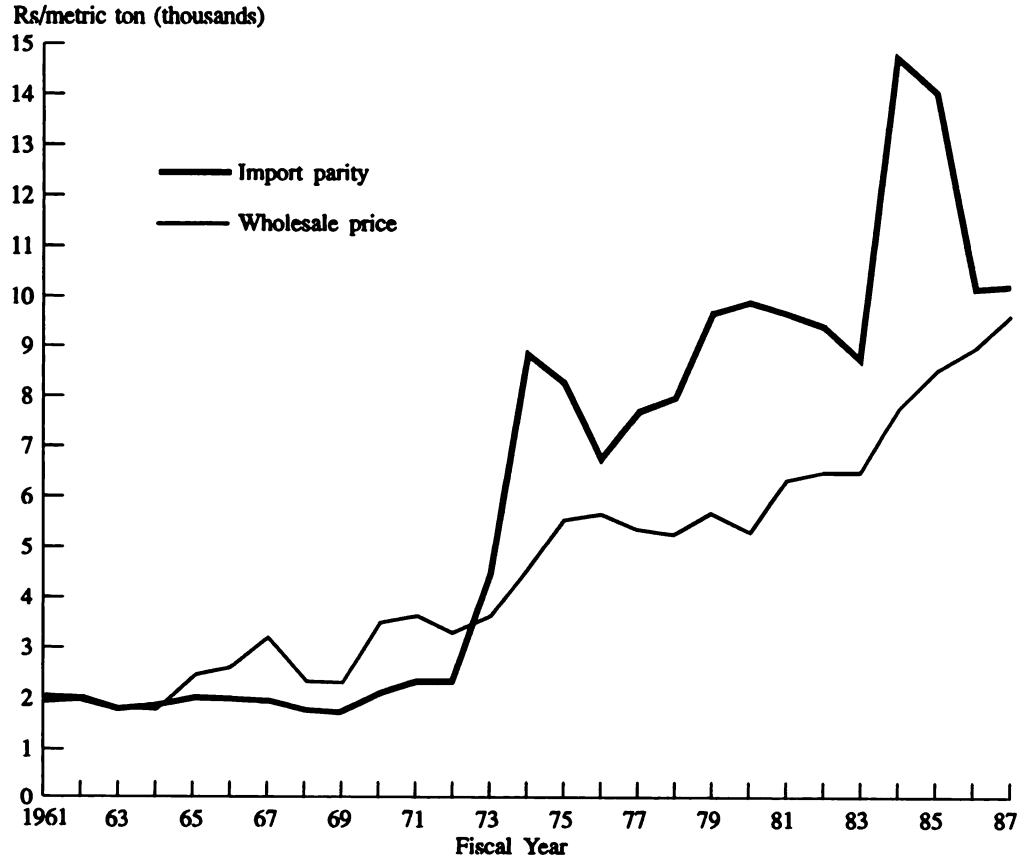
Figure 11—Vegetable oil prices, 1961-87



Sources: Derived from basic data in Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years); and Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

currency. Border prices for sugarcane measured at the farmgate (and assuming no change in domestic milling costs) showed even larger variations (Figure 12).

In 15 of the 27 years from 1961 to 1987, domestic sugar prices (ex-mill) were higher than border prices evaluated at the free-trade-equilibrium exchange rate, while in 12 of the years they were lower. Since 1982, domestic sugar prices (ex-mill) and farmgate sugarcane prices have both been above their corresponding free-trade equilibrium border prices, by an average of 43 and 210 percent, respectively.

Maize

Maize prices (at the official exchange rate) have fluctuated around import parity prices since the mid-1970s (Figure 13). Between 1978 and 1987, however, farmgate prices were on average 19 percent below border prices evaluated at the equilibrium exchange rate. For the overall period 1961-87, farmgate prices averaged 35 percent below import parity (using equllibrium exchange rates).

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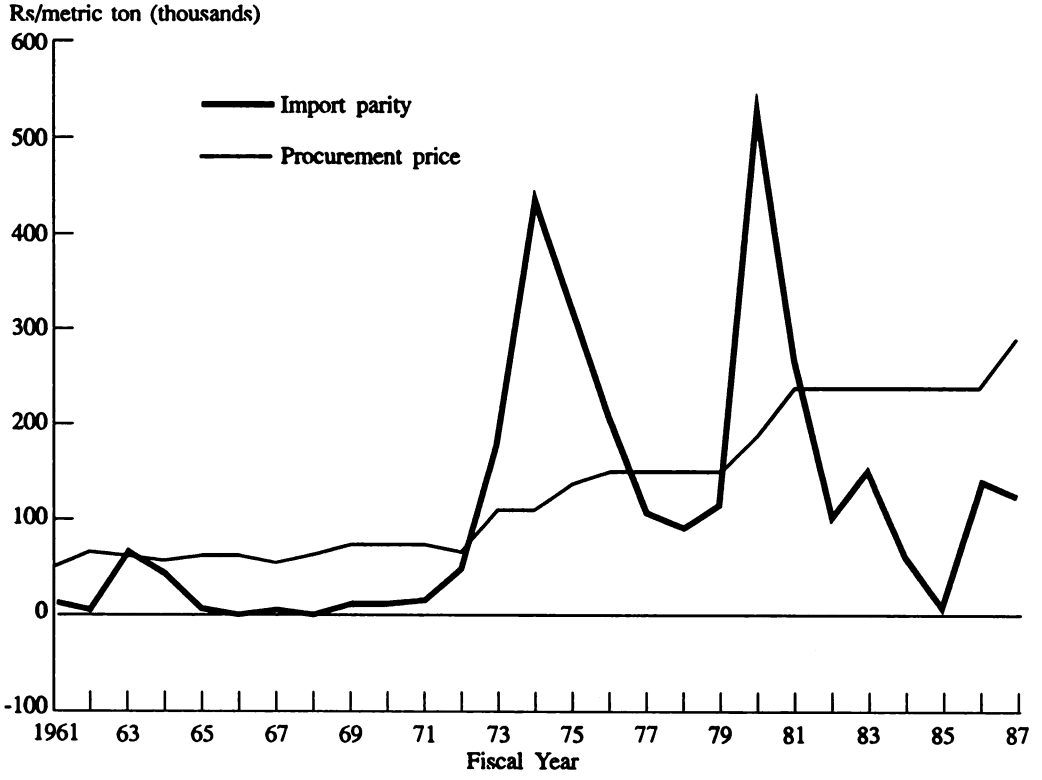
Figure 12—Sugarcane prices, 1961-87



Sources: Derived from basic data in Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years); and Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Milk

The direct effect of trade and agricultural price policies on milk was large and positive during the 1972-87 period (data on import unit values prior to 1972 are not available). From 1978 to 1987, the domestic prices of milk were, on average, 80 percent higher than the import parity prices. Using the equilibrium exchange rates for 1972-87, there was an average subsidy on milk of 35 percent.[22]

Fertilizer

In calculating direct and total effects on fertilizer prices, domestic fertilizer prices are compared with import border prices constructed using a weighted average of urea and diammonium phosphate prices. From 1961 to 1972, domestic prices were above world prices at the official exchange rate (Figure 14). After the devaluation, the direct effect of trade policy on fertilizer output prices was negative. World prices at the

[22] The historical value of production of milk is high (Rs 40,253 million in 1986-87) compared with that of cereals (Rs 28,502 million for wheat and Rs 2,692 million for basmati rice in the same period). That the average protection on importables is positive in spite of the high taxation on cereals reflects that fact.

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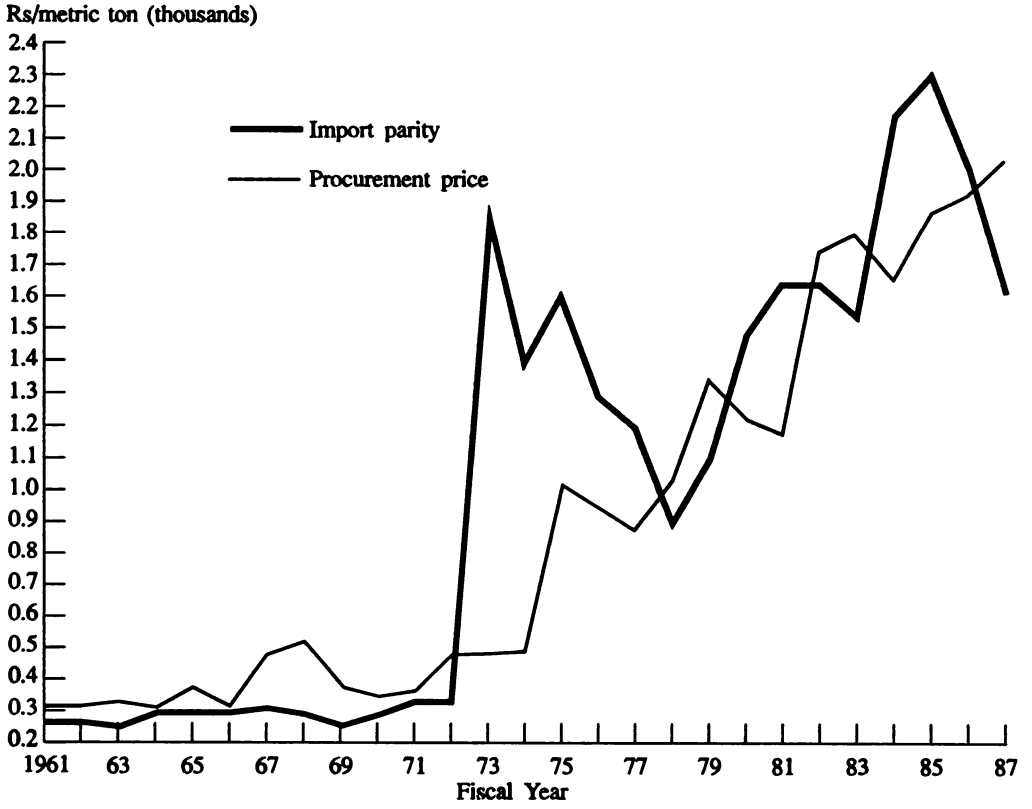
Figure 13—Maize prices, 1961-87



Sources: Derived from basic data in Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years); and Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

equilibrium exchange rate, used as a measure, indicate that there was an average subsidy of 40 percent on domestic fertilizer from 1961 to 1987.

Effective Rates of Protection

Government trade and exchange rate policies influence the prices of tradable inputs into agricultural production as well as output prices. The direct effects on value added per unit of output of commodity i (value of output less value of nonfactor inputs) are measured by the effective rate of protection, defined as

$$ERP_i = (VA_i - VA_i')/VA_i' = VA_i/VA_i' - 1, \qquad (15)$$

where ERP is the effective rate of protection and VA is the value added.[23] Total effects

[23] Or equivalently, $ERP_i = [(VA_i/V_{na}) - (VA_i'/V_{na})]/(VA_i'/V_{na}) = (VA_i - VA_i')/VA_i'$.

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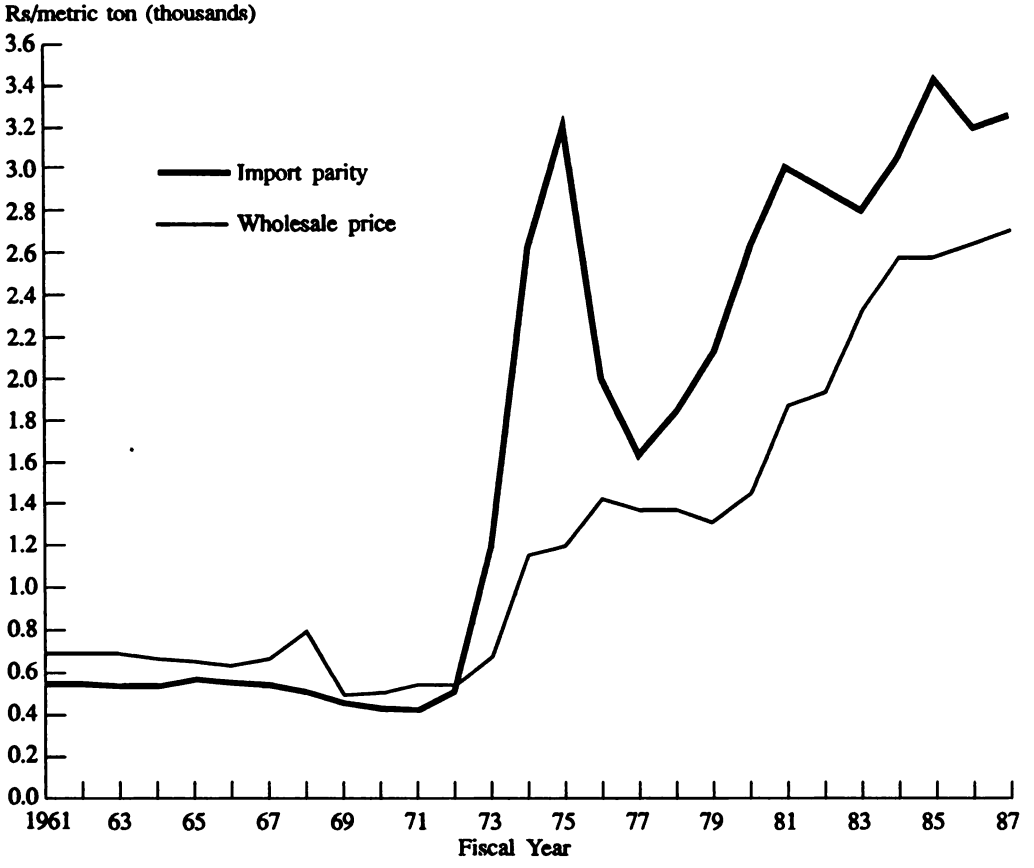
Figure 14—Fertilizer prices, 1961-87



Sources: Derived from basic data in Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years); and Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

(including indirect effects of exchange rate policy) can be measured as

$$ERPT = [(VA_i/V_{na}) - (VA_i^*/V_{na}^*)]/(VA_i^*/V_{na}^*) = [(VA_i/V_{na})/(VA_i^*/V_{na}^*)] - 1, \quad (16)$$

where V_{na} represents value added in the nonagricultural sector and the asterisks indicate that the value added is measured using border prices valued at the equilibrium exchange rate.

However, adjusting V_{na} to V_{na}^* is beyond the scope of this study, and P_{na} and P_{na}^* are used as proxies. Input costs used to calculate value added by crop are based on cost-of-production data for a single year. The time series of input costs assume constant yields and constant input-output relations. Prices of inputs are estimated using price indices of fertilizer, nonagricultural goods and services, and nontraded goods.

In calculating the direct effects of policy on value added, border prices of fertilizer are used, assuming free trade in agricultural inputs, but no change in exchange rates.

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For the calculations of total effects of policy on value added, input cost estimations include effects of exchange rate changes. The price index of nonagricultural goods and services under free trade with equilibrium exchange rates (P^*_{na}) is used in estimating changes in prices of some inputs including irrigation (tubewells and canals), tractor services and plant protection. For sugarcane, cotton, and rice, domestic processing costs are assumed to be unchanged in the calculations of effective rates of protection. To the extent that processing costs are inefficient, costs of production at world prices are overestimated and effective rates of protection underestimated. Details of the calculations are given in Appendix 3.

Table 13 presents results of calculations of the value added and effective rates of protection for wheat, basmati rice, ordinary rice, cotton, and sugarcane. Because value added at world prices is small in some years, the effective rates of protection estimated can be extremely large. In general, the pattern of effective rates of protection is similar to that of direct and total effects of output prices, since traded input costs are small for most commodities considered.

Table 13—Measures of direct and total effective rates of protection to agricultural producers, 1961–87

Commodity/ NPR	Annual Average					Average 1961-71	Average 1972-87
	1961-65	1966-71	1972-77	1978-82	1983-87		
	(percent)						
Importables							
Wheat							
Direct effect	1	36	-44	-42	-25	20	-37
Total effect	-60	-55	-62	-56	-42	-57	-54
Sugarcane							
Direct effect	1,751	510	-18	97	-435	1,074	-112
Total effect	108	393	-52	18	121	263	24
Maize							
Direct effect	87	141	17	92	-10	117	32
Total effect	-28	-19	-26	41	-30	-23	-6
Total importables							
Direct effect	...	...	...	...	...	351	-57
Total effect	...	...	...	...	...	44	-28
Exportables							
Basmati							
Direct effect	-61	-39	-64	-61	-72	-44	-65
Total effect	-88	-86	-78	-72	-78	-86	-76
Ordinary rice							
Direct effect	16	29	-38	-49	12	26	-26
Total effect	-65	-69	-69	-63	-22	-68	-53
Cotton							
Direct effect	34	142	-11	16	117	93	38
Total effect	-61	-55	-44	-18	27	-58	-14
Total exportables							
Direct effect	...	...	...	...	...	43	-3
Total effect	...	...	...	...	...	-67	-43

Source: Author's calculations based on data from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: Total importables is a weighted average of effective rates of protection of importables. The weights are the relative value shares of production (wheat, 65 percent; sugarcane, 31 percent; and maize, 4 percent). Total exportables is a weighted average of effective rates of protection of exportables. The weights are the relative shares of production (basmati, 19 percent; other rice, 36 percent; and cotton, 45 percent).

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Apart from the objective of influencing the average level of prices, one of the reasons why the Pakistan government intervenes in agricultural markets is to provide greater year-to-year price stability for both producers and consumers. Table 14 presents the coefficients of variation for real agricultural prices (nominal prices deflated with an index of nonagricultural prices, P_{na} or P^*_{na}). Agricultural trade and price policies have resulted in greater price stability for producers of wheat, basmati and ordinary rice, cotton, sugar, maize, and milk. Only for vegetable oil and fertilizer are coefficients of variation of border prices calculated using equilibrium exchange rates approximately the same as or lower than coefficients of variation of actual domestic prices. For producers of wheat, rice, cotton, and maize, increased price stability is accompanied by lower average prices.

Table 14—Coefficients of variation of producer prices, 1961-87

Commodity	P_p/P_{na}	P'_p/P_{na}	P^*_p/P^*_{na}
Wheat (import parity)	0.11	0.57	0.42
Wheat (export parity)	0.11	0.48	0.29
Basmati (unmilled)[a]	0.12	0.46	0.22
Basmati[a]	0.09	0.39	0.21
Ordinary rice (unmilled)	0.12	0.67	0.44
Ordinary rice	0.12	0.63	0.42
Cotton	0.14	0.39	0.28
Vegetable oil	0.26	0.27	0.22
Sugar (ex-mill)	0.13	0.71	0.57
Sugar cane	0.17	1.17	0.80
Maize	0.15	0.54	0.40
Milk[b]	0.07	0.42	0.30
Fertilizers	0.26	0.36	0.27

Source: Author's calculations based on data from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: P_p/P_{na} is the actual relative price to producers. P'_p/P_{na} is the border price for a farm product relative to actual prices of nonagricultural product. P^*_p/P^*_{na} is the ratio of the border price of a farm product to the price of nonagricultural products with both prices measured using the equilibrium exchange rate.

[a]Prices for 1960/61-1962/63 are not included.

[b]Border prices for 1960/61-1970/71 are not included.

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7

MODELING THE REAL EFFECTS OF PRICE CHANGES

In this section, a model designed to estimate the effects of changes in agricultural prices on real variables such as production, consumption, and income is presented. The model incorporates tradable as well as nontradable goods and allows endogenous determination of supply and demand of all agricultural commodities, agricultural income, prices of nontraded goods, and the balance of trade for agricultural commodities.

Two simulations are conducted. The first simulates the effects of a policy of free trade in agriculture with no exchange rate adjustment. Domestic prices of traded goods are thus equal to border prices at actual historical exchange rates. The second simulation also examines the effects of a policy of free trade, with an adjustment for the macroeconomic effects of a different trade policy on the real exchange rate.[24] Domestic prices of tradable goods in the second simulation are equal to border prices at a counterfactual equilibrium exchange rate. The simulations project the effects of these policy scenarios on agricultural output, consumption, aggregate agricultural income, and the balance of trade for agriculture.

The main equations of the model are presented first and followed by a list of the definitions of the variables and parameters used. The algorithm used in solving the model is outlined briefly. Finally, the major differences between the new model and that used by Nabi, Hamid, and Nasim (1987) are highlighted, and remaining gaps in the model framework are discussed.

Model Equations

The main equations of the agricultural model and definitions of the variables and parameters are presented here (see the glossary of variables on pages 60-61). Nine equations determine supply, consumption, income, and trade. Equations 27-34 define prices and marketing margins. Various identities are not included here. All domestic prices are expressed in real terms, using PNA(t) or PNA1(t), the historical and simulated price indices of nonagricultural goods and services, as price deflators.

Supply

The supply equations are

$$\begin{aligned}\text{LOG[Area1(t,i)/Area(t,i)]} &= \text{ELAG(i)} \cdot \text{LOG[Area1(t}-1\text{,i)/Area(t}-1\text{,i)]} \\ &\quad + \Sigma_j \text{ESA(i,j)} \cdot \text{LOG[PPE1(t,j)/PPE(t,j)]},\end{aligned} \tag{17}$$

[24] Logically, the indirect effects on the real exchange rate of a free trade in agriculture policy (with no change in industrial trade policy) could have been simulated as well. However, the magnitude of these indirect effects are very small, given the small size of net agricultural trade restrictions (for example, export taxes on basmati rice and cotton with import restrictions on sugar and wheat) relative to total (agricultural and nonagricultural) trade.

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$$\text{LOG[Yield1(t,i)/Yield(t,i)]} = \Sigma_j \text{EY(i,j)} \cdot \text{LOG[PPE1(t,j)/PPE(t,j)]}, \text{ and} \quad (18)$$

$$\text{Prod1(t,i)} = \text{Area1(t,i)} \cdot \text{Yield1(t,i)}. \quad (19)$$

In calculating supply effects, the impact of price changes on both acreage and yield is modeled. Acreage is modeled in a Nerlovian framework as a function of lagged acreage and expected farmgate crop prices (equation 17). Expected farmgate prices are assumed to equal a weighted average of actual farmgate prices in the previous three years (see equations 27 and 28), with weights declining for further back years.[25] Yield is assumed to depend only on expected farmgate crop prices (equation 18).

Consumption

Consumption is calculated as a function of real consumer prices and income.

$$\text{LOG[Cons1(t,i)/Cons(t,i)]} = \text{EDY(i)} \cdot \text{LOG[Y1(t)/GNP(t)]} + \Sigma_j \text{ED(i,j)} \cdot \text{LOG[PC1(t,j)/PC(t,j)]}. \quad (20)$$

Income

The income equations are as follows:

$$\text{YAG(t)} = \Sigma_j \text{PP(t,i)} \cdot \text{Prod(t,i)}, \quad (21)$$

$$\text{YNAG(t)} = \text{GNP(t)} - \text{YAG(t)}, \quad (22)$$

$$\text{YAG1(t)} = \Sigma_j \text{PP1(t,i)} \cdot \text{Prod1(t,i)}, \text{ and} \quad (23)$$

$$\text{Y1(t)} = \text{YAG1(t)} + \text{YNAG(t)}. \quad (24)$$

In calculating income, it is assumed that nonagricultural income remains unchanged relative to historical values. Agricultural income is calculated as simulated producer prices times the quantity produced (equation 23). Consumer prices of traded goods are simply border prices adjusted for marketing costs (equations 29 and 30).

Trade

$$\text{Trade1(t,i)} = \text{Prod1(t,i)} \cdot [1 - \text{XLOSS(i)}] - \text{Cons1(t,i)}, \text{ for all i, except i} = 4, \text{ and} \quad (25)$$

$$\text{Trade1(t,i)} = \text{Prod1(t,4)} \cdot [1 - \text{XLOSS(4)}] - \text{Cons1(t,4)} + \text{XOIL} \cdot [\text{Prod1(t,12)}] \cdot [1 - \text{XLOSS(12)}]. \quad (26)$$

The model calculates the autarky (no trade) prices of nontraded goods, given income and the prices of traded goods, by solving a system of simultaneous equations. For nontraded goods, equation 30 is used to calculate producer prices received by farmers as the consumer prices less marketing costs.

[25] Weights of 0.50, 0.35, and 0.15 for prices lagged 1 to 3 years are assumed.

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Glossary of Variables and Parameters Included in the Simulation Model

Variables

The variables included in the simulation model are defined as follows:

Area(t,i) = Area of commodity i, year t, in 1,000 hectares.
Area(t,i) = Simulated area of commodity i, year t, in 1,000 hectares.
Cons(t,i) = Consumption of commodity i, year t, in 1,000 metric tons.
Cons1(t,i) = Simulated consumption of commodity i, year t, in 1,000 metric tons.
CPI(t) = Consumer price index, year t.
ER(t) = Nominal exchange rate, year t, Rs per US$.
GNP(t) = Gross national product, year t, in Rs billion.
Marg1t(t,i) = Marketing margin for commodity i from farmgate to processing center, year t, in Rs per kilogram of unprocessed commodity.
Marg2t(t,i) = Marketing margin for commodity i from processing center to wholesale market, year t, in Rs per kilogram of processed commodity.
Pbasm1(t) = Simulated f.o.b. price of basmati rice, Karachi, in US$ per metric ton before comparison with historical ordinary rice price levels.
Pbasm2(t) = Simulated f.o.b. price of basmati rice, Karachi, in US$ per metric ton.
Pbasmw(t) = f.o.b. price of basmati rice, Karachi, in US$ per metric ton.
PC(t,i) = Consumer price of commodity i at the wholesale level, year t, Rs per metric ton.
PC1(t,i) = Simulated consumer price of commodity i at the wholesale level, year t, Rs per metric ton.
PC1M(t,i) = Simulated import parity consumer price of commodity i at the wholesale level, year t, Rs per metric ton.
PC1X(t,i) = Simulated export parity consumer price of commodity i at the wholesale level, year t, Rs per metric ton.
Pordw(t) = f.o.b. price of ordinary rice, Bangkok, in US$ per metric ton.
PNA(t) = Price index of nonagricultural goods, year t.
PNA1(t) = Simulated price index of nonagricultural goods, year t.
PP(t,i) = Producer price of commodity i at the farmgate, year t, in Rs per metric ton.
PP1(t,i) = Simulated producer price of commodity i at the farmgate, year t, in Rs per metric ton.
PPE(t,i) = Expected producer price of commodity i at the farmgate, year t, in Rs per metric ton.

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PPE1(t,i) = Simulated expected producer price of commodity i at the farmgate, year t, in Rs per metric ton.

Prod(t,i) = Production of commodity i, year t, in metric tons.

Prod1(t,i) = Simulated production of commodity i, year t, in metric tons.

SHIP(t) = Shipping costs from Karachi to the Middle East for basmati rice, year t, in US$ per metric ton.

Trade(t,i) = Trade of commodity i, year t, in metric tons (negative value indicates imports).

Trade1(t,i) = Simulated trade of commodity i, year t, in metric tons (negative value indicates imports).

XHAND(t) = Export handling costs of basmati rice, year t, in Rs per metric ton.

Y1(t) = Simulated gross national product, year t, in Rs billion.

YAG(t) = Gross value of major agricultural commodities in Rs billion.

YAG1(t) = Simulated gross value of major agricultural commodities, in Rs billion.

Yield(t,i) = Yield of commodity i, year t, in kilograms per hectare.

Yield1(t,i) = Simulated yield of commodity i, year t, in kilograms per hectare.

YNAG(t) = Gross national product less gross value of major agricultural commodities, in Rs billion.

Parameters

BSDIF = Minimum price differential between basmati and ordinary rice on the world market.

ED(i,j) = Elasticity of demand of commodity i with respect to a change in price of commodity j.

EDY(i) = Income elasticity of demand of commodity i.

EY(i,j) = Elasticity of yield of commodity i with respect to a change in price of commodity j.

ELAG(i) = Adjustment parameter on lagged area, commodity i.

ESA(i,j) = Short-run elasticity of area planted (or production) of commodity i, with respect to a change in price of commodity j.

MARG1(i) = Marketing margin for commodity i from farmgate to the processing center in 1987, in Rs per kilogram of unprocessed commodity.

MARG2(i) = Marketing margin for commodity i from the processing center to wholesale market in 1987, in Rs per kilogram of processed commodity.

PRATE(i) = Conversion factor: kilograms of processed commodity per kilogram of unprocessed commodity.

XLOSS(i) = Waste and storage losses of commodity i per metric ton of production.

XOIL = Rate of kilograms of cottonseed oil to kilograms of lint cotton.

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Prices

The price equations are

$$PPE(t,i) = 0.5 \cdot PP(t-1,i) + 0.35 \cdot PP(t-2,i) + 0.15 \cdot PP(t-3,i), \quad (27)$$

$$PPE1(t,i) = 0.5 \cdot PP1(t-1,i) + 0.35 \cdot PP1(t-2,i) + 0.15 \cdot PP1(t-3,i), \quad (28)$$

$$PC(t,i) = [PP(t,i) + Marg1(t,i)]/PRATE(i) + Marg2(t,i), \quad (29)$$

$$PC1(t,i) = [PP1(t,i) + Marg1(t,i)]/PRATE(i) + Marg2(t,i), \quad (30)$$

$$Marg1t(t,i) = Marg1(i) \cdot CPI(t)/CPI(1987), \quad (31)$$

$$Marg2t(t,i) = Marg2(i) \cdot CPI(t)/CPI(1987), \quad (32)$$

$$LOG[Pbasm1(t)] = LOG[Pbasmw(t)] + (1/ELASB) \cdot [Trade1(t,4) - Trade(t,4)]/20{,}000, \text{ and} \quad (33)$$

$$Pbasm2(t) = \text{Maximum } [BSDIF \cdot Prodw(t), Pbasm1(t)]. \quad (34)$$

For area and yield elasticities with respect to price, see Appendix 1, Table 29. For demand and income elasticities, see Appendix 1, Table 30. For all traded commodities except basmati rice, Pakistan is assumed to be a "small country" in the world market, so that changes in Pakistan's trade do not affect the world price. For basmati rice, for which Pakistan enjoys a monopoly on exports, world price is simultaneously determined with Pakistan's exports in the model. Based on parameter estimates from a regression of world demand for basmati rice (see Appendix 4), the world price of basmati rice is assumed to decline by 0.533 percent for every 20,000-ton increase in Pakistan's exports (equation 33). In addition, it is assumed that the world price for basmati rice will not fall to less than 1.6 times the world price for ordinary rice (5 percent broken) (equation 34).[26]

Model Algorithm

1. For each commodity, area, yield, and production (equations 17, 18, and 19) are calculated as functions of expected producer prices (equations 27 and 28).
2. For each commodity, the realized producer price is set equal to the expected producer price and the consumer price is set equal to the expected producer price plus marketing costs (equations 29 and 30).
3. For each commodity, the trade status indicator is set to correspond with trade status in the previous year of the simulation (or with historical trade status in the first year of the simulation).
4. Agricultural and total incomes are calculated using realized producer prices and simulated production (equations 21-24).

[26] In the period studied, the minimum ratio of prices of basmati rice to ordinary rice was approximately 1.6.

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5. For each commodity, demand and trade are calculated using simulated consumer prices (equations 25, 26, and 27).
6. Consistency of trade status indicators and trade levels for each commodity are checked.
   - If the trade status indicator is "import parity" and imports are negative (trade is greater than zero), the trade status indicator is set to "nontraded."
   - If the trade status indicator is "export parity" and exports are negative (trade is less than zero), the trade status indicator is set to "nontraded."

   If no trade status indicators were changed in step 6, proceed to step 7; otherwise, to step 8.
7. Whether a solution has been found is determined. Error = Σ_i [Trade (t,i)]^2 is calculated for goods i that have a "nontraded" status. If Error is less than maximum error (= 1.0), a solution has been found. Otherwise, proceed to step 8.
8. The matrix inversion subroutine is called to calculate autarky (no trade) consumer prices of all goods that are nontraded.
9. Autarky consumer prices of nontraded goods are compared with import and export parity prices.
   - If the autarky price is less than export parity, the consumer price is set to the export parity price and trade status is set to "export parity."
   - If the autarky price is greater than import parity, the consumer price is set to the import parity price and trade status is set to "import parity."
10. The world price of basmati rice and the new consumer price of basmati rice are calculated, given simulated exports of basmati rice (equations 33 and 34).
11. For each commodity, the new realized producer price equal to the new consumer price less marketing costs is calculated (equation 30).
12. Return to Step 4.

The trade status of each tradable good (whether the good is exported, imported or not traded) may change from year to year according to simulated domestic demand and supply and world prices. Four goods (sorghum/millet, pulses, meat, and fruit) are treated as nontradables; trade for each of these goods is fixed at zero. Milk is also modeled as a nontradable for years prior to 1972.

For each simulation year, domestic production is determined as a function of expected prices and lagged area; real income is calculated using the simulated levels of production and producer prices. Consumption and trade are then computed using consumer prices equal to producer prices plus marketing costs.

Before solving for equilibrium consumer prices of nontraded goods, trade levels of all tradable goods are checked for consistency with the consumer prices used. If exports (imports) are negative and export (import) parity prices of the commodity are used in calculating consumption and trade, the good is reclassified as a nontraded good. Autarky prices of all nontraded goods (the four commodities that are modeled as nontradable and tradable commodities with negative exports at export parity prices or negative imports at import parity prices) are calculated by solving a system of linear equations in the logarithms of the consumer prices.

The autarky prices of tradable goods are then compared with import and export parity prices. If the autarky price is greater than the import parity price (or less than the export parity price), the consumer price is set at the import (export) parity price. New export parity and consumer prices of basmati rice are also calculated using basmati rice trade levels.

The model iterates by recalculating consumption and trade levels using the new consumer prices. A solution of the model is reached when exports (imports) of all

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goods with export (import) parity consumer prices are positive and when the sum of squares of trade of nontraded commodities is small (less than 1.0). Producer and consumer prices are stored for the following year's simulation.

Data

Domestic supply and demand elasticities are from Hamid et al. (1987) and are presented in Appendix 1, Tables 29 and 30. These own-price elasticities of demand are largely based on econometric estimates. Hamid et al. constructed the full matrix of demand parameters from these econometric estimates, making their own judgments on other elasticities and using constraints imposed by economic theory (symmetry of compensated cross-price elasticities, homogeneity, and an assumption that compensated cross-price elasticities between food and nonfood are zero). Area response parameters are calculated in a similar manner, with the important restriction that the aggregate area supply response for an index of agricultural prices is set at 0.25. This guarantees that the total change in area planted for all crops does not increase too greatly when prices of all crops increase. Changes in relative prices still result in changes in the area mix, and smaller changes in total area planted. In addition, nonzero cross-price elasticities of cotton yields with wheat prices and of wheat yields with cotton prices are specified to capture the trade-offs between these two crops in major production systems in the Punjab. [See Hamid et al. (1987) for more details.]

Marketing margins are based on those used in the calculations of nominal and effective rates of protection (see Appendix 2). Values of the other remaining parameters are given in Appendix 1, Tables 29 and 30.

Overview of the Model

The model described above differs in a number of ways from that used by Nabi, Hamid, and Nasim (1987). Seven additional agricultural subsectors (maize, millet and sorghum, pulses, vegetable oils, meat, milk, and fruit) have been added to the five included in the Nabi, Hamid, and Nasim model (wheat, basmati rice, ordinary rice, sugarcane, and cotton). By endogenizing supply, demand, and prices of nontradables (millet and sorghum, pulses, meat, and fruit), the model is able to capture the effects of trade and exchange rate policies on nontradable agricultural commodities as well as tradables. Moreover, whether a tradable good is imported, exported, or not traded in a given simulation year is determined endogenously. Agricultural income and income effects on demand are included, as well as adjustments in the world price of basmati rice in response to changes in Pakistan's exports.

The models also differ in the parameter estimates used. Nabi, Hamid, and Nasim (1988) use supply elasticities from Tweeten (1985) for calculating changes in the value added of each subsector; the new model uses supply elasticities of Hamid et al. (1987) and calculates changes in real output. Both studies use demand parameters from Hamid et al. (1987).

Several important aspects of the response of agricultural supply and demand to changes in price incentives are not captured in the new model, however. Inputs to agricultural production are not explicit in the model framework because attempts to estimate supply functions that incorporate inputs proved unsuccessful. For variable inputs such as fertilizer, this omission is not of great importance. The model results can be interpreted in two ways, assuming either that technology for each crop is

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constant or that changes in purchases of fertilizer are small compared with changes in value of production calculated in the model. Constraints on price response due to rigidities in cropping patterns and crop rotations also are not modeled explicitly. These constraints are captured to some degree, however, by the cross-price elasticities for area planted and the cross-price elasticities in the cotton and wheat yield equations.

More serious is the absence of explicit price effects on agricultural investment and labor. As shown by Valdés, Hurtado, and Muchnik (1989), price-induced changes in agricultural investment and labor migration have had important long-run effects on agricultural production in Chile. Reduced price incentives discourage investment in agriculture and lessen the capital stock available for future production; low agricultural prices relative to nonagricultural prices reduce labor demand in agriculture as well as the value of output, making migration to urban areas a more attractive option for workers. These effects are also likely to be important in Pakistan, although the types of private investment in agriculture in Pakistan (such as tubewells, tractors, and land improvements for better drainage) differ from those modeled in Chile (stocks of cattle, orchards, and tractors). By including a long lag adjustment in area for fruit trees, the new Pakistan model captures some of the investment effect for this relatively small sector in Pakistan, but the effects of changes in the capital stock of tubewells and tractors for the annual crop sectors are not modeled. The model presented in this chapter should be considered as a short-to-medium-run model. To capture the longer-run effects of the changes in incentives would require an approach that captures the effects on private investment in agriculture and labor employment.

Moreover, the effects of government investment in agriculture (in particular, research and extension on new seeds, irrigation dams and canals, and rural infrastructure such as road and communication networks) are not captured in this framework. Public investment and capital is thus exogenous to the model.

What do these estimated output effects assume about public and private investment and about the elasticity of supply of inputs to agriculture? The parameters come from time series of actual values, but their estimation does not fully or explicitly capture the factor markets in agricultural production or government investment in agriculture. Implicitly, the model assumes a fairly elastic supply of fertilizers, electric power, tractors, new high-yielding varieties (HYVs), and so forth. Higher incentives allow more private capital to be invested in the use of these inputs. But they do not guarantee an elastic supply. To a large extent, except for HYVs, inputs are tradable, and appropriate trade policy should make their supply quite elastic. Public investment is, of course, a different story.

The output response of agricultural tradables implies a resource reallocation within agriculture and between agriculture and nonagriculture. The home-goods-producing sector and the protected industrial sector would, in the long run, release resources (mostly capital) toward the production of tradables. Determining the time path of this adjustment in a long-run context is beyond the scope of this study. The appropriate implicit supply response in agricultural tradables may seem too high. In this analysis, the elasticity of total supply with respect to a change in agricultural prices is equal to the sum of the area and yield elasticities. The area elasticity is constrained to a maximum value of 0.25, and the yield elasticity used is 0.35 (from Hamid et al. 1987); thus the total supply response is 0.60. Given no response of yield to prices for milk, meat, and fruit, and small cross-price effects on yields for wheat and cotton, the aggregate supply elasticity is approximately 0.45 to 0.50.

Finally, the effects of alternative trade policies on the industrial sector are necessarily ignored in this partial equilibrium analysis. Changes in tariffs, quotas, and exchange

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rates would have large effects on outputs of industrial and related sectors, which would induce changes in employment, incomes, demand for agricultural products, and labor and capital availability. Some of these effects may be of secondary importance from the perspective of the agricultural sector, but they are crucial to the industrial sector itself.

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8

REAL EFFECTS OF CHANGES IN PRICE INCENTIVES: SIMULATION RESULTS

In this chapter, the model presented in Chapter 7 is used to simulate the real effects of changes in price incentives during 1961-87. Two simulations are conducted with prices of traded goods determined by border prices. In the first simulation, border prices, based on free trade, are calculated using historical exchange rates. The second simulation uses border prices based on free trade at equilibrium real exchange rates.

The assumptions for the simulations are outlined first. After an overview of the major simulation results, more detailed descriptions of the effects on each commodity are given. The effects of the simulated change in policy on aggregate agricultural income and the balance of trade are also presented. Finally, the simulated effects on the government budget are compared with those of other recent studies addressing the issue of the extent to which agriculture in Pakistan has been taxed.

The Price Policy Simulations

Simulation 1 (free trade with no exchange rate adjustment) models the direct effects of agricultural price policies; simulation 2 (free trade at equilibrium real exchange rates) includes both the direct and indirect effects of exchange rate and trade policies on prices and real variables. Both simulations assume free trade in agricultural products and no government interference in domestic prices. Prices received by producers of traded goods thus are equal to export parity in years in which the goods are exported and equal to import parity in years in which the goods are imported. For years in which domestic supply and demand equilibrates at a price between export and import parities, this autarky (no trade) price is the producer price. Consumer prices are determined in a completely analagous fashion.

A free-trade policy is chosen for these simulations as a reference scenario and because it is suggestive of the gains from trade. This does not mean that absolute free trade is essential for economic prosperity. Certainly, free trade does not benefit everyone, unless the losers can be fully compensated. The results of these simulations, however, provide a comparison with the complex mix of market interventions that have been used by various Pakistani governments to alter producer and consumer prices.

A few characteristics of the policy simulations should be noted. The input data for the simulations include historical levels of production, consumption, trade, and prices, and the border prices for producers and consumers used in the calculations of direct and total effects of trade and exchange rate policies in Chapter 6. In the simulations all domestic prices are deflated by the price index of nonagricultural commodities. In simulation 1, P_{na} (the price index of nonagricultural commodities) is unchanged from its historical level, because only agricultural trade and price policies are assumed to have changed. In simulation 2, P^{*}_{na}, which incorporates the effects of changes in exchange rates and trade policies on nonagricultural prices, is used as the price deflator for simulated prices (P_{na} is still used to deflate historical prices). In both simulations, it is implicitly assumed that the average price of nontradables in the economy is unchanged from the historical levels.

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Procurement prices are used as the historical expected producer prices for basmati and ordinary rice, sugarcane, and cotton for all years of the simulation. Because wheat procurement was small in the years between 1961 and 1968, procurement prices for wheat are used as the historical expected producer price only for years after 1967. For wheat prior to 1968 and for all other goods, historical expected producer prices are a weighted average of past market prices.

Milk is modeled as a nontraded good prior to 1972 because of lack of data on prices of imported milk products for these years. Fruits are modeled as nontraded goods in every year, even though Pakistan has exported some citrus products in recent years, because adequate data on prices of exported and domestic citrus products are unavailable.

Overview of Simulation Results: Three Subperiods

1961-71

In the 1961-71 period, agricultural trade and price policies helped offset the negative protection of agricultural tradables caused by the overvalued exchange rate. Nominal rates of protection measured at the official exchange rate were positive for wheat, ordinary rice, cotton, vegetable oil, sugar, and maize. Only for basmati rice were the direct effects of trade and agricultural price policies negative. Thus, with free trade and no change in the exchange rate as in simulation 1 (Appendix 5, Tables 34 and 35), prices of most agricultural commodities would have declined.

For the 1960s, free trade in agricultural products would have destroyed producer incentives for sugar: expected producer prices and production would have fallen by more than 80 percent.[27] The shift out of sugarcane limits the effect of reduced producer prices for other crops, though; despite a drop in expected producer prices of 18 percent for wheat and 40 percent for cotton, annual production of the two crops is reduced by only about 10 percent. According to the simulation, production of basmati rice would have increased by 47 percent in 1961-71 if the export tax and other marketing restrictions had been removed (see Tables 15 and 16).

With free trade in agriculture and a free-trade equilibrium exchange rate (simulation 2, Appendix 5, Tables 36 and 37), prices of most agricultural commodities would have increased sharply. As a result, in the 1966-71 period, there would have been large increases in the production of wheat (28 percent), maize (51 percent), ordinary rice (77 percent), vegetable oil (42 percent), and cotton (54 percent). Production of basmati rice would have more than doubled. But production of sugar still would have fallen (by 37 percent) in this period.

1972-77

High world prices of most agricultural commodities in the early 1970s, coupled with Pakistan's nominal exchange rate devaluation in 1972, sharply raised the border prices of agricultural commodities measured at the official exchange rate. Beginning in 1974, simulated expected producer prices of all traded commodities would have risen sharply (except for milk prices in a few years). Production of wheat would have

[27] The simulation results for the two subperiods, 1961-71 and 1972-87, for production, consumption, and trade are summarized in Table 18. For details of these results see Appendix 5, Tables 34 through 37. The percentage changes shown in Table 15 and other tables reporting simulation results show the average values that would have prevailed if direct and total price interventions were removed. The percentage changes given are relative to the historical values of the variables.

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Table 15—Direct and total effects of trade and exchange rate policies on agricultural production and consumption, 1961–71 and 1972-87

Subsector/ Commodity	1961-71				1972-87			
	Direct Effects (Simulation 1)		Total Effects (Simulation 2)		Direct Effects (Simulaion 1)		Total Effects (Simulation 2)	
	(1,000 metric tons)	(percent change)	(1,000 metric tons)	(percent change)	(1,000 metric tons)	(percent change)	(1,000 metric tons)	(percent change)
Production								
Wheat	4,613.2	-7.28	6,284.6	22.87	12,252.9	20.11	14,231.0	43.29
Basmati	582.2	46.75	1,115.2	170.31	1,126.6	44.76	1,288.7	72.55
Other rice	1,149.0	5.39	1,757.7	55.53	2,957.4	36.61	3,545.6	65.58
Sugarcane	6,938.2	-60.04	14,892.5	-20.37	27,602.5	1.10[a]	35,409.2	32.47
Cotton	398.6	-6.50	651.3	48.61	760.1	0.72	941.4	28.14
Milk	6,668.7	-4.49	7,495.0	6.73	6,458.7	-29.53	8,093.3	-11.13
Consumption								
Wheat	5,282.0	-0.40	5,087.6	-4.99	9,084.8	-10.89	8,829.9	-12.31
Basmati	248.2	-8.42	222.8	-18.07	450.8	0.29	462.5	8.98
Other rice	930.5	1.75	856.4	-8.47	1,264.0	-3.11	1237.9	-5.15
Sugarcane	2,410.0	61.48	2146.7	41.74	2,905.0	27.63	2852.2	27.25
Cotton	252.2	-3.62	195.0	-26.95	428.1	-1.20	422.0	-2.07
Milk	6,001.6	-5.29	6,745.5	5.85	11,247.3	31.27	10,812.2	27.97

Source: Historical data are from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: The values in absolute terms represent the average values for the subsectors that would have prevailed if direct and total price interventions were removed. The percentage changes are relative to the historical values of these subperiods.

[a]The increase in production of sugarcane in spite of the removal of protection reflects the lag in the producers response to the fall in world sugar prices in 1982 and 1987, so that, in effect, for these years, sugarcane was taxed (see Appendix 5, Table 36 for five-year averages).

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Table 16—Direct and total effects of trade and exchange rate policies on agricultural trade, 1961-71 and 1972-87

Commodity	1961-71			1972-87		
	Simulation 1	Simulation 2	Historical	Simulation 1	Simulation 2	Historical
	(1,000 metric tons)			(1,000 metric tons)		
Wheat	-1,130.2	868.5	-785.3	1,942.8	3,978.0	-930.5
Basmati	275.9	780.9	88.7	563.2	697.3	257.2
Other rice	103.6	725.1	43.3	1,397.7	1,953.2	645.6
Sugarcane	-1,879.6	-1,014.8	-34.4	-746.9	-86.1	-27.2
Cotton	106.5	391.2	124.6	255.9	425.2	228.9
Milk	0.2	0.1	-52.6	-5,434.6	-3,528.8	-139.4

Source: Historical trade data are from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

increased by 28 percent, largely due to a 19 percent increase in yields. Sugar production would have more than doubled in 1976 and 1977, relative to its historical level, as expected producer prices reach 250 percent of historical procurement prices. Production of both basmati and ordinary rice would have increased by nearly 59 percent, but cotton production actually would have fallen by 10 percent relative to historical levels, despite a modest increase in expected producer prices because of negative cross-price effects from high wheat, sugarcane, and rice prices (see Appendix 5, Table 34).

This rosy scenario for agricultural producers has rather disturbing implications for consumers, however. Despite the 10 percent increase in incomes in the rural sector, and assuming that urban nominal wages are unchanged, consumer prices of wheat would have increased by 77 percent and ordinary rice prices by 101 percent. Consequently, consumption of these commodities would have fallen by about 10 percent. To the extent that higher food prices are partly transmitted to urban wages, these consumption effects would change. Consumption of basmati rice and sugar would have increased, however, because increased prices of other staples and increased incomes would have outweighed the effects of increases in consumer prices in basmati rice (see Appendix 5, Table 35).

Similarly, under free trade and equilibrium exchange rates (simulation 2), higher agricultural prices of traded goods would have encouraged large increases in production and net trade at the cost of lower consumption and higher consumer prices (see Appendix 5, Tables 36 and 37). Production of all major commodities would increase: wheat (64 percent), basmati rice (103 percent), ordinary rice (95 percent), sugarcane (84 percent), and cotton (31 percent) (Appendix 5, Table 36).

1978-87

In the 1978-87 period, the effects of moving to a policy of free trade in agricultural goods would have been less pronounced than in the 1972-77 period because world prices of most agricultural commodities had fallen back to levels more in line with long-term trends. Nevertheless, in simulation 1 in 1983-87, higher border prices would have resulted in an increase in expected wheat producer prices of about 30 percent and an increase in production of 11 percent over historical levels. Consumer prices for wheat also would have increased by almost 38 percent, so that wheat consumption would have fallen by 11 percent. Average production of basmati rice in the 1978-82 and 1983-87 periods would have increased by 33 and 42 percent, respectively, but

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the drop in world prices of ordinary rice would have limited the increase in its production to 9 percent in 1983-87. Border prices for sugar also fluctuated greatly; they were somewhat higher than historical procurement prices in 1978-82, but fell sharply after 1982 so that simulated sugar production is more than 44 percent lower than historical levels in 1983-87. Free trade in powdered milk would have reduced consumer prices of milk by almost 40 percent and expected producer prices by 60 percent, so that milk production would have decreased by 41 percent in 1983-87 and milk consumption would have increased by 27 percent (see Appendix 5, Tables 34 and 35).

Under free trade and an equilibrium exchange rate (simulation 2), wheat production in 1983-87 would have increased by 24 percent, consumer prices for wheat would have increased by 58 percent, and consumption of wheat would have declined by 12 percent. The increases in average 1983-87 production of maize (29 percent), basmati rice (52 percent), ordinary rice (29 percent), vegetable oil (100 percent), and cotton (29 percent) would also have been large (see Appendix 5, Table 36). Real incomes are essentially unchanged for the period as a whole (and are even slightly lower in 1986 and 1987) because of a large decline in prices and output of milk and sugar.

Effects on Agricultural Income and the Balance of Trade

Tables 17 and 18 summarize the effects of the two alternative policy scenarios on total agricultural income and the balance of trade. Under simulation 1 (free trade in agricultural products with no exchange rate adjustment), income would have been lowered by 6 to 8 percent in the 1960s because of reduced producer prices and output for most agricultural commodities. During the 1972-77 period of high world prices and, after 1972, a devalued rupee, incomes would have been 12 percent higher because of large increases in production and prices of traded agricultural goods (Table 17). Historically, in the late 1970s, world prices fell; thus, the positive effect on income of increasing domestic prices to the level of free-trade prices would have been diminished. Lower incomes for producers of sugarcane and especially milk would have outweighed the small increases in value of other commodities. In 1983-87, total income would have been reduced by 5 percent.

Table 17—Effects on agricultural income of simulated policy changes, 1961-87

Period	Simulation 1		Simulation 2	
	Agricultural Income	Change	Agricultural Income	Change
	(Rs billion)	(percent)	(Rs billion)	(percent)
1961-65	21.5	-6.48	26.3	14.41
1966-71	37.6	-8.06	47.6	16.51
1972-77	114.4	12.14	139.9	37.04
1978-82	262.2	0.93	284.3	9.43
1983-87	492.6	-5.07	514.3	-0.89
1961-87	177.5	-1.48	194.4	7.88

Source: Historical trade data are from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

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Table 18—Effects of simulated policy changes on the balance of trade and on world basmati rice prices, 1961-87

Period	Historical Trade Value	Simulation 1 Trade Value	Simulation 2 Trade Value	Simulation 1 Price of Basmati Rice	Simulation 1 Change	Simulation 2 Price of Basmati Rice	Simulation 2 Change
		(Rs billion)		(US$/metric ton)	(percent)	(US$/metric ton)	(percent)
1961–65	2,400.13	-154.70	139.48	215.54	-13.71	180.11	-27.90
1966–71	-1,131.16	-236.04	338.10	208.69	-11.33	202.52	-13.95
1972–77	-6,093.85	465.78	1,471.39	377.36	-18.28	345.63	-25.15
1978–82	-120.58	-34.82	1,084.78	542.94	-18.31	500.66	-24.67
1983–87	-688.34	-796.75	189.52	457.41	-30.51	420.21	-36.16
1961–87	-324.43	-131.59	663.92	355.40	-20.34	325.70	-27.00

Sources: Historical trade data are from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years); and Dee-Cheok Cheong, *Terms of Trade and the Role of Government in Pakistan's Agriculture*, World Bank Staff Working Paper 34 (Washington, D.C.: World Bank, 1964).

Under simulation 2 (free trade in agricultural products with an equilibrium exchange rate), total agricultural income would have been dramatically higher—about 15 percent higher in the 1960s and 37 percent higher in the early 1970s. As in simulation 1, lower world prices of most commodities would have reduced the positive effects of free-trade price policy from 1978 to 1987. The drop in the value of production of sugarcane and milk is approximately the same as the gain in the value of production of other commodities, so that income would have fallen by only 1 percent in 1986 and 1987.

With free trade and no change in the exchange rate (simulation 1), Pakistan's balance of trade in agricultural products would have deteriorated in every period except 1972-77, when world prices for agricultural commodities were high (Table 18). In the 1960s, increased exports of basmati rice and decreased imports of vegetable oil would have been outweighed by larger imports of wheat and sugar. In the 1978-87 period, wheat would have become an export good and the volume of exports of basmati and ordinary rice would have increased by 117 and 68 percent, respectively, but a decline in world basmati rice prices, averaging about 25 percent (due to increased exports by Pakistan), and a large increase in milk imports from about 2.5 million tons per year to nearly 7 million tons (liquid milk equivalent) per year would have reversed the net effect on the balance of trade in agricultural products (see Appendix 5, Table 35).

Using equilibrium exchange rates in simulation 2 improves the balance of trade for traditional exports (cotton, basmati rice, and ordinary rice) in every period. The increase in rice exports is mainly due to a sharp increase in production in 1978-87 (55 percent for basmati and 48 percent for ordinary rice) (Appendix 5, Table 36). The consumption response (a 9 percent decrease) would have been more significant in expanding cotton exports, but the 27 percent increase in production still would have been the main determinant. In the case of milk, a substantial drop in production of 25 percent and a large increase in consumption of 25 percent account for the large increase in imports from 4.5 to 4.7 million tons in liquid milk equivalent per year (about 40 percent of total domestic consumption). Under this pricing scenario, the response of wheat production would have been very large—a 31 percent increase; this, coupled with a decrease in consumption of 13 percent, would have turned wheat into a major export, averaging almost 4 million tons per year of exports, about one-fourth of production (see Appendix 5, Table 37).

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Effects on Nontraded Goods

In the model simulations, changes in the demand and supply of nontraded goods are mainly determined by cross-price and income effects. As expected prices of competing crops increase (decrease), production of nontraded goods decreases (increases). Similarly, as prices of substitute goods increase (decrease), demand for nontraded goods increases (decreases). Whether equilibrium prices of nontraded goods rise or fall depends on the magnitudes of the cross-price elasticities of supply and demand and the income elasticity of demand.

For example, in simulation 1, lower prices of most traded goods would have led to lower incomes in the 1961-71 period, and both demand for meat and equilibrium meat prices would have fallen. In 1978-87, lower milk prices also would have hurt meat producers by discouraging production, while a decline in incomes would have reduced the demand for meat. Again, equilibrium meat prices would have fallen, although in this case supply-side effects play an important role. The price policy effects on other nontraded goods can be analyzed in a similar manner. Because cross-price effects on demand and supply are generally small, the simulated changes in equilibrium prices, production, and consumption of nontraded goods are likewise smaller in size than changes in these variables for traded goods (see Appendix 5, Tables 34 and 35).

Measures of Total Taxation of Agriculture

The above simulations of alternative price policies provide a measure of the transfers into and out of agriculture as the result of government trade and pricing policies. By combining these measures of indirect taxation with data on actual levels of direct taxation of agriculture (land and income taxes) and with data on subsidies and taxes, estimates of total net taxation of agriculture are constructed (Table 19). Similar estimates of total net taxation of agriculture have also been constructed by Nabi, Hamid, and Nasim (1987 and 1988) and Qureshi (1988). To facilitate comparison of results, Tables 20 and 21 present the estimates of these studies in the same table format as Table 19.

The estimates for direct taxes, open input subsidies, and concealed input subsidies in Table 19 are taken from Qureshi (1988) and reproduced in Table 21 with a few slight modifications. Direct taxes include the land revenue tax, the agricultural income tax, and the *usher* (a levy collected from Muslim landowners and leaseholders, introduced in 1982, which is equal to about 5 percent of the value of output).[28]

Total open subsidies include subsidies on fertilizer,[29] tubewells (subsidy rate per tubewell installed), plant protection (free spraying of pesticides on farmland), and seeds. The estimates for open subsidies in Table 19 again follow the definitions used by Qureshi and differ only slightly from those of Table 21.[30]

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[28] Nabi, Hamid, and Nasim (1987) used a different source for the land revenue tax and omitted agricultural income taxes and the *usher* from their estimates. The Qureshi (1988) estimates of direct taxes in the 1980-83 period average Rs 45 million (about 20 percent) more than the Nabi, Hamid, and Nasim (1987) estimates.

[29] Domestic and imported fertilizers are both subsidized. The subsidy covers marketing costs and any costs in excess of the ceiling sales prices set by the government. Part of the subsidy accrues to fertilizer producers who receive a price higher than the border price; therefore, the series in Table 18 overstates the subsidy to farmers.

[30] The Nabi, Hamid, and Nasim (1987) estimates differ more significantly because the revenue collected from the surcharge levied on the low cost producers is subtracted from the subsidy on fertilizers. For the 1980-83 period, the Nabi, Hamid, and Nasim (1987) estimates exceed the new estimates by an average of Rs 313 million (16 percent).

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Table 19—Net transfers to agriculture from direct price and nonprice-related transfers for five commodities, based on model simulations, 1973-87

Year/ Period	Total Direct Taxes (1)	Total Open Subsidies[a] (2)	Total Concealed Subsidies (3)	Subtotal for Net Subsidies to Producers (1)+(2)+(3) (4)	Total Indirect Taxes[b] (5)	Total Net Subsidies to Producers (4)+(5) (6)	Transfers Due to Output Price Interventions (Direct)[c] (7)	Subtotal for Price Intervention Effects (4)+(7) (8)	Public Investment in Research and Extension (9)	Total Price and Nonprice-Related Transfers (8)+(9) (10)
						(Rs million)				
1973	-167	441	40	314	-712	-398	-12,158	-11,844	1,598	-10,246
1974	-201	203	21	23	-704	-681	-30,609	-30,586	2,380	-28,206
1975	-232	454	339	561	-692	-131	-28,652	-28,090	3,127	-24,963
1976	-266	897	374	1,005	-826	179	-19,833	-18,828	3,501	-15,327
1977	-136	920	394	1,178	-372	806	-10,741	-9,563	4,433	-5,130
1978	-125	1,009	364	1,248	-471	777	-10,560	-9,312	3,471	-5,840
1979	-291	1,991	389	2,089	-247	1,842	-14,981	-12,892	4,391	-8,501
1980	-175	2,723	344	2,892	-1,015	1,877	-27,719	-24,827	4,298	-20,529
1981	-227	2,479	680	2,932	-1,860	1,072	-24,316	-21,384	5,934	-15,450
1982	-287	1,826	936	2,475	-348	2,127	-10,352	-7,877	6,332	-1,545
1983	-427	1,980	932	2,485	-1,410	1,075	-11,679	-9,195	7,869	-1,326
1984	-465	1,466	1,455	2,456	-1,036	1,420	-7,104	-4,648	9,000E	4,352
1985	-505	1,501	2,220	3,216	-878	2,338	-5,190	-1,974	10,000E	8,026
1986	-460	2,424	2,366	4,331	1,002	5,333	1,673	6,004	10,100E	16,104
1987	-365	2,044	3,250	4,929	1,526	6,455	1,328	6,257	10,300E	16,557
Average										
1973-77	-201	583	234	616	-661	-45	-20,399	-19,782	3,008	-16,775
1978-82	-221	2,006	543	2,327	-788	1,539	-17,586	-15,258	4,885	-10,373
1983-87	-445	1,883	2,045	3,483	-159	3,324	-4,195	-711	9,454	8,742
1973-87	-289	1,491	940	2,142	-536	1,606	-14,060	-11,917	5,782	-6,135

Sources: Columns (1), (2), (3), and (5) are from Sarfraz Khan Qureshi, "Prices, Taxes, and Subsidies: A Further Analysis of Issues Affecting Agricultural Sector of Pakistan," Pakistan Institute of Development Economics, Islamabad, 1988 (mimeo). Column (9) is from Ijaz Nabi, Nawed Hamid, and Anjum Nasim, "A Comparative Study of the Political Economy of Agricultural Pricing Policies: The Case of Pakistan," Revised Version, a paper prepared for the World Bank, Washington, D.C., 1988 (mimeo). Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: A minus sign indicates a transfer out of agriculture. E indicates an estimated amount.

[a]For years 1977, 1978, 1980, 1984, 1985, figures were changed from Qureshi's paper to reflect the data from the *Economic Survey*.

[b]Indirect taxes (export duties and corporation profits on rice and cotton and cesses on sugarcane and cotton) are not separately added in the subtotals (8) and (10) because they are already reflected in the transfers from output price interventions.

[c]Excludes input price interventions because they are included under (2).

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Table 20—Net transfers to agriculture from direct price and nonprice-related transfers, adapted from Nabi, Hamid, and Nasim (1987), 1973-87

Year/ Period	Total Direct Taxes (1)	Total Open Subsidies (2)	Total Concealed Subsidies (3)	Subtotal for Net Subsidies to Producers (1)+(2)+(3) (4)	Total Indirect Taxes[a] (5)	Total Net Subsidies to Producers (4)+(5) (6)	Transfers Due to Output Price Interventions (Direct) (7)	Subtotal for Price Intervention Effects (4)+(7) (8)	Public Investment in Research and Extension (9)	Total Price and Nonprice-Related Transfers (8)+(9) (10)
					(Rs million)					
1973	-168	365	-23	174	-570	-396	-10,162	-9,988	1,598	-8,390
1974	-180	32	-30	-178	-643	-821	-34,849	-35,027	2,380	-32,646
1975	-182	161	112	91	-1,637	-1,546	-47,538	-47,447	3,127	-44,320
1976	-259	552	219	512	-1,172	-660	-32,451	-31,939	3,501	-28,437
1977	-136	325	252	441	-760	-319	-25,343	-24,902	4,433	-20,469
1978	-125	806	252	933	-687	246	-25,953	-25,019	3,471	-21,548
1979	-290	1,832	387	1,929	-789	1,140	-31,982	-30,053	4,391	-25,663
1980	-172	2,566	588	2,982	-538	2,444	-39,198	-36,215	4,298	-31,917
1981	-227	2,109	793	2,675	-1,380	1,295	-49,307	-46,632	5,934	-40,698
1982	-286	1,465	1,001	2,180	-527	1,653	-45,824	-43,644	6,332	-37,312
1983	-249	1,613	1,205	2,569	-812	1,757	-39,349	-36,780	7,869	-28,911
1984	...	629	1,402	2,031	-558	1,473	2,031	...	9,000[b]	...
1985	...	...	...	...	...	...	...	...	10,000[b]	...
1986	...	...	...	...	...	...	...	...	10,100[b]	...
1987	...	...	...	...	...	...	...	...	10,300[b]	...
Average										
1973-77	-185	287	106	208	-956	-748	-30,069	-29,860	3,008	-26,852
1978-82	-220	1,756	604	2,140	-784	1,356	-38,453	-36,313	4,885	-31,427
1983-87	-249	1,121	1,304	2,300	-685	1,615	-39,349	-17,374	9,454	-28,911
1973-87	-207	1,038	513	1,362	-839	522	-34,723	-30,468	5,782	-29,119

Source: Adapted from Ijaz Nabi, Naved Hamid, and Anjum Nasim, "A Comparative Study of the Political Economy of Agricultural Pricing Policies: The Case of Pakistan," report prepared for the World Bank, Washington, D.C., 1987 (mimeo).

[a]Indirect taxes (export duties and corporation profits on rice and cotton and cesses on sugarcane and cotton) are not separately added in the subtotals (8) and (10) because they are already reflected in the transfers from output price intervention.

[b]These values are estimated from the revised 1988 version of the Nabi, Hamid, and Nasim paper cited above, Table 4.14.

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Table 21—Net transfer to agriculture from direct price and nonprice-related transfers, adapted from Qureshi (1988) for five commodities, 1973-87

Year/ Period	Total Direct Taxes (1)	Total Open Subsidies (2)	Total Concealed Subsidies (3)	Subtotal for Net Subsidies to Producers (1)+(2)+(3) (4)	Total Indirect Taxes (5)	Total Net Subsidies to Producers (4)+(5) (6)	Transfers Due to Output Price Interventions (Direct) (7)	Subtotal for Price Intervention Effects (4)+(7) (8)	Total Price Intervention Effects (9)
					(Rs million)				
1973	-167	441	40	314	-712	-398	-847	-533	-533
1974	-201	203	21	23	-704	-681	-6,873	-6,850	-6,850
1975	-232	454	339	561	-692	-131	-6,450	-5,889	-5,889
1976	-266	897	374	1,005	-826	179	-4,665	-3,660	-3,660
1977	-136	562	394	820	-372	448	-2,105	-1,285	-1,285
1978	-125	1,026	364	1,265	-471	794	-8,561	-7,296	-7,296
1979	-291	1,991	389	2,089	-247	1,842	-118	1,971	1,971
1980	-175	2,721	344	2,890	-1,015	1,875	-1,479	1,411	1,411
1981	-227	2,479	680	2,932	-1,860	1,072	-7,105	-4,173	-4,173
1982	-287	1,826	936	2,475	-348	2,127	-1,867	608	608
1983	-427	1,980	932	2,485	-1,410	1,075	-5,165	-2,680	-2,680
1984	-465	1,482	1,455	2,472	-1,036	1,436	-5,551	-3,079	-3,079
1985	-505	1,517	2,220	3,232	-878	2,354	-2,625	607	607
1986	-460	2,424	2,366	4,331	1,002	5,333	4,585	8,916	8,916
1987	-365	2,044	3,250	4,929	1,526	6,455	900	5,829	5,829
Average									
1973-77	-201	511	234	545	-661	-117	-4,188	-3,644	-3,644
1978-82	-221	2,009	543	2,330	-788	1,542	-3,826	-1,496	1,496
1983-87	-445	1,889	2,045	3,490	-159	3,330	-1,571	1,918	1,918
1973-87	-289	1,470	940	2,121	-536	1,585	-3,195	-1,074	-1,074

Source: Adapted from Sarfraz Khan Qureshi, "Prices, Taxes, and Subsidies: A Further Analysis of Issues Affecting Agricultural Sector of Pakistan," Pakistan Institute of Development Economics, Islamabad, 1988 (mimeo).

Notes: Public investment and research extension figures are not included in Qureshi. The five commodities included are wheat, basmati rice, ordinary rice, sugarcane, and cotton.

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The estimates of concealed subsidies in Table 19 are also those of Qureshi (see Table 21). Concealed subsidies include subsidies on irrigation water (the difference between operating and maintenance expenses and the irrigation receipts),[31] agricultural credit (the difference between noninstitutional and institutional rates, estimated to be 9 percent), and electricity (the difference between cost and sale price times consumption of electricity). The estimates of concealed subsidies by Nabi, Hamid, and Nasim (1987) do not include electricity subsidies and they also differ because Nabi, Hamid, and Nasim use a different credit subsidy rate (4 percent up to 1971/72, 5 percent from 1972/73 to 1976/77, and 7 percent from 1978/79 to date).

Indirect taxes on agriculture (Table 19, column 5) include export duties on rice and cotton, profits of the rice and cotton export corporations, and cotton and sugarcane cesses (taxes). Data from Nabi, Hamid, and Nasim differ slightly because they do not include the cotton and sugarcane cesses, and estimates on profits from export corporations are higher than those of Qureshi. Thus the series for net subsidies (Table 19, column 6) are essentially the same as those of Qureshi but is somewhat higher than the Nabi, Hamid, and Nasim series, mainly because of the difference in estimating fertilizer subsidies.

Agriculture has provided relatively little actual tax revenue in Pakistan. Total tax revenues, including direct taxes (column 1 in Table 19) and indirect taxes (column 5) averaged Rs 1 billion at their peak in 1978-82, but this represented only 2.6 percent of total government revenues. In more recent years, tax revenues from agriculture fell further as lower world prices for rice and cotton changed export tax revenues to net export subsidies in 1986 and 1987 (column 5). Government budget subsidies to agriculture have exceeded tax revenues collected in every year since 1975. From 1979 to 1985, net subsidies to producers ranged from Rs 1.1 to 2.3 billion (1,000 million) per year. With the aforementioned drop in export tax revenues in the mid-1980s, net subsidies to producers averaged Rs 5.9 billion in 1986 and 1987.

These estimates of net subsidies to agricultural producers neglect most of the effects of government trade, exchange rate, and price policies, however. These policies have major effects on agricultural prices and production, as shown in the simulation results. Much of the resources that flow into or out of agriculture do not accrue to the government and so do not appear in calculations of government budget subsidies or taxes. Instead, these implicit transfers of resources accrue to consumers of agricultural products and to the nonagricultural sectors of the economy.

Both Qureshi (1988) and Nabi, Hamid, and Nasim (1987) estimate the size of price transfers based on calculations for five major crops: wheat, basmati rice, ordinary rice, sugarcane, and cotton. But the Qureshi estimates do not include any exchange rate adjustments. Thus in order to compare the estimates, the transfers shown in Tables 19, 20, and 21 are measures of the direct effects (with no exchange rate adjustments) for the five major crops only. From 1973 to 1983, the direct effect of output price intervention was a tax on agricultural producers of Rs 10-31 billion (Table 19, column 6). The direct effect of output price intervention in 1986 and 1987 is a subsidy to producers of Rs 1.7 billion in 1986 and Rs 1.3 billion in 1987. As discussed earlier, sharp declines in world prices of wheat, cotton, and rice in the mid-1980s caused border prices to fall relative to domestic prices.

Table 22 presents the various estimates of the transfers resulting from price policy intervention. The estimates by Qureshi are significantly lower than either the estimates

[31] See Qureshi 1988.

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Table 22—Output price intervention effects based on three estimations, 1973-87

Year/ Period	Direct Effects				Total Effects	
	Estimation for 5 Commodities[a]	Qureshi	Nabi, Hamid, and Nasim	Estimation for 12 Commodities[b]	Estimation for 5 Commodities[a]	Estimation for 12 Commodities[b]
	(Rs million)					
1973	-12,158	-847	-10,162	-12,028	-32,321	-37,556
1974	-30,609	-6,873	-34,849	-31,279	-53,817	-59,750
1975	-28,652	-6,450	-47,538	-25,171	-41,406	-42,384
1976	-19,833	-4,665	-32,451	-12,293	-36,649	-35,980
1977	-10,741	-2,105	-25,343	4,871	-26,580	-15,670
1978	-10,560	-8,561	-25,953	6,803	-24,691	-10,978
1979	-14,981	-118	-31,982	-1,302	-28,028	-17,686
1980	-27,719	-1,479	-39,198	-13,667	-43,613	-32,257
1981	-24,316	-7,105	-49,307	-11,282	-40,021	-31,348
1982	-10,352	-1,867	-45,824	7,354	-23,458	-11,152
1983	-11,679	-5,165	-39,349	11,441	-25,733	-7,259
1984	-7,104	-5,551	...	18,151	-21,842	-3,330
1985	-5,190	-2,625	...	27,398	-17,150	9,717
1986	1,673	4,585	...	36,041	-12,704	13,875
1987	1,328	900	...	38,385	-11,204	19,947
Average						
1973-77	-20,399	-4,188	-30,069	-15,180	-38,154	-38,268
1978-82	-17,586	-3,826	-38,453	-2,419	-31,962	-20,684
1983-87	-4,195	-1,571	-39,349	26,283	-17,726	6,590
1973-87	-14,060	-3,195	-34,723	2,895	-29,281	-17,454

Sources: The estimations for 5 and 12 commodities are based on model simulations prepared for this report. The Qureshi estimates are from Sarfraz Khan Qureshi, "Prices, Taxes and Subsidies: A Further Analysis of Issues Affecting Agricultural Sector of Pakistan," Pakistan Institute of Development Economics, Islamabad, 1988 (mimeo). The Nabi, Hamid, and Nasim estimations are from Ijaz Nabi, Naved Hamid, and Anjum Nasim, "A Comparative Study of the Political Economy of Agricultural Pricing Policies: The Case of Pakistan," revised, a report prepared for the World Bank, Washington, D.C. (mimeo).

[a]The 5 commodities are wheat, basmati rice, ordinary rice, sugarcane, and cotton.

[b]The 12 commodities are wheat, basmati rice, ordinary rice, sugarcane, cotton, maize, pulses, millet and sorghum, vegetable oil, fruit, milk, and meat.

presented in this report or those from Nabi, Hamid, and Nasim, for two major reasons. First, Qureshi calculates the price policy effect only for the amount of the crop that is marketed. This measures the transfers to agricultural producers net of their benefits or costs as consumers of agricultural products. Second, the three studies make different assumptions in calculating border prices. For example, for wheat—the most important crop in terms of value—both Qureshi and Nabi, Hamid, and Nasim use the average import price of wheat to calculate border prices rather than export prices in the world market.[32]

[32] Qureshi (1988) estimates the border price of wheat in 1987 as Rs 3,132 per ton (import unit value) and marketing costs between farmgate and the wholesale market in Karachi at Rs 265 per ton. The difference between border prices and domestic prices is Rs 867 per ton. This study estimates the difference between border prices and domestic prices for wheat in 1987 as Rs 308 per ton, using a total marketing cost between farmgate and the import price of Rs 159 per ton, a figure 50 percent smaller than that of Qureshi. Multiplying the difference in prices by the estimate of marketed wheat (8,528,000 tons), the Qureshi estimate for the price policy effect for wheat is Rs 7.3 billion using total production of wheat and the alternative price differential gives Rs 4.3 billion.

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Table 23—Net transfers to agriculture from direct and indirect price and nonprice-related transfers for five commodities, based on model simulations, 1973-87

Year/ Period	Total Direct Taxes (1)	Total Open Subsidies (2)	Total Concealed Subsidies (3)	Subtotal for Net Subsidies to Producers (1)+(2)+(3) (4)	Total Indirect Taxes (5)	Total Net Subsidies to Producers (4)+(5) (6)	Transfers Due to Output Price Interventions (Direct and Indirect) (7)	Subtotal for Price Intervention Effects (4)+(7) (8)	Public Investment in Research and Extension (9)	Total Price and Nonprice-Related Transfers (8)+(9) (10)
						(Rs million)				
1973	-167	441	40	314	-712	-398	-32,321	-32,007	1,598	-30,409
1974	-201	203	21	23	-704	-681	-53,817	-53,794	2,380	-51,414
1975	-232	454	339	561	-692	-131	-41,406	-40,845	3,127	-37,718
1976	-266	897	374	1,005	-826	179	-36,649	-35,644	3,501	-32,143
1977	-136	920	394	1,178	-372	806	-26,580	-25,402	4,433	-20,969
1978	-125	1,009	364	1,248	-471	777	-24,691	-23,443	3,471	-19,972
1979	-291	1,991	389	2,089	-247	1,842	-28,028	-25,939	4,391	-21,549
1980	-175	2,723	344	2,892	-1,015	1,877	-43,613	-40,721	4,298	-36,423
1981	-227	2,479	680	2,932	-1,860	1,072	-40,021	-37,089	5,934	-31,155
1982	-287	1,826	936	2,475	-348	2,127	-23,458	-20,983	6,332	-14,651
1983	-427	1,980	932	2,485	-1,410	1,075	-25,733	-23,248	7,869	-15,380
1984	-465	1,466	1,455	2,456	-1,036	1,420	-21,842	-19,386	9,000	-10,386
1985	-505	1,501	2,220	3,216	-878	2,338	-17,150	-13,934	10,000	-3,934
1986	-460	2,424	2,366	4,331	1,002	5,333	-12,704	-8,373	10,100	1,727
1987	-365	2,044	3,250	4,929	1,526	6,455	-11,204	-6,276	10,300	4,024
Average										
1973-77	-201	583	234	616	-661	-45	-38,154	-37,538	3,008	-34,530
1978-82	-221	2,006	543	2,327	-788	1,539	-31,962	-29,635	4,885	-24,750
1983-87	-445	1,883	2,045	3,483	-159	3,324	-17,726	-14,243	9,454	-4,790
1973-87	-289	1,491	940	2,142	-536	1,606	-29,281	-27,139	5,782	-21,357

Source: Authors' calculations based on Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: The 5 commodities included are wheat, basmati rice, ordinary rice, sugarcane, and cotton. For years 1977, 1978, 1980, 1984, and 1985 in column (2), figures were changed from Qureshi's paper to reflect the data from the *Economic Survey*. In column (8), indirect taxes (export duties and corporation profits on rice and cotton and cesses on sugarcane and cotton) were not separately added in because they are already reflected in the transfers from outprice interventions. Open subsidies (2) include subsidies on fertilizer, tubewells, plant protection and seeds. Concealed subsidies (3) include subsidies on irrigations (does not include recovery on capital investment), agricultural credit, and electricity. Figures in columns (1), (2), (3), (5), and (9) are based on official actual figures, not estimates. Transfers due to output price interventions (7) are computed at the actual level of production.

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Estimates of the total direct and indirect effects of price policy for the five crops are also presented in Tables 22 and 23. Transfers out of agriculture are substantial, averaging about Rs 35 billion per year from 1972 to 1982 and about Rs 12 billion per year in 1986 and 1987. When all 12 agricultural subsectors modeled are included, the direct and total effects of price policy (including an exchange rate adjustment) result in approximately the same level of transfers up to the mid-1970s (Table 23). In the late 1970s and early 1980s the estimated size of subsidies rose substantially due to the differential between historical world and domestic milk prices, so that by 1985 the total transfer was positive (that is, agriculture was subsidized). Estimates of both direct and total effects of price policy from Nabi, Hamid, and Nasim (1987) are shown in Table 24.

Nabi, Hamid, and Nasim (1987) estimate transfers into agriculture in the form of public investment and research and extension expenditures (see Tables 19 and 22, column 9). Although the full benefit of these investments does not accrue to farmers in the year the investments are made, the investment series represents a measure of the transfers to the agricultural sector in a given year. From the farmers' point of view, however, one rupee transferred through public investment is not necessarily equivalent to one rupee transferred from price interventions. Public investment in infrastructure and expenditures on research and extension increased from Rs 1.6 billion in 1973 to Rs 7.9 billion in 1983, equal to roughly 20 percent of the taxes due to output price intervention for the five major crops in Pakistan (Table 19). However, the actual transfer to farmers arising from public investment in infrastructure and expenditures on research and extension are likely to be much greater than the fiscal value of the government investment, especially for research and extension of improved agricultural technology.

Another indication of the size of the transfers is shown in Table 25. In the 1973-77 period, total net transfers out of agriculture averaged 39 percent of GDP. Total net transfers were still 12 percent of GDP in the 1978-82 period, but fell to 2 percent of GDP in 1983-87 because of low world prices of cotton, rice, wheat, and milk. As a percentage of agricultural GDP, the corresponding figures for net transfers are of course much higher. These were 115 percent for 1973- 77, 41 percent for 1978-82, and 7 percent for 1983-87, for the five major crops.

Table 24—Estimates of transfers into and out of agriculture, based on Nabi, Hamid, and Nasim (1988), 1960-87

Period	Land Revenue and *Usher*[a]	Public Investment in Research and Extension	Total Nonprice Transfers	Price-Related Transfers		Total of Price and Nonprice Transfers	
				Direct	Total	Direct	Total
(average)			(Rs million)				
1960-65	-120	573	453	848	-1,455	1,301	-1,002
1966-70	-105	1,284	1,179	985	-4,172	2,164	-2,993
1971-75	-164	1,871	1,706	-3,438	-15,536	-1,732	-13,830
1976-80	-277	4,609	4,332	-5,205	-26,221	-873	-21,889
1981-85	-445	7,833	7,387	-12,092	-48,205	-4,705	-40,817
1986-87	-381	10,257	9,876	-6,192	-32,593	3,684	-22,717

Source: Based on Ijaz Nabi, Naved Hamid, and Anjum Nasim, "A Comparative Study of the Political Economy of Agricultural Pricing Policies: The Case of Pakistan," report prepared for the World Bank, Washington, D.C., 1987 (mimeo).

Note: A minus sign indicates a transfer out of agriculture.

[a]The *usher* is a levy collected from Muslim landowners and leaseholders.

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Table 25—Direct and total price and nonprice-related transfers as a percentage of GDP, for five commodities, 1973-87

Year/Period	Direct Effects				Total Effects	
	Net Subsidies to Producers (1)	Transfers Due to Output Price Intervention (Direct) (2)	Public Investment and Research and Extension (3)	Total Price and Nonprice-Related Transfers (1)+(2)+(3) (4)	Transfers Due to Output Price Intervention (Direct and Indirect) (5)	Total Price and Nonprice-Related Effects (1)+(5)+(3) (6)
			(percent of GDP)			
1973	0.46	-18.01	2.37	-15.18	-52.63	-49.80
1974	0.03	-34.74	2.70	-32.01	-65.88	-63.15
1975	0.50	-25.77	2.81	-22.45	-39.98	-36.67
1976	0.77	-15.21	2.69	-11.76	-30.61	-27.15
1977	0.79	-7.17	2.96	-3.43	-19.55	-15.80
1978	0.71	-5.99	1.97	-3.31	-15.45	-12.77
1979	1.07	-7.69	2.25	-4.36	-15.76	-12.44
1980	1.24	-11.84	1.84	-8.77	-20.74	-17.67
1981	1.06	-8.77	2.14	-5.57	-16.20	-13.00
1982	0.77	-3.22	1.97	-0.48	-8.09	-5.36
1983	0.68	-3.21	2.16	-0.36	-7.85	-5.00
1984	0.58	-1.69	2.14	1.03	-5.81	-3.09
1985	0.67	-1.08	2.07	1.66	-3.94	-1.20
1986	0.79	0.31	1.85	2.94	-2.60	0.04
1987	0.81	0.22	1.69	2.72	-2.05	0.45
Average						
1973-77	0.51	-20.18	2.71	-16.97	-41.73	-38.51
1978-82	0.97	-7.50	2.03	-4.50	-15.25	-12.25
1983-87	0.71	-1.09	1.98	1.60	-4.45	-1.76
1973-87	0.73	-9.59	2.24	-6.62	-20.48	-17.51

Source: Authors' calculations based on model simulations and Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).
Note: The 5 commodities included are wheat, basmati rice, ordinary rice, sugarcane, and cotton.

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Suggestions for Further Modeling

The price policies simulated above are meant to provide a measure of the effects of historical government policies compared with a free-trade policy framework. As such, the simulated counterfactual policies are not intended as realistic policy alternatives in themselves. Some of the problems that would arise under a free-trade regime have already been mentioned and a full discussion is contained in the concluding chapter. The modeling technique used could itself be improved to better simulate the effects of exchange rate, trade, and agricultural price policies in Pakistan.

As discussed earlier, including agricultural investment and capital stock in the model would better capture long-term effects of changes in relative price incentives between agriculture and nonagriculture. An explicit model of the agricultural labor market, including rural-urban migration could also be specified.

One important result of the simulations was the potentially large effect of free trade in milk on milk output, prices, and overall agricultural income. Because milk is a large subsector in agriculture, large imports of milk at lower world prices in conjunction with decreases in milk production would, according to the simulation, have a large effect on agricultural incomes and measures of transfers into and out of agriculture. In the model, imported powdered milk and fresh milk are perfect substitutes (albeit with a quality factor adjustment in calculating equivalent prices of the two commodities). A more realistic demand specification would also include disaggregation of milk demand by rural and urban groups. Domestic supply of milk might also be modeled using the capital stock of cows and buffalo.

The behavior of the sugar industry in the model simulations is perhaps unrealistic in that the capacity for sugar refining is assumed (implicitly) to remain in operation despite violent swings in domestic sugarcane production. Avoiding large variations in domestic sugarcane production and enabling sugar refineries to be financially viable are strong arguments in favor of some form of price stabilization in sugar. (The level at which sugar prices are stabilized is a different, very important issue.)

Finally, a better model of both the meat and fruit subsectors could be obtained by incorporating some form of agricultural investment and capital. Modeling potential exports of these commodities under free trade with exchange-rate adjustments is also difficult because higher prices alone may not be sufficient to induce a large increase in exports without significant investments in infrastructure and the gradual development of trading contacts to establish new markets.

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CONCLUSIONS

Indirect effects of exchange rate policies have been a major factor in determining the overall effects of government policy interventions on agricultural price incentives. Trade policies designed to protect industrial sectors led to an appreciation of the real exchange rate of about 22 percent in the 1960s and about 10 percent in the mid-1970s. Despite the adoption of a managed float nominal exchange rate policy, quantitative restrictions on imports in 1987 resulted in a high implicit import tariff of 47 percent and an appreciation of the real exchange rate estimated at 19 percent.

Appreciation of the real exchange rate has reduced and sometimes reversed the protection provided by agricultural trade policies for some commodities. The overvaluation of the rupee in the 1960s outweighed the protection provided by direct trade policies for wheat, ordinary rice, and cotton, and increased the taxation of basmati rice. Direct effects of trade policies were dominant for wheat, basmati rice, and ordinary rice in the 1970s and early 1980s because the exchange rate effect (the distortion caused by the appreciation of the real exchange rate) was smaller than in the 1960s. For cotton, trade policies had only a small direct effect on domestic prices, but domestic prices remained significantly lower than equilibrium free-trade prices because of the indirect effects of exchange rate appreciation and overall trade policy.

For both wheat and basmati rice, the combined effects of Pakistan's trade and exchange rate policies changed little over almost three decades, because domestic prices were consistently kept below the free-trade equilibrium border prices. A similar story could have been told for seed cotton and ordinary rice up until the early 1980s. However, large declines in world prices of cotton and rice in recent years have resulted in significant reductions in implicit taxation because domestic prices of these commodities have not been allowed to fall as precipitously. Instead, government policies have helped stabilize domestic prices at the cost of losses in tax revenues. The drop in measured levels of taxation of these products may be temporary, however, if world prices rise to previous levels and domestic prices remain near the 1987 levels.

Thus, the five major agricultural products (wheat, basmati rice, ordinary rice, cotton, and sugarcane) were consistently taxed from the 1960s to the early 1980s. As a result, production of these crops suffered. Due to the combined effect of trade and exchange rate policies and agricultural price policies, wheat production was 24 percent lower and basmati rice 52 percent lower in the 1983-87 period than they would have been with no government intervention. In the absence of direct and indirect price interventions, farm incomes from these five major crops would have been 40 percent higher during that period.

Government intervention in agricultural markets also had positive effects, however. Domestic prices of all major agricultural commodities except vegetable oil and fertilizer were less variable than world prices evaluated at the free-trade equilibrium exchange rate. The large dairy sector also greatly benefited from protection from milk imports. In the simulation of free trade with equilibrium exchange rates, milk production fell by 25 percent in the 1978-87 period. As a result, despite large increases in farmers' gross income from major crops, total agricultural gross income increased by only 4 percent.

Transfers out of agriculture due to direct and indirect price policies averaged, for

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the five major crops, Rs 25 billion per year in the 1978-87 period, about 36 percent of agricultural value added. This implicit tax on agriculture was about nine times the estimated level of net subsidies to producers (both budgetary and off-budget) and more than three times public expenditures on research, extension, and infrastructure for agriculture (about Rs 7 billion per year in the 1978-87 period). The Rs 25 billion mostly went to other sectors of the economy and to consumers—not to the government as revenue—because it resulted from quantitative restrictions on imports and not from direct tariffs. Thus, the net effect of price and nonprice-related income transfers is estimated to have been a transfer out of agriculture of approximately 25 percent of agricultural GDP during 1978-87.

When other agricultural commodities (particularly milk, which benefited from an implicit subsidy on production) are included, transfers out of agriculture are reduced to Rs 14 billion in the same period (from 1985 to 1987 transfers were positive)—about 16 percent agricultural value added. The declining trend in the total transfers out of agriculture is mainly due to a decline in world prices of a number of agricultural commodities. In the longer run, it is likely that, without a change in exchange rate or trade policies, total transfers out of agriculture will again be positive as world prices rise.

Without government subsidies for consumers, higher prices for major food crops would mean higher consumer prices for major food crops as well (the removal of the implicit subsidy for consumers). In simulating free trade with equilibrium exchange rates and net trade increases, consumption of food crops declined. Wheat became an export good, with wheat exports rising to 3.7 million tons in the simulation of the 1978-87 period. (Historically, Pakistan imported an average of 858,000 tons in this period.)

Although not modeled here, the foregone agricultural production resulting from government trade and exchange rate and agricultural price policies implies fewer rural employment opportunities, lower labor incomes, and greater incentives for rural-to-urban migration. Incentives for investment in agricultural capital would be reduced as well.

Some of the other sectors of the economy benefited from these policies. In particular, import-competing industries enjoyed protection behind the high implicit import tariffs, and all consumers faced lower and more stable prices for food products but higher prices for nonfood goods and services.

Given the inherent inability of most agricultural supply models, including this one, to capture fully the interdependence between sectors (that is, the effects on investment behavior, labor and capital flows, and others), the output response predicted here should be considered as a very preliminary result. The effects of these intersectoral resource flows are likely to be of lesser importance, however, for the simulations of the direct effects than of the total effects.

It should be emphasized that these quantitative results are meant mainly as an aid to understanding some of the major linkages between macroeconomic policies and agriculture; they provide only rough estimates of the magnitudes of policy effects. The model used does not capture longer-run effects of price policies on agricultural investment and capital, considerations likely to be important for the livestock and dairy sectors in particular. Supply and demand parameters (taken from Hamid et al. 1987) are known only approximately and fail to explicitly capture differences in rural and urban consumption patterns. Moreover, the model simulations assume no change in public investment in agriculture and rural infrastructure compared with historical levels. This is not meant to imply that these investments did not play a significant role in Pakistan's agricultural development. The simulations merely reflect the purpose of the study: to assess the effects on agriculture of government macroeconomic and sectoral price interventions, holding other factors (including public investment) constant.

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Finally, the scenarios modeling free trade with and without real exchange rate adjustments are not meant as policy recommendations. Rather, the simulations enable the indirect effects of macroeconomic policies to be highlighted and analyzed. On this issue, two other considerations should be noted: (1) the indirect price interventions as such do not yield revenue to the government (at least not from the agricultural sector, although industrial protection could yield revenues if tariffs apply, whereas in Pakistan quantitative restrictions predominate); (2) the direct price interventions on exports yield revenues, and this could be a factor to consider in the transition. Placing tariffs on all importables would certainly more than compensate for the reduction in fiscal revenues from elimination of export taxes on agricultural exportables.

There may be some scope for increasing the direct taxation of agriculture, particularly if the indirect taxation of agriculture arising through trade and exchange rate policies is reduced (for example, by reducing import restrictions in the nonagricultural sector). In theory, it would be possible to levy direct taxes on agriculture in conjunction with changes in trade and exchange rate policies that reduce the indirect taxation of agriculture so that agricultural incomes are unchanged. In practice, a direct taxation of agriculture is made difficult by problems in measuring agricultural incomes, valuation of land, and tax avoidance. The issues involved in a complete analysis of fiscal policy are complex; they involve comparisons of taxes and expenditures across sectors of the economy—issues that are beyond the scope of this study.

This paper has shown that the indirect effects of trade and exchange rate policies on agricultural producer prices are large and have persisted for more than two decades for several major commodities. Indirect effects taxed producers and subsidized consumers of most food crops and cotton. Milk was the only major commodity for which the indirect effects (appreciation of the real exchange rate) did not outweigh the high levels of direct protection in the last decade. For most of the period, the net effect of the prevailing policies was lower overall agricultural growth. These indirect effects, therefore, are too large to be ignored and should be taken into account in the analysis of agricultural pricing policy and taxation in Pakistan, as well as in the design of trade policy for the nonagricultural sector.

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APPENDIX 1: SUPPLEMENTARY TABLES

Table 26—Tariffs and effective exchange rates, 1960-87

Year	$1 + t_m$ (1)	$1 - t_x$ (2)	Equivalent Tariff (3)	E (4)	E_x (5)	E_m (6)
1960	2.34	1.65	1.42	4.78	7.89	11.19
1961	2.34	1.69	1.38	4.79	8.10	11.18
1962	2.36	1.62	1.45	4.77	7.74	11.25
1963	2.45	1.56	1.57	4.79	7.48	11.74
1964	2.52	1.62	1.55	4.79	7.77	12.06
1965	2.85	1.77	1.61	4.80	8.49	13.70
1966	2.73	1.64	1.67	4.79	7.84	13.07
1967	2.86	1.59	1.79	4.80	7.65	13.73
1968	3.01	1.66	1.81	4.79	7.95	14.40
1969	3.14	1.77	1.78	4.80	8.50	15.09
1970	3.02	1.73	1.74	4.79	8.30	14.45
1971	3.22	2.00	1.62	4.78	9.54	15.42
1972	2.65	1.78	1.48	5.56	9.92	14.73
1973	1.53	1.08	1.41	10.56	11.45	16.11
1974	1.33	0.90	1.47	9.90	8.93	13.15
1975	1.24	0.99	1.25	9.90	9.77	12.24
1976	1.44	1.19	1.21	9.90	11.75	14.28
1977	1.53	1.18	1.30	9.90	11.68	15.13
1978	1.46	1.17	1.24	9.90	11.58	14.41
1979	1.51	1.01	1.49	9.90	10.00	14.91
1980	1.55	0.96	1.62	9.90	9.49	15.35
1981	1.55	1.03	1.51	9.90	10.17	15.33
1982	1.44	1.04	1.38	10.55	11.01	15.17
1983	1.42	1.01	1.41	12.70	12.81	18.04
1984	1.47	1.05	1.40	13.48	14.21	19.85
1985	1.46	0.95	1.53	15.16	14.46	22.07
1986	1.52	1.00	1.51	16.13	16.18	24.47
1987	1.47	0.95	1.54	17.17	16.35	25.23

Source: Authors's calculations based on Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: In column (1), t_m is the implicit tariff on imports. Weights for 1972-87 are as follows (1960-71 weights are in parentheses): fuel, 0.30 (0.04); fertilizer, 0.05 (0.03); wheat, 0.05 (0.10); and vegetable ghee, 0.05 (0.03).

In column (2), t_x is the implicit tax on exports.

Weights for 1972-87 are as follows (1960-71 weights are in parentheses): raw cotton, 0.31 (0.44); cotton yarn, 0.12 (0.18); cotton textiles, 0.14 (0.19); basmati rice, 0.33 (0.19); and petroleum, 0.10 (0.00). See Chapter 4, equation (4).

(3) The equivalent tariff = $(1 + t_m) / (1 - t_x)$.

(4) E is the effective exchange rate.

(5) E_x = effective exchange rate for exports = (4) • (2).

(6) E_m = Effective exchange rate for imports = (4) • (1).

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Table 27—Equivalent tariff calculations, 1963/64

Item	Exports	Effective Exchange Rate
	(US$ million)	
Raw cotton	71.4	4.45
Hides and skins	10.7	4.76
Raw wool	15.7	4.76
Cotton yarn, goods	39.8	6.31
Rice	22.2	6.21
Footwear	2.5	7.66
Leather goods	8.0	10.34
Sport goods	3.9	10.31
Carpets	6.2	8.05
Wheat	0.2	4.76
Other	55.3	7.66
Raw jute	158.1	4.28
Tea	0.0	...
Jute goods	67.9	5.71
Fish	21.0	4.76
Total	482.9	...
Average export tax	...	-13.69
Total West Pakistan	235.9	...
Average export tax (West Pakistan)	...	-29.04

Item	Imports	Nominal Rate of Protection
	(US$ million)	
Chemicals	57.4	81
Electric goods	27.0	308
Machinery	194.2	60
Paper products	8.1	94
Rubber manufacturing	12.4	153
Transport equipment	100.5	249
Art silk, yarn	7.3	350
Cotton manufactures	2.8	225
Iron, steel manufactures	125.4	95
Nonferrous metal	16.8	66
Oil (mineral)	51.1	107
Vegetable oil	26.2	106
Grains, pulses, flour	120.4	85
Other imports	178.4	85
Total	928.0	...
Average	...	110.08

Sources: For the effective exchange rate, A. R. Kemal and Paul A. Popiel, "Effective Exchange Rates of Exported or Exportable Products in Pakistan," Pakistan Institute of Development Economics, Islamabad, and the World Bank, Washington, D.C., 1980, Appendix Table 1, except for cotton yarn goods, jute goods, and others (assumed manufactures). The effective exchange rates for these goods are from S. R. Lewis, *Pakistan: Industrialization and Trade Policies* (London: Oxford University Press, 1970), Table 4.16. Export and import tables are from Lewis, *Pakistan: Industrialization and Trade Policies*, Tables A.16 and A.17.

Notes: Footwear is assumed to equal 7.66; fish, wheat, hides, and wool are assumed to equal 4.76.

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Table 28—Equilibrium exchange rates using a modified elasticities approach, 1960-87

Year	Trade Deficit	$1 + t_m$	$1 - t_x$	E	$Q1_{tx}$	$E1^*_{tx}$	$E2^*_{tx}$
	(Rs million)	(Rs/US$)	(Rs/US$)	(Rs/US$)	(Rs million)	(Rs/US$)	(Rs/US$)
1960	1,066	2.34	1.65	4.78	1,065	11.75	9.82
1961	1,659	2.34	1.69	4.79	1,207	12.86	10.10
1962	1,720	2.36	1.62	4.77	1,402	12.56	9.90
1963	1,851	2.45	1.56	4.79	2,034	11.89	9.78
1964	1,942	2.52	1.62	4.79	2,130	12.28	10.12
1965	2,587	2.85	1.77	4.80	2,783	13.91	11.30
1966	1,726	2.73	1.64	4.79	2,300	12.44	10.47
1967	2,377	2.86	1.59	4.80	3,220	12.66	10.52
1968	1,705	3.01	1.66	4.79	2,984	12.46	10.83
1969	1,377	3.14	1.77	4.80	2,659	12.92	11.42
1970	1,673	3.02	1.73	4.79	2,806	12.83	11.13
1971	1,686	3.22	2.00	4.78	2,729	14.20	12.43
1972	25	2.65	1.78	5.56	5,873	15.49	15.47
1973	-616	1.53	1.08	10.56	6,486	12.96	13.21
1974	2,701	1.33	0.90	9.90	5,491	12.05	11.34
1975	9,492	1.24	0.99	9.90	7,985	13.15	11.38
1976	6,220	1.44	1.19	9.90	14,781	13.67	12.55
1977	6,238	1.53	1.18	9.90	18,502	13.80	12.82
1978	2,696	1.46	1.17	9.90	21,177	12.83	12.50
1979	4,930	1.51	1.01	9.90	24,891	12.73	12.26
1980	5,235	1.55	0.96	9.90	31,567	12.59	12.21
1981	1,572	1.55	1.03	9.90	39,513	12.46	12.36
1982	7,863	1.44	1.04	10.55	38,335	13.41	12.92
1983	-5,686	1.42	1.01	12.70	41,046	14.84	15.18
1984	-227	1.47	1.05	13.48	52,714	16.55	16.56
1985	13,488	1.46	0.95	15.16	52,557	19.07	18.27
1986	-5	1.52	1.00	16.13	62,226	19.81	19.81
1987	-8,126	1.47	0.95	17.17	52,432	19.90	20.40

Source: Author's calculations based on Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: t_m = the implicit tariff on imports and t_x = the implicit tax on exports.

E = the actual nominal exchange rate.

$Q1_{tx}$ = current account imbalance due to trade taxes and quotas

$= (T / 1 + T) \cdot Q_D \cdot n_D \,.\, [1 + T = (1 + t_M) / (1 - t_X)]\,,$ 1960-72

$= [t_m / (1 + t_m)] \cdot Q_D \cdot n_D - [t_x / (1 - t_x)] \cdot (Q_S + \text{Remit}) \cdot e_S\,,$ 1973-87.

$$E1^*_{tx} = E \cdot (1 - t_x) \cdot \left\{ \frac{(\text{Trade Deficit} + Q1_{tx})}{[Q_D \cdot n_D + (Q_S + \text{Remit}) \cdot e_S]} + 1 \right\} \quad \text{1960-72}$$

$$= E \cdot \left\{ \frac{(\text{Trade Deficit} + Q1_{tx})}{[Q_D \cdot n_D + (Q_S + \text{Remit}) \cdot e_S]} + 1 \right\} \quad \text{1973-87.}$$

$E2^*_{tx} = E \cdot (1 - t_x) \cdot \{Q1_{tx} / [Q_D \cdot n_D + (Q_S) + \text{Remit}] \cdot e_S + 1\},$ 1960-72

$= E \cdot \{Q1_{tx} / [Q_D \cdot n_D + (Q_S + \text{Remit}) \cdot e_S] + 1\},$ 1973-87.

In the equations above,

Q_D = the demand for foreign exchange (the level of imports),
n_D = the elasticity of supply of foreign exchange (the elasticity of demand for imports),
Q_S = the supply of foreign exchange (the level of exports), and
e_S = the elasticity of supply of foreign exchange (the elasticity of supply of exports).

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Table 29—Domestic supply (area and yield) elasticities

Commodity	Elasticity of Area with Respect to Price											
	Wheat	Maize	Millet and Sorghum	Basmati Rice	Other Rice	Pulses	Sugar	Vegetable Oil	Fruit	Milk	Meat	Cotton
Area elasticity												
Wheat	0.090	0.002	−0.000	0.003	0.009	−0.003	0.007	−0.002	0.001	0.012	0.005	0.009
Maize	0.034	0.250	−0.050	−0.012	0.003	−0.004	−0.042	−0.018	−0.001	0.018	0.011	−0.024
Millet and sorghum	0.031	−0.040	0.200	−0.005	0.006	−0.004	−0.023	−0.005	−0.002	0.014	0.007	−0.017
Basmati	0.000	−0.015	−0.013	0.600	−0.159	−0.024	−0.094	−0.005	−0.002	0.010	0.003	−0.056
Other rice	0.042	−0.001	−0.001	−0.114	0.250	−0.004	−0.029	−0.000	−0.000	0.010	0.003	−0.024
Pulses	0.017	−0.001	−0.003	−0.009	0.004	0.250	−0.029	−0.037	−0.000	0.010	0.003	−0.030
Sugar	0.006	−0.023	−0.019	−0.043	−0.019	−0.031	0.500	−0.037	−0.012	0.010	0.003	−0.115
Vegetable oil	−0.002	−0.028	−0.011	−0.003	0.005	−0.100	−0.124	0.400	−0.002	0.018	0.011	0.015
Fruit	0.003	−0.002	−0.003	−0.002	−0.000	−0.002	−0.029	−0.002	0.100	0.004	0.001	−0.016
Milk	0.028	0.006	0.001	0.004	0.006	0.001	0.010	0.005	0.001	0.200	0.047	0.013
Meat	0.028	0.006	0.001	0.004	0.006	0.001	0.010	0.005	0.001	0.054	0.200	0.013
Cotton	0.004	−0.013	−0.015	−0.021	−0.014	−0.028	−0.093	0.000	−0.006	0.013	0.006	0.350
Yield elasticity												
Own price	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.10	0.00	0.00	0.35
Cross price	−0.04[a]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	−0.04[b]
Adjusted parameter	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.85	0.60	0.60	0.35

Source: N. Hamid, Thomas C. Pinckney, Susanne Gnaegy, and Alberto Valdés, "The Wheat Economy of Pakistan: Setting and Prospects," International Food Policy Research Institute, Washington, D.C., 1987 (mimeo).

Note: Area elasticities shown in row i and column j represent the percentage change in area of commodtiy i for a 1 percent change in the price of commodity j.

[a]This is the cross-price elasticity of wheat with respect to cotton.

[b]This is the cross-price elasticity of cotton with respect to wheat.

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Table 30—Price and income elasticities of demand

Commodity	Wheat	Maize	Millet and Sorghum	Basmati Rice	Other Rice	Pulses	Sugar	Vegetable Oil	Fruit	Milk	Meat	Cotton
Price elasticity												
Wheat	−0.2500	0.0044	0.0054	0.0250	0.0180	0.0055	0.0066	0.0328	0.0044	0.0260	−0.0034	−0.0043
Maize	0.1403	−0.3500	0.0797	0.0190	0.0140	0.0181	0.0066	0.0067	0.0086	0.0010	0.0014	−0.0023
Millet and sorghum	0.2755	0.0844	−0.3800	0.0305	0.0255	0.0386	0.0436	0.0428	0.0236	0.0997	0.0964	0.0225
Basmati	0.1474	0.0028	0.0028	−0.7000	0.1195	0.0014	−0.0206	−0.0028	0.0114	−0.0297	−0.0464	−0.0225
Other rice	0.1828	0.0046	0.0045	0.1305	-0.4000	0.0109	0.0067	0.0116	0.0107	0.0245	0.0143	0.0011
Pulse	0.0450	0.0033	0.0033	0.0112	0.0056	−0.3000	0.0050	0.0100	0.0100	0.0700	0.0700	0.0000
Sugar	−0.0450	−0.0018	−0.0018	−0.0051	−0.0075	−0.0134	−0.4500	0.0315	0.0582	0.0020	0.0048	−0.0196
Vegetable oil	0.0280	−0.0018	−0.0018	0.0003	−0.0061	−0.0109	0.0317	−0.5700	0.0379	0.0102	0.0231	−0.0200
Fruit	−0.0553	−0.0012	−0.0011	0.0077	−0.0039	−0.0069	0.1363	0.0844	−0.7600	0.0304	−0.0559	−0.0250
Milk	−0.0168	−0.0017	−0.0017	0.0001	−0.0046	0.0022	0.0078	0.0113	0.0107	−0.5800	0.1830	−0.0149
Meat	−0.1163	−0.0040	−0.0039	−0.0098	−0.0134	−0.0110	−0.0160	−0.0080	−0.0127	0.1235	−0.8000	−0.0315
Cotton	−0.0754	−0.0025	−0.0025	−0.0085	−0.0085	−0.0151	−0.0272	−0.0265	−0.0110	−0.0726	−0.0700	−0.5900
Income elasticity	0.19	0.10	−1.00	1.00	−0.05	0.00	0.87	0.89	1.11	0.66	0.81	1.40

Source: N. Hamid, Thomas C. Pinckney, Susanne Gnaegy, and Alberto Valdés, "The Wheat Economy of Pakistan: Setting and Prospects," International Food Policy Research Institute, Washington, D.C., 1987 (mimeo).

Note: Demand elasticities shown in row i and column j represent the percentage change in quantity demanded of commodity i for a 1 percent change in the price of commodity j.

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APPENDIX 2: METHOD FOR CALCULATING NOMINAL RATES OF PROTECTION OF AGRICULTURAL COMMODITIES IN PAKISTAN

Traded Commodities

Wheat (Import Parity)

This series compares the procurement price with the import price nine months later, so world and border prices are prices for the next fiscal year.

The world price is c.i.f. Karachi, which equals the f.o.b. Gulf price (fourth quarter) based on No. 2 (ord.) hard winter wheat (International Wheat Council various years), plus the average freight cost for the shipping year from the Gulf to Karachi. Freight rates for years prior to 1975 were estimated from rates to East India, adjusted by a factor of 0.786 = freight to Karachi (1975) / freight to East India (1975) (International Wheat Council various years).

The border price is measured at the farmgate. It equals the world price times the nominal exchange rate plus import handling and transport from Karachi to Rawalpindi less the cost of transport from the farmgate to the wholesale market (including domestic handling, transport from the farmgate to Rawalpindi, and interest).

Import handling—the unloading cost in Karachi—is assumed to be the same as domestic handling. Transport by rail from Karachi to Rawalpindi includes other charges such as handling, bags, delivery, and storage. It is estimated for 1985 at Rs 207 per metric ton, based on data from Majeed (1985). Domestic handling is estimated for 1984 at Rs 228 per metric ton, and transport from the farmgate to Rawalpindi is estimated for 1984 at Rs 214 per metric ton (Majeed 1985). Interest, adjusted for the time lag between the harvest (March-April) and import (October-March), is calculated for nine months using fourth-quarter interest rates [see Table 31, (3)].

Handling and transport series were extended using the consumer price index (CPI) and the transport index, respectively [see Table 31, (1) and (2)].

Wheat (Export Parity)

The world price is f.o.b. Karachi, which equals f.o.b. Gulf (second quarter) plus freight from Karachi to the Middle East (estimated to be half of freight from the Gulf to Karachi). It is based on f.o.b. Gulf No. 2 (ord.) hard winter wheat prices from *World Wheat Statistics* (International Wheat Council various years). The border price measured at the farmgate equals world price times the nominal exchange rate minus domestic handling, export handling, and transport from Karachi to the farmgate. The nominal exchange rate and domestic handling costs are derived in the same way as those for the import parity. Export handling is estimated for 1985 at Rs 160 per metric ton. Transport by road from the farmgate in Punjab to Karachi is estimated for 1985 at Rs 200 per metric ton, based on data from Majeed (1985).

Basmati Rice (Milled)

The world price for milled basmati is the export unit value of Pakistan basmati rice based on FAQ clean rice (Cheong 1964; World Bank 1988; Pakistan Ministry of Food, Agriculture and Cooperatives various years).

The border price is measured at the farmgate. It equals the world price times the nominal exchange rate less the cost from the farmgate to the wholesale market (including

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Table 31—Indices used in computing border prices for specific commodities, 1961-88

Year	Commodity Price Indez (1)	Transport Index (2)	Interest Rate (3)	Exchange Rate (4)	Recovery Rate (5)	Freight Rate (6)
1961	33.67	24.03	4.00	4.79	8.53	6.72
1962	33.83	24.03	4.00	4.77	8.53	6.84
1963	33.63	24.03	4.00	4.79	8.53	7.00
1964	35.04	24.03	4.00	4.79	8.53	9.88
1965	36.72	24.03	4.00	4.80	8.53	10.38
1966	37.65	24.03	5.00	4.79	8.53	11.28
1967	40.88	30.62	5.00	4.80	8.53	10.56
1968	42.34	32.56	5.00	4.79	8.53	13.52
1969	43.01	32.56	5.00	4.80	8.76	11.51
1970	44.78	36.39	5.00	4.79	7.52	12.30
1971	47.34	36.63	5.00	4.78	8.32	12.43
1972	49.57	36.54	5.00	5.56	8.60	8.24
1973	54.37	37.04	6.00	10.56	8.90	13.57
1974	70.67	55.16	8.00	9.90	8.70	36.52
1975	89.55	83.30	9.00	9.90	8.60	30.84
1976	100.00	100.00	9.00	9.90	8.30	15.33
1977	111.77	101.18	9.00	9.90	8.20	13.42
1978	120.48	94.13	10.00	9.90	8.80	14.50
1979	128.47	80.22	10.00	9.90	9.40	25.81
1980	142.23	94.72	10.00	9.90	9.40	36.58
1981	159.81	114.23	10.00	9.90	8.96	38.57
1982	175.79	121.12	10.00	10.55	8.69	38.69
1983	183.67	122.41	10.00	12.70	8.80	26.94
1984	199.03	132.63	10.00	13.48	8.40	26.08
1985	213.87	133.04	10.00	15.16	8.90	26.08
1986	224.21	133.41	10.00	16.13	8.70	26.09
1987	232.06	145.43	10.00	17.17	8.70	25.76
1988	...	...	...	...	...	26.68

Sources: The commodity price index and the transport index are from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years). The interest rate and the exchange rate are from the International Monetary Fund, *International Financial Statistics* (Washington, D.C.: IMF, various years). The recovery rate is from Pakistan, Ministry of Food, Agriculture and Cooperatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture, and Cooperatives, various years). The freight rate is from the International Wheat Council, *World Wheat Statistics* (London: IWC, various years).

export and domestic handling, transport from farmgate to Karachi, and interest).

The nominal exchange rate and domestic handling are derived in the same way as for wheat. Export handling is estimated for 1985 at Rs 160 per metric ton. Transport by road from the farmgate in Punjab to Karachi is estimated for 1985 at Rs 200 per metric ton based on data from Majeed (1985). Interest, adjusted for the time lag between harvest in November and the wholesale market in January, is calculated for three months [see Table 31, (3)].

Basmati Rice (Unmilled)

The world price for unmilled basmati is the same as that for milled basmati rice.

The border price is measured at the farmgate. It equals the border price of milled rice less the milling cost times the milling rate. The milling cost is estimated to be the difference between the procurement price of milled rice and unmilled rice. The series was extended prior to 1976 using the CPI.

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The milling rate equals 67 percent.

Handling and transport series were extended using the CPI and the transport index, respectively.

Ordinary Rice (Milled)

The world price for ordinary rice is f.o.b. Karachi. It equals the price for f.o.b. Thailand, 5 percent broken (FAO various years) with a 25 percent quality discount.

The border price is measured at the farmgate. It equals the world price times the nominal exchange rate less the cost from the farmgate to the wholesale market (including export and domestic handling, transport from the farmgate to Karachi, and interest). The nominal exchange rate and domestic handling are derived the same as for wheat. Export handling is the same as for basmati rice. Transport by road from the farmgate (Sind) to Karachi is estimated for 1984 at Rs 200 per metric ton (Majeed 1985). Interest, adjusted for the time lag between harvest (October) and the wholesale market (January), is calculated for three months [see Table 31, (3)].

Ordinary Rice (Unmilled)

The world price is derived in the same way as that for milled ordinary rice.

The border price is measured at the farmgate. It equals the border price of milled rice less milling cost times the milling rate. The milling cost is estimated to be the difference between the procurement price of milled and unmilled rice. The series was extended prior to 1976 using the CPI. The milling rate equals 67 percent.

The handling and transport series were extended using the CPI and the transport index, respectively.

Sugarcane

The world price is c.i.f. Karachi, which equals the f.o.b. Caribbean (second quarter) price plus freight (the same as for wheat) (International Monetary Fund various years b).

The border price is measured at the farmgate (Punjab). It equals the c.i.f. Karachi price times the nominal exchange rate plus domestic handling and transport (from Karachi to mill) times the recovery rate of sugarcane less the processing cost at the mill. The nominal exchange rate and the domestic handling cost are derived in the same way as those for wheat. Transport by rail from Karachi to the mill (Punjab), estimated for 1985, is Rs 207 per metric ton (Majeed 1985). The recovery rate is the country average [see Table 31, (5)]. The processing cost, estimated for 1986, is Rs 1.88 per kilogram of white sugar (Ilahi 1978).

Sugar (Ex-mill)

The world price for processed sugar is c.i.f. Karachi, which equals f.o.b. Caribbean (second quarter) plus freight (the same as for wheat) (International Monetary Fund various years b).

The border price, measured at the mill (Punjab), equals the c.i.f. Karachi price times the nominal exchange rate plus domestic handling and transport (from Karachi to the mill).

The nominal exchange rate and the domestic handling cost are derived in the same way as those for wheat. Like sugarcane, transport is by rail from Karachi to the mill.

The handling and transport series were extended using the CPI and the transport index, respectively.

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Fertilizer

The world price of fertilizer is c.i.f. Karachi, which equals urea f.o.b. Europe (76 percent) and diammonium phosphate (DAP) f.o.b. Gulf (24 percent) plus freight (estimated the same as for wheat) (World Bank 1982).

The border price at the farmgate (Punjab) equals c.i.f. Karachi times the nominal exchange rate plus the domestic and retail handling and transport costs (from Karachi to the farmgate at Multan). The nominal exchange rate and the domestic handling cost are derived in the same way as those for wheat. The retail handling cost is derived in the same way as the domestic handling cost. Transport by rail from Karachi to the farmgate (Multan) is estimated for 1984 at Rs 123 per metric ton (Majeed 1985). Handling and transport cost series were extended using the CPI and the transport index, respectively.

Seed Cotton

The world price of seed cotton is f.o.b. Karachi, which equals the export unit value of cotton lint (NT/Sg) (FAO various years b).

The border price for seed cotton at the farmgate equals one-third the border price for lint cotton plus two-thirds the border price for cottonseed less transport from the farmgate to the ginning mill, which is estimated for 1985 at Rs 200 per metric ton.

The border price of lint cotton equals the f.o.b. Karachi price less export handling, transport from Karachi to the ginning mill, and the ginning cost.

Export handling is estimated for 1985 at Rs 36.25 per 40 kilograms (Pakistan, Agricultural Prices Commission 1985).

Transport from Karachi to the ginning mill is estimated for 1985 at Rs 24.25 per 40 kilograms (Pakistan, Agricultural Prices Commission 1985).

The ginning cost is estimated for 1983 at Rs 100 per 40 kilograms of lint cotton (Pakistan, Agricultural Prices Commission 1985).

The border price of cottonseed equals the border price of vegetable oil times the extraction rate of cottonseed less the processing cost. The extraction rate of cottonseed is 11 percent (USDA 1984, 271f). The processing cost is estimated for 1983 at Rs 6.45 per 40 kilograms of cottonseed (USDA 1984, 271f). The handling and transport series were extended using the CPI and the transport index, respectively.

Maize

The world price is c.i.f. Karachi, which equals the price for f.o.b. Gulf yellow No. 2 plus freight (estimated the same as for wheat) from the Gulf to Karachi (International Monetary Fund various years b).

The border price is measured at the farmgate. It equals the world price times the nominal exchange rate plus import handling and transport costs (from Karachi to Rawalpindi) less the transport cost from the farmgate to the wholesale market (including domestic handling and transport from the farmgate to Rawalpindi). The nominal exchange rate and other costs are derived in the same way as for wheat. These include import handling, transport by rail from Karachi to Rawalpindi, domestic handling, and transport from the farmgate to Rawalpindi. Handling and transport series were extended using the CPI and the transport index, respectively.

Milk

The world price is the unit import value of dry skim milk (Pakistan, Federal Bureau of Statistics various years).

The border price, measured at Karachi, equals the world price times the nominal

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exchange rate plus import handling, adjusted by a conversion ratio of 1:8 (1 kilogram of dry powder converts into 8 liters of milk), and a quality factor of 90 percent.

Import handling is estimated for 1987 at Rs 6.50 per kilogram. The quality factor is the ratio of the market price to the wholesale price. The market price equals the world price plus import handling, import duty, and other surcharges. The import duty, which includes other charges, is estimated for 1987 at Rs 11.50 per kilogram. Other surcharges include a 25 percent Iqra[33] surcharge and a 12.5 percent sales tax. These charges and the conversion rate are taken from three sources: Director of Agricultural Policy and Chemonics International (1988); Pakistan, Federal Bureau of Statistics (various years b); and Pakistan, Ministry of Finance (various years).

The domestic price is the wholesale price of milk in Karachi for 1987, extended for other years using the wholesale price index for milk. The import handling and duty series were extended using the CPI.

Vegetable Oil

The world price is c.i.f. Karachi, which equals the price for soybean oil Dutch f.o.b. (50 percent) and for palm oil Malaysia f.o.b. (50 percent) plus freight (estimated the same as for wheat).

Soybean oil prices are taken from the International Monetary Fund's (IMF) *Yearbook* (various years c), and palm oil prices are from IMF's *Supplement on Prices* (various years b). The border price of refined oil at wholesale equals c.i.f. Karachi times the nominal exchange rate plus import handling and refining margin. The nominal exchange rate and import handling are derived in the same way as for wheat. The refining margin is estimated for 1983 at Rs 3.4 per kilogram (USDA, Office of International Cooperation and Development 1984). The domestic price of vegetable oil is the wholesale price of cottonseed oil. Handling charges and the refining margin series are extended using the CPI.

Nontraded Commodities

Pulses

The pulses included are gram, masoor, mung, and mash.

The wholesale price Karachi is a weighted average of wholesale prices from the *Agricultural Statistics of Pakistan* (Pakistan, Ministry of Food, Agriculture and Co-operatives various years). Weights are the production shares of these pulses.

Millet and Sorghum

This category includes bajra and jowar. The wholesale price Karachi for millet and sorghum is a weighted average of the wholesale prices from the *Agricultural Statistics of Pakistan* (Pakistan, Ministry of Food, Agriculture and Co-operatives various years). Weights are the production shares.

Meat

Meat includes beef.

The wholesale price Karachi is an extended series of the wholesale price for 1986/87 from Pakistan, Federal Bureau of Statistics (various years b), using the wholesale price index for meat (Pakistan, Federal Bureau of Statistics various years b).

[33] Iqra is a surcharge on internationally traded goods.

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Fruits

The wholesale price Karachi for fruits is computed from the total value of production divided by the total production of fruits. The value of production for each fruit is derived from the unit value of each fruit and production data taken from Pakistan, Agricultural and Livestock Marketing Advisor (1981).

The values of the fruits included are mangoes, Rs 5,668; bananas, Rs 1,859; apples, Rs 12,941; guava, Rs 2,551; and dates, Rs 3,530.

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APPENDIX 3: METHODOLOGY FOR EFFECTIVE RATES OF PROTECTION

Cost of production estimates used to calculate value added for wheat, cotton, basmati rice, and ordinary rice are based on data from the Pakistan Agricultural Prices Commission (1986) on average costs of all farmers in the Punjab in the 1982/83 cropping year. For sugarcane, the cost of production is based on data for 1975 from Ilahi (1978).

In order to construct time series of the costs of production, constant technology and yields were assumed. Therefore, changes in cost of production were derived from changes in input prices only. A time series of the cost of fertilizer was constructed using an index of the retail price of fertilizer:

$$P_f(t) = P_f(1983) \cdot PFI(t)/PFI(1983), \tag{35}$$

where $P_f(t)$ is the cost of fertilizer in year t, and PFI(t) is the index of retail prices of fertilizer in year t.

Time series for plant protection, canal and tubewell irrigation, and tractor (tillage) costs were constructed in the same way, using an index of the price of nonagricultural goods and services [$P_{na}(t)$]. A time series for the cost of manure was constructed using an index of prices of nontradables, the consumer price index (CPI).

The value of by-products was assumed to be a constant percentage of the value of the harvest; seed costs were assumed to vary with the price of output. For cotton, seed costs were assumed to vary with the price of cottonseed, which was derived from the price of cottonseed oil (see Appendix 2).

In calculating the cost of production under free trade and no change in exchange rates, prices of all inputs except goods with essentially no tradable component (such as manure) were assumed to change. The new fertilizer price series was constructed using the free-trade price of fertilizer PFI'(t) instead of PFI(t). Seed costs were calculated using the free-trade prices of output. Time series of plant protection, canal and tubewell irrigation, and tractor (tillage) costs, C(i,t), were estimated using $P'_{na}(t)$, the index of free-trade prices of nonagricultural goods and services:

$$C(i,t)' = C(i,t) \cdot P'_{na}(t)/P_{na}(t). \tag{36}$$

Cost of production figures under free trade with equilibrium exchange rates were constructed in a similar manner using PFI(t)* and $P_{na}(t)$* instead of PFI(t)' and $P_{na}(t)'$.

The price indices for nonagricultural goods and services were calculated as follows.

$$P_{na}(t) = w1 \cdot P_{mna}(t) + w2 \cdot P_{xna}(t) + (1 - w1 - w2) \cdot P_{nt}(t), \tag{37}$$

where

$P_{na}(t)$ = price index of the nonagricultural sector in year t;

$P_{mna}(t)$ = price index of nonagricultural imports in year t, a weighted average of the domestic prices of nonagricultural imports, which were used in the

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computation of $(1 + t_m)$ in Table 26 (see also Chapter 4, equation 3);

$P_{xna}(t)$ = price index of nonagricultural exports in year t, a weighted average of the domestic prices of nonagricultural exports, which were used in the computation of $(1 - t_x)$ in Table 26 (see also Chapter 4, equation 4);

P_{nt} = price index of nonagricultural nontradables in year t; the Pakistan CPI was used as a proxy.

The weights w1 (= 0.05) and w2 (= 0.20), the shares of nonagricultural importables and exportables in nonagricultural value added, were estimated using 1980/81 data for GDP and nonagriculture value added from the Pakistan Economic Survey for 1987-88 (Pakistan, Ministry of Finance 1988). The nonagricultural export sector was estimated as value added in textiles, wearing apparel, cotton ginning, and sports equipment. The remainder of value added in manufacturing was assigned to the nonagricultural import sector.

$$P'_{na}(t) = w1 \cdot E \cdot P_{mna\$}(t) + w2 \cdot E \cdot P_{xna\$}(t) + (1 - w1 - w2) \cdot P_{nt}(t), \quad (38)$$

and

$$P^*_{na}(t) = w1 \cdot E^* \cdot P_{mna\$}(t) + w2 \cdot E^* \cdot P_{xna\$}(t) + (1 - w1 - w2) \cdot P_{nt}(t), \quad (39)$$

where

$P'_{na}(t)$ = price index of the nonagricultural sector evaluated at the official exchange rate in year t,

$P^*_{na}(t)$ = price index of the nonagricultural sector evaluated at the equilibrium exchange rate in year t, and

$P_{mna\$}(t)$ = index of prices in U.S. dollars.

$$P_{mna\$} = (P_{m\$} - d1\,P_{ma\$})/(1 - d1), \quad (40)$$

d1 = 0.20;

$$P_{ma\$} = b1 \cdot P_{wheat\$} + (1 - b1) \cdot P_{vegoil\$}, \quad (41)$$

b1 = 0.77 for 1960-71 and 0.50 for 1972-87,

$$P_{xna\$} = (P_{x\$} - e1\,P_{xa\$})/(1 - e1), \quad (42)$$

e1 = 0.05;

and

$$P_{xa\$} = c1 \cdot P_{cotton\$} + (1 - c1) \cdot P_{rice\$}, \quad (43)$$

c1 = 0.70 for 1960-71 and 0.48 for 1972-87;

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where $P_{m\$}$ = price index of imports and $P_{x\$}$ = price index of exports, used in the construction of $(1 + t_m)$ and $(1 - t_x)$ (see Table 24), E = official exchange rate, and E^* = equilibrium exchange rate.

Time series for P_{na}, P'_{na}, and P^*_{na} are presented in Table 32.

Table 32—Indices of nonagricultural prices, 1961-87

Year	P_{na}	P'_{na}	P^*_{na}	P'_{na}/P_{na}	P^*_{na}/P_{na}
1961	19.39	16.90	18.46	87.18	95.23
1962	19.85	17.32	18.85	87.23	94.97
1963	19.56	16.95	18.52	86.62	94.66
1964	20.44	17.74	19.42	86.77	94.99
1965	21.20	18.27	20.07	86.16	94.68
1966	21.77	18.80	20.59	86.36	94.57
1967	23.82	20.81	22.84	87.37	95.86
1968	24.63	21.39	23.58	86.87	95.74
1969	25.21	21.61	23.99	85.69	95.13
1970	26.55	22.83	25.16	85.99	94.76
1971	28.35	24.27	26.87	85.59	94.79
1972	30.38	26.32	29.30	86.63	96.45
1973	33.43	30.78	32.14	92.07	96.16
1974	43.81	41.38	42.12	94.45	96.14
1975	55.12	52.33	53.36	94.94	96.82
1976	61.71	57.71	60.71	93.52	98.37
1977	67.12	62.45	65.99	93.04	98.31
1978	71.51	67.70	71.23	94.67	99.61
1979	76.47	71.91	74.84	94.03	97.86
1980	87.19	80.84	84.25	92.71	96.62
1981	100.00	91.78	96.51	91.78	96.51
1982	108.41	101.65	106.24	93.76	98.00
1983	113.32	106.27	110.65	93.78	97.64
1984	122.53	113.83	119.49	92.90	97.51
1985	129.22	120.76	125.29	93.45	96.95
1986	134.68	125.23	131.04	92.98	97.29
1987	138.20	129.90	134.72	93.99	97.48

Source: Authors' computations based on data from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years).

Notes: P_{na} = the price index of nonagriculture,
P'_{na} = the price index of nonagriculture, with free trade at the official exchange rate.
P^*_{na} = the price index of nonagriculture with free trade and an equilibrium exchange rate.

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APPENDIX 4: MODELING WORLD DEMAND FOR BASMATI RICE

Essentially all of the basmati rice traded on the world market is exported from Pakistan to countries in the Middle East. Thus Pakistan's annual exports are equal to total export demand for basmati rice (apart from changes in stocks and losses).

Clearly, Pakistan is not a price-taker in the world market for basmati rice, and changes in the level of Pakistan's exports are likely to have a significant effect on the world price.

World demand for basmati rice is assumed to be a function of the per capita income of the Middle Eastern importing countries and the ratio of the world prices of basmati rice to the world price of ordinary rice. Equation (44) shows the results of a regression on annual time series data from 1972 to 1987.

$$\underset{}{QD} = \underset{(1.79)}{1.037} - \underset{(-2.22)}{0.533} \cdot BSMORD + \underset{(3.70)}{0.422} \cdot PERGDP; \qquad (44)$$

D.W. = 1.85, R^2 = 0.42;

where

QD = log(Pakistan export volume of basmati rice per capita),[34]

BSMORD = log(world price of basmati/world price of ordinary rice), and

PERGDP = log(Saudi Arabia GDP per capita deflated by the CPI).

Data used for this regression are shown in Table 33. The world price of basmati rice is f.o.b. Karachi plus the cost of freight from Karachi to the Middle East (estimated to be half of the cost of freight from the Gulf of Mexico to Karachi (see the freight rates in Appendix 2, Table 31). The world price of ordinary rice is f.o.b. Karachi (see the section on ordinary rice in Appendix 2).

For the model presented in Chapter 7, equation (44) was modified in two ways. First, the equation was linearized around the mean export value in order to make solution of the model easier. Second, it was assumed that the world price of basmati rice could not fall lower than 1.6 times the world price of ordinary rice (the price differential represents an estimated quality differential between basmati and ordinary rice).

[34] The population includes the major countries importing Basmati rice: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

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Table 33—Data used in the regression on world demand for basmati rice, 1972-87

Year	World Price of Basmati Rice	World Price of Ordinary Rice	Per Capita GDP of Saudi Arabia, Adjusted by CPI	Per Capita Demand for Basmati Rice
	(US$/metric ton)		(1970 = 100)	(kilograms/capita)
1972	272.78	98.50	127.45	19.98
1973	260.99	146.50	122.81	6.59
1974	552.12	428.25	326.49	18.63
1975	800.85	299.25	345.38	15.39
1976	531.08	193.75	294.17	29.12
1977	352.71	194.50	275.57	45.45
1978	374.04	277.00	274.05	25.02
1979	759.12	228.25	291.62	14.42
1980	734.57	302.25	422.85	23.70
1981	728.08	363.75	526.48	29.40
1982	727.48	248.00	499.44	17.96
1983	637.61	203.00	380.02	15.61
1984	613.79	190.75	334.12	25.57
1985	637.58	166.50	289.04	10.52
1986	671.81	171.50	249.44	15.08
1987	730.24	154.28	212.53	10.47

Source: International Monetary Fund, *International Financial Statistics* (Washington, D.C.: IMF, various years).

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APPENDIX 5: SIMULATION RESULTS

Table 34—Agricultural production (simulation 1)

Commodity/ Period	Area 1	Change	Yield 1	Change	Production 1	Change
	(1,000 hectares)	(percent)	(metric tons/ hectare)	(percent)	(1,000 metric tons	(percent)
Wheat						
1961-65	4,885.8	-1.97	0.81	-2.87	3,953.7	-4.79
1966-71	5,507.2	-5.18	0.95	-4.70	5,272.7	-9.76
1972-77	6,400.9	6.11	1.55	18.60	10,111.6	27.81
1978-82	7,168.4	4.87	1.76	15.78	12,638.9	21.64
1983-87	7,528.7	1.85	1.86	8.99	14,008.1	10.87
1961-87	6,272.7	1.36	1.38	8.87	9,085.5	12.31
Basmati rice						
1961-65	484.4	29.75	0.93	7.57	456.5	40.54
1966-71	664.5	50.21	1.05	1.37	707.9	52.95
1972-77	551.2	26.96	1.43	18.47	833.0	58.93
1978-82	843.4	15.87	1.35	12.85	1,158.9	32.92
1983-87	1,055.6	30.90	1.31	8.85	1,388.0	42.42
1961-87	711.5	29.82	1.22	10.23	898.6	44.61
Ordinary rice						
1961-65	856.3	-1.71	0.95	-0.50	817.1	-2.19
1966-71	1,145.0	9.97	1.26	1.04	1,480.9	12.96
1972-77	1,386.6	21.35	2.14	28.44	3,011.7	58.21
1978-82	1,461.0	17.27	2.28	21.62	3,308.4	42.22
1983-87	1,287.4	4.65	1.99	4.18	2,552.2	9.39
1961-87	1,230.1	11.31	1.72	12.93	2,235.0	29.05
Maize						
1961-65	463.9	-3.28	0.96	-6.35	447.2	-9.47
1966-71	604.1	0.50	0.94	-13.48	568.5	-13.19
1972-77	733.6	16.82	1.43	19.96	1,074.7	43.57
1978-82	708.0	0.70	1.31	4.89	930.3	5.83
1983-87	812.4	1.16	1.29	0.04	1,046.2	1.24
1961-87	664.7	3.72	1.19	1.68	814.0	7.45
Millet and sorghum						
1961-65	1,349.8	2.15	0.48	-0.37	642.7	1.82
1966-71	1,399.3	5.38	0.46	-5.81	639.6	-0.53
1972-77	1,183.0	3.09	0.55	3.30	663.8	7.67
1978-82	1,009.8	0.49	0.55	5.20	558.5	5.80
1983-87	923.7	1.66	0.52	0.38	482.5	2.17
1961-87	1,181.9	2.85	0.51	0.54	601.4	3.34
Sugarcane						
1961-65	334.7	-28.61	29.12	-13.85	9,747.5	-38.50
1966-71	184.8	-68.75	22.30	-41.06	4,128.9	-81.58
1972-77	697.0	7.45	44.96	24.88	31,340.5	34.19
1978-82	844.4	3.87	40.20	9.00	33,943.9	13.27
1983-87	562.7	-34.01	31.14	-15.38	17,523.2	-44.16
1961-87	518.5	-22.70	33.55	-7.27	19,218.1	-21.45
Cotton						
1961-65	1,416.5	1.17	0.24	-4.37	346.7	-3.05
1966-71	1,806.2	6.24	0.25	-15.45	450.4	-9.95
1972-77	1,786.3	-7.28	0.30	-3.84	545.2	-10.40
1978-82	2,008.3	-0.95	0.33	3.17	662.7	2.29
1983-87	2,512.9	8.43	0.42	-0.09	1,072.3	10.27
1961-87	1,897.9	1.50	0.31	-4.09	606.7	-0.96

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Table 34—Continued

Commodity/ Period	Area 1	Change	Yield 1	Change	Production 1	Change
	(1,000 hectares)	(percent)	(metric tons/ hectare)	(percent)	(1,000 metric tons	(percent)
Vegetable oil						
1961-65	579.2	9.64	0.16	-0.33	93.9	9.59
1966-71	693.4	27.52	0.17	-10.75	121.8	14.34
1972-77	587.8	0.79	0.22	4.09	131.1	4.35
1978-82	625.1	24.63	0.28	19.70	174.8	49.55
1983-87	667.5	50.54	0.32	19.61	215.5	80.38
1961-87	631.4	20.65	0.23	7.23	145.9	31.14
Pulses						
1961-65	1,374.8	1.49	0.53	-0.71	726.2	0.74
1966-71	1,342.4	7.38	0.47	-4.83	634.4	2.45
1972-77	1,493.5	0.81	0.52	-0.23	776.8	0.42
1978-82	1,409.7	-4.04	0.42	1.08	594.7	-3.25
1983-87	1,377.4	-1.64	0.53	-0.45	732.8	-2.10
1961-87	1,401.0	0.84	0.50	-1.18	693.9	-0.22
Fruits						
1961-65	112.7	-1.64	8.24	-2.22	927.8	-3.83
1966-71	158.8	2.99	8.74	-5.34	1,385.7	-2.69
1972-77	185.6	2.25	9.68	0.18	1,802.2	2.66
1978-82	219.2	-6.41	9.14	-1.09	2,008.1	-7.37
1983-87	315.1	-7.20	8.93	-2.45	2,806.8	-9.55
1961-87	196.3	-2.83	8.97	-2.18	1,771.9	-4.80
Milk						
1961-65	...	...	...	...	6,457.6	-2.82
1966-71	...	...	...	...	6,879.8	-6.16
1972-77	...	...	...	...	7,667.4	-5.74
1978-82	...	...	...	...	5,256.5	-42.10
1983-87	...	...	...	...	6,452.1	-40.76
1961-87	...	...	...	...	6,596.8	-21.15
Meat						
1961-65	...	...	...	...	388.7	-2.74
1966-71	...	...	...	...	473.4	-4.60
1972-77	...	...	...	...	646.7	1.28
1978-82	...	...	...	...	709.6	-13.48
1983-87	...	...	...	...	962.9	-11.04
1961-87	...	...	...	...	630.6	-7.06

Sources: Authors' calculations based on data from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years); and Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years).

Notes: For wheat, maize, millet and sorghum, production and yield are expressed in terms of unmilled grain. For basmati and ordinary rice, production and yield are expressed in terms of millet rice (the conversion factor is 67 percent). For sugarcane, production and yield are expressed in terms of refined sugar. For cotton, production and yield are expressed in terms of lint cotton. For vegetable oil, area includes areas of rape and mustard, groundnuts, and sesamum seeds. Production and yield are expressed in terms of oil (using extraction rates of 34 percent for rape and mustard seed oil, 45 percent for groundnuts, and 40 percent for sesamum seed oil). For pulses, production and yield are expressed in terms of unmilled grains of grams and other pulses. For fruits, area, production, and yield include citrus fruits, mangoes, bananas, apples, guava, dates, apricots, peaches, pears, grapes, and pomegranates. For milk, production is expressed in terms of whole milk. For meat, production includes beef, mutton, and poultry. Change indicates percent change relative to historical levels.

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Table 35—Consumer prices, consumption, and trade (simulation 1)

Commodity/ Period	Consumer Prices 1	Change	Consumption 1	Change	Trade 1	Historical Trade
	(Rs/metric ton)	(percent)	(1,000 metric tons)	(percent)	(1,000 metric tons)	
Wheat						
1961-65	432.7	-1.1	4,638.6	-1.24	-1,080.3	-959.2
1966-71	449.0	-14.3	5,925.4	0.45	-1,180.0	-640.3
1972-77	1,572.8	77.2	7,372.2	-9.78	1,728.3	-1,051.2
1978-82	2,347.6	61.8	9,019.7	-12.11	2,355.4	-911.0
1983-87	2,799.6	38.4	10,862.6	-10.79	1,744.6	-805.2
1961-87	1,482.6	42.8	7,495.9	-8.05	681.1	-871.3
Basmati rice						
1961-65	1,006.1	17.2	201.6	-15.28	209.2	54.4
1966-71	968.1	-7.3	294.7	-1.55	342.5	117.3
1972-77	3,511.4	46.7	246.5	2.26	503.2	230.7
1978-82	5,337.5	19.7	495.3	0.75	547.7	293.0
1983-87	6,640.4	6.7	610.5	-2.15	638.7	253.2
1961-87	3,399.9	17.2	362.4	-2.26	446.4	188.5
Ordinary rice						
1961-65	490.4	-7.0	710.5	4.25	24.8	70.2
1966-71	576.3	-4.9	1,150.4	-0.75	182.4	20.8
1972-77	2,173.4	101.3	1,175.6	-10.43	1,534.9	400.7
1978-82	2,748.3	49.3	1,267.5	-6.22	1,710.0	742.1
1983-87	2,508.6	-4.9	1,348.8	7.32	948.2	842.9
1961-87	1,675.4	28.7	1,133.0	-2.20	878.5	400.2
Maize						
1961-65	268.2	-18.5	468.5	5.37	-66.0	0.0
1966-71	298.1	-26.5	620.3	5.25	-108.7	0.0
1972-77	1,200.1	65.8	644.1	-4.40	323.1	0.0
1978-82	1,323.8	0.6	852.0	7.69	-14.8	0.0
1983-87	1,739.3	-6.7	989.2	6.36	-47.6	0.0
1961-87	949.8	5.4	708.7	3.95	23.9	0.0
Millet and sorghum						
1961-65	379.4	-5.0	578.5	1.83	...	...
1966-71	417.4	-13.1	575.6	-0.52	...	...
1972-77	1,061.6	14.4	597.3	7.65	...	...
1978-82	1,816.6	3.6	502.7	5.81	...	...
1983-87	2,710.4	2.5	434.5	2.24	...	...
1961-87	1,237.3	3.0	541.3	3.35	...	...
Sugarcane						
1961-65	606.9	-63.0	1,930.8	54.82	-1,182.5	-30.4
1966-71	468.1	-73.3	2,889.2	68.13	-2,576.7	-37.7
1972-77	3,093.1	-4.6	2,066.7	12.66	304.4	-43.3
1978-82	3,752.9	-28.0	2,984.5	21.07	-251.6	-34.6
1983-87	2,940.8	-63.5	3,663.9	49.15	-2,293.6	-0.6
1961-87	2,143.3	-44.6	2,690.0	39.25	-1,195.3	-30.1
Cotton						
1961-65	2,221.3	-2.0	192.4	-3.80	119.6	121.8
1966-71	2,236.4	-4.4	312.0	-3.44	93.3	127.0
1972-77	8,317.4	35.1	422.1	1.06	68.6	130.0
1978-82	12,313.7	11.7	377.6	-3.29	218.8	192.6
1983-87	13,619.7	-2.3	484.7	-1.37	480.4	383.8
1961-87	7,559.1	9.1	358.5	-1.79	187.6	186.4
Vegetable oil						
1961-65	1,934.2	16.8	129.0	-16.74	-21.6	-54.2
1966-71	2,089.8	-8.8	179.5	-6.63	-40.2	-63.4
1972-77	6,467.4	-10.7	391.8	18.48	-237.8	-177.5
1978-82	9,359.0	-12.5	597.3	7.81	-396.3	-406.1
1983-87	11,740.1	-10.4	849.0	-0.36	-584.3	-680.4
1961-87	6,167.0	-9.7	418.7	3.30	-247.4	-264.8

(continued)

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Table 35—Continued

Commodity/ Period	Consumer Prices 1	Change	Consumption 1	Change	Trade 1	Historical Trade
	(Rs/metric ton)	(percent)	(1,000 metric tons)	(percent)	(1,000 metric tons)	
Pulses						
1961-65	457.1	-5.0	653.6	0.74	...	...
1966-71	618.1	-11.9	571.0	2.45	...	...
1972-77	1,297.3	1.0	699.1	0.42	...	...
1978-82	3,931.2	3.7	535.2	-3.24	...	...
1983-87	5,191.0	-2.6	659.6	-2.08	...	...
1961-87	2,199.6	-0.9	624.5	-0.22	...	...
Fruits						
1961-65	707.6	-19.1	835.0	-3.84	...	...
1966-71	812.1	-27.7	1,247.1	-2.69	...	...
1972-77	2,202.9	5.5	1,622.2	2.68	...	...
1978-82	3,614.8	-3.3	1,807.4	-7.37	...	...
1983-87	4,285.5	-16.7	2,526.4	-9.54	...	...
1961-87	2,264.0	-10.2	1,594.8	-4.80	...	...
Milk						
1961-65	693.7	-2.0	5,811.6	-3.68	0.2	-53.0
1966-71	890.3	2.5	6,191.6	-6.90	0.2	-52.3
1972-77	1,365.3	-31.5	9,461.1	28.33	-2,560.5	-51.0
1978-82	1,924.2	-41.7	11,544.8	38.13	-6,814.0	-186.4
1983-87	3,045.2	-39.6	12,736.1	27.35	-6,929.3	-198.5
1961-87	1,550.0	-32.9	9,051.1	18.57	-3,113.9	-104.1
Meat						
1961-65	1,138.7	-0.7	349.8	-2.74	...	...
1966-71	1,668.0	4.3	426.1	-4.60	...	...
1972-77	3,398.5	-7.1	582.0	1.29	...	...
1978-82	7,520.7	3.6	638.7	-13.48	...	...
1983-87	10,758.3	-0.2	866.4	-11.06	...	...
1961-87	4,721.8	0.0	567.5	-7.06	...	...

Sources: Model simulations and data from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years); and Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years).

Notes: For wheat and maize, trade is expressed in terms of unmilled grain. For basmati and ordinary rice, trade is expressed in terms of milled rice. For sugarcane, trade is expressed in terms of refined sugar. For cotton, trade is expressed in terms of lint cotton. For vegetable oil, trade includes soybean oil, palm oil, and cotton oil. For milk, trade is expressed in terms of whole milk (dry milk is converted, using a quality factor of 90 percent and a conversion ratio of 1:8). Milk was not traded prior to 1971. Millet and sorghum, fruits, meat, and pulses are nontradables. Change indicates percent change relative to historical levels.

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Table 36—Agricultural production (simulation 2)

Commodity/ Period	Area 2	Change	Yield 2	Change	Production 2	Change
	(1,000 hectares)	(percent)	(metric tons/ hectare)	(percent)	(1,000 metric tons)	(percent)
Wheat						
1961-65	5,263.8	5.61	0.91	9.74	4,834.9	16.43
1966-71	6,372.4	9.72	1.16	16.68	7,492.6	28.24
1972-77	7,128.6	18.18	1.81	38.04	12,972.0	63.96
1978-82	7,580.6	10.90	1.89	24.40	14,351.6	38.12
1983-87	7,891.5	6.76	1.98	15.95	15,621.3	23.64
1961-87	6,840.2	10.53	1.54	22.28	10,993.6	35.90
Basmati rice						
1961-65	596.8	59.84	1.15	31.97	704.3	116.79
1966-71	931.5	110.56	1.54	47.93	1,457.6	214.91
1972-77	643.2	48.16	1.64	35.98	1,063.8	102.96
1978-82	916.3	25.89	1.47	23.12	1,361.5	56.16
1983-87	1,070.3	32.71	1.39	14.89	1,485.9	52.46
1961-87	828.4	51.14	1.45	31.05	1,218.0	96.00
Ordinary rice						
1961-65	926.2	6.31	1.16	21.50	1,088.7	30.33
1966-71	1,277.2	22.66	1.77	42.16	2,314.3	76.54
1972-77	1,503.5	31.58	2.46	47.52	3,709.8	94.88
1978-82	1,554.5	24.77	2.52	34.34	3,894.1	67.40
1983-87	1,380.9	12.26	2.18	14.14	3,000.1	28.59
1961-87	1,333.0	20.62	2.02	32.78	2,817.0	62.66
Maize						
1961-65	514.4	7.27	1.16	12.61	600.2	21.50
1966-71	741.1	23.29	1.34	22.78	990.2	51.20
1972-77	892.9	42.19	1.74	45.92	1,569.3	109.65
1978-82	781.0	11.08	1.45	16.21	1,136.6	29.29
1983-87	909.2	13.21	1.46	13.77	1,333.4	29.03
1961-87	771.4	20.36	1.44	23.23	1,137.3	50.14
Millet and sorghum						
1961-65	1,348.6	2.06	0.50	5.26	679.4	7.63
1966-71	1,340.0	0.92	0.50	3.43	672.6	4.60
1972-77	1,131.9	-1.36	0.56	4.30	639.1	3.68
1978-82	1,006.3	0.14	0.56	6.75	564.5	6.94
1983-87	929.3	2.27	0.54	3.72	501.5	6.20
1961-87	1,157.5	0.73	0.53	4.64	614.7	5.63
Sugarcane						
1961-65	421.6	-10.08	416.19	1,139.08	15,689.0	-1.01
1966-71	403.6	-31.75	409.81	979.33	14,228.8	-36.51
1972-77	877.5	35.29	549.76	1,426.21	43,081.7	84.46
1978-82	946.6	16.43	472.53	1,187.82	41,249.7	37.65
1983-87	612.8	-28.13	364.77	889.86	20,361.6	-35.11
1961-87	651.5	-2.87	445.37	1127.53	27,050.5	10.57
Cotton						
1961-65	1,670.0	19.27	0.30	17.01	507.4	41.89
1966-71	2,215.1	30.29	0.35	18.18	771.3	54.21
1972-77	2,156.6	11.94	0.36	15.25	799.4	31.37
1978-82	2,217.9	9.38	0.36	12.93	800.8	23.61
1983-87	2,726.2	17.63	0.45	8.13	1,252.3	28.78
1961-87	2,196.3	17.46	0.36	13.96	823.2	34.37
Vegetable oil						
1961-65	636.5	20.48	0.19	15.56	120.6	40.69
1966-71	691.9	27.24	0.22	11.56	151.0	41.80
1972-77	636.7	9.19	0.25	17.59	160.9	28.01
1978-82	668.6	33.31	0.30	28.51	200.7	71.78
1983-87	698.3	57.47	0.34	26.93	239.2	100.20
1961-87	666.3	27.33	0.26	20.46	173.1	55.63

(continued)

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Table 36—Continued

Commodity/ Year	Area 2	Change	Yield 2	Change	Production 2	Change
	(1,000 hectares)	(percent)	(metric tons/ hectare)	(percent)	(1,000 metric tons)	(percent)
Pulses						
1961-65	1,338.9	-1.16	0.55	3.10	734.3	1.87
1966-71	1,243.0	-0.58	0.51	2.18	630.0	1.73
1972-77	1,457.7	-1.60	0.54	4.03	791.8	2.37
1978-82	1,401.5	-4.60	0.43	2.98	602.4	-1.99
1983-87	1,367.0	-2.39	0.54	1.07	738.4	-1.35
1961-87	1,360.8	-2.05	0.51	2.69	700.2	0.69
Fruits						
1961-65	114.1	-0.42	8.53	1.23	975.2	1.09
1966-71	155.4	0.79	9.31	0.82	1,446.0	1.54
1972-77	193.7	6.75	10.15	5.03	1,971.8	12.32
1978-82	231.3	-1.23	9.27	0.24	2,145.8	-1.02
1983-87	320.2	-5.71	9.00	-1.65	2,875.9	-7.32
1961-87	200.8	-0.61	9.29	1.31	1,870.1	0.47
Milk						
1961-65	...	...	...	...	7,028.8	5.77
1966-71	...	...	...	...	7,883.5	7.53
1972-77	...	...	...	...	9,127.6	12.21
1978-82	...	...	...	...	6,820.8	-24.87
1983-87	...	...	...	...	8,124.7	-25.40
1961-87	...	...	...	...	7,849.6	-6.17
Meat						
1961-65	...	...	...	...	407.8	2.02
1966-71	...	...	...	...	513.3	3.44
1972-77	...	...	...	...	717.8	12.42
1978-82	...	...	...	...	770.0	-6.12
1983-87	...	...	...	...	1,011.8	-6.53
1961-87	...	...	...	...	679.1	0.08

Sources: Model simulations and data from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years); and Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years).

Notes: For wheat, maize, millet and sorghum, production and yield are expressed in terms of unmilled grain. For basmati and ordinary rice, production and yield are expressed in terms of millet rice (the conversion factor is 67 percent). For sugarcane, production and yield are expressed in terms of refined sugar. For cotton, production and yield are expressed in terms of lint cotton. For vegetable oil, area includes areas of rape and mustard, groundnuts, and sesamum seeds. Production and yield are expressed in terms of oil (using extraction rates of 34 percent for rape and mustard seed oil, 45 percent for groundnuts, and 40 percent for sesamum seed oil). For pulses, production and yield are expressed in terms of unmilled grains of grams and other pulses. For fruits, area, production, and yield include citrus fruits, mangoes, bananas, apples, guava, dates, apricots, peaches, pears, grapes, and pomegranates. For milk, production is expressed in terms of whole milk. For meat, production includes beef, mutton, and poultry. Change indicates percent change relative to historical levels.

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Table 37—Consumer prices, consumption, and trade (simulation 2)

Commodity/ Year	Consumer Prices 2	Change	Consumption 2	Change	Trade 2	Historical Trade
	(Rs/metric ton)	(percent)	(1,000 metric tons)	(percent)	(1,000 metric tons)	
Wheat						
1961-65	699.2	59.8	4,441.1	-5.4	-89.6	-959.2
1966-71	795.1	51.7	5,626.4	-4.6	1,116.9	-640.3
1972-77	2,085.3	134.9	7,229.2	-11.5	4,445.5	-1,051.2
1978-82	2,765.2	90.5	8,892.3	-13.4	4,024.1	-911.0
1983-87	3,188.7	57.7	10,688.2	-12.2	3,371.0	-805.2
1961-87	1,872.1	80.3	7,305.2	-10.4	2,589.0	-871.3
Basmati rice						
1961-65	1,660.5	93.4	192.1	-19.3	441.7	54.4
1966-71	2,062.9	97.6	248.3	-17.1	1,063.6	117.3
1972-77	3,969.2	65.8	292.6	21.4	664.8	230.7
1978-82	5,935.6	33.1	512.5	4.3	712.8	293.0
1983-87	7,127.3	14.5	616.4	-1.2	720.9	253.2
1961-87	4,067.0	40.2	364.8	-1.6	731.4	188.5
Ordinary rice						
1961-65	935.1	77.4	641.9	-5.8	338.0	70.2
1966-71	1,258.3	107.7	1,035.2	-10.7	1,047.6	20.8
1972-77	2,543.9	135.7	1,182.3	-9.9	2,156.6	400.7
1978-82	3,337.7	81.4	1,229.3	-9.1	2,275.5	742.1
1983-87	2,940.9	11.5	1,313.3	4.5	1,386.8	842.9
1961-87	2,180.8	67.6	1,082.5	-6.6	1,452.8	400.2
Maize						
1961-65	493.9	50.1	429.7	-3.3	110.4	0.0
1966-71	648.7	59.8	550.2	-6.7	341.0	0.0
1972-77	1,578.2	118.0	615.4	-8.7	797.0	0.0
1978-82	1,632.2	24.1	822.5	4.0	200.5	0.0
1983-87	2,273.5	21.9	930.4	0.0	269.7	0.0
1961-87	1,309.6	45.4	663.2	-2.7	360.4	0.0
Millet and sorghum						
1961-65	446.9	11.9	611.4	7.6	0.0	0.0
1966-71	502.9	4.7	605.3	4.6	0.0	0.0
1972-77	999.6	7.7	575.2	3.7	0.0	0.0
1978-82	1,862.3	6.2	508.1	6.9	0.0	0.0
1983-87	2,817.3	6.6	451.5	6.2	-0.1	0.0
1961-87	1,283.2	6.8	553.3	5.6	0.0	0.0
Sugarcane						
1961-65	1,102.5	-32.9	1,682.7	34.9	-478.3	-30.4
1966-71	904.9	-48.4	2,533.3	47.4	-1,461.9	-37.7
1972-77	3,731.0	15.1	2,176.8	18.7	1,099.0	-43.3
1978-82	4,054.5	-22.2	3,005.3	21.9	322.5	-34.6
1983-87	3,355.9	-58.3	3,509.5	42.9	-1,916.8	-0.6
1961-87	2,606.7	-32.6	2,564.8	32.8	-464.5	-30.1
Cotton						
1961-65	4,495.4	98.4	146.8	-26.6	309.9	121.8
1966-71	4,983.0	112.9	235.2	-27.2	459.0	127.0
1972-77	10,629.8	72.7	458.0	9.7	261.4	130.0
1978-82	14,995.0	36.1	357.4	-8.5	363.3	192.6
1983-87	16,050.7	15.2	443.4	-9.8	683.7	383.8
1961-87	10,051.2	45.1	329.5	-9.7	411.4	186.4
Vegetable oil						
1961-65	3,151.0	90.3	115.9	-25.2	26.1	-54.2
1966-71	3,497.2	52.7	165.3	-14.0	21.5	-63.4
1972-77	7,562.9	4.5	425.8	28.7	-228.2	-177.5
1978-82	10,696.7	0.1	587.6	6.0	-354.1	-406.1
1983-87	13,020.7	-0.6	821.6	-3.6	-523.7	-680.4
1961-87	7,433.4	8.8	413.8	2.1	-203.7	-264.8

(continued)

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Table 37—Continued

Commodity/ Year	Consumer Prices 2	Change	Consumption 2	Change	Trade 2	Historical Trade
	(Rs/metric ton)	(percent)	(1,000 metric tons)	(percent)	(1,000 metric tons)	
Pulses						
1961-65	493.8	2.6	660.8	1.9	...	...
1966-71	709.8	1.2	567.0	1.7	...	...
1972-77	1,336.0	4.1	712.7	2.4	...	...
1978-82	3,936.7	3.9	542.2	-2.0	...	...
1983-87	5,244.8	-1.6	664.7	-1.3	...	...
1961-87	2,246.4	1.2	630.2	0.7	...	...
Fruits						
1961-65	937.6	7.3	877.7	1.1	...	...
1966-71	1,145.7	1.9	1,301.3	1.5	...	...
1972-77	2,658.1	27.3	1,774.6	12.3	...	...
1978-82	3,711.4	-0.7	1,931.3	-1.0	...	...
1983-87	4,411.5	-14.3	2,588.9	-7.3	...	...
1961-87	2,523.2	0.1	1,683.2	0.5	...	...
Milk						
1961-65	692.9	-2.1	6,326.0	4.9	0.0	-53.0
1966-71	836.5	-3.7	7,095.0	6.7	0.2	-52.3
1972-77	1,571.8	-21.1	9,824.9	33.3	-1,610.0	-51.0
1978-82	2,205.6	-33.2	10,933.1	30.8	-4,794.4	-186.4
1983-87	3,411.8	-32.3	11,877.9	18.8	-4,565.7	-198.5
1961-87	1,703.8	-26.3	9,155.7	20.0	-2,091.1	-104.1
Meat						
1961-65	1,062.3	-7.4	367.0	2.0	...	...
1966-71	1,496.2	-6.4	462.0	3.4	...	...
1972-77	3,350.7	-8.4	646.0	12.4	...	...
1978-82	6,965.5	-4.0	693.0	-6.1	...	...
1983-87	9,957.8	-7.6	910.6	-6.5	...	...
1961-87	4,407.7	-6.6	611.1	0.1	...	...

Sources: Model simulations and data from Pakistan, Ministry of Finance, *Economic Survey* (Islamabad: Ministry of Finance, various years); and Pakistan, Ministry of Food, Agriculture and Co-operatives, *Agricultural Statistics of Pakistan* (Islamabad: Ministry of Food, Agriculture and Co-operatives, various years).

Notes: For wheat and maize, trade is expressed in terms of unmilled grain. For basmati and ordinary rice, trade is expressed in terms of milled rice. For sugarcane, trade is expressed in terms of refined sugar. For cotton, trade is expressed in terms of lint cotton. For vegetable oil, trade includes soybean oil, palm oil, and cotton oil. For milk, trade is expressed in terms of whole milk (dry milk is converted, using a quality factor of 90 percent and a conversion ratio of 1:8). Milk was not traded prior to 1971. Millet and sorghum, fruits, meat, and pulses are nontradables. Change indicates percent change relative to historical levels.

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