Argentina: Country Case Study of Agricultural Prices and Subsidies

SWP386

World Bank Staff Working Paper No. 386

April 1980

Prepared by: Lucio G. Reca (Consultant)
Agriculture and Rural Development Department

The views and interpretations in this document are those of the authors and should not be attributed to the World Bank, to its affiliated organizations, or to any individual acting in their behalf.

WORLD BANK

Staff Working Paper No. 386

April 1980

ARGENTINA: COUNTRY CASE STUDY OF AGRICULTURAL PRICES, TAXES AND SUBSIDIES

This study examines pricing policy in Argentina from 1950-1975 for seven major agricultural products. Based on estimates of coefficients of nominal and effective protection, price and tax discrimination against producers appears to have declined between the 1950's and the 1960's. This was probably a contributing factor to the improved growth performance of Argentine agriculture in the 1960's, as compared with the previous decade. Estimates of domestic resource costs for grains suggest that, while Argentina has a comparative advantage in grain production, this advantage deteriorated for wheat in 1960-74, but improved in the cases of corn and grain sorghum as a result of recent productivity gains for these two crops. The high taxation to which the grains were subjected during these years implied a massive redistribution of incomes from producers largely to consumers and the Government, with consumers collecting about half of the income transfer and Government one-third. Argentina's comparative advantage as defined by various estimates of domestic resource costs appears clear-cut in the case of wool but less certain for cattle and cotton.

Prepared by: Lucio G. Reca (Consultant)
Agriculture and Rural Development Department

ARGENTINA: COUNTRY CASE STUDY OF

AGRICULTURAL PRICES, TAXES AND SUBSIDIES

TABLE OF CONTENTS

PREFACE

This paper is one of a number of companion papers (see below), which report on the results of a research project -- Country Case Studies of Administered Agricultural Prices, Taxes and Subsidies, RPO 671-42 -- which commenced in the second half of 1976. The research, which included some desk studies besides the eight country case studies (Argentina, Egypt, Kenya, Mexico, Pakistan, Portugal, Thailand and Yugoslavia), was oriented towards eventually providing operational guidelines for country economic, agricultural sector and project planning work. Two of the country case studies involved the use of formal agricultural sector models (Mexico and Portugal), while the other six involved the use of a number of informal methodologies.

An overview and integrated summary of the results of the six country case studies and the complementary desk studies given in:

> "Agricultural Prices, Taxes and Subsidies: a Review of Experience", a Staff Working Paper (forthcoming), prepared by Gilbert Brown and Graham Donaldson.

The informal methodologies are described, reviewed and evaluated in:

> "Methodologies for Measuring Agricultural Price Intervention Effects", a Staff Working Paper (forthcoming), prepared by Pasquale Scandizzo and Colin Bruce.

These other country case studies, in addition to the present one, are considered of significant individual merit and have also been published. These are:

> "Thailand - Case Study of Agricultural Input and Output Pricing", Staff Working Paper No. 385, prepared by Trent Bertrand (Consultant).

> "Prices, Taxes and Subsidies in Pakistan Agriculture, 1960-1976", Staff Working Paper No. 387, prepared by Gilbert Brown and Carl Gotsch (Consultant).

> "Agricultural Price Management in Egypt", Staff Working Paper No. 388, prepared by William Cuddihy.

I. INTRODUCTION

1.01 Argentine agriculture is usually regarded as formed by two different components: the "Pampas" - where the main comparative advantage seems to lie - and the "rest of the country", an aggregate of areas highly specialized in producing one particular commodity (cotton, sugarcane, grapes, wool, etc.). This study deals in depth with seven major commodities - wheat, corn, grain sorghum, beef cattle, cotton, wool and rice - all of which have been chosen for their national or regional importance. It attempts to explore the comparative advantage of these seven commodities in various ecological areas of the country as well as the price-related incentives (disincentives) granted for their production through time.

1.02 The analysis goes back to either 1950 or 1960, according to the information available for grains, beef cattle and wool. For rice and cotton shorter series have been constructed. Given the frequent changes in policies directly affecting agriculture (e.g., wheat prices) or indirectly (e.g., a devaluation), it was considered desirable to work with historical series going back as far as possible. This perspective clearly shows that from 1950-1975 there were two distinct subperiods from the point of view of performance in agriculture. Up to about 1963/64, gains in productivity and increases in output were meager. However, after 1964 the picture became slightly more favorable. It seems appropriate then to compare policies with performance in the two subperiods.

1.03 In all cases calculations have been based on averages. This applies to yields as well as to the different inputs considered in each production process. The information is by no means homogeneous or equally abundant for the different activities covered in this study. The grain sector, in this respect, is in better shape than the critical beef production sector.

1.04 The estimation of nominal and effective protection coefficients and of domestic resource costs for the seven major commodities, presented in Section IV, constitutes the core of this study. But it would be very difficult to make any evaluation without an overall framework. Consequently, a general view of the agricultural sector in Argentina is presented in Section I and a summary of price and tax policy in Section II. Certain socioeconomic implications of price intervention are discussed in Section V.

1.05 The derivation of accounting prices is discussed in Annex I, while Annex II supplements the methodological explanations provided in the main text. An effort is made in Annex III to determine the extent to which economic incentives influence the level of production in Argentina. The fact that producer prices are found to have a definite influence on production decisions adds to the significance of this study.

II. THE AGRICULTURAL SECTOR

A. The Performance of Agriculture (1950-1975)

2.01 As in most countries, the relative importance of agriculture in Argentina has been declining. In 1950/54, Argentine agriculture generated 18.7% of GNP (at factor cost) and employed 20% of the labor force. It contributed 92% of total exports in 1961/65. By 1970/71, these percentages had declined to 12.4% for GNP, 16% for employment and 85% for exports.

2.02 Between 1950 and 1975, agricultural production in Argentina grew at the annual rate of 2.3% (Table 1). The annual rate of growth of 2.9% in the 1950's is somewhat deceptive owing to an abnormally low starting base caused by severe crop failures in 1950 and 1952, which drove production down 15% from the already low values prevailing at that time. Real progress in agriculture began in the 1960s, with overall growth rates on the order of 2.4%

Table 1

ARGENTINA: ANNUAL RATES OF GROWTH IN THE AGRICULTURAL SECTOR
(selected periods, 3 year averages)

	1973/75 / 1950/52	1973/75 / 1966/68	1966/68 / 1956/58	1956/58 / 1950/52
All Agriculture				
All country	2.3	2.4	1.9	2.9
Pampas	2.2	1.8	1.8	3.5
Non Pampas	2.4	3.8	2.2	1.2
Crops				
All country	3.3	3.4	2.5	4.4
Pampas	3.6	3.0	2.4	6.4
Non Pampas	2.9	4.0	2.6	2.2
Livestock				
All country	1.6	1.5	1.4	1.8
Pampas	1.6	1.1	1.4	2.3
Non Pampas	1.5	3.6	1.4	1.1

2.03 In the period covered here, the share of crops in total agricultural production grew at the expense of livestock. While crops accounted for only two-fifths of total agricultural production in the early 1950's, they represented one-half of this total by the early 1970's (Table 2). The increased share of crop was due to a number of factors, which included the introduction of improved

Table 2

RELATIVE COMPOSITION OF AGRICULTURAL PRODUCTION

	Period				
	1950-59	1955-59	1960-64	1965-69	1970-74
All agriculture					
Crops	40.1	42.4	43.7	45.1	47.2
Livestock	59.9	57.6	56.3	54.9	52.8
Pampas					
Crops	30.2	32.4	33.8	35.3	37.6
Livestock	69.8	67.6	66.2	67.4	62.4
Non-Pampas					
Crops	65.2	69.4	69.6	71.9	71.3
Livestock	34.8	30.6	30.4	28.1	28.7

crop varieties and technologies, which increased the relative profitability of crops, and the considerable cyclical fluctuations in beef prices which discouraged development in this sector. Within crops, grains and oilseeds increased their proportion of production in the period under consideration at the expense of industrial crops (cotton, sugarcane, tobacco, wine grapes, etc.) The share of fruits and vegetables remained constant. The composition of livestock production showed some changes, but not enough to alter substantially the picture prevailing at the beginning of the 1950s. The share of beef production increased slightly, but remained close to two-thirds of all livestock production. Poultry production, which was almost negligible in the early 1950s, represented 4.5% of total livestock production by the early 1970s. On the other hand the relative importance of both milk and wool declined, with the share of wool decreasing from 9% to 6.5% of total output.

2.04 The area planted to crops grew at an average rate of 1.1% per year from 1950 to 1975. The expansion was stronger after the early 1960s, equalling approximately 1.4% per year and reflecting the modest but steady agricultural upswing that began in the early 1960s.

2.05 Agricultural productivity increased between 1950/54 and 1970/74. Average productivity coefficients in Argentine agriculture (Table 3) show the following relationships: (a) labor productivity increased more in the first decade under analysis than in the second; (b) land productivity increased at a substantially higher rate in the second decade than in the 1950s. Two-thirds of increases in production per unit of land in all the period took place in the period 1960/64 to 1970/74, mainly as a consequence of increases in grain yields; (c) the ratio between output and stock of tractors decreased at a substantially higher rate in the first decade as compared to the second; (d) the ratio between production and the stock of beef cattle grew steadily during the period analyzed; and (e) productivity relative to the stocks of buildings grew until the mid-1960s and then declined.

Table 3

INDICES OF INPUTS AND PARTIAL PRODUCTIVITY RATIOS IN ARGENTINE AGRICULTURE (1960=100)

INPUTS

Period	Labor	Land	Tractors	Cattle Numbers	Constructions
1950-54	107.4	95.9	20.3	94.8	88.2
1955-59	107.1	99.8	63.2	102.9	96.2
1960-64	97.9	101.0	122.9	104.5	102.9
1965-69	102.1	104.9	166.4	114.7	106.9
1970-73	113.6	105.8	289.4	119.3	110.8

PRODUCTIVITY RATIOS

Indices of Volume of All Agricultural Output Relative to

Period	Labor	Land	Tractors	Cattle Numbers	Buildings
1950-54	80.8	90.5	450.1	91.6	80.6
1955-59	90.4	97.8	173.9	95.2	90.4
1960-64	105.9	102.7	85.7	99.4	105.0
1965-69	114.5	111.2	70.5	102.3	114.5
1970-74	110.9	122.0	68.4	108.1	109.6

Sources and Notes: Labor input is total man days per year, source Banco Central de la Republica Argentina (BCRA). Land is measured by an index of productive services obtained adding up land indifferent uses (cattle breeding, fattening, grain crops and crops in non-Pampean areas) weighed by a measure of rent to each use.

Tractors are measured in horse power and cattle in animal units at the beginning of the year. Stocks of buildings and constructions are estimated from series on annual investment (BCRA).

2.06 The substantial increases in labor productivity observed in the 1950s stemmed primarily from the substitution of capital (tractors especially) for labor accompanied by migration from rural to urban centers. The rate of growth of land productivity accelerated after 1960 due primarily to the introduction of better crop varieties in the case of certain crops and better pasture management and particularly the substitution of improved for natural pastures in the case of beef cattle.

B. Regional Differences

2.07 Agricultural production in Argentina comes from several natural regions that differ in ecological characteristics, size and importance. The Pampas, which is the most productive agricultural region in the country, covers some 45 million hectares in the East-Central part of the country. Output from the Pampas has accounted for between two-thirds and three-fourths of total agricultural output from 1950 to 1974. This area receives sufficient rainfall to grow cereals, oil bearing crops and pastures. Rainfall decreases from East to West, and the Western boundary of the Pampas is found at the rainfall line of 500 milimeters approximately. In general there is a remarkable degree of substitutability in production in the Pampas, so that producers can decide to grow one of several crops or use the land for pasture under different schemes. The degree of substitutability is not uniform throughout the region, however, as one would expect in such a large area.

2.08 The other agricultural regions of Argentina are: (a) the Northeast, specialized in cotton, citrus, rice, tobacco, tea and livestock; it produces between 7% and 9% of total agricultural production; (b) the Northwest, where sugarcane is the most important commodity, also produces tobacco, citrus and vegetables. It supplies 8%-9% of total production; (c) Cuyo, in the Central Western part of the country, is heavily specialized in grapes and fruit production, supplying 6% to 7% of total output; and finally, (d) the Patagonia, in the Southern half of the country where sheep raising is the dominant activity, contributes about 4% to 5% to total output.

2.09 Almost 90% of the total area planted to crops in 1950/54 and close to 86% of the total in 1970/74 was in the Pampas (Table 4). The rate of growth of crop production has traditionally been higher in the Pampas than elsewhere; however, beginning in the 1960s crop production started to grow at a higher rate outside the Pampas (Table 1). While the percentage of crop land in grains remained constant at about 88% between 1950 and 1974 in the Pampas, it grew from around 25% in 1950/54 to almost 50% in 1970/74 outside the Pampas (Table 4). Nonetheless, crop production from the Pampas supplies most of domestic consumption and all of the export market.

2.10 Beef production is more important in the Pampas than in the rest of the country (70% and 55% of total livestock production, respectively), but while the share of beef production has remained constant in the Pampas, in the rest of the country it has grown substantially. Milk production is far more important in the Pampas, while wool is more important outside the Pampas where it accounts for 20% to 25% of total livestock production.

Table 4

AREA PLANTED TO CROPS IN ARGENTINA
(five year averages, figures in million ha)

	Period				
	1950-54	1955/59	1960/64	1965/69	1970/74
All Crops					
Pampas	13.4	14.1	14.2	16.0	16.0
Non Pampas	1.5	1.8	2.1	2.3	2.6
Total	14.9	15.9	16.3	18.2	18.7
Grains and Linseed					
Pampas	11.7	12.4	12.6	14.2	14.0
Non Pampas	.4	.5	.7	1.0	1.2
Total	12.1	12.9	13.3	15.2	15.2
Industrial Crops					
Pampas	1.4	1.5	1.4	1.5	1.8
Non Pampas	1.1	1.2	1.2	1.2	1.4
Total	2.5	2.7	2.6	2.7	3.2
Truck Crops					
Pampas	.2	.2	.2	.2	.2
Non Pampas	.1	.1	.1	.1	.1
Total	.3	.3	.3	.3	.3

Sources: Secretary of Agriculture and Bolsa de Cereales.

Note: Grains include wheat, corn, grain sorghum, barley, millet, rice, bird-seed, oats and linseed. Industrial crops include sunflower, sugarcane, grapes, cotton, peanuts, tobacco, tung, tea, yucca, olives and soybeans. Truck crops include potatoes, tomatoes, onions, sweet potatoes, green peas, garlic and peppers.

C. Factor Shares in Argentine Agriculture

2.11 Estimates from an aggregate production function for the agricultural sector of Argentina (1950-74) 1/ yield, under the usual assumptions, the following contributions of inputs to total output: labor .24, land .38, buildings .07, livestock .12, machinery .06 and intermediate inputs .12. Constant returns to scale seem to prevail, while technical change has taken place at an approximate rate of 1% per year between 1960 and 1974.

1/ Reca L. and Verstraeten J. "La Formación del Producto Agropecuario Argentino", Desarrollo Económico, Vol. 17 número 67, Buenos Aires, 1977.

2.12 It is of some interest to compare these results, derived from a Cobb-Douglas production function with those obtained by M. Ballesteros in his study of Argentine agriculture (1908-54) 1/ where he utilized a different procedure to derive factor shares. In the Ballesteros study the labor and land coefficients are .46 and .36 respectively. Results for the most recent period confirm the tremendous importance of land as a contributor to production in Argentine agriculture. Few land substitutes have been developed (or are currently used). The labor input in the Ballesteros study is higher than the one found for 1950-75, possibly because he did not allow for intermediate inputs and also because substitution of machinery for labor took place to a considerable extent only in the recent past. Machinery and buildings contributed to .08 of total output in 1908-54, while in 1954-74 their share was almost twice that figure (.13). The general trend in factor substitution and agricultural development provides a reasonable explanation for this change. The livestock coefficients in both periods are about the same.

2.13 The figures previously discussed provide the following characterization of Argentine agriculture: 62% of total output from 1950-1974 is accounted for by two of the primary factors of production (land and labor) and if it is assumed that approximately one half of construction and machinery is value added, then almost 70% of the value of output consists of returns to the direct factors of production. It then becomes evident how much Argentina's agricultural production relies on these primary factors. The figures analyzed also suggest that this characteristic of Argentine agriculture has not changed significantly through time, in spite of the significant changes observed in agriculture in other countries.

D. Land Tenure

2.14 About three-fourths of the land in Argentina is owner-operated (Table 5). Although the area operated by tenants is only about 10% countrywide, it includes almost 20% of the land in the Pampas.2/ Share cropping arrangents are infrequent in Argentina and other contractual arrangements are important only in the north.

2.15 The most detailed analysis of land tenure in Argentina was carried out by CIDA/CFI/CONADE 3/ on the basis of the 1960 census (Table 6). The criterion followed in that study was to group land holdings according to their possibilities of creating employment. Four categories were considered:

1/ Ballesteros, Marto, "Argentine Agriculture 1908-54: A Study in Growth and Decline" unpublished Ph.D. dissertation, U. of Chicago, 1958.

2/ Based on the 1969 Agricultural Census.

3/ CIDA/CFI/CONADE, Tenencia de la Tierra

Table 5

LAND TENURE PATTERNS IN ARGENTINA (1969)
(regional distribution, percentages)

Area	Owners	Tenants	Share Croppers	Other Forms	Difference	Total Area (Million ha)
	---------Percent-----------					
All Country	73.2	10.7	1.1	8.3	6.7	200.5
Pampas	73.2	18.3	2.6	4.3	1.6	67.6
Northeast	62.3	9.5	.7	19.7	7.8	22.4
Northwest	68.8	9.2	.9	10.7	10.4	26.7
Cuyo	69.4	12.4	1.0	8.8	8.4	26.7
Patagonia	79.6	5.0	.3	7.2	7.9	62.7

Source: "La Tierra en la Argentina", Consejo Agrario Nacional. Buenos Aires, 1975, Table 7.

Notes: The column "Difference" includes lands occupied by squatters and other non-defined categories. Pampas in this table includes the entire area of five provinces and exceeds the ecological area usually called the Pampas.

sub-family farms, able to give permanent employment up to two workers; family farms, from two to four workers; medium multi-family farms, from four to twelve workers; and large multi-family farms, more than twelve workers. The typical farm was found to be a family farm, encompassing 340 hectares and employing 3 permanent workers. When the Pampas were separated from the rest of the country, the typical farm remained the family farm, but its size decreased to 151 hectares while the permanent labor force remained at 3 (Table 7).

Table 6

ARGENTINA: DISTRIBUTION OF FARMS BY AREA, NUMBER AND LABOR ABSORPTION

Size	Area (ha million)	Number of Farms ('000)	Permanent Workers ('000)
1. Sub-family	5.8	200.9	404.5
2. Family	77.7	226.6	600.0
3. Multi-family Medium	58.8	33.9	161.9
4. Multi-family Large	31.5	3.0	78.5
Total	173.9	465.5	1,245

Source: CIDA/CFI/CONADE, op. cit.

Table 7

PAMPEAN REGION: DISTRIBUTION OF FARMS BY AREA, NUMBER AND EMPLOYMENT

Category	Area	Number	Permanent Workers
1. Sub-family	1.5	52.3	92.5
2. Family	18.5	122.5	324.5
3. Multi-family Farm	16.3	18.7	90.6
4. Multi-family Farm	9.1	1.8	30.4
	45.4	195.3	538.0

Source: CIDA/CFI/CONADE, op. cit.

III. PRICE AND TAX POLICY

A. Producer and Consumer Price Control

3.01 Open government intervention in domestic product markets began in the 1930's, when commodity prices dropped substantially as a consequence of falling external demand. Regulations were then and still are usually implemented by agencies created to trade in specific products.

3.02 For grains, the price policy in effect from 1946 to 1955 was based on a state monopoly over both domestic and exports markets combined with substantial differences between domestic and world prices implemented through export taxes and exchange rate differentials. The subsidization of domestic wheat consumption was substantial. Farmgate prices were announced before harvest time. Inflation brought about frequent upward revisions of prices, but these revisions were not able to prevent a steady decline in grain production due to inadequate material incentives.

3.03 Another chapter of grain policy began at the end of 1955: prices of most of the crops already planted were increased by 40%, in a clear attempt to boost farm income, and export taxes were not used as heavily as in previous years. The state monopoly was discontinued except for wheat and beginning in 1957, official prices became minimal price, farmers being free to dispose of their crops elsewhere if they preferred.

3.04 Between the late 1950s and 1973, government prices did not mean much except for wheat and eventually for linseed. The main price control instrument during this period was export taxes. However, between 1973 and 1975, the state once again became the only buyer of wheat, corn, grain, sorghum and sunflower. Fixed producer prices became effective at the farmgate for wheat in 1974 and for the other three products in 1975. Export taxes were also increased.

3.05 Like grains, cotton, tobacco, sugarcane, and "yerba mate" are examples of commodities which have been subject to a variable degree of intervention in domestic product markets. However, intervention in products like wool, olive oil, tung oil, dairy products, meats, hides and fresh fruit and other exportables has generally been implemented through foreign trade control and not domestic market intervention.

3.06 Beef prices have traditionally posed a special problem because of their wide variations and high incidence in the cost of living and consequently in the real wage. At times of soaring prices, maximum beef prices at the consumer level have been usually imposed. Several attempts to help regulate meat prices at the producer level have been unsuccessful. The last one was put into effect in May 1973 and lasted until July 1975. The imposition of meat-less days in the big urban centers of Argentina has proved to be the most effective measure to dampen the increase in producer prices. Different such "veda" schemes were used in 1964/65 and 1972/73 in times of high and increasing prices. Some estimates indicate that domestic consumption declined about 10% as a consequence of the veda scheme. Given the low price elasticity of demand for beef (.4) in the absence of veda, prices would have increased some 35%. However, experience also shows that this instrument is a typical short run tool. Difficulties in fully controlling the process of slaughter and distribution of meat create conditions, after some time, for the functioning of a sophisticated black market. In 1973 some 10% of total slaughter was channeled through this market.

3.07 During periods of low beef prices, no direct government intervention in the market has taken place. Only a timid and unsystematic use has been made of anticyclical measures, mainly cheap credit and tax deductions.

B. Customs Duties and Quotas

3.08 Export duties have been used extensively to tax agricutural products. They have been particularly heavy on grains. Export quotas and prohibitions have been used less frequently. Rarely, has the Government resorted to prohibitions, although in February 1972 and again in 1973 wheat exports were banned because the crop turned out to be below preliminary estimates. Oilseeds and edible oils are probably the most important group of commodities subject to export quotas in the period under study. Exports were totally suspended between 1973 and 1976, in order to ensure domestic supply at less than world prices. Other agricultural products like sugar, rice and cotton have been subject to relatively complex quota systems.

3.09 On the input side imports have been regulated mainly by quantitative restrictions or outright prohibitions. At times the Secretary of Agriculture can be required to grant permission for the importation of certain quantities of a given product. Imports of nitrogen fertilizer were virtually prohitited for years in order not to compete with domestic fertilizer production. Consequently, the domestic prices for nitrogen fertilzer in Argentina have been well above world prices.

C. Differential Exchange Rates

3.10 Fixed exchange rates followed by substantial devaluations were characteristic of the period under analysis. Between 1950 and 1955, the average rate of exchange for imports was 50% higher than that for exports, while the financial rate of exchange has been higher than the commercial rate since 1971 and previous to 1955 (Table 8). In this study, a weighted average of financial and commercial rates have been used since 1971 to determine the effective rate of exchange for each product.

Table 8

EXCHANGE RATES AND PRICE LEVELS IN SELECTED YEARS

Year	Import Rate	Export Rate (new pesos/dollar)	Financial Rate	Wholesale Price Index (1960-100)
1952	.075	.050	.129	16.3
1956	.180	.180	.180	21.3
1960	.828	.828	.828	100.0
1964	1.41	1.41	1.41	251.4
1968	3.50	3.50	3.50	461.8
1972	5.00	5.00	9.98	1,669.3
1974	5.00	5.00	9.98	2,613.8

Source: Banco Central de la Republica Argentina and Instituto de Estadistica y Censos.

D. Credit Rationing and Interest Rates

3.11 Credit supplies to the agricultural sector through the banking system in the period 1952-1974 has been between 11% and 24% of the annual value of production. The high mark (over 20%) corresponds to 1950/54 and 1968/70, two periods when product prices were kept under control and credit used to help boost agricultural production. The low marks (1959 and 1963/64 with 10% and 11% respectively) belong to years of high inflation.

3.12 Except for seven years in the period under study, inflation has been higher than the average rate of interest on agricultural loans. Consequently, credit has frequently had a subsidy component. In some years this element has been particularly important, reaching up to 6% of the annual value of production. It goes without saying that negative rates of interest have impaired the allocative efficiency of credit, particularly because credit has been often attached to particular lines of production. This allocative efficiency has undoubtedly been further impaired by the fact that wealthier producers have greater access to credit than poorer individuals.

E. Wages and Wage Control

3.13 Minimum wage legislation for rural labor has been in effect during all the period covered in this report; it has included both permanent and transitory workers. It is extremely difficult - if not impossible - to know up to what extent the provisions of the law were really enforced. The prevailing opinion in this area is that wages actually paid were, in general, those determined by law. The difference between wages and net payments to workers is large and has increased over time due to the increasing importance of social security components in the wage structure. Today they account for about 40% of gross salary.

3.14 Regional wage differentials have been of the order of 7-15%. Wages in Patagonia - where the cost of living is higher than in other areas of the country and rural life is harder - have been systematically above wages in the remaining areas. Differences between wages in the Pampas and in the Patagonia have been for most of the years on the order of 3 to 5%.

3.15 Relative wages between transitory and permanent workers show different patterns, according to the region. In Patagonia (wool production) wages for transitory work are between 2 and 3 times higher than those of permanent employees. This situation contrasts with the Northeast (cotton) where the same ratio has varied between 1 and 1.5, and in the Northwest (sugarcane) where the ratio has been declining from around 2 to a level slightly above 1. In a broad sense these wage differentials reflect the relative scarcity of labor in the different regions.

F. Rent Control

3.16 Land tenure regulations in Argentina began in 1921. Law 11170 determined that land leases had to be for a minimum of four years and recognized the right of the tenant to be compensated for productive investments. The law insured the tenant the right to sell the produce of the land at his convenience. Amendments and corrections to this law in 1932 did not change its basic premises.

3.17 An important change in the spirit of the legislation took place in 1942 (Law 12771), in the middle of a profound crisis in the agricultural sector initiated by the fall of grain exports during World War II. According to the 1937 agricultural census, 44% of the farms were run by tenants. They occupied more than 40% of the land in the humid Pampas and their contribution to total grain production was certainly more important because tenants were typically grain farmers. By Law 12771, all leases were automatically extended to 1945, independently of the date of expiration determined by the contracts. Evictions were called off. In 1943, rental prices of land were reduced by 20%, given the calamitous situation of the grain market, which was pushing tenants to bankruptcy. Lease contracts were again extended to 1948 when Law 13246 was passed. The main features of this Law were that land-leases had to be for five years, with an extension of three more years automatically granted at the request of the tenant; and contracts due in 1952 were given a three year extension. Apparently, the purpose of the legislation between 1945 and 1956 was to draw resources from agriculture through low product prices, while simultaneously compensating tenants through low land rents. In fact, as rents were fixed in nominal terms and inflation began to press from the mid-1940s on, the disruption in the land market was really serious.

3.18 Different laws passed from 1957 on, basically accepted the "de facto" situation prevailing in the land market and through different schemes tried to induce land sales to tenants. This proved to be a slow and complex process, which required considerable legal ingenuity. On the other hand, the land market did not recover its function: the distortions to which it had been subject were severe and lasted long enough to discourage potential suppliers to enter the market when new and more flexible rules were enacted.

G. Agricultural Taxation

3.19 Export taxes have been, by and large, the single most important source of agricultural taxation. However, other taxes, including income, land, crop and livestock marketing taxes, have also been applied, in a sense more directly, to the agricultural sector. (Table 9). These taxes have never exceeded 3.5% of total value added in agriculture.

Table 9

TAXES ON AGRICULTURE 1/

Year	Income Tax	Land Tax	Livestock Marketing	Crops	Taxes as a Percentage of Value Added by Agriculture
	(in million current pesos)				
1960	2883		1277		2.7
1961	817		1186		1.2
1962	850		1402		.9
1963	1735		4175	2053	2.5
1964	1535		3296	1080	1.3
1965	3503		7205	5087	3.1
1966	3141		5250	1225	1.6
1967	12257		5573		2.3
1968	8817		6448		1.9
1969		19413	7786		2.9
1970		18103	9347		2.4
1971		18998	16665		2.2
1972		32023	43338		2.7
1973		76152	82844		3.4
1974		89595	68056		2.8

1/ This Table deals exclusively with federal taxes, the most important ones for the sector as a whole. This is not to say that in some particular cases state taxes may not be as important or more important than the ones mentioned here (for example state taxes on grape production).

Source: Direccion General Impositiva and our own estimates.

3.20 Although data on income tax revenue originating specifically in agriculture has not been published separately for 1960/68, agricultural income taxes have been calculated here by assuming that the ratio of income tax receipts from agriculture to total income tax receipts is equal to the ratio of agricultural income to total income. For 1969/74 federal land tax payments substituted for federal income tax payments.

3.21 Until 1968, land taxation in Argentina was exclusively under state jurisdiction and divided into two comonents: a general rate applied to all land independently of the size and quality of the holding and a surcharge applied as a function of the value of each particular price of land. There were wide variations between the basic and the additional tax: while the first was in the neighborhood of .5% of land valuations, the second ranged between .2% and 5.5%, depending on the state and the size of the holding. However, the economic significance of most state land taxes was minimal by the late 1960s because the adjustment of land values for fiscal purposes had invariably lagged relative to movements in the general price level.

3.22 The important institutional change in land tax legislation took place at the end of 1968, when a uniform federal land tax (1.6% of fiscal values) was approved. The system remained unchanged for three consecutive years. Land values were readjusted for inflation in 1972 (+70%); in 1973 some degree of progressivity was introduced. The original 1968 legislation was designed to use land taxation to secure some minimum income tax revenue from the rural sector. Land tax payments were, from the legal point of view, a payment to be made in advance of the corresponding income tax. If the income tax liability turned out to be higher than what had been paid in the form of land taxes, the difference was to be paid at the end of the fiscal year. In the opposite case, the land tax payment remained as a final payment, creating no claims or deductions.

3.23 Legislation passed in 1973 tried to improve the 1968 scheme, through a very elaborate procedure: "normal" incomes were to be computed for each particular area of the country and ideally for each land holding. But it turned out to be exceedingly complex and, faced with opposition of rural associations, the system was never put into practice.

IV. MEASUREMENT OF INCENTIVE AND RESOURCE COST COEFFICIENTS

A. Definition of Terms

4.01 In order to determine the extent to which the domestic production of a commodity is encouraged or discouraged (i.e. subsidized or taxed) relative to the standards defined by international trade, a series of incentive coefficients can be calculated.1/ The simplest of these coefficents is the nominal protection coefficient (NPC), which is defined as the ratio of the domestic producer price to the world market or border price. Mathematically, the NPC of the ith commodity can be expressed as:

$$NPC = \frac{p_i^d}{p_i^b}$$

where:

NPC = nominal protection coefficient of the i^{th} commodity

p_i^d = domestic price of the i^{th} commodity

p_i^b = border price of the i^{th} commodity (foreign price times the official exchange rate)

4.02 Since the nominal protection coefficient merely expresses the effect of price intervention measures on the price of a particular output, it is not usually an adequate measure of producer incentive. This is because the producer is concerned not only about the price of output but also about the prices of inputs. The effective protection coefficient (EPC) is designed to capture the net effect of protection on output and the tradable components of inputs. Because it requires the estimation of farm budgets in order to define input/output relationships and the decomposition of non-tradable inputs into tradable and primary factors, the EPC is considerably more difficult to calculate than the NPC. The general formula used for its estimation is:

1/ This is in accordance with the methodology defined by Bela Balassa in his West African Studies.

$$EPC_i = \frac{\left[p_i^d - \sum_{j=1}^{k} a_{ij} \cdot p_j^d \right]}{\left[p_i^b - \sum_{j=1}^{k} a_{ij} \cdot p_j^b \right]}$$

where:

EPC_i = effective protection coefficient of the ith commodity

a_{ij} = quantity of the jth input used to produce one unit of the ith output

$p^d_{i,j}$ = domestic price of output/input for the ith commodity or jth input

$p^b_{i,j}$ = border price of the output/input for the ith commodity or jth input

j = 1 ... k = all traded inputs, direct and indirect

4.03 The prices not only of tradable inputs but also of non-tradable inputs may differ from established norms, the norms for non-tradables being defined in terms of domestic as opposed to international values. The effective subsidy coefficient (ESC) is used to express the combined effects of all forms of price intervention on the incentive to produce. It differs from the EPC in that the value of direct and implied subsidies and taxes on non-tradables are also included in its estimation according to the following formula:

$$ESC_i = \frac{\left[p_i^d - \sum_{j=1}^{k} a_{ij} \; p_j^d + \sum_{j=k+1}^{J} a_{ij} S_j - \sum_{j=k+1}^{J} a_{ij} T_j \right]}{\left[p_i^b - \sum_{j=1}^{k} a_{ij} \cdot p_j^b \right]}$$

where:

ESCi = effective subsidy coefficient of the ith commodity

S = subsidy on the j non-tradable input

T = subsidy on the j non-tradable input

j = k+1, J non-tradable inputs

4.04 Although incentive coefficients indicate the extent of taxation or subsidization, they do not indicate the economic advisability of production, because they do not compare the opportunity cost of domestic non-tradable resources used in the production process with international value added. The domestic resource coefficient (DRC), which can be used to define the real cost of production to the domestic economy, can be calculated according to several different formulas. Ideally the DRC is defined by:

$$DRC_i = \frac{\left[\sum_{j=k+1}^{J} a_{ij} \cdot MPP_j^y \cdot p_y^b\right]}{\left[p_i^b - \sum_{j=1}^{k} a_{ij} \cdot p_j^b\right]}$$

where the denominator is value-added in border prices (exactly as in the EPC calculation) and:

DRC = domestic resource cost coefficient of the i commodity

MPP_j^y = marginal product of the j factor in its best alternative use, (y)

p_y^b = border price of y

j = 1, 2 ...k = inputs of directly traded goods plus the indirect traded inputs derived from non-traded goods upon decomposition

j = k+1, k+2, ... J = inputs of primary non-traded factors including those obtained as a result of decomposing non-traded goods.

B. Coverage of Seven Major Commodities

4.05 Although Argentina produces a wide variety of agricultural products, only seven commodities have been selected here for detailed analysis. These commodities have been chosen on the basis of their importance on a national or regional basis (Table 10). Beef cattle is the single most important commodity. It contributed some 29% to agricultural production (measured in 1961/65 prices) from 1965-1975. Corn and wheat are the second and third most important, having accounted for 10% and 5% respectively of total production in 1973/75. Altogether these seven commodities account for some 55% of total agricultural production in Argentina.

Table 10

COMMODITY SHARES IN TOTAL AGRICULTURAL PRODUCTION, SELECTED YEARS*
(percent)

Period	Corn	Wheat	Rice	Grain Sorghum	Cotton	Beef	Wool
1965/68	9.1	10.2	.4	1.3	1.8	29.2	3.1
1969/71	10.9	7.5	.6	3.6	2.8	28.8	3.3
1973/75	10.4	4.8	.5	4.8	2.6	29.1	2.7

* Value of total agricultural output, 1961-65 average prices.

1. Wheat, Corn and Grain Sorghum

4.06 Wheat, corn and grain sorghum, all of which are primarily grown in the Pampas, represent the three major cereals cultivated in Argentina. During the 1950's, wheat was relatively more important in terms of area planted, output and exports than either corn or grain sorghum (Table 11). However, between 1960 and 1974, the importance of corn and grain sorghum increased, partially at the expense of wheat. The renewed interest in corn in the 1960's can be attributed in part to the development of higher yielding varieties, which raised corn yields considerably above those of wheat. The introduction of grain sorghum was an obvious develoment given its resistance to drought and relatively poor soils. In the less humid areas of the West, it was used to replace corn, which is a much more demanding grain in terms of moisture requirements. Grain sorghum is occasionally grazed by cattle. In the analysis, however, it is considered exclusively in its grain producing capacity.

4.07 Methodology and Units of Analysis: A detailed description of the procedure followed in the analysis of grain crops is given in Annex II. The methodology used is similar for wheat, corn and grain sorghum. All calculations are based on an "ideal" farm. Location, size, yields and composition of capital represent, as close as possible, average conditions of production.

4.08 In the case of wheat, the average farm is located in the Southeast of Buenos Aires, the wheat belt of Argentina. For both corn and grain sorghum, the location is North of Buenos Aires.

Table 11

MAJOR CEREALS: AREA, OUTPUT, YIELDS AND EXPORTS
(five year averages, all country)

Period	Wheat	Corn	Grain Sorghum
	-------Area planted----------		
1950/54	6.0	2.9	-
1955/59	5.4	2.9	-
1960/64	5.4	3.5	1.1
1965/69	6.3	4.4	1.8
1970/74	4.9	4.3	2.9
	----------Output--------------		
1950/54	5.9	3.1	-
1955/59	6.1	3.9	-
1960/64	7.2	5.0	1.1
1965/69	6.5	7.7	2.3
1970/74	6.2	8.6	4.5
	----------Yield--------------		
1950/54	1.0	1.1	-
1955/59	1.1	1.3	-
1960/64	1.3	1.4	1.0
1965/69	1.0	1.7	1.3
1970/74	1.3	2.0	1.6
	----------Exports--------------		
1950/54	2.3	.9	-
1955/59	2.4	1.8	-
1960/64	3.2	2.6	.4
1965/69	2.8	4.0	1.0
1970/75	2.8	4.5	2.6

Note: Area in million ha, output and exports in million metric tons and yields in metric tons per ha planted.

4.09 Bags were the major tradable input used in cereal production until 1965, when bulk harvesting became the usual practice. After the elimination of bags, seeds, maintenance and depreciation costs and fuel became the major cost inputs, with seeds considerably more important in wheat production than corn or grain sorghum production, where per ha seed requirements were somewhat lower. In order to dampen the effects of abnormal weather, three year moving averages of yields were used to calculate the EPC.

4.10 Nominal Protection Coefficient: The nominal protection coefficients for the three cereals are presented in Table 12.

Table 12

MAJOR CEREALS: NOMINAL PROTECTION COEFFICIENTS
(five year averages)

Period	Wheat	Corn	Grain Sorghum
1950/54	.32	.36	-
1955/59	.70	.70	-
1960/64	.83	.87	.92
1965/69	.87	.81	.82
1970/74	.64	.65	.54

4.11 Two components contribute to determine the NPC level: direct export taxes and differences between the rate of exchange for cereals and the financial rate in those years when multiple exchange rates prevailed (1950 to 1954 and 1972 to 1975). The NPCs for corn and wheat show a striking similarity, strongly suggesting that there was a "grain policy" common to the two major crops. The burden of taxation on both these crops appears to have been extremely heavy in the early 1950's, but to have been considerably relaxed starting in the late 1950's and continuing throughout the 1960's. In the early 1960's, grain sorghum was subject to much lighter taxation than wheat or corn, possibly because being a "new" crop it was not quite clear how much importance it was going to have as a source of government income. When the relative weight of grain sorghum became clear by the late 1960's, the same fiscal criteria applied to corn and wheat were put into effect for grain sorghum. The early 1970's show a sharp increase in taxation for all three cereals but even so tax levels in 1970/74 were far below the extreme figures prevailing twenty-five years previously for corn and wheat.

4.12 Effective Protection Coefficient: The EPCs (Table 13) indicate that discrimination against value added in cereal production, as measured by this coefficient, has been systematically above the levels implied by taxes on output. The EPCs follow closely the evolution of the NPCs, but range from 1% to 40% lower than the NPCs.

Table 13

MAJOR CEREALS: EFFECTIVE PROTECTION COEFFICIENTS
(five year averages)

Period	Wheat	Corn	Grain Sorghum
1950/54	.29	.27	-
1955/59	.62	.69	-
1960/64	.72	.79	.54
1965/69	.80	.76	.65
1970/74	.60	.64	.52

The fact that the disparities between the NPCs and the EPCs are generally lower between 1965 and 1974 than previously can be explained in large part by increased efficiency after 1965, particularly in the case of grain sorghum production.

4.13 Domestic Resource Costs: The derivation of the domestic opportunity costs of land, labor and capital, the three primary factors of production, is discussed in Annex I. The same opportunity costs of labor and capital are used for all three cereals; however, in the case of wheat, the rent of land in cattle raising is used to define the opportunity cost of land, while for corn and grain sorghum the rent of wheat land is used instead of land in cattle production.

4.14 The DRC coefficients for the three cereals are shown in Table 14.

Table 14

MAJOR CEREALS: DOMESTIC RESOURCE COST COEFFICIENTS

Year	Wheat	Corn	Grain Sorghum
1961	.62	.67	1.30
1962	.62	.66	1.13
1963	.39	.45	1.06
1964	.30	.65	1.56
1965	.53	.73	1.32
1966	.76	.76	1.67
1967	.44	.51	.67
1968	.39	.51	.74
1969	.58	.65	.89
1970	.53	.57	.88
1971	.60	.55	.78
1972	.90	.27	.52
1973	.65	.37	.53
1974	.61	.50	.69

Land is the most important component of the DRC. For the whole period, it accounts for about 40%, 50% and 60% of total domestic costs for wheat, corn and grain sorghum respectively. Labor which frequently accounts for about 30% of total domestic costs, is more important than capital

4.15 In every year wheat and corn have a well defined comparative advantage. The decreased comparative advantage of wheat after 1971 is due to higher cattle prices which raised the opportunity cost of land. Increased experience with grain sorghum helped to change grain sorghum from a crop with a comparative disadvantage in the eary 1960's into one with a significant comparative advantage. However the figures suggest that after 1970 the comparative advantage of corn production is more pronounced than for the other two cereals. This indicates that corn production should be one of the agricultural activities with high economic priority in Argetina. The average DRC coefficient of .4 observed between 1971 and 1974 for corn implies that Argentina can earn one additional unit of foreign exchange by expanding corn production at a real resource cost roguhly equal to only two-fifths of its international value.

2. Beef Cattle

4.16 Beef cattle production is an important activity not only in terms of domestic output, but also in terms of exports. For most years between 1955 and 1975, about 30% of total agricultural production and 20% of all exports in value terms were provided by the beef industry. While beef cattle production grew at a moderate rate between 1950 and 1974, exports increased substantially (Table 15).

Table 15

BEEF CATTLE: STOCK, SLAUGHTER AND EXPORTS

Period	Stock (million head)	Slaughter	Exports
		(million ton) carcass wt.	
1950-54	43.1	1,858	284
1955-59	46.8	2,312	553
1960-64	47.4	2,207	528
1965-69	52.1	2,456	631
1970-74	54.2	2,718	667

4.17 In order to assess the effect of prices and subsidies on this important activity, the process of beef production and marketing is treated as follows:

(a) There are two clearly defined steps in beef production: breeding and fattening. The former activity is more specific in the sense that resources used for cattle breeding (land and capital) frequently do not have an alternative use. This is particularly relevant in a fraction of the Salado River Basin in the Eastern Center part of the Province of Buenos Aires, in most of the semi-arid lands surrounding the humid Pampas and in the open lands of the N.W. and N.E. of the country. On the other hand, there is competition in the use of resources between fattening beef and growing crops. Consequently, it seems appropriate to consider both steps separately.

(b) In order to treat breeding separately from fattening, world prices for calves must be found. However, because there has been no significant international market for calves, world prices do not exist and it becomes impossible to develop separate estimates of the various coefficients.

(c) The international market for live animals is small and very distorted as the result of all sorts of regulations interfering with its normal functioning. Almost all exports from Argentina are in the form of products with a variable degree of processing, running from half carcasses to canned meats and prepared dishes. In order to evaluate the overall discrepancy between world and domestic prices in the beef production industry, annual estimates of the weighted average tax on meat exports are computed. The series on taxes so constructed are related to the domestic price of the different categories of animals to generate estimates of world price equivalents for beef animals. This is admittedly a highly simplified way of treating a complex and important problem. Ideally one would like to treat beef as a "non-tradable" factor of production and analyze directly the meat packing industry because it is this industry that is the supplier of the export good. But as this possibility is beyond the scope of this study, the procedure mentioned above is followed.

Units of Analysis

4.18 The size of the breeding ranch, which is located in the Salado River Basin, is 1,640 ha, while the size of the fattening ranch is about 40% smaller. The fattening ranch is located in the Western part of Buenos Aires province, an area where this activity competes with wheat for the use of resources. Land is used in native and conventional pastures and for annual forages (oats, rye and sorghum) in approximately the same proportions in both the breeding and fattening ranches. On the fattening ranch a moderate supplement of alfalfa is included in the production function. The labor component is higher for fattening and amounts to .9 man/ha/year versus .5 man/ha/year for breeding. The highly signficant built-in flexibility of beef production, by which coefficients are changed in response to such varibles as relative prices, is ignored for lack of detailed information.

The Process of Production

4.19 Direct expenses represent around 3/4 of total breeding costs in domestic prices; depreciation amounts to 1/5 and the remaining 5% are maintenance costs. Seed used for annual pastures is the single most important cost component (about 22% of total cost). Charges for bull replacements account for 3/4 of total depreciation costs - and consequently represent about 1/6 of the total cost of production, while maintenance of fences absorb 60% of total maintenance costs.

4.20 The value of cull cows, bulls and hides, which is deducted from total cost in order to determine the net input value of calves in the production of steers, turns out to be an exceedingly important element in this analysis. In effect, at domestic prices, sale values exceed the gross input cost of calves in 8 out of 16 years and in world prices in all but 4 years.

4.21 The technological relationship between breeding and fattening requires 1.1 kg of liveweight calf to produce 1 kg of additional liveweight. Livestock costs at the breeding stage are the main determinant of the structure of costs of production at the fattening stage. This follows from the value of cull cows and bulls sold relative to production costs of calves. In years like 1964, 1971 and 1972, when cattle prices increased sharply, the value of the byproducts exceeded costs of production (defined as the sum of production expenses, maintenance costs and depreciation). Thus, at the fattening stage the relative weight of the calf input is low, even negative in some years. In those years, the cost of alfalfa hay represents between 1/2 and 3/4 of direct production expenses. At times of low cattle prices, the calf input represents up to one-half of direct production expenses. These figures give an idea of the high degree of price variability to which the beef cattle industry has been subject, at least in the period under analysis.

4.22 Value added by fattening ranges between .5 and .95 of the final product price. Low ratios correspond to years of low beef prices and vice versa. The structure of costs valued at world prices offers a similar picture, but in this case the effects of variations in the value of calves are even more severe, particularly in 1971 and 1972.

4.23 Nominal Protection Coefficient: The coefficients of nominal protection are derived from the difference between the average exchange rate of meat exports and the rate of exchange used for financial transactions (Table 17).

Table 17

PROTECTION COEFFICIENTS IN THE BEEF CATTLE INDUSTRY

Period	NPC	EPC	ESC
1960-64	.92	.84	.95
1965-69	.90	.84	.88
1970-74	.71	.64	.67

Note: The first observation for the ESC corresponds to 1962-64. The three year average for the same period for the EPC is .93.

It has to be remembered that in this study that the full burden of the meat export tax is assumed to be transferred back to beef producers because they supply the specific factor of production. Our NPC estimates may overstate the effect of the tax if this assumption does not hold strictly.

4.24 The above figures suggest that during the 1960's taxation of the beef sector was lighter than of the grain sector. It also indicates a change in policy in the period 1970/74, probably as a reaction to extremely high world prices of meat, and in an attempt to dampen the effect of higher beef prices on the internal level of prices in Argentina. In this sense lower NPC values are consistent with a counter-cyclical policy, a badly needed instrument for more rational allocation of resources in the Argentine beef industry.

4.25 Effective Protection Coefficient: The EPC follows the same path described for the NPC (see Table 17), but averages about 10% lower. Two considerations seem relevant at this point: first, price policy as applied on inputs did not compensate for the disincentives generated by export taxes. Secondly, given the nature of the beef production process it is fair to say that with the limited use of intermediate inputs which is typical in beef production in Argentina, there are not many possible way to counter-balance the effect of export taxes.

4.26 Effective Subsidy Coefficient: Tax deductions on the sale value of steers have been a familiar policy instrument in Argentina. Between 1962 and 1973, there were tax deductions in all years except 1969 ranging between 15% and 25% of product prices. Taking a very schematic approach in order to quantify the effects of this policy is assumed that the rate of return to total capital is 10%, that steer prices are 1.5 times the price of calves and that calves account for 30% of total capital. In such a situation, a tax deduction of 20% would be sufficient to absorb all taxable benefits: Benefit = .10 Capital = .10 (value of calves/.30) = 1/3 value of calves. Tax deduction = .2 price of steers = .3 value of calves. It is worth noting that the benefit of this type of tax incentive is not evenly distributed between breeders and fatteners. Only the second group collects the benefits of the deduction.

4.27 Assuming no income tax payments by cattle producers as a consequence of the mechanism described, it is possible to derive a tentative measure of the ESC coefficient:

$$ESC = EPC\ (1 + \frac{TD}{VAD})$$

where TD/VAD are tax deductions as a fraction of value added by beef production in domestic prices.

4.28 The results shown in Table 17 (last column on the right) should be considered nothing but rough approximations. However, they indicate that even accepting the extreme assumption of zero income tax payments, fiscal policy has been unable to counterbalance the effects of price policies, but it has moderately increased the returns to direct factors of production in the beef cattle industry.

4.29 Domestic Resource Costs: The estimation of the DRC coefficients for beef production is highly problematic due primarily to difficulties inherent in the choice of an opportunity cost of land. The "best estimate" of the in opportunity cost of land is based on the following line of reasoning:

> Under the prevailing technology, 1 ha of land used in breeding produces 104 kg of calves (liveweight) per year while 1 ha in fattening produces 180 kg per year. Calves are sold weighing 220 kg while steers are slaughtered one year later at 420 kg livewight. Keeping all these coefficients fixed, it follows that 1 metric ton of beef (liveweight) is composed of 524 kg produced at the breeding stage and 476 kg added during fattening. Since 1 ha of land for fattening yields 180 kg per year, it would be necessary to use 2.6 ha of land for fattening to obtain 1 metric ton of beef per year.

Thus the problem of estimating the rent of land is reduced to the problem of calculating the opportunity cost of 2.6 ha of land in wheat. The results 1/ are reported in Table 18.

4.30 The structure of domestic costs shows the minor role played by labor. There is no surprise in this result. It could also be expected that the opportunity cost of land would capture a high fraction of total costs. This is precisely the case: land is the most important income claimer with a share oscillating between one-third and one-half of total cost. The returns to fixed capital and breeding stock are of the same order of magnitude; together they account for approximately one-half of total costs.

4.31 The DRC coefficients in Table 18 reflect properly the evolution of the beef cycle: between 1971-73, a period when meat prices soared, the coefficient takes on values between .4 and .6, and jumps to 1.5 in 1974 (when the EEC suspended imports). In the previous cycle the DRC was between 1.0 and 1.1 in 1964/65, and when prices declined it rose to 1.2 to 1.4. The results in the last cycle were much more pronounced than in the previous one.

4.32 Two considerations are in order: (a) wheat rent has been computed for one of the best farming areas of the Pampas. There are other areas where wheat is grown under less favorable conditions and consequently generates lower rents. (b) The assumption of zero opportunity cost for all land in breeding is difficult to justify. Unquestionably a substantial fraction of land in the Pampas is only suited for breeding, but mixed farming is possible in other areas. So while (a) implies a source of overestimation of DRC, (b) has the opposite effect.

4.33 Two additional estimates of the DRC are computed using two extreme assumptions for the opportunity cost of land. In one case it is considered that the alternative cost of land is zero and in the other the rent of wheat land is applied to all the area on fattening and to 60% of the area on breeding, considering that the remaining 40% of the land on breeding does not have any meaningful economic alternative. The lower and upper limit of the DRC coefficient are set in this way and it could be argued that the "true" DRC has to be somewhere between them (Table 19). The results show that when no opportunity cost of land is taken into account beef production is a valid economic alternative. On the other hand, cattle production would not be economic if all land were suited for wheat.

1/ Under the assumption of no alternative cost for land used in cattle breeding.

Table 18

BEEF CATTLE PRODUCTION:
DOMESTIC RESOURCE COST COEFFICIENTS

Year	DRC
1960	.95
1961	1.31
1962	1.83
1963	1.42
1964	1.02
1965	1.11
1966	1.33
1967	1.04
1968	1.18
1969	1.44
1970	1.03
1971	.41
1972	.46
1973	.63
1974	1.55

Table 19

BEEF CATTLE PRODUCTION: DOMESTIC RESOURCES COST COEFFICIENTS UNDER ALTERNATIVE ASSUMPTIONS

Period	Opportunity Cost of Land = 0	Opportunity Cost of Land = Rent on Wheat
1960-64	.74	1.88
1965-69	.67	1.84
1970-74	.46	1.23

4.34 It would be presumptuous to try to answer if it is economically advantageous for Argentina to devote resources in the Pampas to cattle rearing on the basis of the preceding analysis. The question is far too difficult to pretend to derive a final answer from a preliminary analysis like this. More detailed research is required. However, the results in this section suggest that beef production is likely to be somewhat over-expanded in the Pampas.

3. Cotton

4.35 The cotton economy is an almost unique case in the agriculture of Argentina: in addition to being the main source of rural income in a non-Pampean area, its development in the 1930's and 1940's, as an import substitute, took place decades after the agricultural boom in the Pampas. Cotton production, valued in 1971/74 prices, accounted for some 20% of crop production outside the Pampas in the early 1950's. Although output levels remained more or less constant between 1960 and 1974, cotton's share in total non-Pampean crop production decreased to about 15% by the early 1970's (Table 20).

Table 20

ARGENTINE: COTTON PRODUCTION AND TRADE

Period	Output	Imports (1,000 mt)	Exports
1960-64	110	6.1	26
1965-69	104	13.0	8
1970-74	113	12.2	13

Note: The high figure for exports in 1960-64 is mainly the consequence of surplus accumulated in the late 1950's. Output was also very high in 1961 and 1963.

4.36 The province of Chaco has been historically the center of cotton production in Argentina. Land settlement, based on the uncontrolled occupation of public land, took place in this province at the beginning of the 20th century and numerous problems dealing with land rights still remain unsolved. The fact that about 40% of the area cultivated in Chaco is not owner operated but farmed by producers who have probably been on the same piece of land for several years but who lack land titles seriously limits access to official credit and also has important consequences from the point of view of investment.

Unit of Analysis and Methodology

4.37 The unit of production chosen is a small commercial farm, which is 60 ha large and full specialized in cotton growing. Labor is largely supplied by the family. Maintenance and depreciation charges account for roughly one half of total costs. Gas-oil is the second most important cost component (between 1/3 and 2/5 of total costs). Fertilizer and pesticides are not used.

4.38 The domestic price of cotton is computed by subtracting the cost of ginning and adding the value of seed to the gross price of cotton at the farm level. The international price of cotton is derived from the CIF Liverpool price of the type of cotton/fiber closest to the bulk of Argentine production adjusted for transportation costs and converted to pesos at the financial rate of exchange.

4.39 Nominal Protection Coefficient: As can be seen from the NPCs in Table 21, price policy discriminated against cotton in the 1960's. However, social unrest and political pressure in Chaco led to increased minimum prices in the 1970's. The result was net protection, which was enforced through the use of import quotas, which were granted only for special qualities of cotton not produced domestically, and export subsidies.

Table 21

COTTON: PROTECTION COEFFICIENTS

Period	NPC	EPC
1960-64	.89	.81
1964-65	.81	.72
1970-74	1.39	1.14

4.40 Effective Protection Coefficient: The sequence of EPCs (Table 21) gives a picture similar to the one provided by the NPCs. The primary factors of production received some protection through price policy in the last five years considered. EPC values are lower than the corresponding NPC coefficients during the entire fifteen years analyzed for the same reason already given for other products.

4.41 Domestic Resource Costs: Results in Table 22 show DRC coefficients higher than one in two cases and higher than .9 in two other years. These values, which do not include any return to land, strongly question the economic rationale of supporting cotton production in Chaco. Some clarification on this point is convenient: small commercial farms like the one taken as the basis for this analysis do not have the economic opportunity to substitute other crops for cotton because the value added by 1 ha of cotton is usually 4-5 times higher than the value added by 1 ha of, for example, grain sorghum. Consequently, as long as the current structure of land holdings persists - as well as the additional restrictions provided by loose land titles - there is no valid economic alternative to cotton production for a large group of farmers.

4.42 Nevertheless, it could be argued that the explanation offered is not consistent with the concept of DRC, because the results presented here depend upon a given structure of land tenure. When the rent of land in grain sorghum, a feasible alternative for the few commercial farmers, is included in the calculation of DRC coefficients for cotton, these coefficients take on values always higher than 3.0.

Table 22

COTTON DOMESTIC RESOURCE COST COEFFICIENTS

Year	DRC
1960	.75
1961	.67
1962	.66
1963	.57
1964	1.13
1965	.74
1966	.90
1967	.76
1968	.64
1969	.66
1970	.62
1971	.77
1972	1.08
1973	.77
1974	.91

4. Wool

4.43 By the end of the 19th century the sheep population in Argentina had reached its peak of 74 million head. Wool exports in 1899 totalled 237,000 tons of greasy wool. In the course of the 20th century, sheep numbers declined as a consequence of the increasing competition of beef cattle pushed by technological developments in ocean transportation of chilled and frozen beef. Since about 1950, the sheep population has been stable at about 40 million head.

4.44 With minor annual variations wool output stands at 170,000 to 180,000 metric tons of greasy wool per year. Exports absorb the largest fraction of annual production, between 65% and 80% of total output.
In the period covered by this study (1960-1973) the annual value of wool production declined. It was 10% of total livestock production and 6% of agricultural production in the early 1960's, while it accounted only for 6.5% and 3.5% respectively at the beginning of the 1970's. These facts reflect stagnation in wool production as well as falling wool prices.
Export earnings from wool vary between 60 and 150 million dollars per year, equivalent to 4 to 6% of total export earnings of Argentina in the period 1960-73.

4.45 Unit of Analysis and Methodology: Costs of production and returns have been calculated for an "estancia" located in Puerto Deseado (Chubut, Patagonia). It is assumed to be representative of sheep raising operations in Patagonia, the semi-arid plateau occupying the southern half of Argentina which is the most important wool producing region of the country. Wool production is an extremely land intensive operation as a consequence of the low quality of the resource base. Carrying capacities are of the order of .3 sheep/ha.

4.46 The price of wool used in this study is the annual average prices for all types of greasy wool quoted in Buenos Aires. The well known fact that Patagonia wools command higher prices than wools from other regions of the country was taken into account by assuming that transportation costs to Buenos Aires compensate for the better quality of Patagonia wools.

4.47 Two basic elements in the measurement process merit special attention. Firstly international product prices are derived by dividing domestic prices by the NPC which is computed as indicated for beef cattle. The idea of estimating the implicit tariff comparing international prices FOB Buenos Aires with domestic prices was dropped after finding some inconsistent results. Secondly, the international price of sheep - which is required to calculate the value added at world prices - is estimated by adjusting the domestic price of sheep by export taxes on sheep meat. This procedure - which is admittedly nothing but an approximation - rests on the assumption that sheep being the specific factor of production for mutton, most - if not all - all of the burden of the export tax on the latter will be shifted back to the specific factor.

4.48 Wool and sheep meat, are joint products given the annual replacement of old breeding ewes and the sale of surplus lambs. With the technology briefly outlined and product and factor prices prevailing in Patagonia, the sale price of sheep approximately equals all production expenses. About one-half of operating costs correspond to depreciation - out of which some 80% or 90% are ram replacement costs, - the remaining half is divided in two equally important fractions, one covering direct production expenses and the other the maintenance of buildings and other fixed investments.

4.49 Nominal Protection Coefficient: As in the cases of other agricultural products, price policy has discriminated against wool production. Internal prices have always been below world prices, regardless of fluctuations in world market prices (Table 23).

4.50 The level of "taxation" on wool - around 20% of world prices - has been substantially lower than the one imposed on grain crops. In this respect it could be argued that price policy - as implied by the NPCs took into account the differences in the quality of the natural resource base between the Pampas and Patagonia. Nonetheless the wool industry in Argentina has suffered from technological stagnation, which may have been avoided if price policy had been different.

Table 23

WOOL: PROTECTION COEFFICIENTS
(five year averages)

Period	NPC	EPC
1960-64	.83	.79
1965-69	.85	.80
1970-74	.80	.72

Note: The last EPC includes only three observations.

4.51 Effective Protection Coefficient: The EPCs computed for wool depend upon wool prices, mutton prices, maintenance and depreciation costs and input prices. The EPCs (Table 23) stand very close to the NPCs, but are slightly lower. It has been suggested that export taxes have been used as an income stabilization device, but the plotting of EPC values against international wool prices does not support this hypothesis, with the possible exceptions of 1965/66.

4.52 Value added in wool production expresed as a fraction of wool price is very high measured at domestic or world prices. It is in no case under .90, indicating that the use of intermediate inputs in wool production is very limited. This result is consistent with the use of the land-intensive technology predominant in Patagonia.

4.53 Domestic Resource Costs: In order to compute the DRC coefficients, labor is valued at market price (inclusive of social security payments), while capital costs are estimated using an approximation to the historical rate of return to capital in Argentina. No opportunity cost is considered for land given that there is no meaningful alternative to sheep raising in most of Patagonia.

4.54 In all cases, except 1971, the DRC coefficients turn out to be below 1 (Table 24). This result is hardly surprising. If such a large area of Argentina - like Patagonia - has specialized in sheep raising for more than half a century, without protectionistic policies, one could anticipate that there had to be some comparative advantage for the activity in the area.

5. Rice

4.55 Large scale production of rice in Argentina is a relatively new phenomenon. It was not until the early 1940's that rice output began to grow steadily, (Table 25), the increasing importance of rice after 1940 coinciding with an extended import substitution campaign launched in all areas of the economy. Hence, like grain sorghum and cotton, rice is a relatively new crop. Like cotton, it is a non-Pampean crop. It is grown in the provinces of Corrientes, Entre Rios and North of Santa Fe. Argentina exports only small quantities of rice.

Table 24

WOOL: DOMESTIC RESOURCE COST COEFFICIENTS

Year	DRC
1960	.40
1961	.54
1962	.52
1963	.39
1964	.54
1965	.71
1966	.76
1967	.70
1968	.79
1969	.73
1970	.96
1971	1.01
1972	.57
1973	.42

Table 25

AREA PLANTED AND PRODUCTION OF RICE IN ARGENTINA

Period	Area Planted	Production	Yield
1930/34	9	15	1.8
1935/39	20	50	2.7
1949/44	39	107	3.0
1945/49	40	125	3.0
1950/54	61	170	3.1
1955/59	64	181	3.2
1950/64	57	178	3.4
1965/69	76	255	3.7
1970/74	92	313	3.6

Note: Source: SEAG. Area planted in thousand ha, production in thousand metric tons and yields in metric ton per ha harvested.

4.56 The analysis presented in this section covers the period 1968/69 to 1974/75 and is based on information obtained from official sources (SEAG) as well as private (Asociacion de Productores and Cooperativas Arroceras).

4.57 Rice production is a relatively capital intensive operation. Supplementary irrigation is provided systematically to the rice fields. Water is pumped from the Parana River or other streams. Land is rented for rice growing ("arroceras") and rice is grown several consecutive years on the same piece of land until the loss of fertility or weed problems call forth a shift to a new location. There is a well developed land rental market for rice producton, so the DRC is computed, in this case, on the basis of actual rental values.

4.58 Unit of Analysis: The unit of production used in this study is located in Entre Rios. From 1968 to 1970 calculations are based on "Carolina" rice, and from then on a new variety, "Blue Bonnet", is assumed. Fuel expenses and depreciation account for 50% to 65% of total input costs.

4.59 In rice, as well as in cotton, there is an industrial step which has to be taken into account because these products are internationally traded only after some degree of processing. Because an investigation of rice processing is beyond the scope of this study it is merely assumed here that 1.8 is a stable price relationship between husked rice and paddy and that one kilogram of husked rice requires 1.28 kg of paddy. Furthermore, 51% of the price differential between 1 kg of husked rice and 1 kg of paddy is assumed to correspond to inputs, and 49% to value added.

4.60 Nominal Protection Coefficient: Domestic prices used in the calculation of the NPCs are prices of paddy plus processing and transportation costs. World prices are average export prices for Argentine rice, FOB Buenos Aires.

4.61 Figures in Table 26 indicate that rice was a protected commodity in terms of product prices in three of the seven years considered. In the last three years covered by this study NPCs are well below one.

Table 26

RICE: PROTECTION AND RESOURCE COST COEFFICIENTS

Year	NPC	EPC	DRC
1968/69	1.13	1.53	1.63
1969/70	.72	.45	1,31
1970/71	1.01	1.21	1.16
1971/72	1.54	2.79	1.52
1972/73	.91	1.11	.58
1973/74	.79	.82	.58
1974/75	.82	1.03	.57

4.62 Effective Protection Coefficient: The EPCs follow rather loosely the NPC pattern. The main source of variation in the EPC in the period 1969/72 comes from changes in the domestic price of rice, which is closely linked to the domestic availability of rice, as shown in Table 27.

Table 27

RICE: OUTPUT PRICES, EXPORTS AND AVAILABILITY

Year	Output (1,000 MT)	Price (Peso/MT)	Availability ------(1,000 MT)-------	Exports
1968/69	345	43.9	393	.29
1969/70	407	23.2	478	.32
1970/71	288	45.6	377	.40
1971/72	294	75.6	315	.10
1972/73	260	91.7	305	.23
1973/74	351	47.6	425	.26

Note: Output in thousand metric tons of paddy, prices in pesos of 1960 per metric ton, availability in thousand metric tons on April 1, exports as a fraction of output.

The large 1970 crops (equivalent to more than two years of domestic consumption), which pushed prices down, was responsible for the low NPC and EPC values observed in 1970. Value added in that year was also very low (.30).

4.63 In 1971/72, output was below average; the harvest was delayed; a new variety was introduced and in addition producers were expecting a subsidized export regime for rice. All these circumstances created a strong upward pressure on prices which had very little to do with objective market conditions, and the protection coefficients climbed to the highest values observed in the whole period. The 1972 value for the NPC clearly indicates the amount of protection - probably unwanted - that rice enjoyed. The final outcome of this atypical situation was the lowest rate of exports in all the period.

4.64 Domestic Resource Cost: This coefficient clearly reflects the drastic changes which occurred in the world market. Up to 1971/72, with prices of about 100 dollars/metric ton, there was no comparative advantage in rice production. On the contrary, the DRC coefficients were unmistakenly above 1 (Table 26). When rice world prices increased sharply from 1973 on, the DRC coefficients fell clearly below one. It is interesting to note that rice and wool offer two symetrically opposed examples: only with high world prices is rice production justified in Argentina from a pure resource allocation point of view, while in the case of wool, low world prices drive the DRC towards one, but only exceptionally reach that limit. Preliminary calculations to determine the break even point (DRC=1) for rice suggest that it is slightly above 200 dollars/metric ton FAS Buenos Aires.

C. The Effective Subsidy Coefficient

4.65 The effective subsidy coefficient has not been estimated in the preceding section on a commodity by commodity basis except for beef cattle due to the fact that interventions which affect the prices of non-tradables often cannot be realistically apportioned among the various affected commodities. However, the average impact of intervention on the EPC has been estimated here in order to determine the extent to which the taxation of agricultural commodities has been offset (or aggravated) by the pricing of non-tradable inputs. In what follows, global reference is made to the effects of (1) credit policy, (2) tax policy, and (3) the funding of research and extension on the EPC values. Informational limitations confine the analysis to a high level of aggregation.

1. Credit

4.66 $$ESC = \frac{VAd + \text{Subsidy on Credit}}{VAw} = EPC + \frac{\text{Subsidy on Credit}}{VAw}$$

where VAd = value added in domestic prices

VAw = value added in border prices

4.67 Agricultural credit as a fraction of VAd has oscillated between .13 and .32, but 50% of the observations in the period 1950/74 fall between the 20% and 29% range. Changes in the ratio essentially result from policy decisions, since most of agricultural credit is provided by the official banking system.

4.68 Interest rates for the agricultural sector have tended to be about two points below interest rates for the rest of the economy in the period under study. Consequently, the returns to domestic factors of production in agriculture have been higher than the values indicated by the EPC coefficients.

4.69 The amount of the subsidy received by agriculture through the differential interest rates is equal to the product of the difference in rates times the ratio between Credit and VAd:

$$ESC = \frac{VAd + rz\ \ VAd}{VAw} = \frac{VAd}{VAw}(1 + r\ z) = EPC\ (1 + r\ z)$$

where:

ESC = Effective Subsidy Coefficient

EPC = Effective Protection Coefficient

z = Agricultural Credit/VAd

r = Average difference between interest rates for the economy and for agriculture

4.70 As r is positive the ESC will be larger than the EPC. However, the magnitudes involved are such that the amount of the correction is very modest (in the neighborhood of half a percent). In this sense, it is clear that the credit policy did not change the penalization imposed by the price policy on agriculture.

4.71 It should be noted that the effect of credit, as discussed in this section underestimates the total impact of credit policy on agriculture in the years and particular areas of the country, when and for which special credit regimes involving extended periods of repayment have been used. When crops have been severely damaged (hail, floods, droughts, etc.) the area affected has been usually granted special treatment which has included cheap credit and moratoriums on outstanding credit and taxes. It has not been possible to derive quantitative estimates of the effects of this special credit treatment.

4.72 Another way of assessing the effects of credit policies on the return to the original factors of production is to estimate the annual amount of the subsidy accruing to the sector via differences between inflation and nominal rates of interest, expressing the quantities so derived in terms of VAd and computing the ESC as explained at the beginning of this section. For the whole period, the average correction would be on the order of .015. This means that the ESC coefficient should be 1.5% higher than the EPC for all agriculture. However, it is clear that the correction implied by the credit subsidy computed in this second way is also far from being enough to offset effects of price policy as reflected by the EPC coefficients.

2. Tax Adjustments

4.73 In order to approximate the effects of differential taxation on agriculture vis-a-vis other sectors of the economy, a similar procedure to the one followed in the case of credit was used. The starting point was estimates of income tax as a fraction of value added for agriculture and for the rest of the economy for the period 1956-1973. In all years agriculture turned out to be less taxed than the other sectors. Average rates for the entire period were 1.2% and 2.5% respectively.

4.74 Consequently, tax policy towards agriculture has been such that it has increased the return to primary factors by a figure on the order of 1% of the EPC. As in the case of credit, the figure above in some cases underestimates the true contribution of differential taxation in agriculture to the EPC because our measure does not include special tax deductions and promotional regimes.

3. Expenditures on Research and Extension

4.75 The research and extension system in Argentina, at the Federal level, has been financed by a 2% export tax on the value of agricultural products during the last twenty years. If all tax proceeds were productively spent for the specific purpose for which they are collected, it is relatively simple to estimate the order of magnitude of the modifications to the EPC implied by expenditures on research and extension. As in the other two cases discussed in this section the exercise is carried out at the aggregate level.

Define: R = annual expenditures on agricultural research and extension;

X = annual value of agricultural exports;

Q = value of agricultural production.

4.76 As a broad average the value of agricultural exports is between 25% and 30% of the value of total production and the domestic value added is close to 70% of the value of production. Substituting, we have:

Q = 1.25 VAd (where VAd is valued added measured at domestic prices).

X = .25 Q = .3125 VAd.

As indicated above R = .02 X = .02 (.3125 VAd) = .0062 VAd

Now we can replace in the original expression for ESC

$$ESC = \frac{VAd + R}{VAw}$$

Where VAw = value added at world prices

$$ESC = \frac{VAd + .0062\ VAd}{VAw} = 1.0062\ \frac{VAd}{VAw}$$

$$ESC = 1.006\ EPC$$

4.77 The figure above suggests that the inclusion of federal expenses in research and extension in agriculture imply an upward correction close to 2/3 of one percent of the EPC.

4.78 Agricultural research at the State level is usually much less important in terms both of quantity and quality of resources used. As a first approximation it could be assumed that all resources (Federal and State) channeled to research and extension in agriculture increase the EPC by a figure close to 1%, clearly insufficient to compensate for the value taken away from agriculture by price policies.

4. Conclusions

4.79 Once we add up the effects of credit, tax and research and extension policy, two conclusions emerge:

(a) credit, tax, research and extension policy, have resulted in a net transfer of resources into agriculture;

(b) These policies, as a first approximation, have corrected the EPC by some 3%.

4.80 The 3% figure has to be regarded as a minimum estimate of the effects of the already mentioned policies. There were in effect other instruments in the fields of fiscal and credit policy for which no quantitative estimate were available, and whose inclusion would certainly have increased the ESC coefficient. Nonetheless, given the magnitude of the EPC coefficients, it is hardly conceivable that what has been left out in terms of credit and taxes would be enough to change the economic results of the pernicious price policies towards agriculture, which systematically implied an underpayment to the direct factors of production in terms of world market values.

V. SOCIOECONOMIC IMPLICATIONS

A. Welfare Changes Associated With Grain Policy

5.01 The policy of export taxation as has been continuously applied in Argentina in the case of grains inevitably brings about decreased domestic production and increased domestic consumption. The result is an increase in consumer benefits and government revenue at the expense of reduced exports and producer surplus. In addition, the redistribution attributable to export taxation invariably involves a net loss (called here the social cost) to the system, because a fraction of the decrease in producers' surplus is neither transferred to consumers nor collected by the government. The value of this fraction depends upon the amount of the tax, the price elasticities of supply and demand and the quantities produced and consumed domestically of the good in question (see Appendix II.5 for a more detailed explanation).

5.02 Given the extremely high importance that export taxation has had for Argentine agriculture it seems proper to estimate the amount of the losses to society occasioned by this policy. The exercise performed for wheat, corn and grain sorghum yields the results presented in Table 29.

Table 28

SOCIAL COST OF GRAIN PRICING POLICIES IN SELECTED YEARS
(as a percentage of total value of production)

Period	Wheat	Corn	Grain Sorghum
1953/55	10.3	13.2	-
1963/65	.1	.4	.1
1973/75	6.5	6.3	3.6

Grain production has been valued at international prices. No computations are attempted for grain sorghum in 1953/55 because of its relative unimportance during the 1950's.

5.03 The figures in Table 28 clearly indicate how policy changed through time, moving to low levels of taxation in the early 1960's and to high levels again in the early 1970's. There is a parallel relationship between the three crops analyzed. In absolute terms, the direct social costs of the export tax scheme are presented in Table 29.

5.04 A third measure related to the welfare implication of the export tax policy is given in Table 30 where estimates of the economic cost - in terms of losses to the economy relative to export tax proceeds are presented. In all cases the coefficients are higher than unity. They also exhibit considerable variation through time. The general pattern shown by the figures in Table 30 indicate that yields are low at the beginning and at the end of

Table 29

ESTIMATES OF SOCIAL COST OF EXPORT TAXES ON GRAIN
(five year averages in million pesos of 1960)

Period	Wheat	Corn	Grain Sorghum
1950-54	32.7	30.6	-
1955-59	13.6	2.6	-
1960-64	1.8	.5	.1
1965-69	1.7	3.4	.8
1970-74	12.4	18.0	4.1

Note: For grain sorghum the periods considered are 1961/65, 1966/70 and 1971/75. For corn the first period is 1951/55 and so on. All figures are annual costs computed as explained in Annex II.

the period under examination, meaning that in these years tax proceeds were more expensive in terms of the economic value foregone. These subperiods are associated with higher levels of taxation as mentioned in the specific discussions of protection coefficients for grain crops. On the other hand, years with a low tax burden make this type of taxation much more attractive in terms of the economic costs involved.

Table 30

RATIO OF EXPORT TAX YIELDS TO SOCIAL COST

Period	Wheat	Corn	Grain Sorghum
1950-54	2.7	1.4	-
1955-59	3.7	8.2	-
1960-64	8.2	15.2	6.0
1965-69	8.7	8.0	5.2
1970-74	2.9	3.8	4.1

Note: Periods for corn and grain sorghum are the same as in the preceding table. Tax proceedings divided social cost for each year and product.

5.05 The results in Table 30 partially depend upon the fraction of total output exported, as can be easily recognized comparing the coefficients for wheat and corn during the 1950's. In the early 1950's both crops were subject to essentially the same levels of taxation, but while 39% of wheat was exported, only 29% of corn was sold abroad.

5.06 Consumers have been, by far, the main beneficiaries of the pricing policies described in this paper, either directly - as in the case of wheat - or through subsidized inputs (corn and grain sorghum) used in the production of milk, poultry and pork. Changes in consumer surplus resulting from price policy usually represent one-half or more of total reallocation effects. Tax collections oscillate between 30% and 40% of total cost while the remaining 5% to 12% is an economic loss, i.e. the social cost (Table 31).

5.07 The loss in producer surplus is equivalent to the sum of consumer benefits, tax collection and social cost (columns 1, 2, and 3 in Table 31). The ratio of producer surplus loss to the total value of production reached its highest levels in the early 1950's. It was reduced substantially in the late 1950's and 1960's, but grew again in the early 1970's.

Table 31

ESTIMATES OF GRAIN PRICE POLICIES EFFECTS
(in million pesos of 1960)

Crop	Period	Benefit to Consumers (1)	Tax Collections (2)	Social Cost (3)	Value of Production (4)	Ratio of Total Effects to Value of Production (5)
Wheat	1950/54	144.2	85.6	32.8	332.9	.79
	1955/59	70.8	50.8	13.6	287.4	.47
	1960/64	23.4	14.7	1.8	259.6	.15
	1965/69	22.2	14.8	1.7	283.4	.14
	1970/74	68.4	35.9	12.3	264.4	.44
Corn	1951/55	125.5	44.0	30.6	226.9	.88
	1956/60	23.6	21.5	2.6	179.7	.26
	1961/65	8.1	7.6	.5	184.6	.09
	1966/70	25.7	26.4	3.3	248.2	.22
	1971/75	71.0	68.7	18.1	328.9	.48
Grain Sorghum	1961/65	1.6	.6	.1	24.7	.09
	1966/70	6.0	4.2	.8	54.6	.20
	1971/75	21.6	16.8	4.1	120.1	.35

Note: Computed according to the procedure explained in Appendix B.5.
Figures are averages for each period.
Total Effects = (1) + (2) + (3).

5.08 As a point of clarification, it should be kept in mind that in the early 1950's the financial rate of exchange used in this study as a measure of comparison was well above the "equilibrium rate". Consequently, there is room to revise (downwards) the estimates for 1950/54 (Table 32).

Table 32

REVISED ESTIMATES OF GRAIN PRICE POLICIES EFFECTS USING "EQUILIBRIUM" EXCHANGE RATES

Crop	Period	Benefit to Consumers	Tax Collections	Social Cost
Wheat	1950/54	54.9	32.6	12.5
	1955/59	51.0	38.8	10.3
	1960/64	58.7	36.7	4.6
	1965/69	57.4	38.3	4.3
	1970/74	58.6	30.8	10.6
Corn	1951/55	62.7	22.0	15.3
	1956/60	49.6	45.0	5.3
	1961/65	50.2	46.8	3.0
	1966/70	46.3	47.6	6.1
	1971/75	45.0	43.5	11.5
Grain Sorghum	1961/65	69.6	25.9	4.5
	1966/70	54.3	38.6	7.1
	1971/75	50.7	39.5	9.8

Note: From figures in Table 31.

Once the appropriate adjustments are made it still turns out that the early 1950's was the period with the highest distortions and largest transferences between producers and consumers (Table 31).

B. Social Costs of Fertilizer Policy

5.09 The detrimental effects that "cheap" grain policies have had on the Argentine economy is illustrated by the value of the foregone production of corn, given the distorted fertilizer/corn price ratios in the country. On the basis of a fertilizer response function estimated in Argentina some years ago, W. Peterson 1/, under conservative assumptions regarding the rate of use of fertilizer, estimated the following social costs:

1/ Peterson, W.L. "The Social Cost of a Cheap Food Policy: the Case of Argentine Corn Production", staff paper p. 75-28 Dept. of Agricultural and Applied Economics, U. of Minnesota, November 1975.

Period	Assumed Nitrogen Application (kg/ha)	Yield Loss (bu/acre)	Social Cost (bu/acre)
1950-54	30	6.0	3.7
1955-59	45	7.8	4.6
1960-64	60	9.5	5.4
1965-69	75	11.0	7.3
1970-74	90	12.7	9.9

Source: Peterson, W., op. cit.

5.10 A step further in the analysis carried out by Peterson allows us to gain an idea of the capitalized value of the losses incurred as the consequence of excluding fertilizer from any practical use in grain production. This exclusion was, basically, the result of price policies which discriminated against agriculture.

Period	Area Planted to Corn	Average Price	Social Cost (Ha)	Social Cost (Total)	Social Cost (million dollars of 1970)
1950-54	2.9	13.2	381	14,584	41.67
1955-59	2.9	16.5	495	23,685	67.67
1960-64	3.5	18.2	603	38,411	109.74
1965-69	4.4	17.9	698	54,974	157.06
1970-74	4.4	5.2	806	53,905	154.01

Note: Area in million hectares, average price in "pesos moneda nacional de 1970" per metric ton, social cost per ha in kgs/ha. Rate of exchange 350 pesos to the dollar".

5.11 The present value of the losses incurred (in 1970 dollars) is slightly above one billion dollars, certainly an impressive figure. Translated into an annual flow discounted at 8% during 20 years - the period covered in this simple analysis - this figure is equivalent to 105 million dollars per year, a number close to 10% of total value of exports during most of the period under construction.

C. Income Distribution Effects

5.12 Table 33 shows the distribution of the area planted to corn and wheat, the two most important annual crops grown in Argentina, relative to farm size. Table 34 does the same thing for beef cattle production. If it is assumed that land is a reasonable proxy for wealth and hence income,1/ the conclusion that the income level of beef cattle producers exceeds that of wheat producers, which in turn exceeds that of corn producers can be readily drawn. For example, while 32% of the area planted to corn is concentrated on farms of less than 100 ha, only 15% of the wheat area and 9% of the beef area are in this category.

5.13 If the tax burden imposed on corn production were less than that imposed on wheat, which in turn were less than that imposed on beef cattle, then the tax system could be regarded as progressive. However, judging from the EPC data (Table 36), this does not seem to be the case. In general, beef cattle production has been taxed less heavily than corn and wheat production, which have been taxed more or less equally. In this sense economic policy in agriuclture has not been fulfilling the income redistibution goals which are considered an important aspect of fiscal policy.

Table 33

DISTRIBUTION OF AREAS PLANTED TO SELECTED CROPS ACCORDING TO FARM SIZE

Farm Size (ha)	Wheat: Frequency Distribution	Wheat: Cumulative Distribution	Corn: Frequency Distribution	Corn: Cumulative Distribution
	percent			
Less than 25	1	1	3	3
25-100	14	15	29	32
100-200	20	35	24	56
200-400	24	59	15	71
400-1,000	20	79	11	82
1,000-2,500	11	90	8	90
2,500-5,000	6	96	5	95
5,000 and over	4	100	5	100

Source: 1960 Agricultural Census.

1/ Although the value per unit of land is higher for small and medium size farms, this difference in value is clearly not large enough to offset the basic relationship between size and wealth.

Table 34

BEEF CATTLE POPULATION AND FARM SIZE

Size (ha)	Frequency Distribution	Cumulative Distribution
	Percent	
less than 25	1.0	1.0
25 - 100	8.4	9.4
100 - 200	12.9	22.3
200 - 400	15.3	37.6
400 - 1,000	18.3	55.9
1,000 - 2,500	12.3	85.6
2,500 - 5,000	8.5	94.1
5,000 and more	5.5	100.0

Source: 1960 Agricultural Census.

VI. SUMMARY

6.01 The nominal and effective production coefficient estimates derived from this study for the major grains and beef cattle have been summarized in Tables 35 and 36.

Table 35

MAJOR GRAINS AND BEEF CATTLE:
NOMINAL PROTECTION COEFFICIENTS

Period	Wheat	Corn	Grain Sorghum	Beef Cattle
1950-54	.32	.37	-	-
1955-59	.70	.70	-	-
1960-64	.83	.87	.92	.92
1965-69	.87	.81	.82	.90
1970-74	.64	.65	.54	.71

Table 36

MAJOR GRAINS AND BEEF CATTLE: EFFECTIVE PROTECTION COEFFICIENTS

Period	Wheat	Corn	Grain Sorghum	Beef Cattle
1950-54	.29	.27	-	-
1955-59	.62	.69	-	-
1960-64	.72	.79	.54	.84
1956-69	.80	.76	.60	.84
1970-74	.60	.64	.52	.64

6.02 The NPC was close to the EPC in all cases except grain sorghum from 1960-69. However, the EPC was invariably lower than the NPC, which is indicative of the fact that instead of compensating for the tax burden imposed on grain and beef output, input price policy added to the overall discrimination imposed on the production of these commodities.

6.03 The extent of discrimination as measured by these coefficients changed through time. The peak coincided with the earlier years covered in this study. Returns to domestic factors as a fraction of world prices increased substantially during the late 1950's and 1960's. In the early

1970's, the coefficients declined sharply, but did not reach the low levels of the 1950's. It can be hypothesized that the fact that agricultural output grew steadily in the 1960's, performing better than in the previous decade, is related to the lower levels of price discrimination to which agriculture was subject in the early 1960's.

6.04 The discrimination against the three major grains was more severe than for the other commodities covered in this study. At least in the case of beef cattle, this is due partially to the fact that beef cattle producers have been more effective politically than grain producers. The tax burden fell more or less equally on wheat and corn and somewheat heavier on grain sorghum after the mid-1960's.

6.05 The NPC and EPC estimates for rice, cotton, wool, the three commodities whose production is concentrated outside the Pampas, have been summarized in Table 37.

Table 37

RICE, COTTON, WOOL: NOMINAL AND EFFECTIVE PROTECTION COEFFICIENTS

	Nominal Protection Coefficient			Effective Protection Coefficient		
Period	Rice	Cotton	Wool	Rice	Cotton	Wool
1960-64	-	.89	.83	-	.81	.79
1965-69	.93 1/	.81	.85	1.00 1/	.72	.80
1970-74	1.09	1.39	.80	1.40	1.14	.72

1/ Based only on 1968/69 and 1969/70

6.06 It appears as if wool was subject to the same treatment received by the major grains and beef cattle. The results shown for rice and cotton have to be taken cautiously because: (a) of limitations in the data base and (b) in order to compute the EPC some processing had to be taken into account which may have biased the results. In both cases, some degree of protection appears to have been introduced after 1970.

6.07 Value added turned out to be a very large fraction of product price, taking up values between .60 and .90 in most cases (with the notable exception of rice). This result is illustrative of an extremely important characteristics of Argentine agriculture, namely, its enormous dependence on the primary factors of production. This assertion is confirmed by the results obtained from an aggregate production function for the sector; in which land and labor inputs - to mention only two of the primary factors - account for two-thirds of total output. It is also worth noting that this particular situation does not seem to have changed substantially for a long period of time.

6.08 The estimates of DRC coefficients, which, like the EPC estimates, were based on the use of fixed input/output coefficients and average conditions of production, have been summarized in Table 38. They indicate a comparative advantage in all seven commodities studied for 1970/74, when international agricultural prices were high. Even when world prices were lower throughout the 1960's, Argentina appears to have had a comparative advantage in wheat, corn, grain sorghum, wool and cotton at the official exchange rate. 1/ If the official exchange rates were adjusted to better approximate equilibrium or free trade rates (see Annex I), the DRC coefficients would be reduced and hence the degree of comparative advantage increased.

Table 38

DOMESTIC RESOURCE COSTS IN ARGENTINE AGRICULTURE

Product	Period 1960/64	1965/69	1970/74
Wheat	.46	.54	.69
Corn	.58	.63	.45
Grain Sorghum	1.27	.97	.63
Beef Cattle 1/	1.30	1.22	.86
Wool	.48	.74	.60
Rice	-	1.47	.88
Cotton	.75	.74	.83

6.09 The evolution of DRC coefficients from 1960 to 1974 showed a relative loss in the case of wheat largely explained by increases in beef prices in the early 1970's, and a strong increase in the comparative advantage of corn and grain sorghum, attributable to gains in productivity in both crops in the recent past. The DRC coefficients for beef cattle production stayed somewhat above the critical level of one, except in the period 1970/74 when beef prices were at a record high. However, because estimates of DRC coefficients for beef cattle production during the 1960's can range from .67 to 1.88, depending entirely on the opportunity cost assigned to land, it is very difficult to come to a final conclusion about the overall comparative advantage of beef production.

6.10 The comparative advantage of wool showed up unmistakenly during the entire period under study, while rice production could only be justified on pure resource allocations grounds when world prices were high, as in 1972/73. Coefficients for cotton have to be evaluated taking into account that no opportunity cost for land was considered in this particular case.

1/ It should be noted that a DRC coefficient greater than unity may be due to the over-expansion of a certain activity and not to any inherent comparative disadvantage.

6.11 Aggregate estimates of the ESC indicate that credit, taxes and expenditures on research and extension provided moderate subsidies to agriculture, but in no case were they sufficient to compensate for the full effects of price policy.

6.12 The social cost of grain policy was high. Net losses to society accounted for more than 10% of the value of production in the early 1950's and to some 4% in the early 1970's. The high taxation to which grains were subject implied a massive redistribution of income from producers, to consumers and the Government, reaching a peak of 80% of the value of production measured at world prices in 1950/54 for wheat and corn. Producers fared the best in the early 1960's, when only about 10% of the value of production was extracted from them. Consumers were, by far, the main beneficiaries of these policies collecting about one-half of the income transference. Government received approximately one-third.

6.13 The fact that the burden of taxation has been less on beef cattle than wheat and the same on corn and wheat implies that the government has not been using price policy as a means to redistribute income in favor of smaller producers.

ANNEX I

ACCOUNTING PRICES

1. The Shadow Price of Capital

The following rates of return to capital have been used in this study:

Period	Rate of Return
1950-54	.10
1955-59	.12
1960-64	.12
1965-69	.11
1970-74	.10

They were estimated following the methodology suggested by A.C. Harberger 1/ which requires knowledge of the different types of capital existing in the economy and of the functional distribution of income. When the only available information refers to annual investments, it becomes necessary to generate series of stock under specific assumptions about growth and depreciation rates. The procedure depends heavily on the quality and quantity of information at the National Account level.

Two short comments on the results for Argentina: (a) returns to capital in the period 1950/74 describe a long cycle with two low points at the beginning and the end of the period, resulting from explicit policies of income distribution which increased the share of labor; (b) a rough sensitivity analysis suggests that the rates of return used in this study would not depart substantially from the "true" ones if adjusted series on capital turned out to be somewhat different from the ones used to derive the rates of return.

2. Labor

For all commodities except cotton the market wage was considered to be the appropriate measure of the shadow price of labor. In the case of cotton, given the structural unemployment existing in Chaco, a 10% deduction was used as a first approximation to the opportunity cost of labor in Chaco.

1/ Harberger, A.C. "On Estimating the Rate of Return to Capital in Columbia", published in Project Evaluation, Markham Publishing Co/Chicago 1973. For Argentina: Reca, L. and Verstraeten, J.: "Estimacion Preliminar de la tasa de retorno al capital en Argentina", unpublished, Buenos Aires, 1976.

3. Land

The alternative cost of land for corn and grain sorghum is the rent accruing to wheat in the Southeast of Buenos Aires. To a certain extent this procedure tends to increase the DRC of corn and grain sorghum because the area chosen is extremely favorable to wheat growing.

The opportunity cost of land for wheat is the rent generated in beef production, which is the difference betweeen value added measured in world prices and the returns to capital and labor valued in social terms. Two points merit attention. First this procedure assumes that from a social point of view there is no comparative advantage in raising cattle, since by definition the DRC coefficient in this activity is equal to 1 (recall that rent of land is the difference between world market value added and the return to labor and capital measured in social prices). Alternatively it could be argued that the procedure overestimates the rent of land, since presumably Argentina has some significant comparative advantages in beef production. Secondly, shifts between wheat and beef cattle production are not "symmetric". Moving resources from wheat to cattle implies a capital requirement (buying steers for example), which are not taken into account in computing the DRC coefficients in the way explained. However, as the rent of land is surely overestimated for the reason explained first, we have - at least - two forces operating in opposite directions.

For cotton and wool no alternative cost for land has been considered. For rice, rental payments for land were available and they were used to approximate the opportunity cost of land.

In all cases the opportunity cost of land was the average rent of the two previous years expressed in pesos of the current year.

4. Exchange Rate

All coefficients have been computed using the "financial rate of exchange" as a measure of the value of foreign exchange. This market rate is not necessarily the shadow rate which is the variable required to assess properly the DRC coefficient and hence the comparative advantage of different agricultural activities. For example, the financial rate is 10 pesos/dollar, while the shadow rate should be 12 pesos/dollar) the DRC computed using the financial rate will underestimate the comparative advantage of the product studied, since value added at world prices will be converted at a rate below the shadow rate, and consequently the denominator of the DRC would be below its true value.

There are a number of different ways by which shadow exchange rates can be estimated. One aproach is to chose a normal year, when there was no pressure on the domestic currency and there were no particular restrictions on imports. The exchange rates prevailing in this normal year can then be adjusted by an apropriate ratio between domestic and international price levels in order to estimate shadow rates for the other years.

In Table 39, 1960 was chosen as a normal year and exchange rates adjusted by the ratio between domestic to international wholesale price levels.

Table 39

Period	Ratio Between Financial and Equilibrium Rates of Exchange Using 1960 as a Normal Year
1950-54	1.13
1955-59	.84
1960-64	.98
1965-69	.86
1970-74	.98

The figures in Table 39 suggest that time and again there have been substantial differences between the rates actually used and those considered to be closer to equilibrium. Differences are particularly important in the 1950's and in the late 1960's. In the first subperiod the financial rate was some 13% above equilibrium, so DRC estimates should be adjusted upward by 1.13. On the other hand, in 1955-59, there was a variable over-valuation of the peso, so the true DRC should have been, on the average, some 12-15% below the levels discussed in the sections where commodities were individually analyzed.

A different approach to cope with the problem of overvaluation of the exchange rate was proposed by B. Balassa in his already mentioned study of the West African countries. There he indicated a procedure to compute the exchange rate which should prevail in the absence of tariffs and duties on foreign trade.

Berlinski and Schydlowsky have estimated an overvaluation of 40% in 1969 following the procedure suggested by Balassa 1/ and under the following assumptions:

1) elasticity of foreign demand for Argentina's traditional exports = -4;

2) elasticity of supply for traditional exports = 1.8;

3) elasticity of supply of foreign exchange = .75;

4) foreign demand elasticity of non-traditional exports is considered very high, while supply elasticity = 2.0;

5) domestic demand elasticity for imports = 2.6;

1/ Berlinski, J. and Schydlowsky, D.M. "Argentina" in Developing Strategies in Semi-industrial Countries, World Bank in preparation.

6) taxation of traditional exports = 10%, subsidization of non-traditional exports = 20% and the average weighted nominal duty on importables approximately equal to 56%;.

7) traditional exports amount to to 1.4 billion dollars in 1969, non-traditional are .2 billion and total imports are 1.6 billion.

The estimates of Berlinski and Schydlowsky imply that the free trade equilibrium in Argentina in 1969 was 4.90 pesos/dollar (financial rate times 1.4 or 3.5 x 1.4 = 4.90 pesos/dollar). This figure can be tentatively projected forward and backwards a few years using relative rates of inflation. The shadow exchanges so derived are presented in Table 40.

Table 40

ESTIMATE OF SHADOW EXCHANGE RATES UNDER ASSUMPTIONS OF FREE TRADE

Year	Index of Inflation (1)	Exchange Rate: Financial (2)	Exchange Rate: "Free Trade" (3)	Ratio (2):(3) = (4)
1968	4.45	3.50	4.83	.72
1969	4.51	3.50	4.90	.71
1970	4.78	3.50	5.19	.67
1971	6.12	4.00	6.65	.60
1972	9.53	9.39	10.35	.90
1973	12.41	9.98	13.48	.74
1974	12.59	9.98	13.68	.73

Note: Column (1) is the ratio between the Argentine WPI and a World Index of Inflation; Column (2) is the financial rate of exchange; column (3) is the shadow free trade rate of exchange. For 1969 it was derived as explained in the text. For all other years it is the 1969 rate (4.90) times the ratio between the index of inflation for each year and the index for 1969: Column (4) is the ratio between the financial and the free trade exchange rates.

The above results indicate that:

(a) the "real" DRC if adjusted by the correction factor derived in Table 40 should be for every year in the period 1968-1974 below the DRC coefficients computed using the financial exchange rate. In other words the Argentine currency has been overvalued during all the period;.

(b) the amount of correction implied in the "free trade approach" is higher than the one resulting from the normal year approach", the former being some 30% higher than the latter; however the direction of the adjustment is the same in both cases.

ANNEX II

METHODOLOGY

The basic procedures followed to estimate the protection coefficients have been explained in the text. This Annex gives some additional information on the same topic and then discusses the methodology used to estimate the welfare costs of grain policy.

1. Grain Crops: For wheat and corn two locations were chosen in order to reflect situations of high and low land productivity. For grain sorghum the availability of data limited work to only one location.

On the basis of the 1960 Agricultural Census the following farm sizes were chosen: 170 ha for wheat (Buenos Aires), 190 ha for wheat (La Pampa), 120 ha for corn (Buenos Aires), 130 ha. for corn (Entre Rioas) and 130 ha for grain sorghum (Buenos Aires). We have assumed full specialization in production in each farm. This is a strong simplication, but if depreciation costs can be distributed linearly among different activities the assumption is not that restrictive.

Product prices were taken from Bolsa de Cereales, the leading market in Argentina. For each product monthly quotations corresponding to the marketing season were used. In order to transform those prices in farmgate prices, transportation costs and handling charges were deducted. An average farm to port of Buenos Aires distance was arbitrarily set. Railway fares were used throughout.

Two alternative procedures were followed to estimate "international prices" for the grain crops. In the first one the CIF quotations (London and Rotterdam) were adjusted for transportation costs from Buenos Aires. No allowance was made for commissions and insurance expenses for lack of data.

The second alternative was to consider the prices reported by grain traders. In order to avoid underbilling minimum export prices were often set by Government ("precios indices"). As these prices have not followed systematically market variations through time, they often create problems of interpretation. For those years when Government was the single buyer in the grain market, the "world" price chosen was the price implicit in the official trade statistics. For the remaining years the price chosen was the highest between the two series developed, to correct for possible underreporting of prices. Export prices so determined were transformed into farm gate prices in the way explained above for domestic prices. The results obtained using this procedure gave strange results for some years (domestic prices higher than world prices, a situation difficult to reconcile with a regular flow of exports). Given these unsatisfactory results a different procedure was tried: all export taxes were added (including the tax resulting from the difference between the financial rate of exchange and the exchange rate used each year for the particular commodity studied). The world price is then the ratio between the domestic price at the farm gate and (1-T) where T represents all export taxes:

$$T = t \frac{TCE}{TCF} + \frac{TCF - TCE}{TCF}$$

where

T = total export taxes

t = export taxes on the commodity rate of exchange

TCF = financial rate of exchange

TCE = rate of exchange for the commodity studied

Input prices (domestic) correspond to quotations from Buenos Aires because no information on transportation costs to the countryside was available. This omission is not as important as it may look like because there are inputs with uniform prices in all the country (gas-oil for example). International prices for imported inputs are their CIF prices Buenos Aires, annual weighted averages. In the case of seeds (wheat for all the period and corn and grain sorghum until 1965) international prices are domestic prices divided by the NPC coefficient (a measure of their world opportunity cost). For corn and sorghum as hybrid seeds are used since 1965 a proxy for their international price was derived multiplying the grain world price by the ratio seed price/grain price at the domestic level.

It was not possible to obtain reliable information on prices of imported machinery because there is not a steady flow of imports of these inputs and consequently the information is not representative. Series of tractor prices in other countries were available but it was not possible to find information on freight rates. In any event, differences in machinery prices do not affect our estimates substantially: for example a 50% reduction in the price of machinery would have increased value added by 4%. Tractor is the most important single item in machinery (40% of all machinery value). In order to have an idea of what the possible price of a tractor (world prices) could be, the tractor/wheat price ratio was computed for the USA (1960-1970). Assuming a similar ratio could prevail in Argentina and taking the price of wheat as numeraire the equivalent price of the tractor in Argentina was between 50% and 70% below the domestic price. No allowance was made in this calculation for transportation costs.

Given their relatively low weight, no attempts were made to evaluate fences and other inputs used in the maintenance of constructions and buildings at international prices.

Some important changes in the organization of production took place in the period under analysis: tractors fully replaced draft power, mechanical harvest of corn substituted for hand picking and bags were no longer used. In this study it was assumed that mechanical power was used during the whole period. This is valid proposition for all producers from the end of the 1950's on approximately. Some preliminary calculations were done assuming the use of draft power and they did not show substantial difference in the resulting coefficients.

Changes in input/output ratios are examined in the section devoted to each particular crop. In principle those changes have not been very important. The use of insecticides and fertilizers in grain production is not a common practice at the aggregate level, so no allowance has been made for their use.

Several assumptions were required to estimate depreciation allowances and maintenance costs of machinery and constructions for each of the different items in this group. Shortage of data on prices of machinery and the high proportion of tractor values in total value of machinery suggested the use of annual tractor prices as an indicator of total annual value of machinery. This procedure was used for each year. Another important aspect in the treatment of machinery is the division between value added and intermediate components. The information available 1/ indicates that 46% of the value of "machinery" corresponds to intermediate inputs and consequently depreciation and maintenance allowances were computed on that fraction of total value added. The return to capital assumes that capital is at 1/2 of its useful life. If all capital were "new" the DRC would have increased by 3% to 13% of the observed values.

It was assumed that all harvesting is done exclusively by custom work. This is the typical situation for medium size farms, like the ones analyzed in this study. The cost of gas-oil and bags were deducted from harvesting costs and the difference was considered value added. In order to compute the DRC all the resulting value added was considered to be return to labor. This assumption is not very strong.

2. Beef Cattle: The two models used in this study were prepared using information from several sources and designed to describe two ranches using average technology for beef production. For reasons of simplicity the following assumptions were made:

1/ BCRA: "Transacciones Intersectoriales de la Economia Argentina Ano 1963". Boletin Estadistico BCRA Buenos Aires, January 1974.

(a) total specialization in either breeding or fattening:

(b) constant technical coefficients for the whole period;

(c) fences, buildings and water wells were valued only at internal prices;

(d) land preparation for annual forages is done by custom work. It was considered that depreciation and interest on machinery had a very minor incidence and no allowances were made to cover them. Only fuel and oil expenses were taken into account;

(e) capital items were computed taking into account only the value of their input components. According to the input-output tables for Argentina, the coefficients are: .50 for vehicles and .46 for fences, water wells and other fixed investments;

(f) depreciation charges were computed using the sinking fund factor. Interest rates were 9% between 1960 and 1965 and 12% from 1966 on. Expected lives were 10 years for vehicles, 30 for water wells and 50 years for fences and buildings;

(g) bull prices ("puros por cruza") were obtained from auctioneers. This particular input is not internationally traded so the same price was used to estimate the VA_w. The same procedure was followed in connection with grass seed (Festuca sp, etc.);

(h) international prices for oats, sorghum and rye were estimated taking into account the existing export taxes on an annual basis;

(i) transportation and marketing expenses were computed taking into account annual changes in sales taxes;

(j) interest charges on breeding stock were computed in the following way: prices of heifers are, on the average, equal to .9 of cow prices, so the total number of cow units is equal to 1457 (1100 cows plus 386 heifers x .9). As total calf production is 170 metric tons liveweight per year, 8.51 cow units are required to produce 1 metric ton of beef. The annual average price of cows, times the interest rate, times 8.51 gives the interest on breeding capital per year per metric ton of beef.

3. Cotton: The series on capital were generated from historical information covering six years in the period 1960-74. Annual series were constructed adjusting for changes in the price level. The single most important capital item is the tractor, representing about 40% of the total value of machinery. In turn, machinery accounted for 92% of total capital, the remaining 8% going to fences, buildings, etc. The extremely low share

of buildings and improvements is consistent with the land tenure situation described in the text. Interest charges, depreciation and maintenance costs have been computed in the usual way.

Valued at domestic prices, maintenance and depreciations costs of fixed capital and farm improvements (investments) represent 50% of total costs. Fuel adds between 20% and 30%. Seed and bags account for the rest. The share of maintenance and depreciation increases up to 65%/70% when inputs are valued at international prices. For the period 1971-4, cotton prices at the producer level have been adjusted by the "Cotton Fund" tax.

4. Wool: The ideal unit of production used in this analysis is 10,000 ha large and is specialized in sheep raising. This choice reflects a mode of production representative of the conditions prevailing in the province Chubut (Patagonia). All land is in native pastures of low carrying capacity (.28 sheep/ha).

The value of fixed investments was estimated for each year separately, using the same structure (fences, buildings, water wells and barns), and average annual prices for each item. Fences turned out to be the most important capital component (between 50% and 60% of total capital). Buildings accounted for 12 to 18%.

Maintenance and depreciation expenses were derived in the same way as explained for grain crops and beef cattle. Depreciation charges were computed each year on the fraction of capital corresponding to inputs from other sectors. Expected lives considered were: fences 50 years, buildings 50 years, water supplies 30 years and rams 5 years. For all items but rams the annual depreciation charge was estimated using the sinking fund factor formula. Interest rates used are 9% from 1960 to 65 and 12% from 1965 on. Rams are by and far the most important component of depreciation charges (90%), given their relative short length of life relative to the other items of capital.

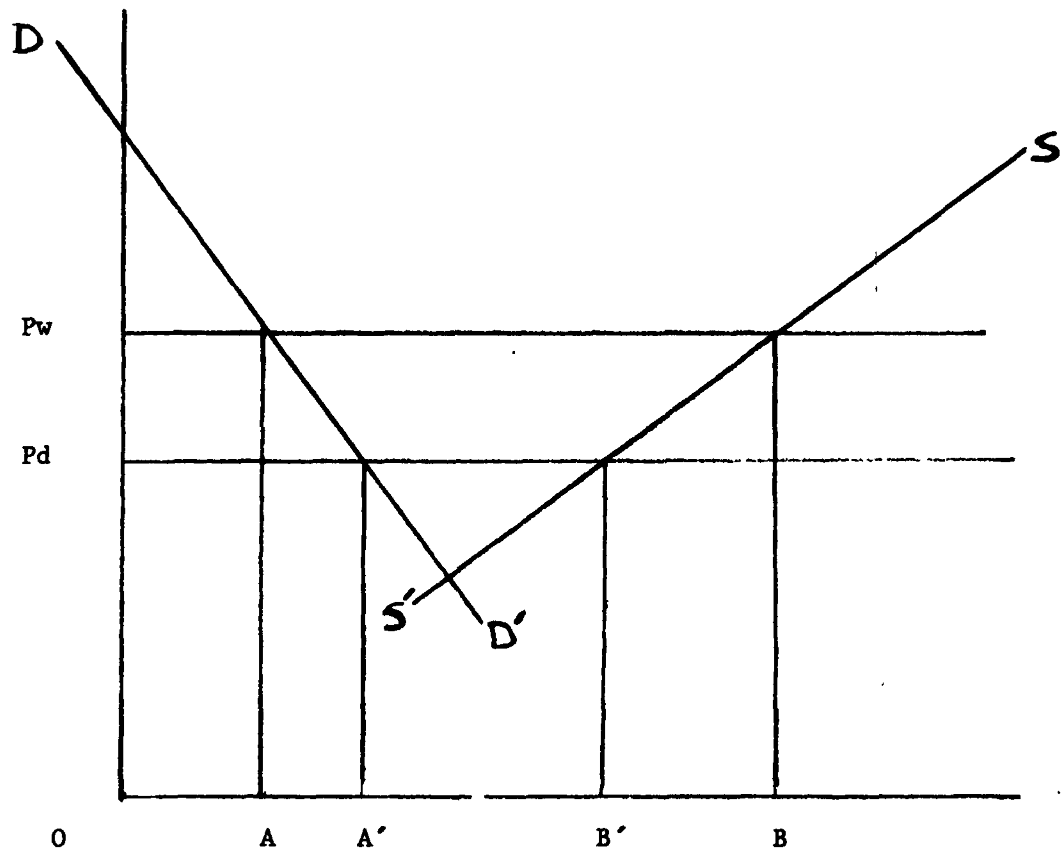
Forages (alfalfa hay) and fuel account for 60% to 75% of current expenses valued at domestic prices. Vaccines, remedies and feed corn, are individually much less important.

There are important differences when inputs are valued at international prices: corn is more expensive (due to the effect of export taxes) and fuel prices are usually lower when valued at world prices.

Few units of labor enter the wool production function. There are only two permanent workers and seasonal labor amounts to 140 man/day per year. Shearing requires 80 man days. In total, labor per ha is less than 1 man/ha/year.

Turning to DRC estimates, as indicated in the text no allowance was made for returns to land. There are two sources of capital costs: returns to physical capital and to breeding stock. The first category is betweeen two and four times larger than the second which was valued at twice the market price of old ewes.

5. <u>Welfare Changes Associated with Grain Policy.</u> The welfare transfers occasioned by the introduction of an export tax can be illustated by reference to the following figure:



where: DD′ is the domestic demand function

SS′ is the domestic supply function

OB and OB′ are the quantities supplied before and after the export tax respectively

AB and A′B′ are the quantities exported before and after the export tax respectively

Pw and Pd are the prevailing prices before and after the export tax respectively

The welfâre transfers can be decomposed into four components as follows:

(a) Loss in Producer Surplus = (Pw - Pd) (OB′) + 1/2 (Pw - Pd) (B′B)

(b) Gain in Consumer Surplus = (Pw - Pd) (OA) + 1/2 (Pw - Pd) (AA′)

(c) Increased Government Revenue = (Pw - Pd) (A′B′)

(d) Social Cost = 1/2 (Pw - Pd) (B′B) + 1/2 (Pw - Pd) (AA′)

It should be noted that the loss in producer surplus is equivalent to the gain in consumer surplus plus increased government revenue plus the social cost (i.e. a = b + c + d)

The social cost can also be estimated from the following formula:

$SC = 1/2T^2Pw(nQd + eQs)$

Where: SC = social cost

T = ratio of the unit export tax to the world price i.e.(Pw - Pd)/Pw

Qd = quantity demanded domestically

Qs = quantity supplied domestically

e = price elasticity of demand

n = price elasticity of supply

In the case of wheat, the price elasticity of supply can be assumed to be .3 for 1950/64 and .5 for 1964 onward while the price elasticty of demand can be assumed to be -.25 throughout. For corn and grain sorghum the price elasticities can be assumed to be .3 and -.4 for supply and demand respectively.

ANNEX III

PRICES AND OUTPUT RESPONSE IN ARGENTINE AGRICULTURE, 1950-1974

The nature and extent of price response in Argentine agriculture has important consequences. As agriculture supplies several key "wage goods", there is continuous pressure for low agricultural prices from the manufacturing sector. On the other hand, agriculture is the main supplier of foreign exchange. Artificially low agricultural prices have two opposite effects: (a) they help to keep wages down; (b) they impair (by discouraging production) the ability of the country to generate foreign exchange which is necessary, among other things, to supply the manufacturing industry with imported inputs. This dilemma, faced by several nations, has important economic and political consequences. It is thus appropriate to explore in some detail the relation between prices and agricultural output.

This section includes some estimates of the supply response of Argentine agriculture (1) in the aggregate and then separately for (2) crop production outside the Pampas, and (3) grain production in the Pampas.

1. Aggregate Production

The usual Nerlovian model has been used to estimate the supply response of the sector as a whole. 1/ The independent variable is an index of total agricultural production which was constructed using the available information on individual commodities except for beef cattle, where a special series was developed in order to avoid the use of slaughter as a proxy for output. Average 1971/74 prices were used as weights. Four independent variables were considered: prices, credit, technology and weather.

Prices. Given that the dependent variable is aggregate agricultural production, it seemed appropriate to use a comprehensive measure of prices. (The agriculture WPI -- wholesale price index -- relative to non-agricultural products lagged one year was used for this purpose.)

Credit. An index of outstanding credit for agriculture at the end of each year, deflated by the GNP deflator was included as a second independent variable. The official banking system supplied the largest fraction of credit. As real rates of interest have been negative for most of the years in the period under study, the credit market has usually faced excess demand and politically based rationing.

The other two independent variables are technology and a corrective variable for weather. Both of these enter the equation as dummy variables. Two different technological levels were defined, one covering the period 1950-64 and the other the rest of the period. Admittedly this is only a

---

1/ All computations were made using OLS, variables in natural numbers.

first and crude approximation to a difficult problem. The dummy variable takes on the value of zero before 1965 and one from then on. Years with bad climatic conditions were also identified with a dummy variable (D=1 for 1952, 1968 and 1972).

Results are shown in Table 41. Different alternatives were tried excluding in each case one of the explanatory variables. The coefficients

Table 41

AGRICULTURAL OUTPUT IN ARGENTINA AS A FUNCTION OF SEVERAL VARIABLES (1950-1974)

Variable	Equation Number				
	(1)	(2)	(3)	(4)	(5)
Output prices in (t-1)	.357	.545	.376	.264	.228
	(2.575)	(4.550)	(2.589)	(1.648)	(1.657)
Credit	.103	.154	.124	.091	-
	(2.193)	(3.423)	(2.617)	(1.698)	-
Technology	7.186	11.441	-	7.583	9.648
	(1.701)	(3.027)	-	(1.513)	(2.162)
Weather	-9.076	-9.533	-9.241	-	-8.497
	(1.963)	(2.895)	(2.878)		(2.541)
Output lagged one year	.372	-	.545	.424	.534
	(2.019)		(3.384)	(1.945)	(2.883)
Constant	16.449	27.540	-2.781	20.181	25.159
	(1.122)	(2.116)	(.284)	(1.164)	(1.627)
R^2 adj	.87	.86	.86	.82	.85
DW	2.28	2.04	2.07	2.29	1.97
See	5.4	5.9	5.7	6.4	5.9
Elasticities					
(a) Price					
short run	.33	.50	.35	.24	.21
long run	.52	-	.78	.42	.45
(b) Credit	.12	.19	.16	.11	-

Note: In this and similar tables the numbers in parenthesis below the coefficients are the "t" values. R^2 adj is the adjusted coefficient of multiple correlation. DW is the Durbin Watson statistic and See the standard error of the estimate.

show, in general, a remarkable stability. The supply elasticity (short run) takes on values between .21 and .35 except in equation 2 where it jumps to .50. As in that particular equation no distinction is made between the short and the long run, the price coefficient probably reflects that fact. There is a wide range of variation in the long run coefficients, running from .42 to .78, but in three out of four cases, the long run supply elasticity falls between .42 and .52. 1/

The effect of credit is clear. The output-credit elasticity is of the order of .1 to .2, clearly lower than the price elasticities. This point has some interest because at times subsidized credit has been used as a substitute for higher prices in order to promote product (1950-54 for example), with less than overwhelming success. Figures in the table suggest that to achieve a given increase in production, and holding the other variables constant, would require a percentage change in the amount of credit effectively used by producers twice as much a change in prices, e.g. 10% compared with 5%.

Technology and weather also show a considerable influence on production. According to the latter, in extremely bad years output may decrease up to 7%-8%. Technology has been responsible for an increase in production on the order of 8% to 10% of total output between 1965 and 1974.

The statistics of the 5 different equations briefly reviewed take on reasonable values. The goodness of fit, as measured by the standard error of the estimate is particularly high. In summary, keeping in mind the conceptual and statistical limitations of the analysis carried out, the model discussed strongly supports the contention that product prices were one of the key determining variables of the behavior of agricultural production in Argentina in the last twenty-five years.

2. <u>Crop Production in the Non-Pampean Areas</u>

In order to study price and output relationships in the areas outside the Pampas, the same supply response model was estimated using ordinary least squares. The results have to be taken with caution, given the heterogeneity of the commodities grouped in the production index, and considering also that some of them are perennial crops. The distributed lag model used on this occasion includes the following variables:

<u>Output</u>: (dependent variable): includes annual production of the main crops outside the Pampas: grapes, cotton, sugarcane, tobacco, rice, corn and wheat. The last two only enter the index with the quantities produced outside the Pampas. Average 1971/74 prices were used as weights.

1/ "Long run" elasticities are derived dividing the short run coefficients by 1 minus the coefficent of the lagged variable.

Prices: the prices of the three main commodities grown outside the Pampas were transformed into indices and weighted by the average value of production in 1961/65. The weights are .337 for sugar cane, .435 for grapes and .228 for cotton. As those three crops account for 90% of total output, it was not considered worth the effort to develop an index of prices including all the commodities listed in the production index. The index of prices constructed in the way described was deflated by the WPI for all products and enters the equation lagged one year.

Area: includes the area planted annually to sugar cane, grapes, tobacco, rice, cotton, wheat and corn. The base period (1950/54 = 100) is equivalent to 1.466 million ha of land.

Yields: Two options were chosen to measure trends in yields. The first one is an index based on three year moving average yields of each of the three main crops (sugar cane, grapes and cotton), weighed in the same way as prices. The second option is a short cut: taking into account the evolution of yields through time, the period under analysis is divided in two sub-periods one of them characterized by "low" yields (D=0) and the second, starting in 1965 by "high" yields (D=1). Even though the second procedure is less rigorous, it avoids possible problems between explanatory and explained variables, given the way in which yields are derived. Another dummy variable was used to take into account the effects of exceptionally good years. It takes on the value of one for 1955, 1970 and 1974. The result of this exercise (Table 42), strongly supports the hypothesis that prices play an important role in determining the levels of crop production outside the Pampas. The price coefficients are strong. Short run elasticities vary between .12 and .18 while long run elasticities are only slightly higher (.25 to .28).

Production lagged one year - which hopefully captures the incidence of perennial crops - has also significant influence, particularly when yields are treated as a dummy variable (equation 2). On the other hand the results of the interrelationships between both variables shows up: the production coefficient is weaker, while yields (treated as moving averages in equation 1) enter strongly and vice versa. Consequently equation 2 seems preferable.

Table 42

ESTIMATES OF CROP PRODUCTION OUTSIDE THE PAMPAS
(1950-74)

Variables	Equation Numbers (1)	(2)
Production lagged one year	.358 (1.760)	.521 (2.775)
Product prices lagged one year	.229 (2.994)	.154 (2.320)
Area planted to crops	.427 (2.224)	.426 (2.048)
Crop yields	9.294 (2.075)	-
Dummy for yields	-	7.89 (1.16)
Dummy for unusually high production	20.410 (3.610)	22.217 (3.757)
Constant	-94.25 (2.59)	-10.52 (.49)
R^2 adj	.87	.85
DW	2.04	1.96
See	8.54	9.10
Price Elasticities		
(a) Short run	.18	.12
(b) Long run	.28	.25

Note: for meaning of symbols see footnote in Table 41.

3. Agricultural Production in the Pampas

The bulk of grain and oilseed production in Argentina comes from the Pampas. Between 11 and 14 million ha of land are annually planted to crops there. About one-half of total grain output is consumed domestically and the rest is exported, generating more than one-third of total foreign exchange earnings of Argentina.

Grain crops and oilseeds compete with beef cattle for the use of land in the Pampas. It is often stated that the beef/wheat price ratio is the single most important relative agricultural price in Argentina. In view of the possibilities of substituting wheat for beef cattle and vice-versa, and given the importance of both activities, that assertion seems warranted. Given the amount of resources committed to grain and oilseed production and the substitutability of beef cattle for crops, it is important to try to understand how the grain-beef economy allocates resources between alternative uses.

The approach used to deal with this problem is the usual multiple regression model, where the dependent variable (area planted to crops and oilseeds) is a function of "expected" product prices, prices of substitutes, level of technology, availability of credit and weather.

Conceptually, the problem of substitution of grain for beef cattle and vice versa is a typical exercise of marginal analysis. There are subregions in the Pampas fully specialized in cattle production while in other areas of the Northern Pampas the ecological conditions and the size of the farms have determined specialization in grain production, with little cattle raising. Ideally we would like to consider only those areas where land is effectively shifted from one activity to the other. As there is no information to proceed in this way, the analysis is performed in terms of aggregate figures for all the Pampas.

Another word of qualification is required: part of the area planted to wheat is grazed at early stages of the growing season. In that sense wheat and cattle should be regarded as complements rather than substitutes. No figures are available to explore this point further, so it can not be considered in the quantitative analysis that follows. In fact we are then assuming that on the aggregate wheat grazing is not a very important phenomenon.

The variables are:

Area planted: includes the five most important crops 1/ planted in the five Pampa provinces (Buenos Aires, Cordoba, Santa Fe, Entre Rios and La Pampa). As double cropping is negligible in the period studied, this way of measuring land planted to crops is adequate. Between 1950/54 and 1970/74 the area planted to annual crops in the Pampas grew at a rate of 1% per year.

1/ Wheat, corn, sunflower, linseed and grain sorghum.

The annual variability of area planted for the whole period is around 12.6% and it has been higher in the second part than in the first (the respective coefficients of variations are 7.3% for 1950/65 and 10.6% for 1965/74). The shares of the five components of the area variable changed through time: corn and particularly grain sorghum increased their importance.

Price is the weighted sum of the previous year prices of the five crops. The reason for lagging prices one year is the familiar Nerlovian model in which they are then a proxy for expected prices. The structure of weights used to construct the price series changed according to the relative importance of each crop in aggregate production value in three different periods, as follows:

Period	Wheat	Corn	Grain Sorghum	Linseed	Sunflower
1950/59	.582	.289	.005	.056	.068
1960/68	.464	.310	.058	.091	.077
1969/74	.307	.392	.167	.042	.092

The coefficients of variation for prices are slightly higher than for aea, 13.1% in 1950/64 and 10.9% in 1965/74. The deflator used to construct the price index was the general WPI.

Yields are treated in this analysis as a binary variable, which takes on the value of zero until 1965 and one thereafter. This method was used after examining an index of yields constructed in the following way: three year moving averages were computed for all commodities, except linseed which does not show any significant change in yields through time. The three year moving averages were subsequently transformed into indices (1950/54 = 100). The weights used to aggregate these indices are those used to construct the price index (adjusted for the exclusion of linseed) for the period 1961/65. The weights are: .51 wheat, .34 corn, .06 grain sorghum and .08 sunflower. For 1950/54 the index of yields averaged 107, while for 1965/74 it climbed to 123. In addition to this difference, the whole series for the yield index looks like a step function, with two well defined periods.

Beef Cattle Slaughter: annual averages for the whole country, adjusted for clandestine slaughter - which was particularly important in 1973 and 1974.

Stock of Beef Cattle: for the whole country. Series developed from census data and annual slaughter which allows to estimate a "natural" rate of growth of the stock.

Credit: Outstanding credit for all crop production in the country at the end of each year, deflated by the WPI and divided by the area planted to crops. This procedure allows to identify years when credit was below usual levels and could then be visualized as a major constraint to production. Five years fall in this category (1959, 1960, 1962, 1963 and 1964).

The different results of supply responses in the grain subsector are summarized in Table 43. In equation (1) the area planted to grain crops is defined as a function of expected grain prices, historical yields and availability of credit (only in this case D=1 for years of low credit/area).

Equation (5) includes two variables alternatively considered in equations (1) and (2). The results improved slightly and the credit variable becomes significant.

Equations (3) and (4) explore the same issue, following a different procedure: instead of beef stock numbers, annual slaughter is used as an indicator of competition for the use of land between crops and livestock. The expected sign of the coefficient is positive (a higher rate of slaughter - ceteris paribus - makes more land available for crops). The slaughter coefficients turn out to have the right sign and are statistically highly significant. The area/slaughter elasticity in both equations is around .25 for the whole period, indicating that a 10% increase in slaughter would, other things equal, induce an increase in area planted in the order of 2.5%. The approach followed in this section regarding decisions with respect to areas planted to crops, in the framework of partial equilibrium analysis, necessarily considers as given whatever happens in the beef producing sector of the economy. This last point is not in contradiction to what has been mentioned above in connection with the relevance of the beef/wheat price relationship. Our main interest is to know the relationship, if any, between prices and areas planted to crops. For any given year the rate of slaughter, mainly determined by the relationship between beef and wheat prices, can be taken as a first approximation as given.

In equations (3) and (4) the area price coefficients turn out to be only marginally significant from a statistical point of view. Their absolute value is between 1/3 to 1/2 of the values found in equations (1) and (2). Adding up the slaughter and price coefficients in equation (3), the resulting value is close to the price coefficient in equation (1) and (2). Supply elasticities in equations (3) and (4) are .14 and .15 respectively, well below the values found in equations (1) and (2).

In terms of goodness of fit, equations (3) and (4) show a close correspondence between observed and computed values. For these two equations, the standard error of the estimate is the lowest among all the set of equations studied.

Finally, the credit variable, even though it has the right sign, is not statistically significant.

The exclusion of grain sorghum (equation 6) was tried in order to have an idea of the effect of a component of the aggregate dependent variable which has a strong upward trend. Naturally, the price variable was computed excluding grain sorghum. The explanatory value of (6) is well below the other two alternatives. The elasticity of supply is .39, but the most interesting result here is the high significance of the cattle stock coefficient.

Table 43

SUPPLY (AREA) RESPONSE IN THE GRAIN SUBSECTOR
(Five Provinces in the Pampas, 1950/1974)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Price	.44 (4.30)	.405 (3.87)	.148 (1.38)	.183 (1.46)	.468 (4.45)	.355 (3.57)
Yield per ha	23.248 (8.82)	28.592 (5.71)	21.835 (9.88)	21.855 (9.72)	28.976 (6.09)	23.036 (4.26)
Credit per ha	-4.596 (1.32)	-	-	1.599 (.56)	5.368 (1.80)	6.283 (1.98)
Stock of cattle	-	-.269 (1.03)	-	-	-.323 (1.30)	-.932 (3.54)
Slaughter	-	-	.246 (3.44)	.227 (2.85)	-	-
Constant	55.976 (4.72)	87.414 (3.15)	58.099 (6.26)	55.280 (5.18)	82.409 (3.11)	153.840 (5.60)
R^2a	.82	.82	.88	.87	.83	.56
DW	2.29	2.33	2.57	2.56	2.57	1.86
See	5.3	5.5	4.5	4.6	5.2	6.0
Area/Price Elasticity	.43	.39	.14	.18	.45	.39

Notes: See note to Table 41.

Equation (2) yields results which are very close to those of equation (1). The difference is the inclusion of the stock of cattle as an independent variable, under the hypothesis that even though there is some flexibility in the animal unit/land ratio, a larger stock requires more land which is then excluded from crop use. The results barely supports this hypothesis: the coefficient has the expected sign but it is only marginally significant. The yield coefficient carries a high explanatory value in this as well as in all the other equations considered. Since this coefficient shows a remarkable stability no more comments will be made on the subject.

The set of equations reviewed supports the following conclusions: (a) changes in area planted to annual crops in the Pampas can be explained using straightforward economic analysis; (b) expected product prices show distinctively their effect under the two alternatives considered. Supply elasticities fluctuate between .20 and .40 approximately, according to the procedure followed to estimate them. In terms of policy these elasticities mean that an artificially depressed price may not cut down substantially production from one year to the next, or on the other hand, no spectacular increases in areas planted - for the whole - could be expected from an increase in the general level of crop prices. One crop may very well expand in area, but this will not hold for all the crops taken together. The effects of artificially low prices for crops will become evident some time later through the disinvestment process in agriculture which they will inevitably trigger. (c) The evidence developed in this section supports the presumption that crop production has operated at a higher level of technology in the second half of the period analyzed. Yield series, which were used to approach the problem, show coefficients large in absolute value and highly significant from statistical point of view. Other things equal (prices and slaughter for example), the area planted to crops in the Pampas from the mid 1960's on was some 20% higher because of "technology", as reflected in yields. (d) The influence of cattle population also appears strong. Cattle and crops compete for the use of land. This is a delicate and complex question, of far reaching economic and political implications. The elasticity of cropped area of grains with respect to cattle slaughter is about .25, illustrating the magnitude of the substitution involved.