The University of Nottingham

SCHOOL OF ECONOMICS

Evaluating the Impact of Economic Agricultural Policies during the Reform Era for Major Crops and Crop Rotations in Egypt: A Policy Analysis Matrix Approach

by

Ahmed Mohammed Salah El-Kholei, B.A. (Hons), M.Sc.

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In The Name of Allah The Most Graceful, The Most Merciful.

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ABSTRACT

In 1986, Egypt implemented a succession of comprehensive economic reforms both in the agriculture sector and more generally such as the Economic Reform and Structural Adjustment Program (ERSAP) of 1991. Since then, the agricultural sector has been gradually transformed from one characterised by central planning and governmental controls to one that is more free market oriented.

This study employs the Policy Analysis Matrix technique to evaluate the impacts of reform policies on eleven major crops (wheat, maize, sugar cane, soy bean, broad bean, cotton, rice, tomatoes, potatoes, long and short berseem) and their associated crop rotations (crop mix) during the period 1986-2000. The PAM offers six tools of economic indicators. The first (Private Cost Ratio) is used to identify the competitiveness of crops domestically. The second (Domestic Resource Cost) is employed in an attempt to identify those commodities in which Egypt has a comparative advantage/disadvantage. The third (Nominal Protection Coefficient for inputs and outputs) is used to measure the divergences between the domestic and international prices for inputs and output. The fourth (Effective Protection Coefficient) reflects the complete pattern of incentives to farmers in the tradable commodities markets, combining the separate influences of polices represented by the NPCO and NPCI measures. The fifth and sixth (Profitability Coefficient and Subsidy Ratio to Producers) estimates the net protection effects afforded to each of the major sectors by the whole range of policy intervention.

The most important findings are that: (1) The Egyptian pricing policy in the reform era is still encouraging domestic production of importable products (by setting their prices above world prices) while export products are taxed relative to their equivalent world prices. (2) Cotton, the main historical export commodity, is shown to be grown with a comparative disadvantage since it receives the highest levels of subsidy. (3) On the other hand, wheat showed a remarkably positive example for the high response from farmers to the reformed pricing policies with an increase in its area and its productivity by 83% and 60% respectively. (4) There is a high response of change in planted area to water charges. The conclusion of these analyses is that the impact of policy changes has indeed been positive, especially in relation to areas of crop production. But many remains to be done, for example, growers' still face problems in marketing, accessing to inputs, processing and trade.

Chapter I

Chapter I: Introduction

Introduction:

In the last few decades, many changes have taken place in the world economic system as new forms of trade relations, known as regional trade agreements (RTAs)[1] have arisen. These changes should signal to the developing countries that there must be a change in economic policies if benefits are to be gained from the new global trade regime.

Egypt, as a developing country facing various economic problems, is trying to meet the challenges imposed by the new system. This can be done by adapting its economic situation to get the maximum gain (or the minimum loss) from any changes. The problems of adopting and applying an economic reform policy in the 1980s was one of the challenges that faced Egypt. The Egyptian agricultural sector may be considered the leading sector in the policy reform that started in 1986.

The Egyptian agricultural sector has been subject to a wide variety of government interventions since the 1950s. The major two goals of these interventions have, through most of Egypt's history, been to provide a cheap agricultural surplus to the manufacturing sector and to keep food prices low for the urban population. The main forms of intervention have been price controls on major (strategic) commodities, state trading and marketing of inputs and outputs, subsidies on inputs, area controls, predetermined low prices for major

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[1] By the end of the second world war new forms of RTAs were formed such as :
a) North American Free Trade Agreement (NAFTA), which consists of USA, Canada, Mexico.
b) APEC's 21 Member Economies which consists of Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; The Republic of the Philippines; The Russian Federation; Singapore; Chinese Taipei; Thailand; United States of America; Vietnam. c) The European Union which includes, Belgian, Denmark, Netherlands, France, Germany, Greece, Ireland, Italy, Luxembourg, Portugal, Spain, UK, Austria, Finland, Sweden.

crops and an overvalued exchange rate, which in turn implicitly taxed agricultural exports and subsidises competing imports. The net effect of these polices had been to encourage resource transfers from agriculture to other sectors, especially the industrial sectors, which were highly protected.

The performance of the agriculture sector suffered heavily as a consequence of those policies. For example, the sector's average growth rate of less than 2% fell below the population growth rate of 2.8% during the period 1981-1992, whereas over that period a minimum rate of 4% was needed to sustain the government's growth rate target of 5%. Self-sufficiency ratios for major commodities fell significantly compared to historical levels. For example, the wheat and maize gaps increased from 577 and 50 million tons respectively in 1960 to more than 1706 and 73 million tons in 1970, and further to 6558 and 1045 million tons respectively in 1983. In addition, the agricultural trade balance fell sharply from a surplus of US$ 287 million in 1961-73 to a deficit estimated at US$ 1786 in 1974-86.

At the macro level, substantial macroeconomic imbalances started in the mid-1970s and continued in the 1980s, with the government budget deficit averaging about 20% of GDP. Unemployment also increased, jumping from about 5% in the mid-1970s to some 10%-15% of the labour force in the 1990s. The economy was increasingly overburdened by a debt overhang debt outstanding and disbursed (DOD) which hit the US$ 50 billion by the end of June 1990. Government expenditure peaked at 63% of GDP in the 1982 fiscal year, compared to an average 40% for all developing countries in the mid-1980s

These indicators left the government of Egypt no choice other than to seriously implement a comprehensive economic reform. This occurred progressively; an economic reform started in the agriculture sector in 1986, followed by a stand-by arrangement (SBA) with the IMF in May 1991, coupled with a structural adjustment loan (SAL) from the World Bank in November of the same year to facilitate reform in the areas of pricing and subsidies, the foreign exchange system, interest rates, the money supply, and the budget deficit. This was the first real structural adjustment package (SAP) in the history of Egypt.

Aim of the study:

The agricultural sector as a whole contributes about 17% to GDP, of this 4% is from livestock production while the remainder is from crop production[2]. Since crops are both the dominant output and as such have been subject to the majority of policy intervention, the study concentrates on crop production.

The main aim of the study is to analyse the outcomes and impact of the agricultural policy reforms in Egypt from 1986 until 2000, in terms of their impact on the efficiency of resource allocation, and the structures of incentives and protection. This requires data on governmental interventions in the markets for the major exportable, importable and fodder crops in Egypt. The impacts of government intervention on price policies for major agricultural commodities will be estimated with respect to producers and society as a whole.

[2] The importance of livestock in the Egyptian agricultural sector is discussed in greater detail in Chapter 2.

Analysing the reform policy for the agriculture sector raises a number of questions.

I. What have been the effects of these new reform policies on production of crops and crop rotations?

II. Have these policies led to the allocation of scarce resources efficiently among competing crops?

III. Will these policies help the government to achieve its goal of flourishing agricultural trade and food security?

IV. What are the effects of these policies on producers' outputs, prices, incomes and subsidies received?

These questions are answered here at the farm gate level using the policy analysis matrix (PAM) approach as the policy tool. The farm gate level is used to provide understanding of the likely responses of farmers.

Outline of the Study

The study analyses the impact of policy reforms for the main 11 sectors and their 14 possible rotations (crop mix) that constituted about 94% of total crop value and 98% of the total planted area. Theses sectors are: wheat, cotton, rice, maize, broad beans, soybeans, sugar cane, tomatoes, potatoes, long berseem and short berseem. This study attempts to offer answers to a number of questions and offers the policy advisor in Egypt a full picture for the performance of each sector and asks whether policy reforms led to an efficient reallocation of resources. Specifically, we demonstrate that the applied policies are in the right way to achieve the expected prosperity in agricultural production (as what achieved in wheat, rice and maize production) or failed to meet its target (as in cotton and potatoes production). The study also provides a comprehensive framework for other policy analysts who wish to apply the PAM as the study offers way of its estimation in depth how the PAM can be constructed most compactly and logically using empirical data. The data provided in our study provides a resource for other researchers.

The data used in our study come mainly from secondary data published by national institutions such as the Ministry of Agriculture and Land Reclamation (MALR) and the Central Agency for Mobilisation and Statistics (CAMPS) and from international sources, such as the International Monetary Fund (IMF), Food and Agriculture Organisation (FAO), World Bank and the United Nations Economic and Social Commission for Western Asia (ECSWA) publications.

A brief introduction to each chapter of the thesis is presented here. Chapter 2 identifies the contribution of the agricultural sector to the national economy, and presents a historic overview of its performance and features during the last two decades. The chapter also reports on the cropping patterns, the rotation system, the relative importance to costs of farming inputs, and crop profitability.

Chapter 3 provides the background to the main features of the agricultural polices followed in Egypt from the Second World War until 2000. A major concern in this chapter is the changes in the production of major crops. The chapter is divided into four main sections: (i) Egyptian agricultural policy before the 1952 revolution, the socialistic era (under Nasser's regime), and the open door policy era (Sadat's period); (ii) the aims, structure, components and tools of the Economic Reform and Structural Adjustment

Programme (ERSAP); (iii) the agricultural sector and the ERSAP; (iv) a preliminary statistical evaluation of policy reforms.

Having described the performance of the agricultural sector and provided a background on the associated policies in different time periods of Egypt's history, chapter 4 discusses the policy analysis matrix (PAM) as a tool for assessing the effects of policy reform. This chapter presents the structure of the PAM methodology and discusses the economic indicators by which reforms are measured. This chapter is divided into four major sections; (i) an illustration of the PAM matrix; (ii) the modelling of PAM economic indicators, in which six indicators are of major concern; (a) Private Cost Ratio (PCR); (b) Domestic Resource Cost (DRC); (c) Nominal Protection Coefficient for Outputs (NPCO); (d) Nominal Protection Coefficient for Inputs (NPCI); (e) Profitability Coefficient (PC); (f) Subsidy Ratio to Producer (SRP); (iii) data and tables needed to conduct the PAM; (iv) an illustrative numerical example of constructing a PAM matrix.

Chapter 5 presents the type of data created for the purpose of PAM manipulation and the methodology use for estimating the social (world) reference prices for major agricultural commodities and inputs. The chapter is divided into 5 main sections (i) estimating the shadow exchange rate; (ii) estimating the parity price for traded outputs such as cotton, maize, sugar cane, wheat, soybean, broad bean, rice, potatoes and tomatoes; (iii) estimating the parity prices for traded inputs such as fertilisers (nitrogenous, phosphates and potash), pesticides and seeds; (iv) estimating parity prices for non-traded inputs such as irrigation water, land, labour, animal work and manure; (v) estimating parity prices for farm machinery such as tractors and water pumps.

Chapter 6 reports on the results of the estimation of measures such as the private cost ratio (PCR) and comparative advantage using domestic resource cost (DRC), net private profitability (NPP), net social profitability (NSP),and social cost benefit (SCB) for major commodities. This chapter also makes a comparison with the results of comparative advantage estimates made by other researchers. The final section of chapter 6 investigates whether reform has generally improved private profitability and the efficiency of agricultural production.

Chapter 7 is concerned with assessing the Egyptian protection policies and their effect on major agricultural commodities and inputs, using the various nominal and effective protection coefficients (NPCO, NPCI and EPC). The final section of chapter 7 makes a comparison with protection coefficient estimates made by other researchers.

Chapter 8 assesses the Egyptian agricultural policies and their effect on producers, using the profitability coefficient (PC) and the subsidy ratio to producer coefficient (SRP).

Chapter 9 bridges the gap in the partial equilibrium nature of the PAM analysis by linking the results obtained from the PAMs in a way that allows us to analyse and predicts the impacts of changes in policy. The final section of the chapter estimate the impact of introducing water charges on the profitability (as measured by the PCR) and hence the area planted to each crop in Egyptian agriculture.

Finally, chapter 10 presents a summary of the major results from the previous chapters and makes some recommendations.

Chapter II

Chapter II: The Egyptian Agricultural Sector

2.1 : Introduction:

The perceived importance of the agricultural sector was shared by most economies all over the world until the start of the industrial revolution in the nineteenth century, when industrialisation was seen as the key to economic development in most economies, especially in the developed countries. In most underdeveloped economies agriculture is still considered one of the important sectors in the economy. This is particularly true in Egypt, which has traditionally relied heavily on the agricultural sector as a source of finance for economic development programmes. In addition, it is the main supplier of raw materials needed for the industrial sector as well as the principal source of the population's food requirement.

The main aim of this chapter is to discuss the importance and contribution of the agricultural sector in the Egyptian economy, as well as the development of domestic production and yields of the major crops. Hence, section two discusses the size of the population and the labour force in the Egyptian agricultural sector. Section three presents a short description of Egypt's agricultural sector: the current cropping pattern, the rotation system, trends in planted areas, yields and production, production costs, farm gate prices and relative profitability for major crops. Section four draws on the main findings of all the previous sections.

2.2 : The Role of the Agricultural Sector in the Egyptian Economy

2.2.1 : Agricultural land, population and employment

Although Egypt's total land area (100,145 thousand hectare) is three times more than that of the United Kingdom (24,299 thousand hectare), the arable land in Egypt constitutes only 2.5% of the whole (compared with 28.3% in UK), the rest of land area being desert. Despite the proportion of arable land to total area in the UK being over eleven times that of Egypt, the agricultural sector in Egypt is considered one of the most important sectors in the economy. For example, in satisfying the increased population food requirement it is responsible for feeding 64 million (2000 FAO estimate). Also, it makes a significant contribution to employment, GDP, and exports (as will be discussed below).

The majority of the cultivated area in Egypt is restricted to the Nile Valley and the Delta area. Total agricultural land is distributed among "Old Land", comprised of the Nile River Valley and the Delta (72 percent of the total), "New Land" or reclaimed lands (25 percent of the total), and the small proportion consisting of rainfed areas and oases.

Agriculture is still a central source of employment and gross domestic product (GDP). The Egyptian agricultural population has been estimated at 31 million (1980-2000 average) which constitutes 45% of the total population (see Figure 2-1). It is the second main economic sector in terms of employment, using 37% of the country's labour force during the same period (see Figure 2-2).

In contrast, the employment shares of industry and services increased from 20.1% and 35.7% in 1980 to 22.3% and 47.9% in 1998 respectively. In this respect, El-Ashry (1992) stated that "historical observation has suggested that this contribution of labour by agriculture to other sectors of the economy is a key requirement for development and modernisation. It is certainly true that the proportion of the labour force in agriculture has generally declined with time and development".

FIGURE 2-1: DISTRIBUTION OF POPULATION DURING THE PERIOD 1980-2000

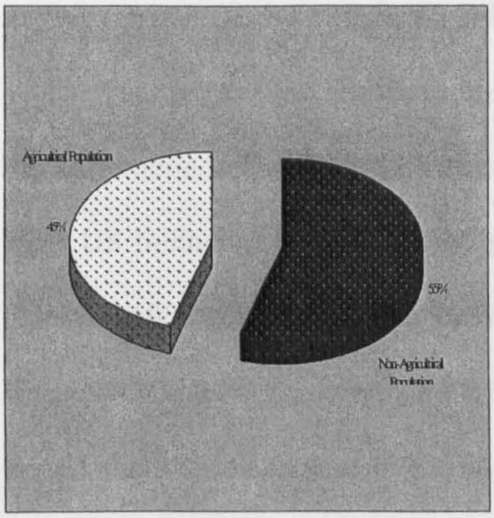
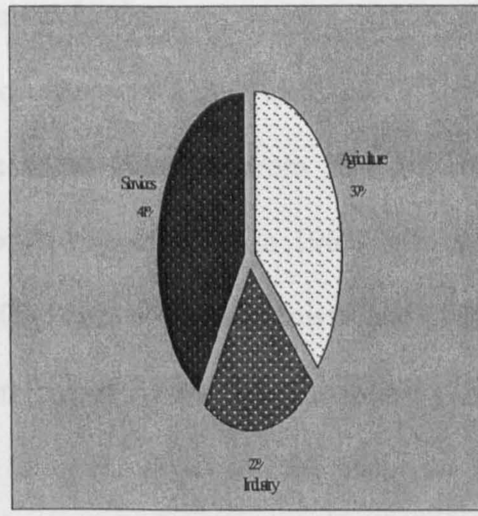


FIGURE 2-2: DISTRIBUTION OF EMPLOYMENT BY SECTORS DURING 1980-2000



Source: World Development Indicators CD-ROM 2002, The World Bank.

TABLE 2-1: PERCENT OF EMPLOYMENT BY MAIN ECONOMIC SECTORS

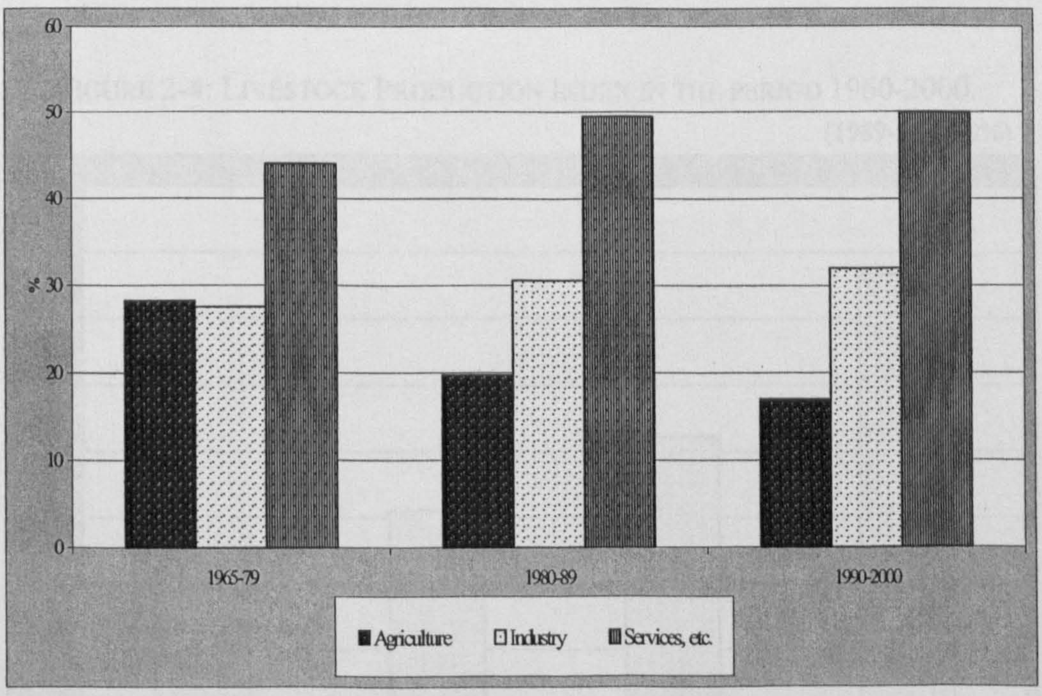
Year	Agriculture	Industry	Services
80	42.4	20.1	35.7
81	40.3	21.9	36.0
82	39.1	21.9	37.6
83	41.0	21.2	36.2
84	40.6	20.1	36.2
85	Na	Na	Na
86	Na	Na	Na
87	Na	Na	Na
88	Na	Na	Na
89	42.4	20.7	36.8
90	39.0	20.7	40.1
91	31.3	24.8	43.8
92	38.4	21.5	40.1
93	35.3	21.7	43.0
94	35.2	21.5	43.3
95	34.0	21.9	44.1
96	Na	Na	Na
97	31.3	22.2	46.2
98	29.8	22.3	47.9
99	Na	Na	Na
2000	Na	Na	Na

Source: World Development Indicators CD-ROM 2002, The World Bank.

Figure 2-3 shows that the share of agriculture in GDP fell from 28% in (1965-79) to 20% and 17% in the 1980s and 1990s. Rapid growth happened in the industrial[1] and services sectors and consequently their shares in GDP formation increased. For example, the share of industry in GDP rose from 28% in 1965-79 to 30% and 33% in the 1980s and 1990s.

The share of the service sector rose from 44% in 1965-79 to 50% over the same period. The agricultural value added increased from 5.06 (constant 1995 US billion $) with an annual growth rate of 2.4% in 1965-79 to 9.56 (constant 1995 US billion $) in 1990-2000 with an annual growth rate of 3%. Hence although agricultural production has risen considerably during this period, there has been a relative decline in the importance of the sector, as it is typically the case in developing economies.

FIGURE 2-3: THE COMPOSITION OF GDP BY MAIN ECONOMIC SECTORS (AGRICULTURE, INDUSTRY AND SERVICES) IN THE PERIOD 1965-2000.



Source: World Development Indicators CD-ROM 2002, The World Bank.

[1] Including the petroleum sector.

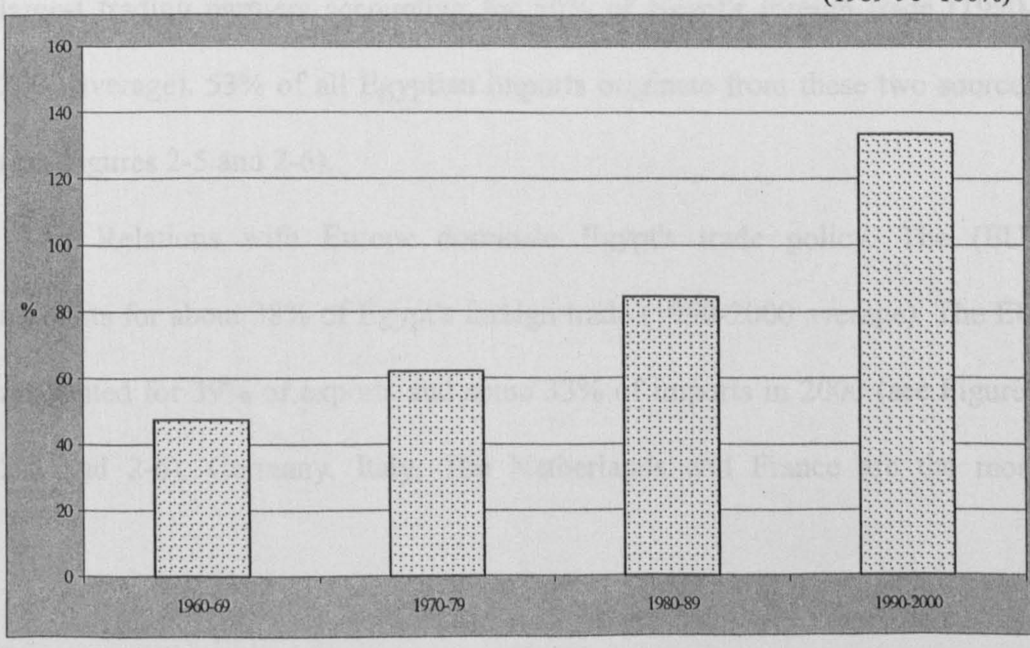
2.2.2 : The Importance of Livestock in the Egyptian Agriculture

The value added of the agricultural sector during the 1990s is estimated at about £E 10 (constant 1995 US billion $), nearly 25% of which is contributed by livestock sector. The majority of livestock and poultry production is relatively intensive and produced in a smaller, subsistence oriented farms in the Delta region (while other parts of the country are desert and therefore can not support natural forage for intensive grazing). These farms provide about 80%, 90% and 70% respectively of the produced beef, milk and dairy products and mutton.

To keep pace with human population growth, the livestock production index had almost tripled by the 1990s compared to the 1960s (see Figure 2-4). In addition, livestock (during the last two decades) are no longer used extensively for animal power as before and most production have been sold for slaughter. Irrigation water is now pumped by electric and diesel engines.

FIGURE 2-4: LIVESTOCK PRODUCTION INDEX IN THE PERIOD 1960-2000.

(1989-91=100%)



Source: Table A2-1

Livestock and poultry compete with crop production for direct food use because they consume maize, barley, wheat and pulses. Livestock also compete directly for land because during the winter a large portion for land is devoted to berseem, which could be used to produce other competitive crops such as wheat, broad beans or other winter vegetable crops (De Boer et al, 1996).

2.2.3 Trade performance.

2.2.3.1 : Merchandise trade by partner (1990-2000).

Egypt has been the centre of trade and enterprise in the Middle East region for centuries owing, in part, to its excellent location. Being situated between Africa, Asia and Europe makes it the crossroads between the East and the West. However, the contribution of Egyptian exports to the world economy is relatively small, falling from about 0.2% in the mid-eighties to 0.1% in 1990 and further to 0.07% in 2000 (see -- 2-1).

The European Union (EU) and the United States (US) are Egypt's largest trading partners accounting for 50% of Egypt's foreign trade (1990-2000 average). 53% of all Egyptian imports originate from these two sources (see Figures 2-5 and 2-6).

Relations with Europe dominate Egypt's trade policy. The (EU) accounts for about 38% of Egypt's foreign trade (1990-2000 average). The EU accounted for 39% of exports and some 33% of imports in 2000 (see Figures 2-5 and 2-6). Germany, Italy, The Netherlands and France are the most

FIGURE 2-5: GEOGRAPHICAL DISTRIBUTION OF EGYPTIAN IMPORTS IN 1990 AND 2000

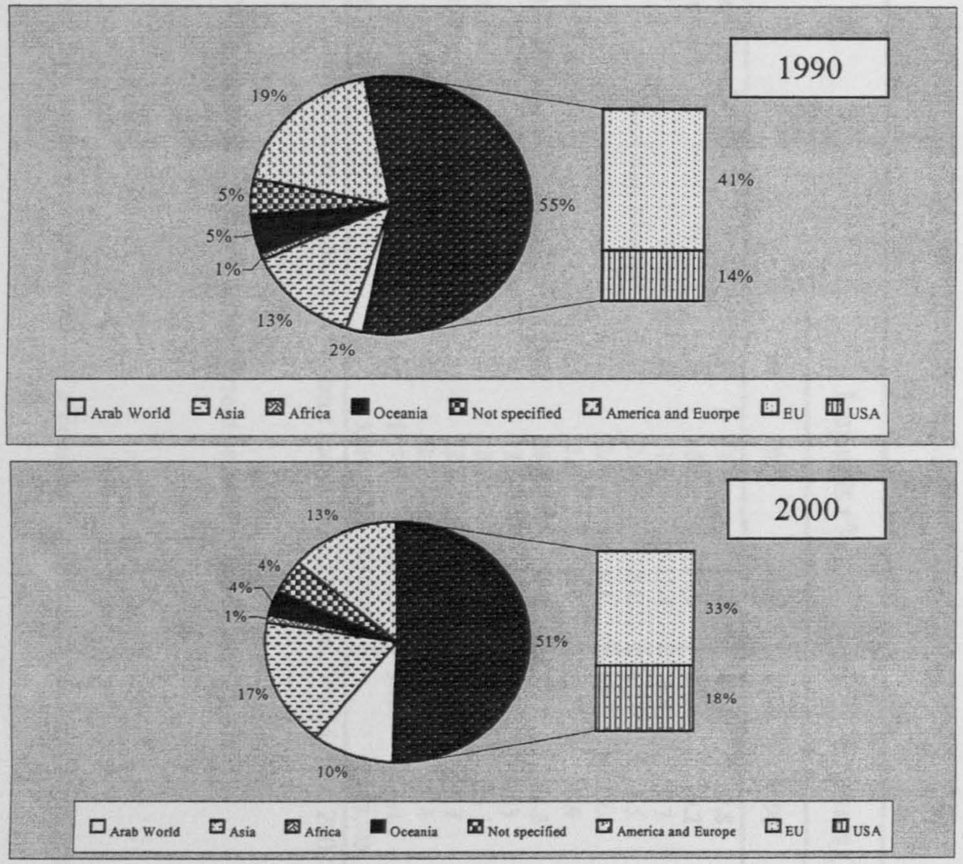
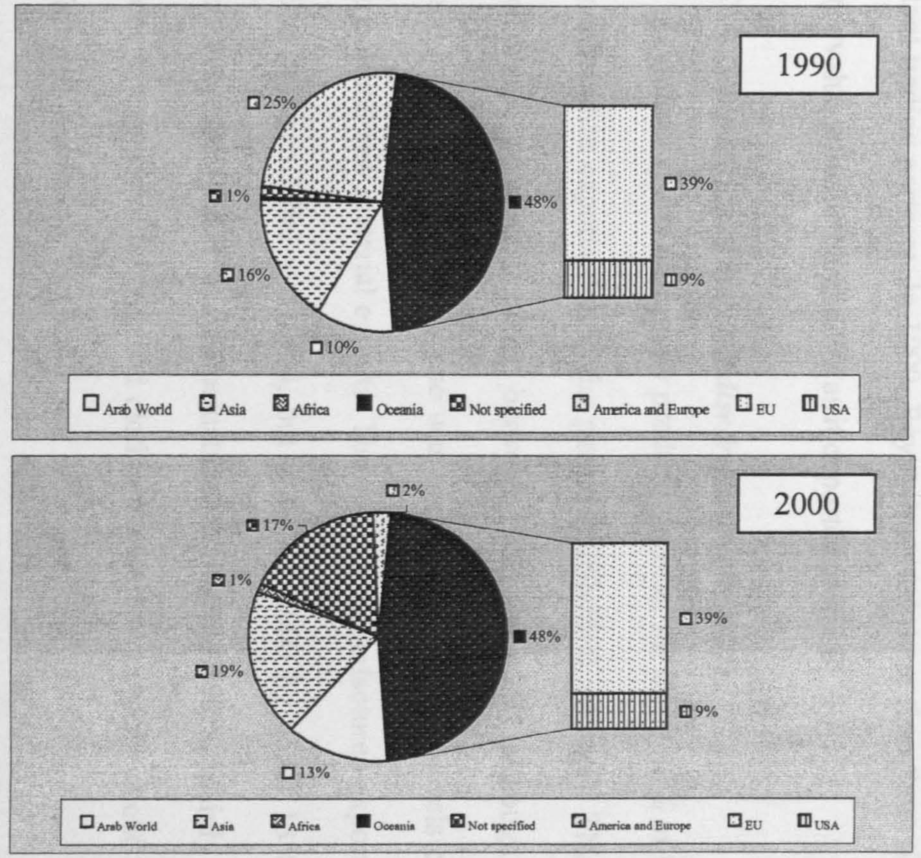


FIGURE 2-6: GEOGRAPHICAL DISTRIBUTION OF EGYPTIAN EXPORTS IN 1990 AND 2000



Source: Table A2-2.

important trading partners. In 1990, Egypt imported more than three times as much (in value terms) from the EU as it exported to the EU[2].

2.2.3.2 : Composition of merchandise trade (1980-2000).

Egyptian exports of primary products account for about 68% of Egypt's total merchandise exports during the period (1980-2000 average). This share declined by 31 percentage points between 1980 and 1990, although it has stabilised subsequently. The decline was mainly due to lower levels of fuels and agricultural raw material exports. The share of manufactured exports grew by 289% between 1980 and 1990, but it fell in 2000 by about 13%; such exports have experienced sharp fluctuations during the 1990s, mainly due to variations in exports of textiles and clothing, which account for about 50% of manufactured exports.

TABLE 2-2: COMPOSITION OF EGYPTIAN TRADE (1990-2000)

	Imports (%)			Exports (%)		
	1980	**1990**	**2000**	**1980**	**1990**	**2000**
Primary Products	**41.0**	**43.7**	**41.0**	**89.1**	**57.8**	**58.1**
Agriculture	**38.6**	**38.7**	**31.9**	**22.4**	**19.2**	**16.8**
Food	32.4	31.5	22.8	6.8	9.7	8.9
Agricultural Raw Material	6.2	7.1	4.4	15.6	9.5	7.9
Fuels	**1.1**	**2.6**	**6.1**	**64.2**	**29.4**	**36.9**
Ores and metals	**1.3**	**2.4**	**3.0**	**2.5**	**8.9**	**4.4**
Manufactures	**59.0**	**56.3**	**59.0**	**10.9**	**42.5**	**37.1**
Chemicals		12.6	11.6		4.3	6.6
Manufacture goods by materials		18.7	15.0		36.1	17.3
Machinery & Transport equipment		22.8	25.3		0.7	1.1
Miscellaneous Manufacture		2.2	7.1		1.4	12.1
Total ($ Mn)	**4,860**	**11,738.9**	**13,963.7**	**3,046**	**3,444.1**	**4,706.5**
World ($ Mn)		**3,516,422**	**6,565,299**		**3,432,703**	**6,355,992**

Source: Calculated from: World Development Indicators CD-ROM, World Bank 2002.

: ESCWA 2002

Note: Components may not sum to100 percent because of unclassified trade.

[2] In 1990, Egyptian imports from the EU accounted for 3861.2 million US$ while exports to the EU were estimated at 991.7 million US$.

Egypt's main imports are machinery and transport equipment, whose share comprises about 41% of manufactured imports and almost 24% of total imports (1990 and 2000 average). Food product imports declined from 32.4% in 1980 to 31.5% in 1990, and further to 22.5% in 2000, primarily reflecting slower growth in the volume of food imports.

2.2.3.3 : Agricultural trade performance (1960-2000)

The Egyptian agricultural trade balance was in surplus during the period (1961-73) that Egypt had a controlled economy[3], estimated at US$ 172 million and since then it has experienced a record agricultural trade deficit from the mid- 1970s (when Egypt adopted the "*Open Door Policy*") until now (see Figure 2-7).

This agricultural trade deficit is a direct result of the dramatic growth in food imports, particularly wheat and wheat flour imports, which increased during the period 1974-80 by an average of £E 251 million, equivalent to about five times the average of the period 1960-73. This is presumably in part due to the rapid increase in population (2.8% annual growth) which was well in excess of the 2% growth in agricultural output. This means that the domestic production of major crops, especially wheat, failed to meet the growing demand for food. Consequently, imports increased and the rate of self-sufficiency rapidly declined (Al-Ashry, 1992).

Figure 2-7 shows the trend of agricultural imports and exports over the period 1960-2000. The agricultural trade deficit grew from US$ 1712 million

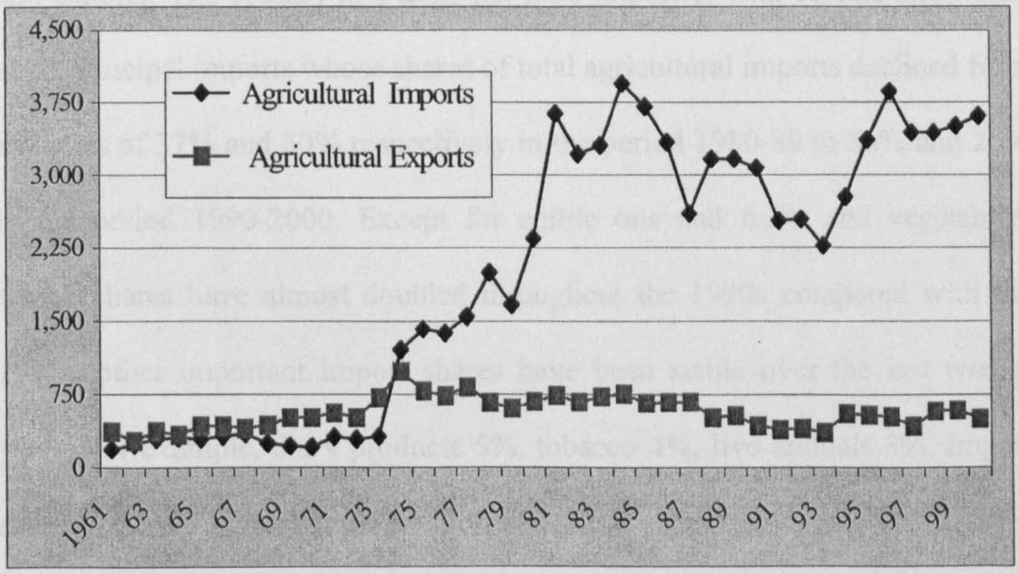
[3] Greater detail about the Egyptian agricultural policies including the "*Open Door Policy*" will be given in Chapter 3

in 1974-85 to US$ 2473 and further to US$ 2651 million in 1986-89 and 1990-2000 respectively.

Table 2-3 shows the relationship between agricultural and aggregate Egyptian trade over the period 1960-2000. The share of agricultural exports decreased throughout the last three decades. It fell from 71% in the 1960s to about 55% in the 1970s and further to 23% in the 1980s, reaching 14% in the 1990s. This fall in the agricultural share is presumably due to the severe intervention in agricultural sector and the consequences that resulted (greater detail concerning the ways and methods of interventions and its effects will be given in Chapter 3).

FIGURE 2-7: AGRICULTURAL IMPORTS AND EXPORTS TRENDS IN EGYPT DURING 1960-2000

(US$ million)



Source: FAO TradeYearbook, several issues.

The share of agricultural imports in total imports is more stable than that of exports, fluctuating around 30% throughout the period, although as Table 2-3 reveals, there was a slight decline in the 1990s, both in absolute terms and relative to total imports. The fall in the agricultural import share may be explained by the considerable growth in crop yields for important cereal and grain imports; for example, wheat yield increased by 50% in the 1990s compared to its level in the 1980s.

TABLE 2-3: TOTAL AND AGRICULTURAL IMPORTS AND EXPORT IN EGYPT IN THE PERIOD 1960-2000

(US$ MILLION)

Year	Agricultural Imports (1)	Total Imports (2)	% (3)*	Agricultural Export (4)	Total Exports (5)	% (6)**
1960-69	275.11	822.33	34	394.67	558.89	71
1970-79	1035.20	2897.40	36	688.90	1321.60	55
1980-89	3243.70	8617.40	38	662.30	2921.20	23
1990-2000	3129.73	11575.36	28	479.09	3474.0	14

* Column (3) = Column (1) / Column (2)
** Column (6) = Column (4) / Column (5)
Source: World Development Indicators CD-ROM 2002, The World Bank.

2.2.3.4 : Composition of Agricultural Trade (1980-2000).

Figures 2-8A and 2-8B describe the composition of agricultural imports and exports. The country is a large net food importer, with cereals and wheat as its principal imports whose shares of total agricultural imports declined from averages of 37% and 30% respectively in the period 1980-89 to 36% and 25% in the period 1990-2000. Except for edible oils and fruits and vegetables, whose shares have almost doubled throughout the 1990s compared with the 1980s, other important import shares have been stable over the last twenty years. For example, dairy products 5%, tobacco 4%, live animals 3%. Import shares for meat and meat preparation and sugar varied between 6-7%, and for coffee, tea and cocoa between 3% and 4%.

Egypt's exports of agricultural products in general have declined in value in the 1990s compared with the 1970s and 1980s. This decline is mainly due to the dramatic decline in textile exports, which fell by 56% between the 1980s and 1990s as a result of both lower cotton output production and lower prices. For example, the share of cotton exports in total agricultural exports fell

FIGURE 2-8A: IMPORTS OF AGRICULTURAL PRODUCTS DURING 1980-2000

1980-89 1990-2000

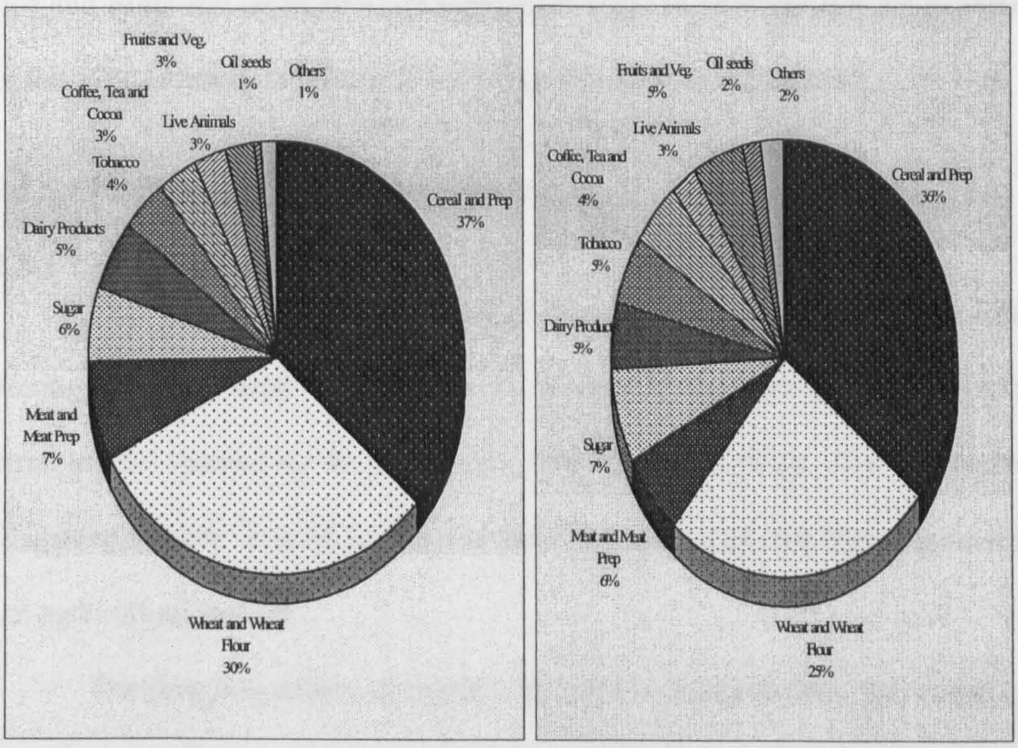
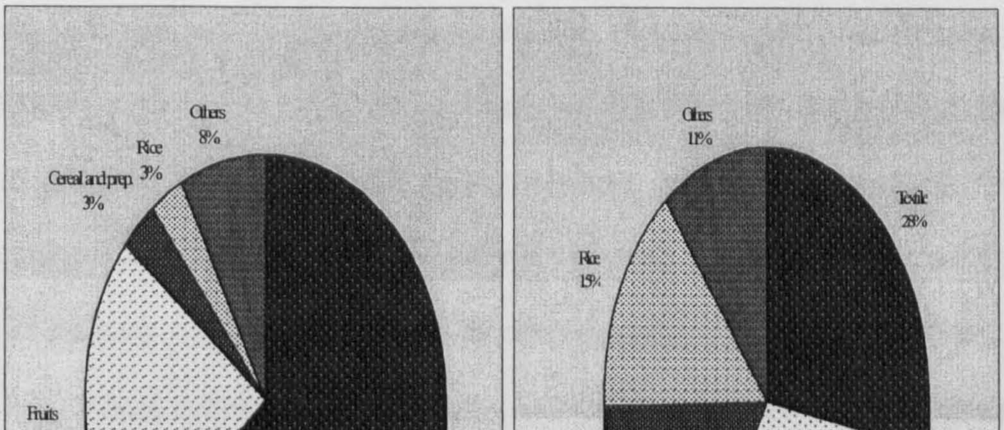


FIGURE 2-8 B: EXPORTS OF AGRICULTURAL PRODUCTS DURING 1980-2000

1980-89 1990-2000



Source: Calculated from FAO Trade Yearbook, Several issue from 42% in 1994 to about 25% in 1997. In contrast, cereals and preparation, rice and fruits and vegetables expanded their share in total agricultural exports in the 1990s relative to the 1980s by 13%, 12%and 8% respectively.

2.3 : Features of Egyptian Agriculture.

2.3.1 : The Cropping Pattern

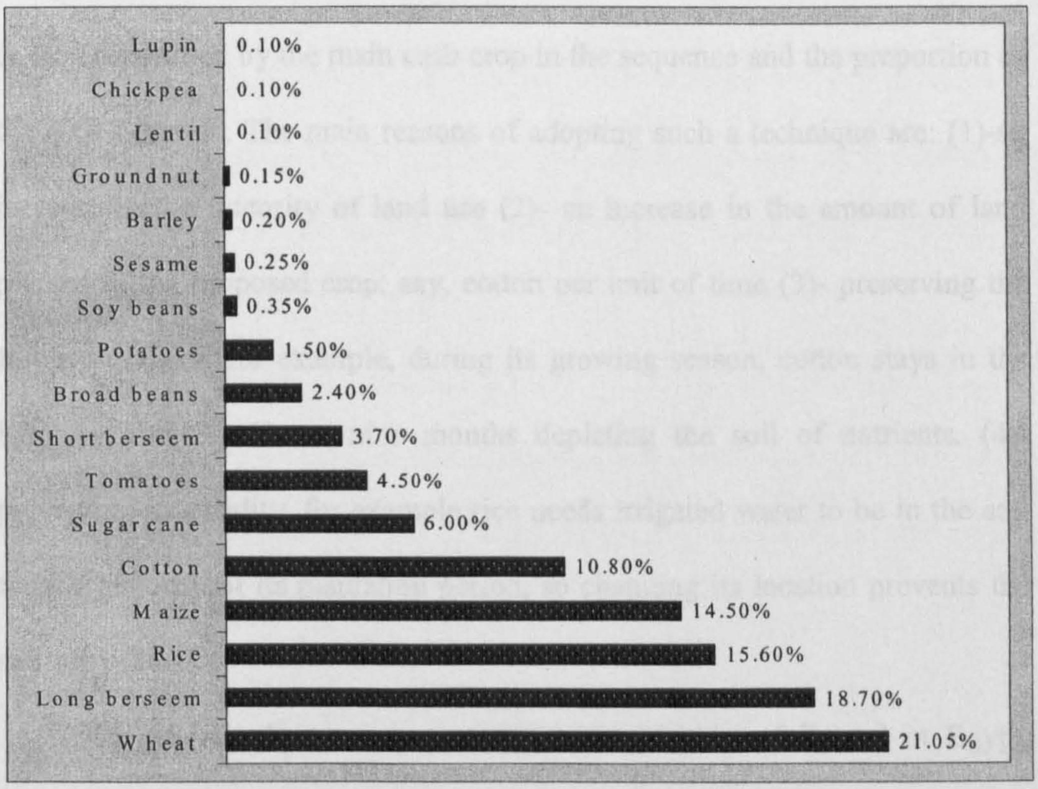
The *"Cropping Pattern"* refers to the allocation of the cultivated area among different crops. The crop mixes, as well as the area devoted to each crop, are determined by the cropping system and crop yields. The *"Optimum Cropping Pattern"* is used to describe that combination of crop that maximises net agricultural income.

The cropping pattern in Egypt is affected by many factors, for example, the limited agricultural land area and water resources, the small sizes of farms (due to fragmentation), in addition to some technical factors (crop rotations) and other factors concerning governmental plan and agricultural policy (Hassan, 1991). With a cropping intensity of approximately 180 percent, the cropped area totals around 5.7 million hectares (13.6 million feddan). The estimated 3.5 million farmers cultivate an average 2 feddan (approximately 0.84 hectare) each; almost half of them cultivate only 1 feddan (Nassar, 1996).

About one third of Egypt's total cultivated area is devoted to perennial crops such as fruits and sugar cane, while the rest is double-cropped and divided evenly between winter and summer crops. The main crops are wheat and berseem (clover) in winter, and cotton, rice and maize in summer. Vegetable and fruit production has also been growing in importance.

Figure 2-9 shows that the most important crops in Egypt are ranked[4] as follows; wheat, long berseem, rice, maize, cotton, sugarcane, tomatoes, short berseem, broad beans, potatoes, soybean, sesame, barley, groundnut, lentil, chickpea, and lupine. Five crops (wheat, long berseem, rice and maize cotton) compromised about 81% of total crop value and 58% of the total planted area in the period 1986-2000.

FIGURE 2-9: THE IMPORTANCE OF MAJOR CROPS IN EGYPT AS A PERCENT OF TOTAL CROP VALUE IN THE PERIOD 1986-2000



Source: Calculated from data obtained from Agricultural Statistics Bulletin, Ministry of Agriculture and Land Reclamation, Statistics Unit, Several issues.

2.3.2 : The Rotation System

The major cropping seasons are the winter (November-May) and summer (May-October) seasons. Another, marginal, season is the Nile season or late summer season (August-October), named after the annual Nile flooding of the past, (Kotb et al., 2000). The Egyptian agricultural year starts in October

[4] On the basis of crop output value and area planted

and continues until the following September. For example the cropping season for 2003 started from October 2002 and ended in September 2003. During each year, the land is cultivated twice, by a winter crop then followed by a summer crop.

Crop rotation is defined as the sequence of crops planted during the cropping season of the year, as well as during a determined number of succeeding years. There are various crop rotations followed in the Nile Valley and Delta areas depending on the soil type and crop choice. Rotations are commonly named by the main cash crop in the sequence and the proportion of the area it covers. The main reasons of adopting such a technique are: (1)-an increase in the intensity of land use (2)- an increase in the amount of land planted to the proposed crop, say, cotton per unit of time (3)- preserving the fertility of land (for example, during its growing season, cotton stays in the land for about seven to nine months depleting the soil of nutrients. (4)- preventing its solidity, for example rice needs irrigated water to be in the soil for the majority of its plantation period, so changing its location prevents the solidity of land.

In general, there are two main rotation systems followed in Egypt, either a three or a two-year rotation. The more intensive is the use of land, the more likely it is that there will be a switch from a three to a two-year crop rotation.

Although there are numerous, slightly differing descriptions of the rotations, the following gives a guide to how a three-year cotton rotation works, where the cultivated land is divided into three more or less equal portions.

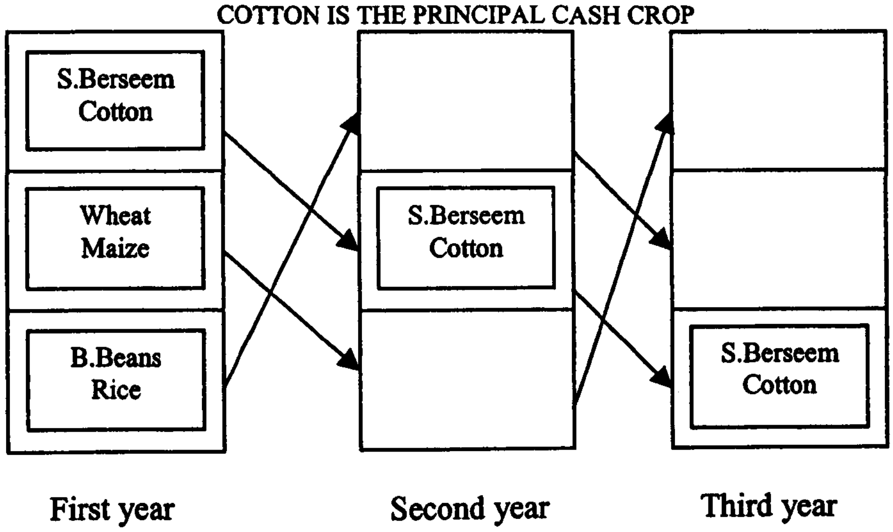
First block	In winter →	Short berseem
	In summer →	Cotton
Second block	In winter →	Wheat
	In summer →	Maize
Third block	In winter →	Broad beans
	In summer →	Rice

In the *first year* of rotation, the first block is planted with a winter fodder crop, say short berseem, and after two cuttings this is followed by cotton as a summer crop. During this time, the second block is devoted to wheat in winter, replaced by maize. The third block is planted by broad beans in winter, replaced by rice in summer.

In the *second year* of rotation, what was planted in the first block is planted in the second block, and what was planted in the second block is planted in the third block, and what was planted in the third block is planted in the first block.

In the *third year* of rotation, what was devoted in the second block is planted in the third block, and what was planted in the third block is devoted to the first block, while what was planted in the first block is planted in the second block. This is illustrated in Figure 2-10 below.

FIGURE 2-10: A DIAGRAM FOR A THREE-YEAR ROTATION SYSTEM WHERE COTTON IS THE PRINCIPAL CASH CROP



The second most prevalent rotation is a two-year rotation, which has the same way and methodology as a three-year rotation. The only difference is that its period is two years only.

Apart from the period of rotation, the adopted rotation varies from region to region according to the crops grown and climatic, soil and geographical requirements. For example, in the northern Delta region, rice is the predominant summer crop followed by winter cereals and legumes. While in southern Delta and Middle Egypt, maize is the dominant summer crop followed by wheat and legumes in winter. As we move south to Upper Egypt, sugar cane replaces cotton as a cash crop. Based on this overall set-up of crop sequences, the major field and vegetable crops cultivated are cotton, maize, rice, sugar can, soybean, wheat, broad beans, tomatoes, potatoes, long and short season clover. The corresponding possible crop rotations are: wheat-maize, wheat-rice, broad bean-maize, broad bean-rice, short berseem-cotton, long berseem-rice, long berseem-maize, potatoes-maize, tomatoes-maize, potatoes-soybean, long berseem-soybean, wheat-soybean, tomatoes-soybean, and sugar cane.

2.3.3 : Cultivated Area, Yields and Production[5].

The annual growth in the arable land area has been very small in the last four decades[6], so the changes that have occurred in the planted area of a certain crop mainly reflect the reallocations of land from one crop to another. Table 2-4 shows the trend in area devoted to production of the major field and

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[5] This part is aimed to give a general picture for the area, productivity and production pattern of major crops planted in the Egyptian agricultural sector. However, greater details about the impact of the reform era for the above mentioned crop output level and productivity will be discussed at the end of the next Chapter.

[6] The annual growth rate for arable land area during the period 1961-1999 is estimated at -0.005%.

TABLE 2-4: AREA, YIELD AND PRODUCTION AVERAGE S OF MAJOR CROPS IN EGYPT IN THE PERIOD 1980-2000

Crop		1980-89 I	90-95 II	96-00 III	Change II-I	Change III-I	% Change II/I	% Change III/I
Wheat	Area	1.33	2.01	2.43	0.68	1.10	50.81	82.99
	Yield	1.65	2.34	2.64	0.69	0.99	41.89	59.95
	Production	2.21	4.69	6.41	2.48	4.21	112.64	190.73
Long berseem	Area	1.78	1.68	1.72	-0.10	-0.06	-5.49	-3.55
	Yield	24.52	25.80	26.94	1.28	2.42	5.22	9.89
	Production	43.61	43.42	46.38	-0.19	2.77	-0.43	6.36
Rice	Area	0.97	1.23	1.47	0.26	0.51	27.30	52.30
	Yield	2.45	3.23	3.63	0.78	1.18	31.85	48.27
	Production	2.37	3.99	5.36	1.63	2.99	68.66	126.24
Maize	Area	1.40	1.65	1.66	0.24	0.25	17.18	17.80
	Yield	2.05	2.67	3.19	0.62	1.14	30.12	55.65
	Production	2.89	4.40	5.28	1.51	2.39	52.21	82.74
Cotton	Area	1.06	0.82	0.83	-0.24	-0.24	-22.74	-22.21
	Yield	1.02	0.99	0.96	-0.03	-0.07	-3.20	-6.37
	Production	1.09	0.81	0.79	-0.28	-0.30	-25.85	-27.31
Sugar cane	Area	0.26	0.28	0.30	0.02	0.04	8.87	16.91
	Yield	37.79	44.43	48.03	6.64	10.24	17.58	27.11
	Production	9.77	12.51	14.49	2.73	4.72	27.96	48.28
Tomatoes	Area	0.15	0.15	0.16	0.00	0.01	-0.98	9.25
	Yield	8.68	12.79	16.40	4.11	7.72	47.38	89.03
	Production	1.32	1.88	2.69	0.56	1.37	42.15	103.48
Short berseem	Area	0.88	0.72	0.66	-0.16	-0.22	-18.17	-25.01
	Yield	9.38	10.63	11.85	1.24	2.47	13.22	26.30
	Production	8.27	7.65	7.82	-0.61	-0.45	-7.44	-5.42
Broad beans	Area	0.28	0.31	0.33	0.02	0.05	8.55	16.51
	Yield	1.02	1.08	1.25	0.06	0.23	5.81	23.03
	Production	0.29	0.33	0.42	0.04	0.13	13.40	42.95
Potatoes	Area	0.09	0.09	0.06	-0.01	-0.03	-6.39	-33.42
	Yield	8.04	7.67	8.22	-0.37	0.18	-4.63	2.28
	Production	0.77	0.68	0.52	-0.09	-0.25	-11.18	-32.82
Soy beans	Area	0.12	0.07	0.03	-0.05	-0.09	-41.23	-75.31
	Yield	1.14	1.15	1.11	0.01	-0.02	0.70	-2.02
	Production	0.13	0.08	0.03	-0.05	-0.10	-41.17	-75.90

Source: Calculated from tables A2-3, A2-4 and A2-5
Area in million feddan, Yield in ton per feddan and Production in million ton.

vegetable crops. It also shows the development of yield (productivity) per feddan as well as the volume of production of these major crops during the period 1980-2000. This period is classified into three periods, the first (1980-89) covers the pre-reform and the early stages of the reform era, while the post-reform era is classified into two periods (the second 1990-95 and the third 1996-2000) to capture the development of reform happened over time.

Policy reform had a significant recuperating effect on the agricultural sector, but crops were not affected equally. Some grew, others declined, depending on the way which policy affected them. The areas of the major cash crops, wheat, rice and maize, increased significantly in the third period (1996-2000 average) compared to the first period (1980-89 average), by about 83%, 52% and 18% respectively. The shift in the cultivated areas of these crops that occurred during the reform period can be partly explained by the relatively high and increasing profitability and yields of those crops. For example, wheat and rice profitability increased by 226% and 86% in the 1990s. This reflects the correction of the previously overvalued exchange rate and the artificially low farm procurement prices that increased the rice-cultivated area in the 1990s (Khedr et al., 1996).

Cotton acreage fell sharply by 22% in the same period, which can be explained by the downward trend in cotton yields as well as the uncertainty created by the world cotton price decline in 1991- 93. In this respect, Nassar (1996) stated that " *In 1991, the official export price was reduced by 30%. This adjustment process culminated in a 1993-export price that was less than 50% of the 1991 level. In 1992 and 1993 farm procurement prices were fully 14-30% above border prices. The government, squeezed by these events, found* *itself without sufficient funds to make an initial payment to farmers in 1993. After several months of delay, it made good its commitment to pay farmers a price that exceeded world prices by about 30%. Many farmers chose not to grow cotton because of its uncertainty."* Consequently, the cotton area continued its decline further from 850,000 feddan in 1991 until it reached the bottom in 1995 to record 710,000 feddan.

Besides cotton, other crops with decreasing area trends include short berseem, potatoes and soybean. The cotton and short berseem areas move together as farmers typically grow these crops consecutively on a given tract of land. Soybean is a relatively new crop to Egypt and its area constituted nearly 50,000 feddan in the last decade. The dramatic fall in the soybean area by (75% in 1996-2000 compared with its level in 1980-89) is accounted for by changes in the policy environment. Farmers were subsidised to grow it in the beginning of the 1980s, whereas in the nineties, after the elimination of subsidies, its controlled price, the lack of an efficient marketing system and the mandatory delivery of its production to government-owned mills through the Principal Bank for Development and Agricultural Credit (in order to insure its availability to public mills, while private sector mills have to import their needs of soybean for oil and soybean meal production) led farmers to not grow it and to shift to another profitable crop.

Yields for all the above mentioned crops (except for cotton and soybean) recorded a considerable upward shift during the 1990s (see Table 2-4). Tomato and wheat yields increased during the third period by 89% and 59% respectively, at an annual growth rate in the period 1980-2000 of 5.4% and 3.8% and with an average yield per feddan of 2.0 and 11.7 ton respectively. Statistical analysis reveals that annual average yield growth rates are ranked as follows: maize (3.2%), rice (2.8%), sugar cane (1.9%), short berseem (1.6%), broad beans (1.5%), long berseem (0.7%) and potatoes (0.4%). Cotton and soybean recorded negative growth rates of -0.8% and -0.2% respectively.

Table 2-4 also shows the trends in the volumes of production of major crops during the period 1980-2000. The figures indicate that, compared to the pre-reform era, production of most crops increased in the third period, albeit to different degrees. For some crops, production levels have increased owing to growth in both planted area and productivity. For example the wheat area increased by 83% and at the same time its productivity increased by 60%. The combination resulted an upward shift in total production by 190% between the third and first periods. In contrast, crops such as cotton, which recorded a fall in planted area and productivity by 22% and 6% respectively, experienced a downward shift in production of 27%. The area under long berseem fell by 3.5%, but its productivity increased by 9% and consequently the fall in cropped area was compensated by the increase in productivity, and as a result its production increased by 6.3%.

In sum, there are those crops that are considered winners from the reform (in terms of higher changes in production during the reform era), such as wheat (191%), rice (126%), tomatoes (103%), maize (83%), sugar cane and broad beans (46%) and long berseem (6%). Other crops are losers, such as soybean (-76%), potatoes (-33%), cotton (-27%) and short berseem (-5%).

Volumes of production of major crops during the period 1980-2000 were estimated as a linear function over time to identify their trend of

TABLE 2-5: ESTIMATED PARAMETERS OF LINEAR TREND MODELS FITTED TO VOLUMES OF AGRICULTURAL PRODUCTION DURING THE PERIOD 1980-2000

(QUANTITIES IN 000 TON)

		R^2	Estimated Growth Rate %
Sugar cane	$\hat{Y}_t = 7780.95 + 354.42\ X_t$ *SE* (214.04) (17.05) *t* 36.35** 20.79**	0.96	3.1
Wheat	$\hat{Y}_t = 744.47 + 288.44\ X_t$ *SE* (249.31) (19.85) *t* 2.99** 14.53**	0.92	7.8
Maize	$\hat{Y}_t = 2066.77 + 165.52\ X_t$ *SE* (144.97) (11.55) *t* 14.26** 14.34**	0.92	4.3
Tomatoes	$\hat{Y}_t = 711.00 + 99.36\ X_t$ *SE* (100.07) (7.97) *t* 7.11** 12.47**	0.89	5.9
Rice	$\hat{Y}_t = 1351.49 + 199.36\ X_t$ *SE* (230.25) (18.34) *t* 5.87** 10.87**	0.86	5.5
Soybean	$\hat{Y}_t = 167.23 - 6.77\ X_t$ *SE* (10.50) (0.84) *t* 15.92** - 8.10**	0.78	-9.5
Cotton	$\hat{Y}_t = 1252.32 - 28.67\ X_t$ *SE* (56.32) (4.49) *t* 22.23** - 6.39**	0.68	-2.9
Broad beans	$\hat{Y}_t = 238.34 + 8.54\ X_t$ *SE* (29.97) (2.39) *t* 7.95** 3.58**	0.40	2.5
Short berseem	$\hat{Y}_t = 8577.81 - 53.92\ X_t$ *SE* (234.19) (18.65) *t* 36.63** - 2.89**	0.31	-0.6
Long berseem	$\hat{Y}_t = 42115.15 + 190.94\ X_t$ *SE* (1349.48) (107.47) *t* 31.21** 1.78*	0.14	0.4
Potatoes	$\hat{Y}_t = 800.31 - 10.67\ X_t$ *SE* (94.58) (7.53) *t* 8.46** -1.42	0.10	-2.0

* Significant at 5%, ** Significant at 1%.
't' tabulated at 19 degree of freedom at 5% = 1.72 and at 1% = 2.53
Source: computed from data of table A2-5.

production, as well as, to identify the annual rate of growth (increasing or decreasing) during the last two decades. Table 2-5 presents the results of the estimated parameters. The results indicate growth for wheat, maize, tomatoes rice and broad beans and decline for soybean, cotton, short berseem and long berseem. Comparing these coefficients with their standard errors indicates that all coefficients (except that for potatoes) are statistically significant from zero at the 1 % level of significance[7].

The estimated growth rates of major crops revealed that wheat growth rate accounted the highest rate of 7.8% followed by tomato 5.9% and rice 5.5%. However, this rate varied between 4.3% and 3.1% for maize and sugar cane. The lowest positive growth rate was achieved by long berseem at 0.4%. Declining rates of production recorded 9.5% for soybean compared with 2.9 % to 2% for cotton and potatoes and 0.6% for short berseem.

2.3.4 : Patterns of Costs of Production for Major Crops

The production cost for growing a certain crop is a function of traded and non-traded input costs. By definition tradable inputs are inputs that are traded in the world market while non-tradable inputs are not. It is difficult for the analyst to split these two types of inputs empirically, simply because tradable inputs almost always have some non-tradable component. For example, tractors are tradable but once they are used on the farm the cost item "tractor" will have some non-tradable input component such as labour used in handling, transportation from port to warehouse, and maintenance. Then, except for pure non-tradable inputs such as land, labour, manure and animal

[7] Note however that since the data is 'non stationary', use of t distribution to evaluate statistical significance is inappropriate, and the outcomes should be treated as indicative, not definitive (see later).

work, all other inputs have to be divided into their tradable and non-tradable components (greater details concerning this issue and its calculation will be discussed in Chapter 5).

Non-traded inputs comprise manure, animal work, irrigation water and other primary factors such as land, labour and machinery. Traded inputs are composed mainly of fertiliser, seeds and pesticides. The sum of their costs composes the crop's total production costs. For the whole period 1986-2000, primary factors accounts for about 63% of total domestic costs in Egypt.

Table 2-6 shows the relative importance of agricultural input costs as a percentage of the crop's total cost. In general it reveals that the cost of inputs such as land cost have increased for all crops, though by different amounts. For example the share of land rent in total cost for rice grew from 8.9% in 1986-90 to 31.1% in 1996-2000. This upward shift in land rent percentage is mainly in response to the land rent reform policy adjustments applied in the reform era. Also, fertiliser and pesticide ratio in total cost grew for all major crops (except for soybean)[8]. Fertiliser share in cost grew during the second period (1991-95) compared to the first (1986-90), then stagnated during the third period (1996-2000). The growth in the fertiliser cost ratio is mainly due to land and planting requirements in response to; (1)- the deterioration of land fertility; (2)- to meet the needs of the high yield varieties introduced by Ministry of Agriculture and adopted by growers; and, (3)- to compensate for the fall in manure supplies, especially the nitrogenous component.

[8] **As mentioned earlier in Section 2-3-3 and Table 2-4, soybean growers ignored its production in response to its low profitability.**

TABLE 2- 6: AGRICULTURAL INPUT COST AS A PERCENT OF TOTAL COSTS FOR MAJOR CROPS IN EGYPT IN THE PERIOD 1986-2000

(PERCENT)

		Land	Labour	Machinery	Fertiliser	Seed	Pesticides	Manure	Animal Work	Water	Others
Cotton	1986-90	13.0	52.5	11.2	5.3	0.8	2.0	6.1	1.0	0.0	7.6
	1991-95	22.1	38.1	11.1	9.0	2.2	1.8	4.7	0.3	0.0	7.6
	1996-2000	33.6	29.5	10.2	9.1	2.9	3.4	4.8	0.2	0.0	5.4
	1986-2000	**21.3**	**38.9**	**10.8**	**7.6**	**1.7**	**2.3**	**5.2**	**0.4**	**0.0**	**6.8**
Rice	1986-90	8.9	39.5	26.5	5.3	7.1	1.0	2.1	3.4	0.0	5.5
	1991-95	17.7	26.0	23.2	7.4	11.3	2.6	1.0	2.1	0.0	7.2
	1996-2000	31.1	18.8	21.9	7.0	7.5	3.5	1.2	1.9	0.0	6.2
	1986-2000	**17.0**	**26.8**	**23.8**	**6.4**	**8.4**	**2.1**	**1.3**	**2.4**	**0.0**	**6.2**
Maize	1986-90	10.4	44.1	16.6	10.2	3.4	0.2	7.7	1.3	0.0	5.2
	1991-95	17.4	30.0	16.0	15.6	5.3	0.8	6.1	0.5	0.0	6.4
	1996-2000	28.4	23.6	13.9	13.5	5.9	1.9	5.2	0.2	0.0	5.7
	1986-2000	**17.3**	**31.5**	**15.4**	**12.9**	**4.7**	**0.7**	**6.3**	**0.5**	**0.0**	**5.7**
Soybean	1986-90	9.6	40.1	20.9	9.2	5.6	3.8	4.4	0.3	0.0	5.2
	1991-95	18.7	26.8	23.8	11.0	6.6	2.2	2.5	0.1	0.0	6.5
	1996-2000	31.9	23.6	20.5	9.9	5.4	0.9	1.1	0.0	0.0	5.5
	1986-2000	**17.9**	**29.4**	**21.7**	**10.0**	**5.8**	**1.9**	**2.3**	**0.1**	**0.0**	**5.7**
Potatoes	1986-90	4.4	20.4	7.4	7.8	42.3	4.8	5.3	1.5	0.0	5.4
	1991-95	5.3	13.4	6.6	10.1	46.8	4.8	4.9	0.8	0.0	6.6
	1996-2000	12.4	13.4	6.7	10.8	38.9	4.7	4.5	0.7	0.0	6.4
	1986-2000	**6.6**	**15.4**	**6.9**	**9.5**	**42.5**	**4.8**	**4.9**	**0.9**	**0.0**	**6.1**
Long berseem	1986-90	15.4	49.0	16.2	2.4	9.2	0.0	0.0	1.9	0.0	4.8
	1991-95	25.6	43.1	13.1	2.6	6.0	0.0	0.0	0.4	0.0	6.5
	1996-2000	36.4	33.5	12.8	3.6	5.8	0.0	0.0	0.3	0.0	6.5
	1986-2000	**24.3**	**41.4**	**13.9**	**2.8**	**6.8**	**0.0**	**0.0**	**0.6**	**0.0**	**5.9**

Continued

		Land	Labour	Machinery	Fertiliser	Seed	Pesticides	Manure	Animal Work	Water	Others
Short Berseem	1986-90	15.2	44.2	17.4	0.0	15.4	0.0	0.0	2.8	0.0	4.3
	1991-95	27.4	41.1	13.9	0.0	10.5	0.0	0.0	0.9	0.0	3.2
	1996-2000	40.5	33.0	13.1	0.0	10.1	0.0	0.0	0.5	0.0	2.5
	1986-2000	**25.6**	**39.1**	**14.7**	**0.0**	**11.8**	**0.0**	**0.0**	**1.0**	**0.0**	**3.3**
Wheat	1986-90	14.1	38.4	20.8	8.3	6.0	0.4	4.4	1.3	0.0	5.4
	1991-95	23.4	24.0	19.3	13.4	6.8	0.8	3.2	0.7	0.0	6.7
	1996-2000	36.3	18.3	17.8	10.5	5.2	1.3	2.9	0.3	0.0	6.0
	1986-2000	**22.9**	**25.6**	**19.2**	**10.5**	**6.0**	**0.8**	**3.4**	**0.6**	**0.0**	**6.0**
Broad beans	1986-90	14.0	40.7	19.4	4.5	12.8	0.8	0.3	1.8	0.0	4.6
	1991-95	23.1	26.1	18.4	6.8	12.4	2.5	1.0	0.6	0.0	6.2
	1996-2000	37.2	19.1	16.9	5.9	8.3	3.9	1.3	0.2	0.0	5.5
	1986-2000	**22.9**	**27.3**	**18.2**	**5.7**	**11.0**	**2.0**	**0.7**	**0.6**	**0.0**	**5.4**
Tomatoes	1986-90	4.9	43.0	13.9	8.0	6.9	8.6	7.5	0.6	0.0	5.5
	1991-95	10.7	32.1	12.1	13.4	7.9	9.5	5.0	0.1	0.0	7.3
	1996-2000	18.2	27.4	12.5	12.9	10.1	8.4	3.3	0.1	0.0	6.1
	1986-2000	**9.8**	**33.6**	**12.8**	**11.2**	**8.2**	**8.8**	**5.0**	**0.2**	**0.0**	**6.2**
Sugarcane	1986-90	10.6	42.8	17.9	12.3	6.2	0.4	0.1	0.3	0.0	7.7
	1991-95	17.7	26.9	16.9	18.3	6.3	0.0	0.1	0.3	0.0	11.2
	1996-2000	28.2	21.2	18.9	17.0	4.0	0.0	0.3	0.0	0.0	8.9
	1986-2000	**17.5**	**29.0**	**17.9**	**15.6**	**5.4**	**0.0**	**0.2**	**0.0**	**0.0**	**9.2**

Note: Water cost ratio recorded zero because there is no charge for water, while irrigation costs such as water pump and its labour operation are included in machinery costs.
The Geometric Mean is used to calculate the average percent during the periods 1986-90, 1991-95 and 1996-2000.

Source: Calculated from data obtained from Agricultural Statistics Bulletin, Ministry of Agriculture and Land Reclamation, Statistics Unit, Several issue

On the other hand labour animal work, manure and (to some extent) machinery cost components shares in total costs have continuously fallen for all major crops during the three successive periods 1986-90, 1991-95 and 1996-2000. For example, the share of labour in cotton production costs fell by 23% in 1996-2000 compared with its 1986-90 level. Total labour costs fell 22% for broad beans and sugar cane, 21% for rice and maize, 20% for wheat, 17% for soybean, 16% for tomatoes and long berseem, 11% for short berseem and 7% for potatoes. The downward shift in labour and machinery share is presumably due to two reasons; first, growers were faced by higher costs of land rent, in response to which they did their best to reallocate their resources and reduce other cost factors to maintain a profit margin, and secondly, the newly adopted varieties needed a relatively lower land service and/or planting processes and consequently lower amount of labour and machinery usage.

2.3.5 The Pattern of Farm Gate Prices for Major Agricultural Products.

Prices are one of the most important signals in market operation. On the production side, prices play a central role in directing/determining the type and level of resource allocation, production level (quantity) and the flow of commodities in market channels (FAO, 1999). *:* In this respect, Taskok (1990, p.2) states *'Because prices are both costs and incomes, individuals respond to them in their roles as producers, intermediaries and consumers. Their responses to incentives induced by price policy inevitably shape the process of economic development and the distribution of incomes and welfare'.*

Agricultural price policy is a major instrument of government intervention. For example, the government of Egypt during the 1950s looked to agriculture to play a central, though supporting, role in the development process and took the view that the surplus should be transferred to industry, the prime engine of growth.

The mechanism used to extract and transfer the agricultural surplus was price policy. The government controlled most of the agricultural prices and there were regular government decrees announcing those prices. This price policy covered all tradable inputs and most agricultural outputs (Greater details are given in Chapter 3).

Table 2-7 shows the development of product values at real prices (1986=100) during the period 1980-2000, as well as the annual rate of growth for eleven major crops in Egyptian agriculture during the reform period 1986-2000. The analysis reveals that product values have significantly increased over time for all crops. Furthermore, real price levels increased in the 1990s for cotton, long berseem, wheat, by 297%, 264% and 230% respectively compared with their levels in the 1980s; this upward shift in domestic product prices is a direct result of the elimination of the controlled price policy in the reform era.

Farm gate prices for fodder crops such as long and short berseem, which are in great demand as a major source for feeding animals, recorded the highest annual rate of growth during the period 1986-2000 of 11.8% and 10.5%, followed by cotton (9.5%), rice (9.3%), sugar cane (8.7%), wheat (8.1%), and around 7.5% for potatoes and broad beans, around 6.5% for maize and soybeans and 4.5% for tomatoes.

2.3.6 Major Crops and Profitability

Profitability is the key criterion for growers. It shows the competitiveness of each of the agricultural sectors, taking into account current

TABLE 2-7: REAL FARM GATE PRICES, ANNUAL GROWTH RATE AND TREND OF PRICES FOR MAJOR CROPS IN EGYPT DURING THE PERIOD1980-2000.

(1986=100) £E/TON

	Wheat	Cotton	Rice	Maize	B. beans	Soybeans	Short berseem	Long berseem	Potatoes	Tomatoes	Sugar cane
1980	39	49	33	56	43	56	34	45	54	44	31
81	41	59	40	43	51	61	41	55	57	53	49
82	36	62	53	57	52	69	49	65	53	58	51
83	49	67	53	76	55	69	58	77	74	68	60
84	55	76	53	79	60	76	60	80	89	77	66
85	76	100	86	89	69	76	67	88	89	91	89
1980-85	**49**	**69**	**53**	**67**	**55**	**68**	**52**	**68**	**69**	**65**	**58**
86	100	100	100	100	100	100	100	100	100	100	100
87	98	118	83	116	120	113	155	157	91	103	112
88	106	148	104	148	121	133	129	135	133	127	125
89	194	208	146	185	126	213	142	135	186	132	164
90	211	270	152	195	151	213	171	170	196	168	190
1986-90	**142**	**169**	**117**	**149**	**124**	**155**	**139**	**140**	**141**	**126**	**138**
91	222	328	176	201	192	227	182	198	239	203	190
92	225	334	192	202	208	224	203	227	270	170	191
93	238	383	204	209	219	213	253	288	320	147	238
94	238	335	245	218	219	233	253	288	396	130	266
95	250	559	265	234	229	280	278	323	272	181	295
1991-95	**235**	**388**	**217**	**213**	**213**	**236**	**234**	**265**	**299**	**166**	**236**
96	285	529	284	245	243	280	321	389	286	191	295
97	296	487	290	251	267	280	392	438	294	200	312
98	303	361	293	264	272	280	417	485	278	199	328
99	307	357	295	276	274	280	418	496	280	203	312
2000	309	364	302	294	275	287	454	519	284	201	328
1996-2000	**300**	**420**	**293**	**266**	**266**	**281**	**400**	**465**	**285**	**199**	**315**
1986-2000	**225**	**325**	**209**	**209**	**201**	**224**	**258**	**290**	**242**	**164**	**230**
Annual Growth Rate % (1986-2000)	**8.1**	**9.5**	**9.3**	**6.4**	**7.4**	**6.7**	**10.5**	**11.8**	**7.6**	**4.5**	**8.7**
β	**25.3**	**148**	**42.6**	**26.6**	**62.7**	**48.5**	**7.4**	**6.9**	**21.3**	**13.3**	**62.7**
t_{β}	**11.1****	**4.3****	**17.2****	**14.7****	**16.5****	**8.2****	**16.2****	**17.7****	**4.2****	**5.1****	**16.9****

Source: Calculated from Table A2-6

**Significant at 1% level, in relation to t distribution, but see previous footnote.

technologies, output values, input costs and policy transfers. Profits are defined as total revenues minus total costs. If profit is negative, growers are then earning a sub-normal rate of return and thus can be expected to exit from this activity/sector unless something changes to increase profits to at least normal level. Alternatively, positive profits are an indication of super-normal returns and should lead to future expansion of the sector.

Table 2-8 shows the profitability per feddan for major crops during the period 1986-2000 in constant prices (1986=100). The figures reveal that profitability has increased at various rates during the second period (1990-94 average) and the third period (1995-2000 average) compared with levels in 1986-89 (average) for most major crops. For example, the profitability of cotton increased by 339% during the third period compared with its level in the first period, other increases being around 275% for rice, 218% for long and short berseem, 152% for tomatoes, 117% for sugar cane and around 84% for corn and wheat and 15% for broad bean.

Soybean showed successive falls in its profitability from 160 to 148 and then to 48 £E/Feddan throughout the periods 1986-89, 1990-94 and 1995-2000 respectively. This very low profitability might explain growers' reluctance to plant soybean, its average area falling by 68% throughout 1995-200 compared with 1986-89.

The profitability of potatoes and cotton fell in the third period by 56% and 2% respectively compared with the second period, while in response, their planted areas fell by 17% for the first and increased by 1.2% for the second. The response of potatoes area to low profitability is simply because potatoes responded to market forces since there was no intervention from the government; consequently efficient producers were still producing them despite their relatively low profitability.

TABLE 2-8: DOMESTIC PROFITABILITY FOR MAJOR CROPS DURING 1986-2000

(1986=100) £E / Feddan

Year	Long berseem	Short berseem	Rice	Maize	Tomatoes	Wheat	Sugar cane	Broad bean	Cotton	Soybean	Potatoes
1986	100	100	100	100	100	100	100	100	100	100	100
1987	195	208	48	161	107	118	106	141	113	150	75
1988	157	165	96	263	119	117	133	108	141	115	182
1989	154	164	212	375	88	271	190	145	283	275	336
1990	179	179	253	423	134	308	254	157	438	267	88
1991	209	217	277	388	199	279	196	125	717	324	148
1992	223	240	277	351	133	292	181	107	944	181	185
1993	274	219	224	228	125	232	207	72	1071	-66	144
1994	259	240	347	269	162	209	265	66	419	33	514
1995	309	302	408	230	253	242	301	166	1185	27	139
1996	406	414	467	350	279	329	299	202	1226	141	159
1997	502	477	463	485	266	296	348	251	1147	138	179
1998	529	582	394	316	249	251	297	111	147	-43	10
1999	529	558	419	478	264	311	209	-16	223	16	47
2000	605	637	418	505	255	321	270	138	271	7	30
Average											
(I): 1986-89	**152**	**159**	**114**	**225**	**104**	**151**	**132**	**123**	**159**	**160**	**173**
(2): 1990-94	**229**	**219**	**276**	**332**	**151**	**264**	**221**	**105**	**718**	**148**	**216**
(3): 95-2000	**480**	**495**	**428**	**394**	**261**	**292**	**287**	**142**	**700**	**48**	**94**

Source: Calculated from data obtained from Agricultural Statistics Bulletin, Ministry of Agriculture and Land Reclamation, Statistics Unit, Several issues.

In the case of cotton, the government set floor prices to compensate for the fall in cotton's world price and continuously protected (subsidised) its output (discussed in greater details in Chapter 8). Fodder crops, including long and short season clover were the most profitable crops during the last period, presumably because of the high and increasing demand for their related industry (animal production).

Table 2-9 shows the trend of private profitability for crop rotations. The results reveal that the profitability of most crop rotations improved during the reform era at various rates. The exception was broad beans, followed by potatoes or soybean, where profitability fell by 24% and 14% respectively

TABLE 2-9: DOMESTIC PROFITABILITY FOR DIFFERENT CROP ROTATIONS IN THE PERIOD 1986-2000

(1986=100) £E / Feddan

Year	Wheat & Maize	Wheat & Rice	Wheat & Soybean	Wheat & Potatoes	Broad bean & Maize	Broad bean & Rice	Broad bean & Potatoes	Broad bean & Soybean	S.Berseem & Cotton	L.Berseem & Rice	L.Berseem & Maize	L.Berseem & Soybean	Tomatoes & Soybean	Tomatoes & Maize
1986	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1987	134	85	128	94	148	97	104	143	158	127	184	183	110	112
1988	169	107	116	154	162	102	150	110	152	129	193	146	119	133
1989	308	242	272	308	225	177	254	183	227	181	230	188	102	116
1990	349	282	296	181	249	202	117	188	317	214	263	204	144	162
1991	318	278	292	204	217	197	138	182	482	241	271	242	208	217
1992	313	284	259	230	192	187	151	128	614	248	267	211	137	154
1993	231	228	145	181	126	144	113	33	672	250	258	178	111	135
1994	231	276	158	385	137	199	321	57	335	300	262	195	153	173
1995	238	322	179	183	189	281	151	126	771	355	282	230	236	250
1996	336	395	274	231	253	327	178	184	846	435	387	331	269	286
1997	363	376	250	229	333	351	210	219	833	484	496	399	256	287
1998	274	319	165	112	182	245	54	66	351	466	456	368	227	255
1999	371	363	225	159	156	190	20	-7	380	478	512	384	246	285
2000	386	368	229	153	266	271	77	101	443	518	571	436	237	280
Average														
1986-89	**177**	**134**	**154**	**164**	**159**	**119**	**152**	**134**	**159**	**134**	**177**	**154**	**108**	**115**
1990-94	**288**	**270**	**230**	**236**	**184**	**186**	**168**	**118**	**484**	**251**	**264**	**206**	**150**	**168**
1995-2000	**328**	**357**	**220**	**178**	**230**	**278**	**115**	**115**	**604**	**456**	**451**	**358**	**245**	**274**

Source: Calculated from data obtained from Agricultural Statistics Bulletin, Ministry of Agriculture and Land Reclamation, Statistics Unit, Several issues.

during the third period compared to the first; this is because the profitability of both potatoes and soybeans fell remarkably during the third period (see Table 2-8).

Summary and Conclusion

Major changes have taken place in Egyptian agriculture over the reform era owing to radical reforms introduced successively since 1986. Reform policy changes will be detailed in Chapter 3, but the changes and trends identified here indicate the extent of government intervention that characterised the pre-reform era.

The most noticeable changes are overall increases for most agricultural commodities in terms of production, yields, farm gate prices and private profitability. The most noticeable impact of the reforms is the massive expansion of production of wheat, rice and tomatoes by 191%, 126%, and 103% respectively. In contrast, soybean, cotton and potatoes production volumes fell by 76%, 27% and 33% respectively.

From the above descriptive analysis we can conclude that land area, yields and production for cereal crops such as wheat and rice showed a increasingly upward trend throughout the period 1980-2000, in particular during the reform era 1986-2000.

There was a drop in Egypt's wheat and wheat flour imports, from 30% to 25% of total consumption, (despite the population growth rate of 2.8%) and a rise in rice exports from 3% to 15% of total production in the 1990s (see Tables 2-7A and 2-7B). Cotton production, which is considered the most important exportable crop in Egypt and a major source of foreign currency, has showed a relatively low performance even in the reform era. This is reflected in Egypt's textile exports, which fell from 64% to 28% of total exports during the 1990s, a case that needs more investigation.

Chapter III

Chapter III:

Egyptian Agricultural Policy: A Historical Overview

3.1 : Introduction

During the 1960s, 1970s and the-mid 1980s, Egyptian economic policies focused on diverting the surplus accumulated in the agriculture sector to finance and develop the manufacturing and services sectors. Improvement of the agriculture sector itself tended to be ignored. The policy goal was achieved through government intervention in the production, distribution and marketing of such strategic[1] crops as cotton, sugarcane, wheat, rice, broad beans, maize, sesame, lentils and soybeans.

As Ott (1991) states, *"Ownership of factors of production and organisation of enterprises changed dramatically under the free officers' regime[2]. In the agriculture sector, redistribution of ownership of land was accomplished by decrees, laws and regulations (Agrarian Reform Law of 1952, with Amendments in 1959, 1961, 1963 and 1969). The land reform laws restricted the size of land holding and banned foreign ownership. Land leases and certificates of tenure were regulated and rents controlled. Production co-operatives became compulsory for all private holdings in agriculture. Cooperatives provided inputs (seeds and fertilisers, pesticides and credits) and enforced crop rotations as well as marketing agriculture outputs.*

[1] These crops are considered strategic for the Egyptian economy as they: a- comprises more than 95% of the total cropped area. b- represent the main exportable (as in cotton, rice) and importable crops (as in wheat, sugar soybeans and maize).
[2] The free officers came to power after the1952 rebellion, when King Farouk was forced to leave the country and the country was transformed to a republic with Nasser as the first president of Egypt.

Government intervention in the agriculture sector goes beyond production and marketing of crops to setting up prices and quotas. Essentially, for agricultural products a dual price system holds. Compulsory delivery for government or public sector enterprises at low fixed prices is set for the procurement of seed cotton, wheat, rice, beans, lentils, sesame, groundnuts and sugar cane. Procurement quotas varying between 10 and 100 percent are enforced" p.p195-196.

This severe intervention in the agricultural sector resulted in adverse effects on the production, prices, exports and imports of the Egyptian agricultural sector. By the mid-1980s the government had reassessed and reoriented its agricultural policy toward liberalising the agricultural sector to the extent that in 1986 most of the agricultural crops were liberalised (except sugarcane).

In this chapter, section 2 gives an overview of the Egyptian setting. Three periods are of particular interest. In the first period (1939-52) the Egyptian economy was in general a private market-oriented economy. The private sector contributed 87% of total value added and 95% of total civilian employment. The public sector's role was confined mainly to the provision of basic services such as water, railways, highways and civil administration. However, the agriculture sector was affected by the ramifications of the Second World War, and as a response the government organised a large-scale system of compulsory deliveries for cereal crops and intervened in the cropping pattern. The second period (1952-71), where the Egyptian economy was transformed (under Nasser's regime) from a private competitive economy to a socialised and centrally controlled economy, involved the establishment of a system of production controls upon farmers[3], and co-operatives with controlled input and output prices. The third period, (1971-81) is characterised by the open door policy *'EL-Infitah'*, central elements of which were, first, the liberalisation of (many) imports and of the foreign exchange markets and, second, the provision of incentives and inducements to private domestic and foreign investment. These objectives were expressed in Law 43, promulgated in 1974. Nevertheless, government intervention continued on a large scale in all economic activities. Section 3 offers an insight into the poor performance of the Egyptian economy in 1986; a situation that indicated an economy in crisis in which there needed to be structural changes in policies. Section 4 discusses the economic reform policy adopted in 1986 and the principles of the Economic Reform and Structural Adjustment Programme (ERSAP) that followed. Section 5 gives an overall picture on the agricultural reform policies and their impact on major crops. Section 6 provides a preliminary statistical evaluation of reforms on production of major crops and the main tradable input used (fertiliser). Section 7 summarises and concludes.

3.2 : Egyptian agricultural policy, 1931-1981

3.2.1 : First period: [1939 - 1952]

Prior to the Second World War Egyptian agricultural policy was characterised by the dominance of economic liberty in economic activities in general and the agricultural sector in particular (Ghoneim, 2000). There was an almost complete absence of direct intervention by the government in the agricultural sector. In this period, privately owned firms with vertically

[3] These controls include area, price and marketing controls as will be discussed in detail later in this chapter.

integrated activities, such as milling, ginning, sugar refining and oils, were common. There was no government intervention in wheat marketing before World War II, producers being free to sell their output directly to traders, and no government restrictions on wheat-using activities such as flour and bread production.

In Egypt, as in most colonial areas, World War II heralded a period of political, social and economic crisis. The response in Egypt, as elsewhere, was the introduction of increasing degrees of government intervention. For example, the need to feed the British troops, whose numbers rose from 50,000 in Egypt and Sudan in 1939 to nearly 200,000 in 1942, led the government to decree a drastic shift from cotton to cereals production, which ignored the established crop rotation, as shown in Table 3-1. For example, by 1944 the cotton acreage had fallen to about 55% of its level in 1940, while areas of other competitive summer cereal crops (maize and rice), and winter cereal crops (wheat) had increased during the same period by 26% and 27% and 13% respectively. Barley, beans and sugar acreage had also increased, by 39%, 8% and 19% respectively.

In addition, the fall of France and Italy in the war and the growth of the 'Axis Power' in the Mediterranean had resulted in a severe shortage of allied shipping capacity. This cut in Egypt's trade capacity severely hampered exports of cotton and imports of fertilisers. The increased use of farm manure and the maintenance of a clover crop[4] could not compensate for the decline in fertiliser imports.

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[4] Clover contributes a considerable amount of natural nitrogenous fertiliser as a result of being cropped.

TABLE: 3-1: CROP AREAS 1939-1952

(1000 Feddan)

Crop / Year	Cotton	Wheat	Maize	Rice	Barley	Beans	Sugar cane
1939	1625	1446	1548	547	263	385	72
40	1685	1502	1527	509	256	369	76
41	1644	1506	1540	448	268	359	78
42	706	1576	1983	673	321	394	88
43	713	1917	1951	642	419	381	88
44	853	1651	1890	620	331	425	96
45	982	1647	1879	630	359	392	96
46	1212	1586	1653	632	245	381	92
47	1254	1630	1608	776	237	382	94
48	1441	1516	1551	786	220	398	91
49	1692	1417	1494	703	168	424	85
50	1975	1372	1451	700	117	356	81
51	1980	1500	1660	490	120	320	90
1952	1970	1402	1704	347	137	355	92

Source: Ministry of Agricultural and Land Reclamation, Agricultural Economic Statistics, various issues.

As a result of intensive cereal cultivation during this period, crop productivity declined markedly (see Table 3-2). Fertiliser imports had fallen from 0.52 million tons at the beginning of the war to about 0.15 million tons during the period 1941-43. In effect, crop productivity had fallen to different extents for both the main exportable crops (such as cotton) and other cereal, legume and sugar crops (such as wheat, maize, rice, barley, and sugar cane).

Owing to the shortages of cereals that developed during the war (and which continued thereafter) the government intervened in the cereals market. There followed a prolonged period of legislation to organise a large-scale system of compulsory quota deliveries: in effect, the government nationalised the grain trade. This system lasted throughout the war period, and was supplemented by a set of laws and decrees that dictated a remarkable increase in the cereal acreage, and a corresponding reduction in the cotton area.

TABLE 3-2: FERTILISER IMPORTS AND CROP PRODUCTIVITY, 1940-52

Year	Fertilisers Imports (Ton)	Crop Productivity (Ton/Feddan)						
		Cotton	Wheat	Maize	Rice	Barley	Beans	Sugar
1939	524,993	0.24	0.92	0.99	1.64	0.91	0.79	34.26
40	513,799	0.24	0.90	0.98	1.31	0.90	0.79	33.08
41	155,240	0.22	0.80	0.84	1.28	0.86	0.77	30.33
42	Na	0.27	0.75	0.73	1.40	0.82	0.77	28.41
43	158,629	0.22	0.67	0.71	1.07	0.75	0.76	25.13
44	272,491	0.24	0.57	0.82	1.31	0.69	0.75	27.07
45	260,125	0.24	0.72	0.90	1.38	0.73	0.79	27.54
46	214,437	0.22	0.73	0.86	1.48	0.72	0.79	27.51
47	457,755	0.23	0.64	0.87	1.65	0.72	0.68	28.82
48	509,214	0.28	0.71	0.91	1.66	0.76	0.72	27.45
49	621,148	0.23	0.82	0.84	1.66	0.82	0.76	26.58
50	683,506	0.19	0.74	0.90	1.77	0.78	0.56	31.22
51	720,211	0.20	0.81	0.84	1.25	0.83	0.72	31.22
1952	753,991	0.23	0.78	0.87	1.46	0.86	0.70	36.90

Source: Ministry of Agricultural and Land Reclamation, Agricultural Economic Statistics, various issues.

The Principal Bank of Agricultural Credit was responsible for the distribution of fertilisers, and paid producers for their cereals according to the variety and quality. Financial penalties were levied on producers who did not deliver their quotas. In addition, the law prohibited transportation of wheat and flour among cities unless permitted by the Ministry of Supply. Such large-scale intervention in the agricultural sector was the point of departure for the succeeding governments, which increasingly intervened.

3.2.2 : Second period [1952-1971] Agriculture under Nasser's Regime.

On the 23rd of July 1952, the Free Officers under the leadership of Mohammed Nagieb, with the aid of some army units, led a successful rebellion against King Farouk. In effect, Farouk was expelled to Italy on the 26th of July 1952 and the Free Officers announced the transformation to a republic. Shortly afterwards, the Free Officers elected Gamal Abdel-Nasser to hold the presidency.

Economic development was one of the main objectives of Nasser's regime, more so in fact than any other since Mohammad Ali's period of prosperity in 1820. The slogan of this development was based on two main concepts, '*Al-Kefaa wa Al- Adle*', meaning '*Efficiency and Justice*'.

Since World War II Egypt, as with many developing countries, has adopted a pro-industrial development strategy, as advocated by many in both the Western World and the Soviet Union. As a consequence the agriculture sector became marginalised. As Richards (1982) puts it, "*in listening to the Western or to Soviet advice, the message squeeze agriculture was the same*" p.176.

The government looked to agriculture to play a central role in its development strategy, principally as a source of funds for development programmes that were intended to be beneficial to industry, the intended prime engine of growth. The mechanism used to transfer this surplus was (a) a system of agricultural co-operatives and (b) a system of crop price controls and area restrictions, as will be discussed below. However, later on it became increasingly clear that a weak agriculture could not support a strong industry.

3.2.2.1 : Outlines of Nasser's Agricultural Policy.

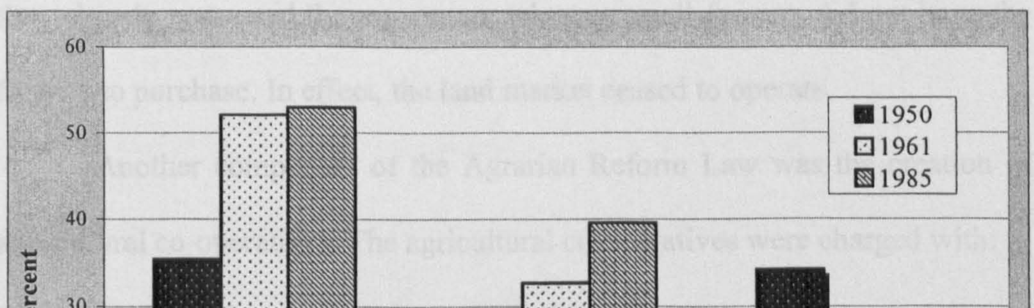
3.2.2.1.1 : The Agrarian Reform Law

The '*Agrarian Reform Law*', established in 1952, was the first instrument to be instituted, the aim being to achieve *justice* for the landless peasants. In short, the law redistributed all agricultural land held by individuals above two hundred feddan per owner or (three hundred per family) among the landless peasants. Recipients of land received between three and five feddan per family as a result of redistribution. The Law also pegged all agricultural land rents at seven times the basic agricultural land tax, as assessed in 1949. It also stipulated that leases had to be in writing and run for a minimum of three years.

This legislation also achieved another two (unannounced) principal goals for the 'Free Officers': first; it eliminated the power of the regime's principal opponents, the nobles and large landowning elite; second, it created the basis of support for the new regime among the small peasants and the poor urban classes.

In attempts to broaden the base of land ownership, this law was amended twice to reduce the ceiling on agricultural land ownership, to one hundred feddan in 1961 and then to fifty feddan in 1969.

FIG: 3-1: THE STRUCTURAL DISTRIBUTION OF LAND OWNERSHIP IN 1950-85 BY AREA



Source: CAMPS

Furthermore the continuous and rapid increase in the population growth rate in Egypt combined with Islamic rules of inheritance meant that the Agrarian Reform Act and its amendments compounded not only the fragmentation of the ownership of the agricultural land area but also the production structure. It is clear from Figure 3-1 that the dominance of small-scale farming in Egyptian agriculture (i.e. farms less than five feddan) sharply increased following introduction of the Act, which applies to 96% of the total number of farmers, 39% of them holding one feddan or less.

The Act created considerable production problems, because although the 334,727 families that benefited from it as recipients of the redistribution were experienced in farming, they tended to have poor access to credit and little experience of modern farm management practices. However, the advantage was that the small-scale farms were able to absorb most of the labour force in the agricultural sector.

Although the legislation had beneficial effects for labour it effectively ossified the land market. The wealthy were not able to purchase any land, as they already possessed the maximum, whereas small farmers did not have the finance to purchase. In effect, the land market ceased to operate.

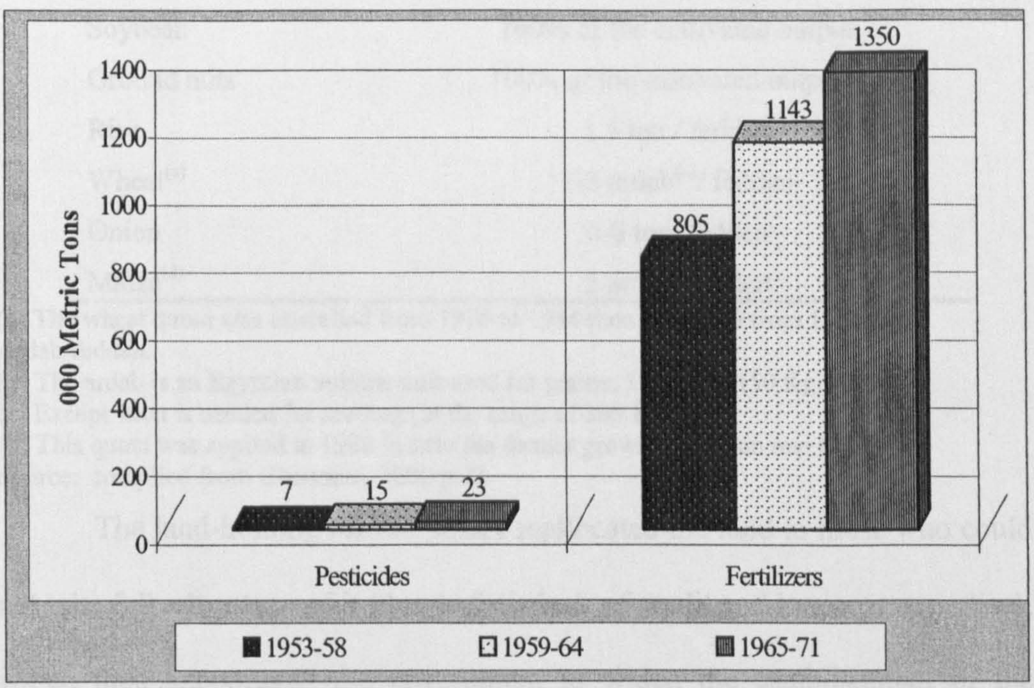
Another component of the Agrarian Reform Law was the creation of agricultural co-operatives. The agricultural co-operatives were charged with:

(1) Determining the crop rotation to be followed by each zone.

(2) Supplying and controlling subsidised means of production, such as fertilisers, seeds, pesticides and low cost machinery.

Co-operatives issued a *"farm holding card"* to every farmer, stating his land holdings and specifying the rotation to be followed. By the mid-1960s, a quota of fertilisers was allocated according to the farmer's holding and the rotation recorded on the card. However, the co-operatives encouraged fertiliser use as an important component in achieving the goal of "vertical extension" (productivity) and high yields. Figure 3-2 shows that consumption of both fertilisers and pesticides increased remarkably during this period.

FIG 3-2: THE CONSUMPTION OF FERTILIZERS AND PESTICIDES FOR THE PERIOD 1953-71.



Source: Calculated from Central Agency for Public Mobilization and Statistics, Statistical Yearbook, Egypt, several issues

The co-operatives were also required to:

(3) Maintain the irrigation and drainage systems that were made available to farmers.

(4) Play a key role in crop marketing, where the aim of government in pricing and marketing the agricultural output was to transfer the surplus formed by the agricultural sector to the industrial sector. This intervention was in the form of the compulsory delivery of crop quota volume at prices below their market prices. These quotas applied to either a specific proportion of the crop or to part of the yield. For example, the compulsory quotas for some crops were as shown in Table 3-3.

TABLE 3-3: THE COMPULSORY QUOTA DELIVERIES FOR SOME CROPS

Crop	Quota
Cotton	100% of the cultivated output
Sugar cane	100% of the cultivated output
Soybean	100% of the cultivated output
Ground nuts	100% of the cultivated output[(c)]
Rice	1.5 ton / feddan
Wheat[(a)]	1-3 ardab[(b)]/ feddan
Onion	6-8 ton/ feddan
Maize[(d)]	2 ardab/ feddan

(a) The wheat quota was cancelled from 1976 to 1984 then reapplied from 1985 at 2 Ardab/feddan..
(b) The ardab is an Egyptian volume unit used for grains; 1 ardab = 150 Kg.
(c) Except what is needed for seeding (in the range of 300 Kg)
(d) This quota was applied in 1986 in case the farmer grows more than one feddan.
Source: complied from Ghounem, 2000 p.22

The land-holding reform policy reallocated the land to those who could not take full advantage of it (due to their lack of credit and business expertise), which then encouraged the government to widen the establishment of the agricultural co-operatives. These co-operatives in effect seized the decision-making role, stipulating the crops to be grown and the inputs to be used. They then marketed the harvested crops at fixed prices.

The increasing number of small size farms encouraged the government to establish the agricultural co-operatives, with all beneficiaries from the Land Reform Act being required to become members; by 1963 the co-operatives had been extended to include all the agricultural land area. This expansion was mainly due to (a) the government's aim to control agricultural sector inputs and outputs, and consequently its surplus, in order to secure the resources needed for industrialisation, and (b) being a core step towards Nasser's target of a socialist economy.

In sum, subsidising input prices and allocating them on a quantitative basis, together with controlling output prices and areas for specific crops, such as cotton, sugar cane, rice and wheat, while leaving fruit, vegetables and fodder crops uncontrolled, had negatively affected the efficiency of resource allocation as well as the incentive structure. On the other hand, the advantage that the cooperatives gave was the increased supply of cheap fertilizers and pesticides to farmers, which consequently had positive effects on crop productivity.

3.2.2.1.2 : Area and Price Controls

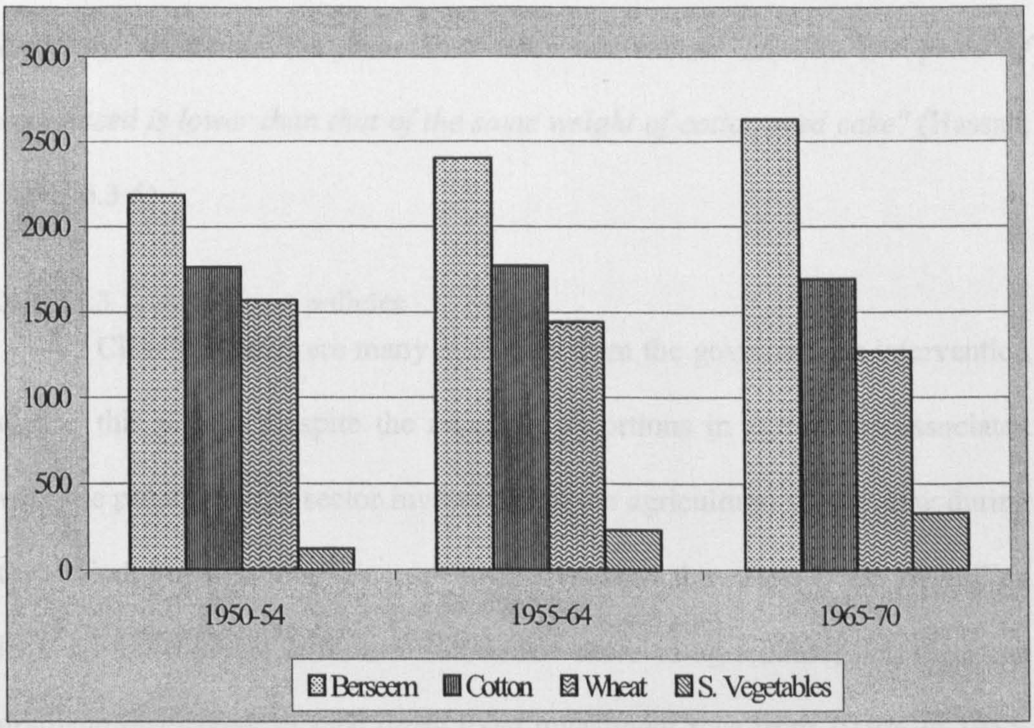
In the early 1960s area and price controls played a central role in Egyptian agricultural policy. Price policies were designed to (a) transfer the agricultural surplus in the form of foreign exchange resulting from agricultural exports to finance the long run strategy of industrialization, (b) supply urban citizens with low cost food in order to ensure high levels of political stability and support in cities, and (c) to avoid food price inflation.

To achieve these goals, the government sought to control the production, marketing and distribution of crops by controlling both physical inputs and the marketing channels through which they passed. Strategic crops were purchased from peasants at prices less than their world prices, either for resale in the international market to gain the much needed foreign exchange or to provide urban consumers with cheap food.

Although policy makers did their best to achieve these goals, it is clear from Figure 3-3 that the cultivated areas of some controlled-price crops, such as cotton and wheat, fell against such higher value uncontrolled-prices crops as berseem (clover) and vegetables. For example, whereas the berseem and vegetables areas grew by 20% and 173%, the cotton and wheat areas fell by 19% and 4% respectively in 1965-70 compared to 1950-54.

FIG 3-3: CULTIVATED AREA FOR SOME MAJOR FIELD AND SUMMER VEGETABLE CROPS DURING THE PERIOD 1950-70

(000 Feddan)



Source: Calculated from Richards (1982)

As noted earlier, the co-operatives sought to control both agricultural output and the means of agricultural production. Of the price-controlled inputs, fertilisers and pesticides were by far the most important. However, these policies of price controls on both agricultural inputs and outputs had led to the insulation of the agricultural sector from world prices. These distortions were widespread and complex: not only were farmers receiving prices for their output less than world prices, but throughout this period they paid 87% more than world prices for fertilisers in 1966. However, from 1973 onwards farmers paid only 40% of fertilisers' world prices.

It is not surprising that such price controls policies caused a misallocation of resources, and many anomalies became commonplace. Production of animal food became more expensive and profitable than that for human consumption. For example, the price of one ton of wheat straw was twice that of flour. Also, *"the price of one kentar of cotton used for upholstery ranges between £E 60 to 70 (third class of raw cotton), while the price of the best raw cotton at the farm level does not exceed £E 50. The price of cottonseed is lower than that of the same weight of cotton seed cake"* (Hassan, 1991, p.3-6).

3.2.2.1.3 : Investment policies

Clearly, there were many outcomes from the government's intervention during this period. Despite the manifest distortions in agriculture associated with the policy, public sector investment in the agricultural sector grew during the period. For example it increased from an annual average of £E 28 million in 1950-52 to £E 60 million in 1956. The share of agriculture, irrigation and drainage investment in total gross fixed investment rose from 10.9% in 1955-56 to 20.2% in 1968-69. Moreover, agriculture's share in public sector investment was estimated to have been as high as 25% in the-mid 1960s.

Investment policies in the agricultural sector focused on the expansion of infrastructure and crop productivity, and four major objectives were established.

(1) The construction of the Aswan High Dam, whose costs accounted for roughly one third of all capital formation during this period. The main stated aims of its construction were: (a) avoiding the threat of floods and droughts (for example, it has been estimated that in 1972 and the early 1980s, if the dam had not been built, the lack of summer water would have meant the loss of 40% of summer crops such as cotton and rice (Richards, 1982)); (b) allowing reclamation of new lands (for example, the increased water supply allowed the conversion of 800,000 feddan in the Upper Egypt basin to perennial

cultivation); (c) increasing the area planted and consequently agricultural output for example, the rice area increased by nearly 500,000 feddan and sugarcane by 85,000 feddan, and in general the total cropped area increased from 9,412,000 feddan in 1950-54 to 10,855,000 feddan in 1970-74; (d) allowing a shift in the planting and cropping dates. For example, shifting the planting date of maize from July/August to May/June allowed more favourable sunlight and heat conditions for its growth, and consequently its yield rose by 40% between 1960-64 and 1965-70. (2) Enlargement of the domestic capacity for the production of fertiliser, such that 62% of the consumed nitrogen fertiliser was produced domestically in 1966 (domestic production of nitrogen fertiliser increased nearly ten-fold between 1952 and 1966). (3) Improving and breeding new crop varieties. (4) Land reclamation - as mentioned earlier, the government reclaimed 912,000 feddan during this period[5]. (5) The mechanisation of agriculture - domestic tractor production developed rapidly in the mid-1960s.

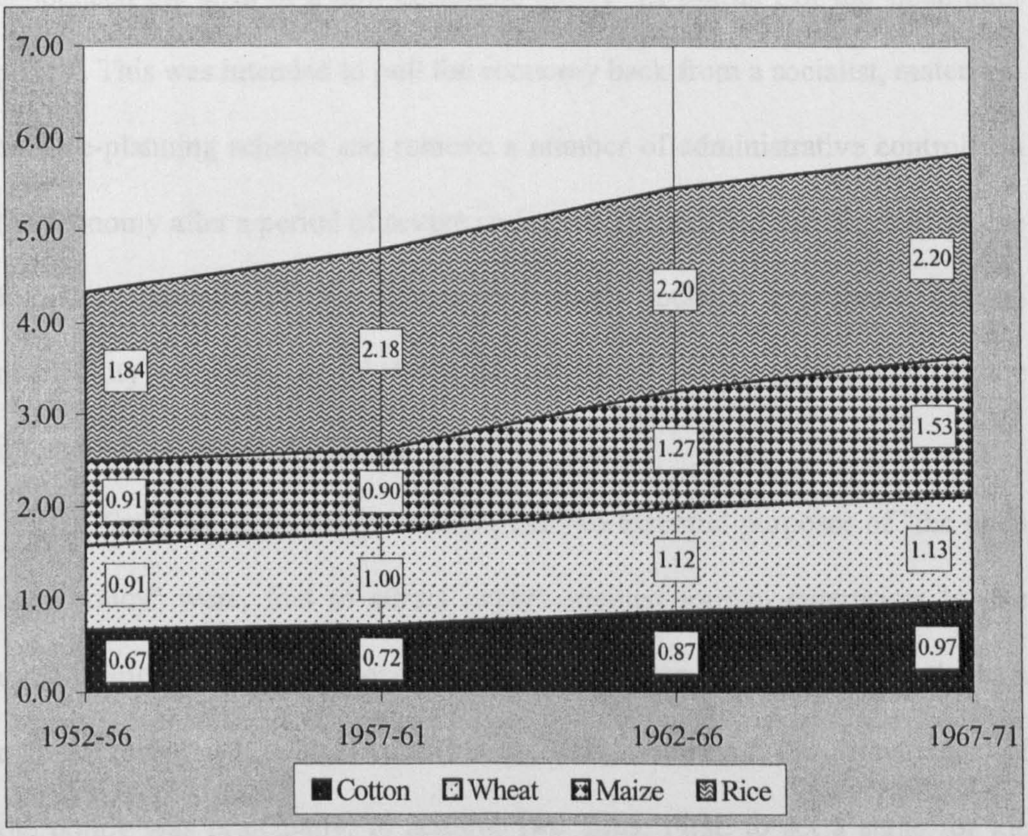
In sum, Egypt was transformed into a state-controlled economy during this period. All large-scale production, infrastructure, finance, imports and exports were either government-administered or run by state-owned enterprises. Government intervention in agriculture not only limited the size of individual land holdings, reducing efficiency, but also taxed the sector heavily, using it as a resource base for industrialisation. The large-scale and widespread establishment of co-operatives, along with a system of price controls, allowed the government to 'siphon off' a sizeable amount of agricultural income for financing its industrialisation plan.

[5] In fact 309,000 feddan only had reached marginal productivity.

However, it is clear that the expansion of fertiliser and pesticides use (as shown in Fig 3-2), and improved seeds (for some crops at least) led to substantial increase in yields. Fig 3-4 shows that yields for the main exportable and food crops (as cotton, wheat maize and rice) had increased over the period 1952-71 to varying degrees. The, maize yield had increased in the third period 1967-71 by 68% than the first period 1952-56, followed by 45%, 24% and 19% for cotton, wheat and rice respectively.

FIG 3-4: CROP YIELDS 1952-71

(Ton/Feddan)



3.2.3 : Third period [1971-81] the setting in Sadat's period.

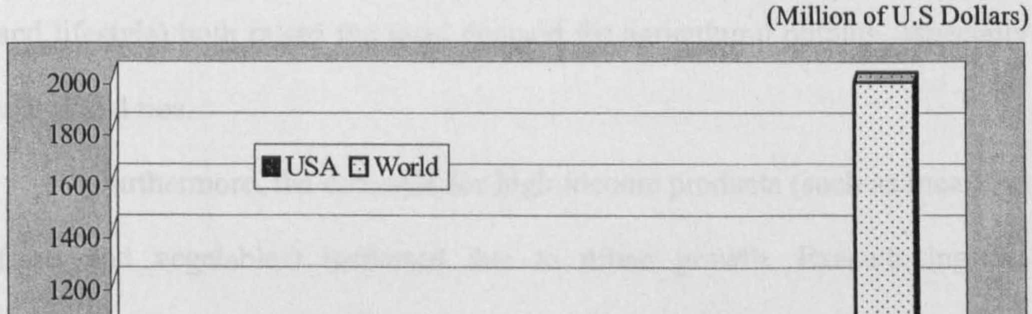
Colonel Sadat, the vice-president, took over the presidency following the sudden death of Nasser in September 1970. After the 1973 war, the Egyptian economy was severely burdened by the war bill accompanied by high inflation and external debt rates. In addition, it also inherited the bureaucratic structure of co-operatives and price policies. As a result Sadat sought a change in the economy through its liberalisation. On the 19th of April 1974 Sadat announced the birth of a new economic policy '*El-Infitah*', or the 'open door policy'. This was intended to pull the economy back from a socialist, materials-balance-planning scheme and remove a number of administrative controls on the economy after a period of severe recession. He justified the *"Infitah"* on the following grounds: (1) the failure of Nasser's socialist experience; (2) the availability of Arab capital from the oil-producing countries; and (3) the international context of détente.

From an economic standpoint, the two essential purposes of "the open door policy" were, first to attract export-oriented foreign enterprises by the establishment of duty-free zones, and second, to attract foreign capital through a liberal investment policy (Korany et al., 1991). However, the ultimate goal of the policy was principally, to achieve two aims. First, to set a stage for the development of the Egyptian economy through joint ventures and projects bringing together Egyptian labour, Arab capital and Western technology and management enterprises. Second to encourage foreign capital flows to help the economy to recover and to finance the increasing trade deficit. The policy also included other objectives, such as modest reforms of pricing and subsidy policies and of legislation affecting the supervision and control of public companies. The gross domestic product growth had been less than two percent for most of the years between 1969-73, and given the high rates of population growth, the economy had actually been shrinking in per capita terms.

There is no doubt that regional, global and political views had changed in this period. Sadat believed that it would be impossible to achieve stable, long-run economic development without securing peace and settlements with border neighbours, and that the key to achieving that was through co-operation with the United States of America (USA) and the West in general. In 1977 Sadat announced that *'the Egyptian socialism experiment in the 1960s was a one hundred percent failure'*.

FIG 3-5: FOREIGN AID RECEIVED DURING (1961-80)

(Million of U.S Dollars)



Source: OECD (1960-97), Geographical Distribution of Financial Flows to Developing Countries, Paris: Organisation for Economic Co-operation and Development.

After the 1973 war and the establishment of good relations with the West and explorations of oil in the Gulf countries, other sources of Egyptian national income became available. For example, the growth in foreign aid, (especially from the USA), in the middle of this period, was a significant new source of revenues, shown in Figure 3-5.

Also, there were massive remittances from those Egyptians who were now working in the Arab and Gulf oil countries. These replaced cotton as the most important source of foreign exchange earnings. In addition to petroleum exports, there was growth in receipts from tourism, and Suez Canal tolls also became important sources of revenue.

The real challenge for agriculture in this period was the development of the capability to supply the increasing growth in demand. The high population growth rate[6] of about 2.8% per annum, and the rapid migration from rural to urban areas (where rural migrants sought cheap subsidised food, better jobs and lifestyle) both raised the local demand for agricultural outputs, especially wheat and rice.

Furthermore, the demands for high-income products (such as meat and fruits and vegetables) increased due to urban growth. Exacerbating the situation was the inherited system of price controls for certain crops and the bureaucracy of co-operatives that led to an expansion in non-price controlled crops (such as berseem) while slowing the growth in area planted of wheat and rice.

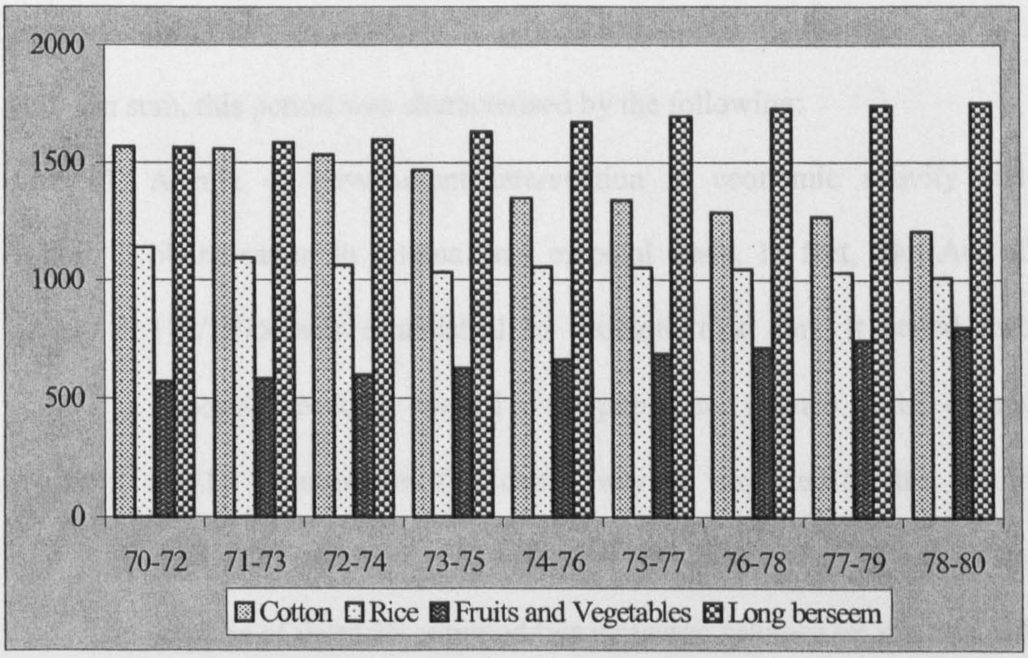
In effect, price policies continued to penalise cotton, rice and wheat growers, so farmers shifted to other (uncontrolled) crops wherever possible. Consequently, areas for crops such as berseem (as an intermediate input in meat production) and fruits and vegetables had increased markedly, as shown in Figure 3-6. For example, cotton and rice acreage had continuously fallen

[6] The total population increased from 33 million in 1970 to about 40 million in 1980.

during this decade, by -3.1% and -1.2% respectively, while (uncontrolled) crops as fruits and vegetables and berseem (clover) achieved positive annual growth rates of 4.3% and 1.4% respectively.

FIG 3-6: AREAS OF CROPS DURING THE PERIOD 1970-80

(Feddan)



Source: Table A2-2 for the period 1980-2000 and Gouniem (2000) for the period 1970-79.

Public and private sector investments in the agricultural sector were relatively low. The share of investment in agriculture had fallen drastically from 25% of total public sector investment in 1965 to only 7% in 1975, while private investment was as low as £E 2 -3 million, accounting for only 4% of gross fixed investment. Moreover, most private sector investment was in fruit and vegetable production, presumably due to the distortionary price polices.

In the late 1960s the government tackled one of the most important problems that had emerged in the agricultural sector: the lack of an adequate drainage system. This had led to soil salinity and the formation of hard pan. When the World Bank carried out a survey for the Egyptian agricultural soil classification in 1973, it reported that 49% should be classified as medium to poor soil, 45% good and only 6% excellent. In response, the government increased spending on drainage from 9% of total agricultural investment in 1969 to 29% in 1975. Subsequently the government approved two comprehensive projects, the first covering 950,000 feddan in the Delta area and the second 300,000 feddan in Upper Egypt, to install with tile drains.

In sum, this period was characterised by the following:

(1) A mix of government intervention in economic activity and liberalisation in internal and external trade. In fact, The Act of 118/1975 was established to promote that aim. It stated that imports were to be opened to the public and private sector, except for 18 commodities that could only be imported by the public sector for subsequent distribution to consumers. Subsequently, imports of these 18 commodities increased reliance on imports and ignorance of their domestic production, consequently the food gap between domestic production and consumption increased to $1.9 billion in 1980 compared with $184 million in 1970.

(2) Subsidising agricultural inputs and credits loans for agricultural producers in addition to the continuing subsidising of commodities important to consumers with low-income levels. Food subsidy expenditure reached 2.2 billion £E in 1981/82 compared to 108 million £E in 1973 and the list of subsidised commodities was enlarged to include wheat, white flour, maize, oils and edibles[7].

(3) The inconsistency between the pricing policy for agricultural output and its costs of production, in addition to the decline in

[7] See (Gunter, 2002; Ahmed, 2002; Lofgren 2001)

returns to land, capital and labour, had resulted in immigration from the agricultural sector.

(4) Encouraging domestic and foreign investment by establishing Act 43/1974 had promoted increases in both domestic and foreign (particularly Arab) capital for direct investment in land reclamation, animal production, transportation, industrialisation, energy and tourism sectors, in addition to importing new technologies.

(5) Encouraging animal and poultry production by subsidising its inputs and means of production in addition to non-intervention in its marketing or pricing. In contrast, apart from fodder, vegetable and fruit crops, there was severe intervention in plant production especially for the main crops, and in their marketing and pricing.

3.3 : The Pre-Reform Period (1981-86): An Economy in Crisis.

After Sadat's assassination in October 1981, General Mubarak, the vice president, took over the presidency. The performance of the Egyptian economy was poor at that time. At the *macroeconomic level* all economic indicators implied that the economy was in crisis. Real growth in gross domestic product (GDP) for 1986-87 was 2.5%, compared with an average of 7% during the period 1982-85.

The current account deficit was equal to 4.7% of GDP over the period of the first half of the 1970s, but it increased dramatically to reach 12.2% of GDP in 1987. The public sector deficit averaged 2% of GDP over the period 1981-85, but in 1986 the deficit-GDP ratio stood at 23%.

The inflation rate (consumer price index, CPI) increased from an average of 13.3% over the period 1981-85 to 30% in 1987. The growth rate of exports declined sharply from 13.5% in 1981-82 to 3.23% in 1986-87. The terms of trade also worsened, from an index value of 64 in 1987 compared with 100 in 1980.

External debt reached US$ 40 billion in 1987, the debt:GDP ratio being 122%. Moreover, debt service in 1987 was equal to 5.3% of GDP and 21.5% of the value of exports.

In 1973, the oil sector contributed less than 4% of GDP, while in 1980-81 it constituted 18% of GDP and 67% of the total value of exports in 1985. During the 1980s there was a significant fall in the world market price of oil, causing a significant weakening of the Egyptian economy and highlighting Egypt's budget and trade deficit problems. By 1986-87 oil revenues had fallen to half their 1985 value, a loss of £E 2.1 billion. Tourism sector revenues had fallen to less than £E 800 million in 1986-87, compared with £E 1.2 billion in 1984-85.

Moreover, domestic sources of hard currencies seem also to have dried up, the remittances of about four million Egyptian working abroad having declined substantially. In 1983/84 remittances reached US$3.9 billion; however in 1984/85 they dropped by 3.7% and in 1985/86 they fell more than 33%. By 1986/87 remittances amounted to less than US$600 million.

The complexity of the adopted multi-tiered exchange rate system, with four different rates in operation[8], where the official exchange rate had stood at £E 0.7 = US$ 1 since 1979, also gave the image of an economy in decline.

In sum, all indicators pointed clearly to the need to reform the Egyptian economy. The retarded and weak performance of the Egyptian economy, plus the massive international debt and its service, left the leadership no option other than to seek comprehensive structural reforms. On the macro level, the first place to start the reassessments and reform regime was the state-owned enterprises as they absorbed about 45% of GDP and supplied about 83% of total exports.

3.4 : The need for an economic reform policy.

3.4.1 : Introduction

As discussed above, over the decades since the promulgation of the Agrarian Reform Act (No 178 of 1952) the output and efficiency of the agricultural sector increasingly deteriorated as a consequence of adopting policies based on control of prices, production, distribution and the cash crop markets, exacerbated by the overvalued exchange rates. This severe government intervention had resulted in an extremely distorted economy, which in turn resulted in its slow rate of growth. The situation left no alternatives for the government of Egypt other than to adopt a comprehensive reform policy.

In response to the poor performance of the economy, Egypt adopted a comprehensive Economic Reform and Structural Adjustment Programme

[8] There were: (a) an official fixed rate of the Central Bank (b) a premium rate set periodically by the authorities (c) a barter agreement rate and (d) a negotiable free exchange rate in the free market.

(ERSAP) in 1986. The programme was accomplished with the aid of the policy unit of the United States Agency for International Development (USAID) and was funded by the Agricultural Production and Credit Project (APCP).

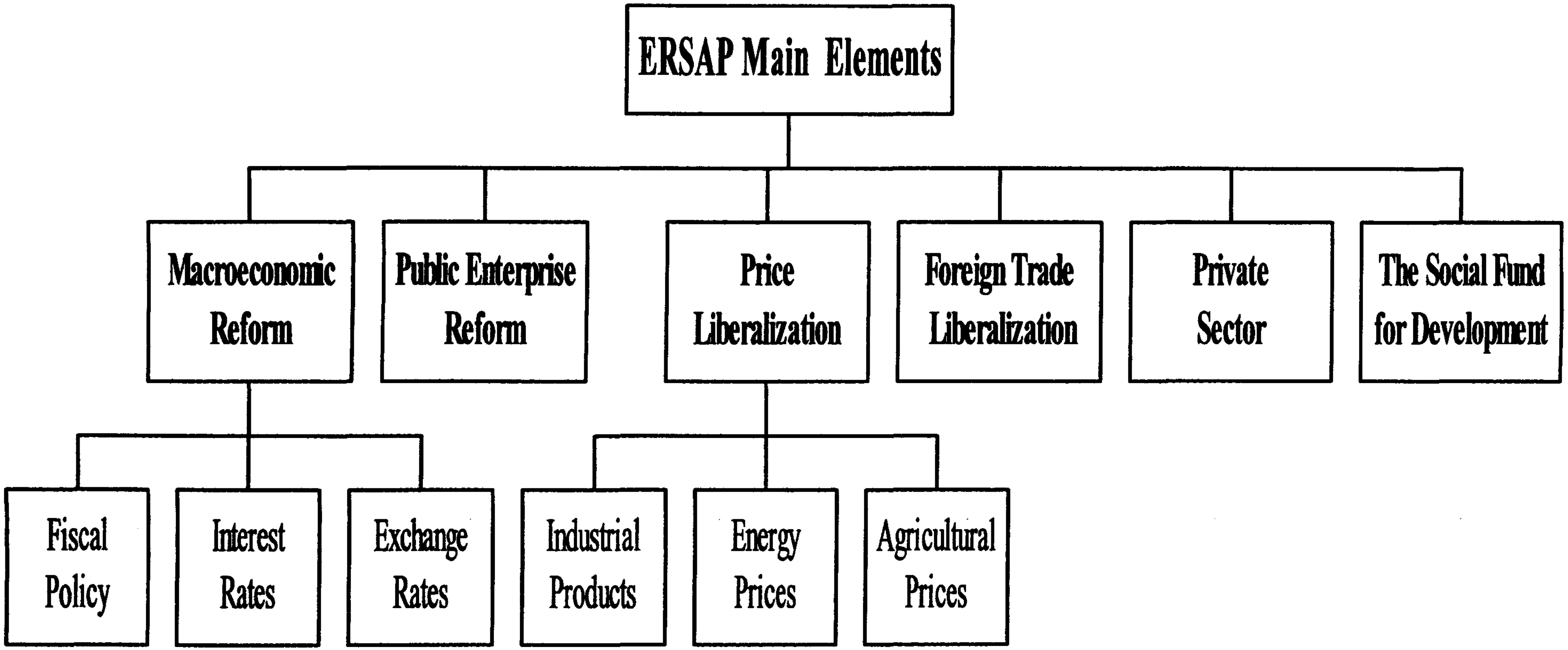
3.4.2 : Economic Reform and Structural Adjustment Programme (ERSAP).

In contrast to the pre reform period, significant policy changes were achieved in the early beginnings of the 1990s. Egypt made an agreement with the International Monetary Fund (IMF) in May 1991 after nearly three years of negotiations[9].

The aim of the Economic Reform and Structural Adjustment Programme (ERSAP) was to give more opportunities to the private sector to play an effective role in the economy, lessen reliance on the public sector and develop a stronger market economy. The programme focused on three policy areas: stabilisation, structural adjustment and social policies. Figure 3-7 shows the ERSAP main components in which we outline each of these components briefly, and after doing that we turn to focus on the agricultural sector. The main components are the following: (a) macroeconomic reforms, (b) public enterprise reform, (c) domestic price liberalisation, (d) foreign trade liberalisation, (e) private sector reform and (f) the Social Fund for Development.

[9] The Egyptian government started to implement IMF recommendations for reform in areas of pricing and subsidies, the foreign exchange rate system, interest rates, the money supply and the budget deficit.

FIGURE 3-7: THE MAIN ELEMENTS OF THE EGYPTIAN ECONOMIC REFORM AND STRUCTURAL ADJUSTMENT PROGRAMME



Source: compiled from Abdel-Khalek, 2001 p.p. 42-51.

3.4.2.1 Macroeconomic Reform

Owing to Abdel-Khalek, 2001[10] and Lofgren, 1993, the macroeconomic reform was to achieve sustainable economic growth and at the same time initiating the country's ability to service its foreign debt. This is the stabilisation foundation of the ERSAP. It consists of fiscal policy, interest rates and the exchange rate regime.

3.4.2.1.1 The Government Budget Deficit and the Money Supply:

Egypt has implemented a remarkable achievement in deficit cut. The target was to cut the ratio of the overall budget deficit to GDP from an estimated high of 22 percent in 1990/91 to about 1.5 percent by 1995/96. Previously, the deficit had been primarily financed by increases in the money supply, now the treasury-bill auctions provided non-inflationary financing. The reduction in deficit was to a large extent due to price increases, particularly energy prices and the greater reliance on indirect taxation such as the introduction of general sales tax in May 1991, escalation of stamp tax, etc. Moreover, in June 1991, the government dictated high restrictions on the money supply by forcing each bank to limit its total loan portfolio to the February level.

3.4.2.1.2 Interest Rates:

During the pre-reform period, interest rates were allowed to fluctuate within a predetermined range. But in 1991, the banks became free to set virtually all deposits and lending rates. The ERSAP included removing all interest rate ceilings, imposing specific domestic credit ceilings that favour the private sector, eliminating any direct credit line between the Central Bank of

Egypt (CBE) and the government and developing a market for treasury bills. Moreover, interest rates were liberalized and weekly treasury bill were started in January 1991; the resulting interest rates provided an anchor for the market-based interest rates used by the banks. As a result, nominal interest rates increased to nearly 20 percent whereas real rates changed from negative levels to somewhere close to zero.

3.4.2.1.3 The Foreign Exchange System:

On October 8, 1991 the government merged three foreign exchange rates for the U.S dollar into one largely determined rate. Moreover, the Egyptian pound was depreciated by 10 percent against the dollar. Also, it was the first time to see legal private moneychangers (greater details are discussed in Chapter 5).

3.4.2.2 Public Enterprise Reform

Reforming public enterprises (PEs) is considered one of the main targets for ERSAP. A new public investment law (Law 203 for 1991) replacing the previous one (Law 97 for 1983) was launched that gave freedom to public enterprises and to create a new regulatory environment common to both public and private sectors. The new law allowed privatisation of PEs, as well as asset sales, divestiture and management contracts with private management teams. In addition, the PEs and the private sector, under the new law, are operating with the same rules i.e. their managers have the complete freedom to decide and choose on investment, product mix, pricing and staffing. Also, National Investment Bank (NIB) funds are not allowed any more to finance PEs' new investment. Instead, they can mobilize their resources from retained earnings,

[10] We relied heavily on this study in presenting this section. As it is considered one of the few

loans from the banking system or placement on the capital market. However, a comparison between the new and old public enterprise laws is discussed in greater details in Table A3-2.

3.4.2.3 Domestic Price Liberalisation

3.4.2.3.1 Industrial Products:

The ESARP agenda for industrial products included a gradual decontrol of ex-factory prices of industrial products produced by the public sector, considering import liberalisation and competitiveness of the domestic market. Except for small numbers of basic foodstuffs, the prices of almost all-industrial products would be liberalised by June 1995.

3.4.2.3.2 Energy Prices:

The ERSAP scheduled a gradual increase in domestic petroleum and natural gas prices to be close to their parity prices by 1995 at the prevailing exchange rate. So that, by May of each year for the period 1992-95 inclusive, the weighted average of the domestic petroleum prices as a percentage of its parity was to be increased 11 percentage points. Also the price of natural gas would rise in parallel with that of fuel oil prices. Electricity prices would be increased as a proportion of and towards eventual equality with, the long run marginal cost by June 1995. This proportion was estimated by 10 percentage points every year during 1992-95 to reach 100 percent (from 59 percent in May 1991)

3.4.2.3.3 Agricultural Prices:

In this category the ESARP included the removal of area and price controls and the gradual elimination of input subsidy. However, greater details

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studies that dealing with the ESRAP.

concerning the ESARP and the agricultural sector are discussed in the next section.

3.4.2.4 Foreign Trade Liberalisation

The government of Egypt has taken serious steps in encouraging investment and foreign trade. The ESARP included: (1) reducing the list of products protected by import bans to be less than 30% from nearly 40% of industrial domestic output; (2) altering the tariff structure so that the minimum tariff rate would be initially 10% and the maximum 80%; (3) removing the discretionary allocation of foreign exchange by the banking system; (4) the gradual elimination of non-tariff barriers other than import suspensions and import bans, beginning with a 50% fall in import NTPs before the formal start of ESARP.

3.4.2.5 Private Sector

The ultimate objective of the ESRAP for the private sector is to create an environment for all types of business enterprises. The reform programme was keen to eliminate the discrimination against the private sector in obtaing licences, purchasing inputs and energy and credits. Thus, by May 1991 the government shortened the '*negative list*' of areas that private investment were banned and promised a direct approval to investments in those areas that did not appear on the list. Moreover, investment-licensing requirements for enterprises are operating under Law 159 (the majority domestically owned firms) had been effectively dropped-aside from a negative list to be reduced further. In addition, a registration process with a definite and short time limit replaced all production and product-mix licensing requirements. Also, liberalisation of investment, production and pricing was extended to other private sector firms (those subject to Law 45 or Law 230 – mostly joint ventures and foreign owned).

3.4.2.6 The Social Fund for Development

The Social Fund for Development (SDF) was initially conceived as a temporary measure of four years life to provide a short-term and temporary compensation to target groups that will be negatively affected by the above elements and or the Gulf crisis. For example, financial resources of $600 million U.S dollars were approved by the Egyptian government, UNDP, and other bilateral and multilateral donors to the (SDF).

3.4.3 : Agriculture and (ERSAP)

McKinnon (1996) argues that Egypt began its liberalising reforms in the *'right'* place - in agriculture, where payoffs can come quickly. The programme was designed to be gradually accomplished in two stages as follows:

3.4.3.1 : The first stage (1987-89)

According to Khedr et al., (1996), the first stage of the reform programme (1987-89) covered reassessment and reform in (1) price and marketing controls. (2) obligatory quota deliveries for ten crops (3) reduction of input subsidies, mainly for fertilisers (4) giving the opportunity for private investment to play an effective role. In effect, the markets for major crops were freed, and farm gate prices for fertiliser were increased by 75%. Input marketing was gradually released from the control of the Principal Bank for Development and Agricultural Credit (PBDAC) to the private sector. Also, for the first time, citrus exports were opened to the private sector as well.

3.4.3.2 :The second stage (1990-94)

The second stage was concerned with: (1) increasing cotton procurement prices[11] to 66% of the world price, (2) removal of quota deliveries on rice, (3) elimination of all input subsidies, (4) reducing the role of the PBDAC in input marketing, (5) rationing and restricting subsidized credits, (6) improving the institutional structure and operations of the PBDAC, (7) reforming the structure of seed marketing and production.

3.5 : Agricultural Polices, Reforms and Their Impact on Major Field Crops, Input Subsidy, Exchange Rate and Land Tenancy.

Drawing on Fletcher (1996), a detailed summary of agricultural policy changes before and after the adoption of ERSAP is given in table A2-1 that covers five sectors in depth, emphasising the pattern and sequence of reforms. The highlighted sectors are: eight minor crops (broad beans, lentils, sesame, ground nuts, onions, garlic, soybeans and potatoes), four main crops (wheat, maize, rice and cotton), input prices, distribution and subsidies, exchange rate and trade policies and the land tenancy system.

Impacts of governmental polices in the pre and post reform era can be summarised as follows:

- *First,* crop area, quota, and price restrictions for the eight minor crops were removed by 1987. Instead of being affected by various degrees of controls in the pre reform period, for example, intergovernmental transport was restricted the case that would have had some impact on geographical price patterns and efficiency of distribution by areas. Also, the artificially

[11] Liberalisation of cotton was considered a main goal in 1992 and it was completely freed in 1994.

overvalued official exchange rate during the 1980s at which crops were imported led to a reduction of domestic costs of their imports. The case that gave the government a margin to subsidise bread prices and yellow corn prices to feed mills, thereby their domestic prices were depressed, consequently shifting resources away from these crops.

- *Second,* the controlled marketing, processing and imports of inputs, the growing consumer subsidy and the applied trade policies for wheat and maize in the pre-reform period 1980-85 drove a wedge between their domestic and world prices. As a result, land area cropped by wheat and maize had fallen during this period by 140 and 36 thousand feddan respectively. Moreover, wheat and maize yields stagnated at 1.5 and 2 ton/feddan during the period 1983-86 (see table A2-3) as farmers reduced their purchased inputs in response to their low domestic prices, and lacked incentives to adopt new technologies that were available. As a result of adopting a new policy regime and creating a favourable policy development in the post reform era (such as the removal of fixed procurement prices, area and quota controls, devaluation of exchange rate and concurrent reduction in subsidy on imported corn and wheat), the land areas devoted for wheat and maize grew by 684 and 149 thousand feddan respectively during the period 1986-2000 compared to 1980-85 (see Table A2-2); yields grew by 53% for wheat and 36% for maize during 1986-2000 (see table A2-3).
- *Third,* the rice area was still controlled in the post-reform era to the extent that there was strong political pressure to reduce it by 30% in 1987 and 13% more in 1988 due to anti-salination of land and its high needs of

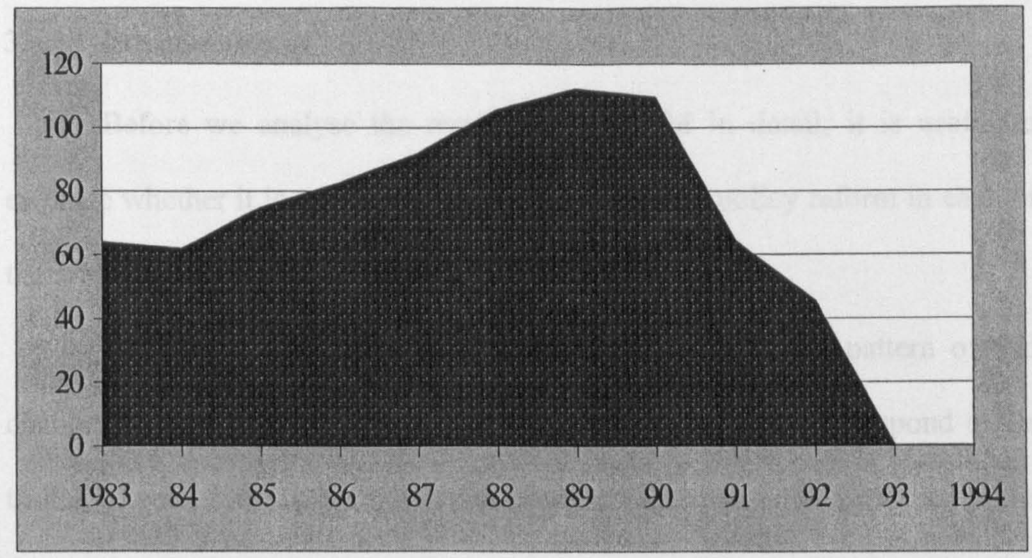
irrigation water. Furthermore, price and marketing controls were removed in 1991. Despite the penalties and government controls, the rice area climbed steeply during the period 1990-2000 with an annual growth rate of 0.04%. In other words, it grew by about 38% of its average area during 1980-1989. This shift in area was most probably because of rice becoming more profitable for farmers to grow; rice profitability during the period 1990-2000 was 44% higher than cotton (the most competitive seasonal crop). Also, rice yields grew considerably from an average 2.4 Ton/Feddan in the pre-reform period 1980-85 to 3.2 Ton/Feddan during the post-reform years 1986-2000. Moreover, the high consumer subsidy was removed in April 1993, while the domestic market controls on private trade were removed in 1991-92.

- *Fourth,* pre-reform policies such as area controls, compulsory delivery of all output at predetermined prices less than 50% of the border price equivalent, applying strict cropping pattern controls by region and variety, prohibiting private sector from ginning and trading cotton (domestically and internationally) continued until 1991. Area controls were removed in 1992, and finally marketing of cotton was liberalised in 1994. Cotton procurement prices increased in 1990-94 to about 130% above the average price in 1986-89. Also, cotton yields grew to 1.13 Ton/Feddan in 1992 and 1.22 Ton/Feddan in 1994 compared with an average 0.90 Ton/Feddan during 1986-91. Consequently, the profitability of the short berseem and cotton rotation exceeded that of wheat and rice and wheat and maize (the most competitive) by 9% and 23% respectively in 1992, and then increased by 49% and 83% respectively in 1993. As a result the maize acreage fell by

3% in 1993 (see table A2-2). An increase in the cotton acreage might have been expected, but such shifts did not happen, and the cropped area of cotton continued its falling trend, decreasing by 22% during the period 1990-95 relative to 1980-89, and falling by a further 3.6% in 1996-2000 compared to 1990-95. This can presumably be explained by the growers' response to the uncertainty created by the world cotton price falls in 1992, 1993, 1996 and 1997. For example, compared to 1991 levels, world cotton prices fell by 16% and 12% in 1992 and 1993, while farm procurement prices were 3-17 percent above world prices in 1992-97. The government, squeezed by these events, found itself without sufficient funds to make an initial payment to farmers in 1993. After several months of delay, it compensated cotton growers, paying them prices that exceeded world prices by 17%. Consequently, small farmers chose not to grow cotton, owing in large part to the uncertainty caused by the government, so the area declined by 1.3% and 4.7% in 1992 and 1993 and then declined further by 9.8% in 1994. Only the more efficient farmers, who had lower costs, continued to plant cotton. The cotton area continued its fall, reaching 623,000 feddan in 2000 compared with 1.2 million feddan in 1980.

- *Fifth*, input subsidies were high in the pre-reform period; for example, the fertiliser subsidy averaged 50%, and the pest control subsidy was 100% for some crops (e.g. cotton). These farm inputs were distributed and controlled by the PBDAC. By 1992 and 1994 the fertiliser and pest control subsidies were removed. Figure 3-8 shows the gradual removal of farm input subsidies for fertilisers, seed and fuel; the level of subsidy grew during the 1980s, and then began to fall in 1990, with 100% elimination in 1993.

FIG 3-8: TOTAL AGRICULTURAL INPUT SUBSIDY FOR FERTILISER, SEED AND FUEL (MILLION £E)



Source: Shousha (1997).

Indirect subsidies kept the exchange rate artificially low for imported agricultural inputs, but the exchange rate gradually grew closer to market rate 3.35£E/US$. In 1987, farmers faced the subsidised exchange rate of 0.7 £E/US$. Direct subsidies reduced the farmer cost for inputs such as fertiliser, seeds and herbicides by lowering the interest rate for loans below the commercial rate. For example, in 1987, growers needing a loan for the purchase of fertiliser received a subsidised interest rate of 3.5%, while the commercial interest rate was 16% (Shousha, 1997). Exchange rate and land rent liberalisation will be discussed in more detail in Chapter 5.

In sum, unifying and liberalising the exchange rate regime in 1990 toward market rates, the removal of compulsory delivery quota for all agricultural products (except for sugar cane), increasing farm gate prices, liberalising cotton, wheat and maize markets, and liberalising land rents in 1998 have resulted a liberal market situation for all major crops in Egyptian agriculture.

3.6 A Preliminary Statistical Evaluation of Policy Reform

3.6.1 Introduction

Before we analyse the results of the PAM in detail, it is useful to evaluate whether it is possible to detect the impact of policy reform in each of the sectors.

As has been discussed in Chapter 2 (Table 2-4), the pattern of and changes to production over the period 1980-2000 appears to correspond to the timing of policy reform implying that they may reasonably be attributed to the policy reform itself. Policy reforms (discussed earlier, see Table A3-1) are expected to increase production in commodities that had been suppressed by the original policy and lower production of those that were subsidised. For example, wheat and rice production levels have dramatically increased by 191% and 126% in the post-reform period compared with their levels in the pre-reform period; cotton and soybeans production levels fell by 27% and 75% respectively (see Table 2-4). These patterns are also apparent in Table 3-4 and Figure 3-9, which show annual growth rates of major crops. The results reveal that the annual growth rate for most agricultural products (those that were directly targeted by price and structural policy reforms) are higher in the post-reform period. For example, annual growth rates of rice, cotton, maize and wheat are 3.9, 3.8, 1.6 and 1.6 percentage points higher following the reforms, whereas for potatoes and soybeans they are 12.2 and 15.4 percentage points lower.

Furthermore, policy reform may have had a sufficiently strong impact to reverse previous trends of production in the post-reform era. This is the case for potatoes, long berseem and to all intents and purposes cotton and short berseem.

In the following section, statistical techniques are used to quantify the effect on production of these policy changes.

TABLE 3-4: ANNUAL GROWTH RATE IN PRODUCTION IN THE PRE AND POST REFORM PERIODS FOR MAJOR CROPS IN EGYPT.

CROP	Annual Growth Rate % Pre reform period* (1)	Post reform period (2)	Difference (2)-(1)
Rice	1.6	5.5	3.9
Cotton	-4.0	-0.2	3.8
Long berseem	-0.001	1.874	1.875
Maize	1.6	3.2	1.6
Wheat	4.5	6.1	1.6
Short berseem	-1.5	-0.1	1.4
Sugar cane	3.2	2.9	-0.3
Tomatoes	7.8	6.5	-1.3
Broad beans	6.6	3.4	-3.3
Potatoes	6.4	-5.8	-12.2
Soybeans	-1.8	-17.1	-15.4

*Note that the pre reform period for maize and wheat is (1980-87) as they were liberalised in 1987. Whereas for cotton it is (1980-94) as cotton liberalised in 1994. Otherwise it is assumed to be (1980-90) for all other crops.

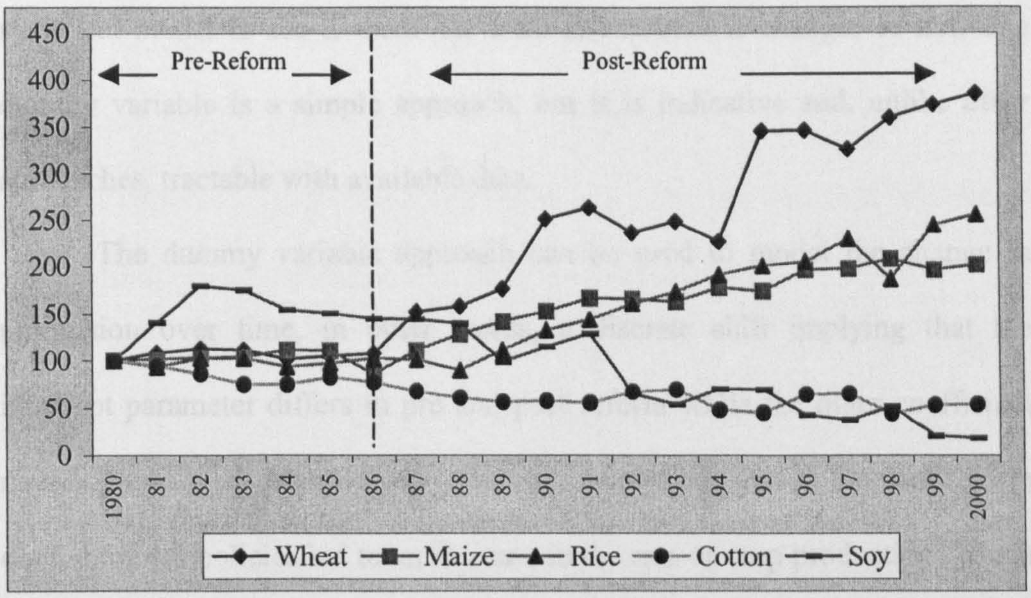
3.6.2 : Methodology

In order to detect the impact of the reform policy on the production of the main agricultural products it is necessary to model production. In this section we simply attempt to describe production patterns. As can be seen from Figure 3-9, many of the production series appear to be trending over time. For example, crops such as wheat, maize and rice seem to have a rising trend over time, while crops as cotton and soybean have a falling trend over time. However, where policy has impacted on production, a change in either the magnitude or possibly even the sign of the trend coefficient may be expected.

The aim here is to provide statistical evidence of structural change and quantify the impact of policy reforms, rather than develop economic models of crop production.

FIG 3-9: PRODUCTION TREND OF SOME MAJOR CROPS IN THE PERIOD 1980-2000

(1980=100) Million Tons



Source: Calculated from Table A2-5.

We assume that production of a crop Y_t may be described by a simple exponential trend model $Y_t = \alpha e^{\beta_1 T} e^{\mu_t}$ where the average rate of growth is given by β_1, T is a time trend and μ_t is a random variable of zero mean and constant variance. Applying logs will yield $ln\ y_t = ln\ \alpha + \beta_1 T + \mu_t$ (where $ln\ \alpha = \beta_0$) simply,

$$ln\ y_t = \beta_0 + \beta_1 T + \mu_t \qquad (3.1)$$

Consequently we can recover the underlying growth rate by regressing the log of the variable on the time trend *(T)*.

Policy reform may be conjectured to affect either β_0 *or* β_1. These changes may be detected via incorporation a dummy variable on production of agricultural products in order to obtain some statistical support for the structural change hypothesis between pre and post reform eras.

In the following section we attempt to elaborate on whether changes in production can be detected following policy reform by using a very simple statistical model to see if there has been any structural changes or not. The dummy variable is a simple approach, but it is indicative and, unlike other approaches, tractable with available data.

The dummy variable approach can be used to model the change in production over time, in other words, a discrete shift implying that the intercept parameter differs in pre and post reform while the other coefficient remain unchanged. Alternatively, we might hypothesis that in the post-reform era the reform policies led to an increase in the rate of crop production growth or decline. In this case, we would expect the slope coefficient to differ in the two periods. The third and final possibility of distinguishing whether there was structural changes in the post reform era is to let both the intercept and the slope coefficients change.

Four different models have been estimated for each crop by using *MicroFIT.4* and production data reported in Table A4-2. The first model estimates the parameter of the time trend to obtain the average annual rate of growth.

We may be interested in testing the hypothesis that both of the coefficients changed between pre and post reform periods, only the intercept coefficients changed, or only the intercept and the coefficient of the time trend changed. The second model introduces a dummy variable D that takes the value one for the post-reform period and zero elsewhere to measure the shift of production over time. Hence, the regression equation we fit will be:

$$Ln\, y_t = \beta_0 + \beta_1 T_1 + \beta_2 D_t + u_t \qquad (3.2)$$

The third model incorporates a dummy variable on the trend, DT[12], to measure the change in the slope. This can be written as

$$Ln\, y_t = \beta_0 + \beta_1 T_1 + \beta_3 DT_t + u_t \qquad (3.3)$$

The fourth model allows a change in both the intercept and slope coefficients. Hence, we specify a general model of the form,

$$Ln\, y_t = \beta_0 + \beta_1 T_1 + \beta_2 D_t + \beta_3 DT_t + u_t \qquad (3.4)$$

Where,
β_0 = ln α
β_1 = coefficient of the time trend (T)
β_2 = measures the shift in the production trend through a change of intercept.
β_3 = measures the shift in the production trend through a change of the slope.

Equations (3.1) to (3.4) were estimated for eleven major agricultural commodities; wheat, cotton, rice, maize, soybean, potatoes, broad beans, tomatoes, long and short berseem and sugar cane, over the period 1980-2000. The dummy variable, D, was costructed for each crop such that

$D \begin{cases} 0 \textit{ for pre-reform period} \\ 1 \textit{ for post-reform period} \end{cases}$ varies from one crop to another depending on the time that the commodity was liberalised. For example, wheat and maize were liberalised in 1987, but cotton was liberalised in 1994, and therefore the pre-reform period for wheat and maize was the period 1980-87 while for cotton it was 1980-94. Note also that for rice the pre-reform period was 1980-91 and for all other crops the pre-reform period is1980-90.

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[12] $DT_t = D_t T$

Evidence in favour of a policy reform effect is indicated by the coefficients β_2 and β_3. Pre-reform production is described by β_0 and β_1; post-reform by $(\beta_0+\beta_2)$ and/or $(\beta_1+\beta_3)$. While the coefficients themselves will indicate the direction and size of the policy effect, we need to evaluate their statistical significance.

Structural change (strictly speaking, 'parameter non-constancy') is initially evaluated using a standard *Chow* test. The Chow test and its supporting t tests are calculated for all the above mentioned commodities to test for structural change. The test compares the residual sum of squares from the unrestricted model (which allows all coefficients to vary between before and after reform era) and the restricted model (which does not). The *Chow* test is simply an *F* test:

$$F = \frac{\left[(RSS_r - RSS_u) / m \right]}{RSS_u / (n-k)} \qquad \sim F_{(M,\, N-K)} \text{ IF } H_{0 \text{ IS TRUE}} \tag{3.5}$$

where: RSS_u and RSS_r are the residual sum of squares in the unrestricted and restricted regressions, m is the number of restrictions and k is the number of parameters in the unrestricted regression. Our null hypothesis H_0 is of no structural change *i.e.* the coefficients on the dummies are jointly zero; if this is true the *RSS* from both models will be similar. If a structural change has occurred then H_0 will be rejected because the RSS from the two models differs substantially.

The Chow test is backed-up by standard t tests on the coefficients of β_2 and β_3, so to evaluate whether the policy is best approximated by a change in intercept or slope or both.

Although t tests of B_2 and B_3 in Equation (3.4) may be used to determine how structural change is best approximated (intercept or slope) in the model, multicollinearity may often affect the standard errors of the parameters. Hence, restricted versions of Equation (3.4) are also estimated in which B_2 and B_3 are evaluated individually. The R^2 of each restricted model can then be used to see which restricted model best describes the structural change.

3.6.2.1 : Testing

3.6.2.1.1 : Testing data in levels

Results are reported in Table 3-5. According to the *Chow* test (at the 10% nominal significant level), there is evidence of structural change in both slope and intercept coefficients in production in rice, maize, wheat, broad bean, cotton, soybean, long berseem and potatoes between the pre and post reform eras. There is no such evidence for short berseem, tomatoes and sugar cane.

Results from the t tests indicate that both the intercept and slope were simultaneously affected in the case of soybean, potatoes and long berseem, while either a slope or an intercept dummy alone captures the structural change for rice, maize, broad and wheat. Crops such as sugar cane, tomatoes and short berseem did not show any significant effect on production trends for the reforms.

Figure 3-10 shows a plot of the actual and fitted values of some of the production models. It illustrates the results of these models estimated in Table 3-5. For example, the sign and magnitude of the slope and intercept coefficients for potato production was significantly affected by reform,

TABLE 3-5: STRUCTURAL CHANGES IN PRODUCTION FOR MAJOR AGRICULTURAL PRODUCTS DURING 1980-2000 (*USING LEVEL DATA*)

Crop	Regressor				R^2	*Chow Test*
	β_0	β_1	β_2	β_3		
Rice	7.50 [0.000]	0.06 [0.000]	-	-	0.87	12.53 [0.000]
	7.70 [0.000]	0.02 [0.075]	-0.14 [0.412]	0.04 [0.009]	0.94	
	7.60 [0.000]	0.03 [0.000]	0.32 [0.003]	-	0.92	
	7.69 [0.000]	0.02 [0.036]	-	0.03 [0.000]	0.94	
Maize	7.75 [0.000]	0.04 [0.000]	-	-	0.89	11.55 [0.001]
	7.89 [0.000]	0.002 [0.872]	-0.009 [0.920]	0.03 [0.009]	0.95	
	7.77 [0.000]	0.03 [0.000]	0.21 [0.005]	-	0.92	
	7.89 [0.000]	0.002 [0.802]	-	0.03 [0.000]	0.95	
Soybeans	5.40 [0.000]	-0.09 [0.000]	-	-	0.76	9.30 [0.002]
	4.95 [0.000]	-0.02 [0.469]	1.67 [0.003]	-0.15 [0.001]	0.88	
	5.35 [0.000]	-0.08 [0.004]	-0.17 [0.584]	-	0.76	
	5.14 [0.000]	-0.04 [0.166]	-	-0.04 [0.056]	0.80	
Potatoes	6.70 [0.000]	-0.02 [0.087]	-	-	0.14	8.75 [0.002]
	6.24 [0.000]	0.06 [0.011]	1.00 [0.042]	-0.12 [0.002]	0.58	
	6.56 [0.000]	0.01 [0.598]	-0.45 [0.104]	-	0.26	
	6.36 [0.000]	0.04 [0.051]	-	-0.05 [0.005]	0.46	
Wheat	7.29 [0.000]	0.08 [0.000]	-	-	0.92	4.94 [0.020]
	7.45 [0.000]	0.03 [0.118]	0.03 [0.860]	0.04 [0.099]	0.95	
	7.32 [0.000]	0.06 [0.000]	0.27 [0.023]	-	0.94	
	7.46 [0.000]	0.03 [0.081]	-	0.04 [0.005]	0.95	
Broad beans	5.50 [0.000]	0.02 [0.001]	-	-	0.42	4.13 [0.034]
	5.30 [0.000]	0.07 [0.001]	-0.02 [0.954]	-0.03 [0.198]	0.5	
	5.37 [0.000]	0.05 [0.000]	-0.37 [0.023]	-	0.61	
	5.30 [0.000]	0.07 [0.000]	-	-0.03 [0.005]	0.57	

Continued

Crop	Regressor				R^2	*Chow Test*
	β_0	β_1	β_2	β_3		
Cotton	7.14 [0.000]	-0.03 [0.000]	-	-	0.66	3.68 [0.047]
	7.20 [0.000]	-0.04 [0.000]	-0.53 [0.092]	0.04 [0.036]	0.71	
	7.20 [0.000]	-0.04 [0.000]	0.13 [0.229]	-	0.70	
	7.20 [0.000]	-0.04 [0.000]	-	0.008 [0.166]	0.70	
Long berseem	10.6 [0.000]	0.004 [0.100]			0.13	2.88 [0.083]
	10.6 [0.000]	-0.78E-5 [0.999]	-0.28 [0.028]	0.02 [0.046]	0.35	
	10.6 [0.000]	0.008 [0.106]	-0.05 [0.347]		0.17	
	10.6 [0.000]	0.004 [0.522]	-	0.65E-4 [0.988]	0.13	
Tomatoes	6.78 [0.000]	0.06 [0.000]	-	-	0.88	1.68 [0.216]
	6.67 [0.000]	0.08 [0.000]	-0.04 [0.887]	-0.01 [0.501]	0.90	
	6.72 [0.000]	0.07 [0.000]	-0.19 [0.102]	-	0.90	
	6.68 [0.000]	0.08 [0.000]	-	-0.01 [0.076]	0.90	
Short berseem	9.05 [0.000]	0.07 [0.009]			0.30	1.33 [0.290]
	9.10 [0.000]	-0.01 [0.023]	-0.13 [0.292]	0.01 [0.148]	0.40	
	9.06 [0.000]	-0.009 [0.069]	0.03 [0.567]		0.32	
	9.08 [0.000]	-0.01 [0.035]	-	0.005 [0.241]	0.35	
Sugar cane	9.00 [0.000]	0.03 [0.000]	-	-	0.95	0.10 [0.897]
	9.00 [0.000]	0.03 [0.000]	0.03 [0.671]	-0.003 [0.646]	0.95	
	9.00 [0.000]	0.03 [0.000]	0.001 [0.975]	-	0.95	
	9.00 [0.000]	0.03 [0.000]	-	-0.0005 [0.855]	0.95	

β_0 is the constant term.

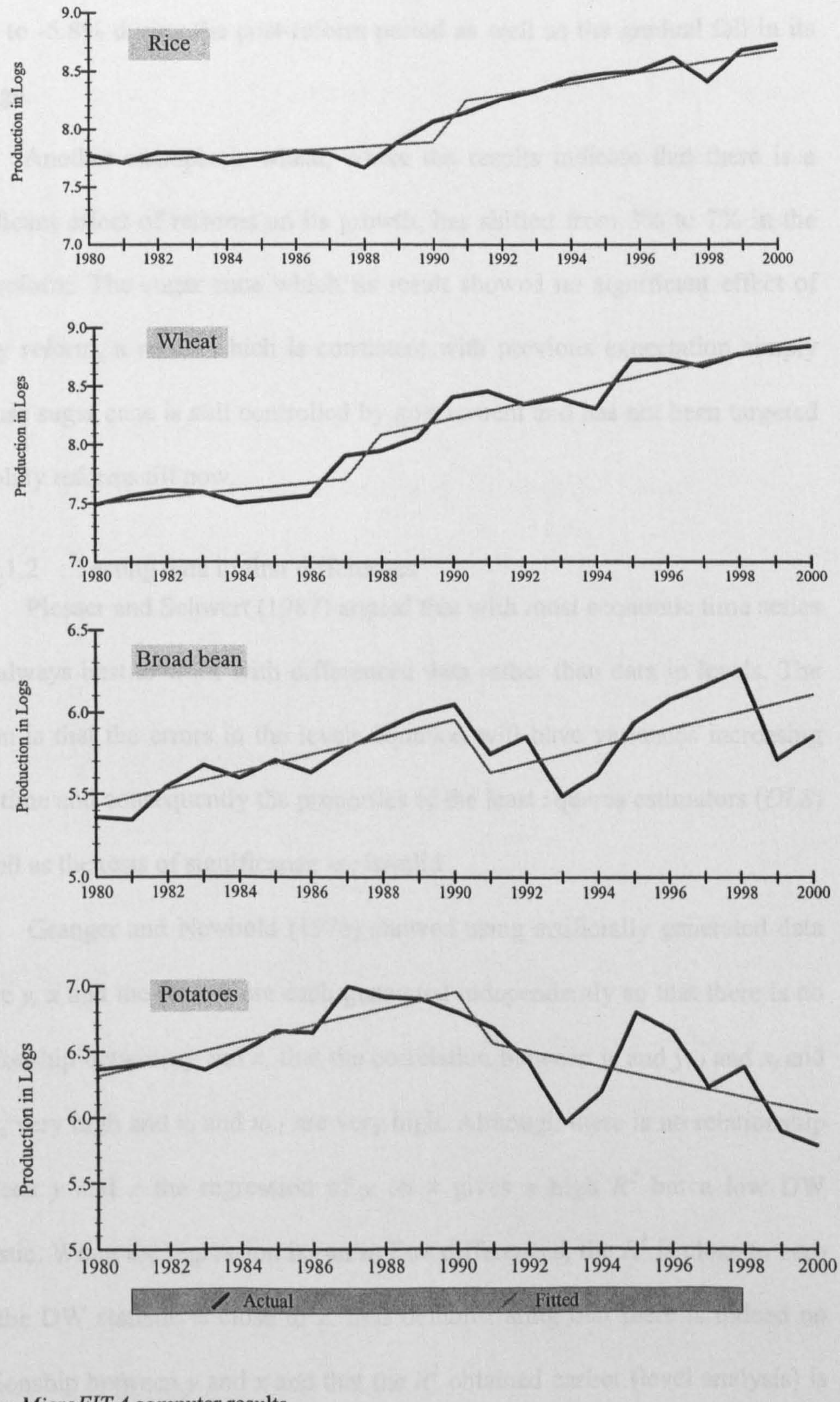
β_1 is the time trend.

β_2 is the Dummy for measuring the shift of the production over time, i.e.; the intercept.

β_3 is the Dummy for measuring the change in parameters slope over time.

Note that maize and wheat were liberalised in 1987 whereas rice in 1991 and cotton in 1994 (see Table A3-1). For wheat and maize the post-reform period started from 1988, for rice 1992 and for cotton 1995. Otherwise it is assumed to start in 1990.

FIG 3-10: ACTUAL AND FITTED VALUES OF REFORMS ON BOTH THE INTERCEPT AND/OR SLOPE OF PRODUCTION FOR SOME MAJOR CROPS IN EGYPT.



Source: *MicroFIT.4* computer results.
Note: Figures in parentheses are probability values.

where the slope during the post-reform era is estimated to be -0.06 compared with 0.06 in the pre-reform era, and the intercept has significantly changed by 16%. The result is confirmed by the decline in its annual growth rates from 6.4% to -5.8% during the post-reform period as well as the gradual fall in its acreage.

Another example is wheat, where the results indicate that there is a significant effect of reforms on its growth, has shifted from 3% to 7% in the post-reform. The sugar cane which its result showed no significant effect of policy reform, a result which is consistent with previous expectation simply because sugar cane is still controlled by government and has not been targeted by policy reforms till now.

3.6.2.1.2 : Testing data in first differences

Plosser and Schwert (1987) argued that with most economic time series it is always best to work with differenced data rather than data in levels. The reason is that the errors in the levels equation will have variances increasing over time and consequently the properties of the least squares estimators (*OLS*) as well as the tests of significance are invalid.

Granger and Newbold (1976) showed using artificially generated data where y, x and the error u are each generated independently so that there is no relationship between y and x, that the correlation between y_t and y_{t-1} and x_t and x_{t-1} are very high and u_t and u_{t-1} are very high. Although there is no relationship between y and x the regression of y on x gives a high R^2 but a low DW Statistic. When the regression is run in first differences, the R^2 is close to zero and the DW statistic is close to 2, thus demonstrating that there is indeed no relationship between y and x and that the R^2 obtained earlier (level analysis) is spurious. Thus regression in first differences might often reveal the true nature of the relationship between y and x. On the other hand, suppose that the level equation is correctly specified. Then all differencing will do is produce a moving average error and, at worst, ignoring it will give inefficient (but unbiased) estimates. Estimating the first difference equation by least squares gives us consistent estimates. Therefore it is better to use differencing and regressions in first differences, rather than regressions in levels with time as an extra explanatory variable (Maddala, 2001).

For instance suppose that we have the model defined above.

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 D_t + \beta_3 DT_t + u_t \tag{3.6}$$

where u_t are independent with mean zero and common variance σ^2. If we difference equation (3.6), we get

$$(Y_t - Y_{t-1}) = (\beta_0 - \beta_0) + \beta_1 (T_t - T_{t-1}) + \beta_2 (D_t - D_{t-1}) + \beta_3 (DT_t - DT_{t-1}) + (u_t - u_{t-1}) \tag{3.7}$$

$$\Delta Y_t = \beta_1 + \beta_2 \Delta D_t + \beta_3 \Delta DT_t + \Delta u_t \tag{3.8}$$

which can be written as,

$$\Delta Y_t = \gamma_1 + \gamma_2 D_t^{\circ} + \gamma_3 DT_t^{*} + v_t \tag{3.9}$$

Where the constant term has disappeared simply because $(\beta_0 - \beta_0) = 0$, $D_t^{\circ} = (D_t - D_{t-1})$ is an impulse dummy, being one in the first year of reform, zero otherwise, whereas $DT_t^{*} = (DT_t - DT_{t-1}) = D_t$ is as defined above (1 during reform period, zero elsewhere). The error $v_t = \Delta u_t = u_t - u_{t-1}$ is a moving average, and, hence not serially independent. D_t° and D_t^{*} are dummies that measure the effect of the reforms on the intercept and slope of the model describing the change in production respectively. Hence, in (3.9) γ_1 represents the pre-reform rate of growth in production, γ_2 the impulse shift in growth upon reform and γ_3 a permanent change in growth rate following reform.

Moreover, note that we can obtain estimates of the pre-reform trend (β_1), the change in intercept (i.e. β_2) and the change in the trend (β_3) either from the levels or from the difference form (as γ_1, γ_2 and γ_3). Although $\beta_1 = \gamma_1$, $\beta_2 = \gamma_2$ and $\beta_3 = \gamma_3$ the coefficients are estimated using different transformation of the data. Given that the levels data are characterised by some form of trending behaviour, it will look quite different to the data in differenced form. However, while the parameters are theoretically the same, their standard errors are not and hence statistical significance of the parameters may be quite different from that obtained using the data in levels. Since the levels data is trending, this will tend to over-state the statistical significance of any relationship using levels data. In essence, estimation of the parameters using differenced data is likely to lead to fewer statistically significant coefficients. Table 3-6 shows the parameter's coefficients estimated by regressions in the first differences model.

As expected (due the limited number of observations (21) used in the analysis) the results do not appear to be as strong as those in levels. Although the estimated coefficients for γ_1, γ_2 and γ_3 are similar in signs and magnitude to a large extent to those estimated using level data, none of the coefficients are significant in the differenced data approach. For example, the estimated coefficients for broad beans in levels, β_1 and β_2, are 0.05 and -0.37 respectively and they are "statistically significant" at the 5% level, whereas

TABLE 3-6: STRUCTURAL CHANGES IN PRODUCTION FOR MAJOR AGRICULTURAL PRODUCTS DURING 1980-2000 *(USING FIRST DIFFERENCES)*

Crop	Regressor			R^2
	γ_1	γ_2	γ_3	
Rice	0.03 [0.455]	-0.37 [0.562]	0.03 [0.517]	0.03
	0.04 [0.105]	0.04 [0.759]	-	0.005
	0.04 [0.144]	-	0.004 [0.669]	0.01
Maize	0.01 [0.709]	-0.08 [0.843]	0.02 [0.614]	0.09
	0.03 [0.201]	0.02 [0.240]	-	0.07
	0.02 [0.434]	-	0.01 [0.204]	0.09
Soybean	0.01 [0.892]	2.87 [0.111]	-0.23 [0.132]	0.14
	-0.09 [0.223]	0.21 [0.535]	-	0.02
	-0.09 [0.254]	-	0.009 [0.745]	0.006
Potatoes	0.04 [0.621]	1.54 [0.306]	-1.42 [0.270]	0.07
	-0.02 [0.705]	0.09 [0.746]	-	0.006
	-0.01 [0.819]	-	-0.01 [0.596]	0.01
Wheat	0.06 [0.316]	-0.15 [0.813]	0.01 [0.843]	0.004
	0.07 [0.058]	-0.03 [0.851]	-	0.002
	0.07 [0.083]	-	-0.002 [0.896]	0.97E-3
Broad beans	0.07 [0.296]	0.30 [0.780]	-0.06 [0.548]	0.15
	0.04 [0.368]	-0.34 [0.107]	-	0.14
	0.06 [0.244]	-	-0.03 [0.089]	0.15
Cotton	-0.05 [0.276]	-1.40 [0...44]	0.09 [0.350]	0.05
	-0.03 [0.470]	-0.03 [0.868]	-	0.001
	-0.03 [0.465]	-	-0.534E-3 [0.962]	0.12E-3
Long berseem	0.05 [0.728]	-0.20 [0.491]	0.01 [0.535]	0.03
	0.01 [0.283]	-0.02 [0.663]	-	0.01
	0.01 [0.298]	-	-0.001 [0.759]	0.005

Continued

Crop	Regressor			R^2
	γ_1	γ_2	γ_3	
Tomatoes	0.05 [0.149]	-0.09 [0.885]	0.008 [0.878]	0.001
	0.06 [0.034]	0.004 [0.973]	-	0.64E-4
	0.06 [0.044]	-	0.66E-3 [0.950]	0.22E-3
Short berseem	-0.1 [0.626]	-0.06 [0.897]	0.006 [0.889]	0.001
	-0.01 [0.580]	0.004 [0.964]	-	0.11E-3
	-0.01 [0.587]	-	0.56E-3 [0.943]	0.29E-3
Sugar cane	0.02 [0.117]	-0.08 [0.733]	0.009 [0.668]	0.02
	0.02 [0.013]	0.02 [0.670]	-	0.01
	0.03 [0.022]	-	0.001 [0.615]	0.01

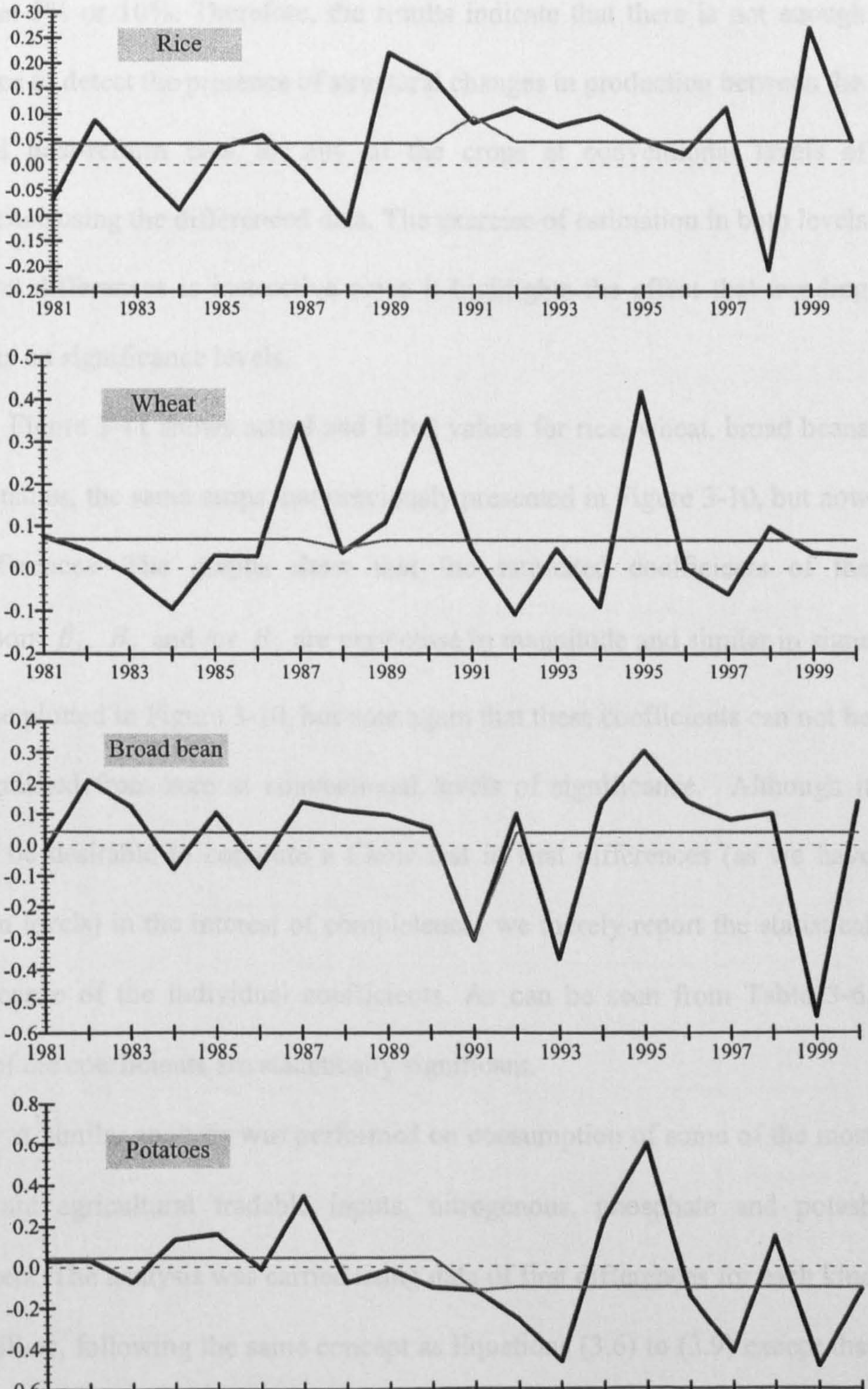
β_1 is the time trend.

β_2 is the Dummy for measuring the shift of production over time, i.e.; the intercept.

β_3 is the Dummy for measuring the change in parameters slope over time.

Note: Figures in parentheses are probability values

FIG 3-11: ACTUAL AND FITTED VALUES (IN DIFFERENCES) OF REFORMS ON BOTH THE INTERCEPT AND/OR SLOPE OF PRODUCTION FOR SOME MAJOR CROPS IN EGYPT



Source: *Micro.FIT4* computer results

when the difference model is used to estimate those parameters, they are estimated at 0.04 and -0.34 respectively, but are not statistically significant at either at 5% or 10%. Therefore, the results indicate that there is not enough evidence to detect the presence of structural changes in production between the pre-and post-reform eras for any of the crops at conventional levels of confidence using the differenced data. The exercise of estimation in both levels and first differences is instructive since it highlights the effect that trending data has on significance levels.

Figure 3-11 shows actual and fitted values for rice, wheat, broad beans and potatoes, the same crops that previously presented in Figure 3-10, but now in differences. The graphs show that the estimated coefficients of the regressors β_1, β_2 and /or β_3 are very close in magnitude and similar in signs to those plotted in Figure 3-10, but note again that these coefficients can not be distinguished from zero at conventional levels of significance. Although it would be desirable to compute a *Chow* test in first differences (as we have done in levels) in the interest of completeness we merely report the statistical significance of the individual coefficients. As can be seen from Table 3-6, none-of the coefficients are statistically significant.

A similar analysis was performed on consumption of some of the most important agricultural tradable inputs, nitrogenous, phosphate and potash fertilisers. The analysis was carried using data of first differences for each kind of fertiliser, following the same concept as Equations (3.6) to (3.9) except that $\Delta C_t = (C_t - C_{t-1})$ is the difference between fertiliser consumption C_t in year t and year $t-1$. Hence, it could be modelled as:

$$\Delta C_t = \delta_1 + \delta_2 D_t^* + \delta_3 DT_t^* + v_t \qquad (3.10)$$

where δ_1 is the time trend, δ_2 is the dummy for measuring the intercept shift of the fertiliser consumption between the two eras and δ_3 is the dummy for measuring the change in average growth rate between the two periods.

Table 3-7 reports the results. It indicates that none of the estimated coefficients of parameters for nitrogenous, phosphate or potash consumption after the reform period is statistically significant from zero at conventional levels of confidence. The result supports our previous results obtained in Table 3-6, in that there is not enough evidence to detect the presence of structural changes in fertiliser consumption between the pre-and post-reform eras at conventional levels of confidence using the differenced data.

TABLE 3-7: STRUCTURAL CHANGES IN FERTILISER CONSUMPTION DURINF THE PERIOD 1961-2000 *(USING FIRST DIFFERENCES)*

Fertilizer	Regressor			R^2
	δ_1	δ_2	δ_3	
Nitrogenous	0.04 [0.015]	0.43 [0.745]	-0.01 [0.797]	0.03
	0.04 [0.009]	0.09 [0.343]	-	0.02
	0.04 [0.010]	-	0.003 [0.355]	0.02
Phosphate	0.02 [0.419]	-0.71 [0.759]	0.02 [0.753]	0.003
	0.03 [0.292]	0.02 [0.919]	-	0.284E-3
	0.03 [0.299]	-	0.64E-3 [0.900]	0.428E-3
Potash	0.09 [0.132]	0.83 [0.850]	-0.03 [0.835]	0.003
	0.08 [0.112]	-0.08 [0.796]	-	0.001
	0.08 [0.112]	-	-0.003 [0.784]	0.002

Note that any kind of governmental subsidy on fertilisers was eliminated in 1992, thus reform period of fertiliser is the period from 1993 till 2000

3.6.3 Discussion

It is obvious that the levels results concur with what was discussed earlier in Section 3-5, Table 3-4 and Figure 3-9. For example, the *Chow* test (at 5%) indicated a significant structural change in crops that had been directly targeted by reforms such as rice, maize, wheat, broad beans and cotton or indirectly affected as soybeans and potatoes. Results using levels data with the aid of dummy variables also showed a significant effect on production during the post reform era, through the significant effect of the dummy on the intercept and/or the slope (see Section 3-6-3-1).

It is observed that some economists rely heavily on parameters and coefficients estimated using levels data in their specification for modeling the impact of new policy reforms on agricultural production. For example, Ghounem (2000) evaluated the impacts of Egyptian reform policies using the dummy variables on production, area, and costs depending only on levels data. As our analysis demonstrates, we should be very cautious in relying only on levels data in giving policy advice or evaluation simply because statistical significance offers a very different picture depending on whether the regressions are conducted in levels or first differences. Table 3-8 compares the results obtained for estimating the coefficients for β_1, β_2 and β_3 (equivalently γ_1, γ_2 and γ_3) using both approaches that are reported in Tables 3-5 and 3-6, we find a totally different picture in terms of significance and R^2 values, but there are some coefficients that are similar in size and sign. In other words, we may find that the magnitude of regressors in both approaches are similar, but the significance of the estimated coefficients as well as the R^2 values in the first differences approach has dramatically fallen, as is the case for the major crops reported in Table 3-8. For example, the estimated values for β_1 & β_2 and β_1 & β_3 or equivalents (γ_1 & γ_2) and (γ_1 & γ_3) for broad beans are very close in magnitude and similar in sign. Those estimated coefficients are statistically significant in levels whereas they are not after first differencing. Moreover, the value of R^2 has fallen dramatically from 61% and

TABLE 3-8: A COMPARISON BETWEEN COEFFICIENT'S MAGNITUDE AND SIGNS FOR SOME MAJOR CROPS ESTIMATED IN LEVELS AND FIRST DIFFERENCES.

Crop		**Regressor**			
		β_1	β_2	β_3	R^2
Broad beans	Levels	0.05 [0.000]	-0.37 [0.023]	-	0.61
	First differences	0.04 [0.368]	-0.34 [0.107]	-	0.14
	Levels	0.07 [0.000]	-	-0.03 [0.005]	0.57
	First differences	0.06 [0.244]	-	-0.03 [0.089]	0.15
Rice	Levels	0.03 [0.000]	0.32 [0.003]	-	0.92
	First differences	0.04 [0.105]	0.04 [0.759]	-	0.005
	Levels	0.02 [0.036]	-	0.03 [0.000]	0.94
	First differences	0.04 [0.144]	-	0.004 [0.669]	0.01
Maize	Levels	0.03 [0.000]	0.21 [0.005]	-	0.92
	First differences	0.03 [0.201]	0.02 [0.240]	-	0.07
	Levels	0.002 [0.802]	-	0.03 [0.000]	0.95
	First differences	0.02 [0.434]	-	0.01 [0.204]	0.09

Source: Tables 3-6 and 3-7.

57% between β_1 & β_2 and β_1 & β_3 respectively in level data to 14% and 15% in first-differences data. Since first differencing of production data will automatically reduce R^2, this drop in R^2 observed here is unsurprising. More importantly, the comparison of results from the data in levels and first differenced form offers a cautionary reminder when conducting statistical inference using trending data. Specifically, trends in the data bias the tests for structural change in favour of detecting such change. The (equivalent) test using first-differenced data detects the same changes (in terms of sign and in some cases magnitude of the structural change) but can not assure the analyst of such changes with the conventional degrees of confidence. Hence, whilst "inconvenient", given the sample size used and simplicity of the models, this should not be a surprising outcome.

Overall however, although the results are subject to the above caveat, they are indicative that reform had the following effects on production levels: (1) Crops that had been directly targeted by reforms such as rice maize and wheat, had shown a positive upward shift, while in the case of cotton and broad bean there was a dramatic fall. (2) Soybean, potatoes, tomatoes, long and short berseem were indirectly affected negatively by reforms. (3) Sugar cane was not affected by reforms.

3.7 : Summary and conclusion.

This chapter reviewed the main features and characteristics of Egyptian agricultural policies since 1939 until the reforms in the mid-1980s and beyond to 2000, where government intervention was a theme for the successive governments. A system of compulsory deliveries for cereal crops and controls over cropping patterns characterised the formation of government intervention during the Second World War. Agricultural polices during Nasser's regime showed high levels of intervention that negatively affected the agricultural sector, especially after the promulgation of the Agrarian Reform Act (No. 178 of 1952), where a system of controls was established, where the co-operatives controlled input and output prices, and where a high proportion of agricultural production was channelled through official agencies. These policies continued until the first half of the 1970s. However, the Egyptian economy was affected by several events that created major changes in its socio-economic structure. Government responded with the 'open door policy', and new sources of national income became important, such as the remittances of Egyptians working in the Arab and Gulf oil countries, petroleum exports and receipts from tourism and Suez Canal tolls.

Furthermore, owing to the adoption of the Agrarian Reform Act and other similar policies, the performance of the Egyptian economy had been so poor that it left no alternative other than comprehensive reform in 1986. Major changes took place in the agricultural sector over the reform era. For example, quotas, area controls and subsidies were gradually eliminated over a wide array of commercially important crops[13].

As a precursor to the analysis of the reforms a simple analysis has been undertaken to investigate the effect of reforms on production of crops. Structural changes in production have been examined for the period 1980-2000 using levels and differenced data. The results for levels data indicate a 'statistically significant' structural change in production in favour of the reform period for most crops. However, while the differenced data indicates the same changes (in terms of sign and in some cases magnitude of the structural change) they are not statistically significant at conventional degrees of confidence. In other words, we can not be assured that the coefficients obtained in levels are really statistically significant and that the significance

[13] Greater detail on policy changes affecting the exchange rate and the agricultural land tenancy system is given in Chapter 5, while the impact of the adopted reform polices on the efficiency of the use of agricultural resources is the subject of Chapter 6.

attached to the estimates is perhaps spurious. This does not mean that there is no evidence of a policy effect, it is just that we are unable to attach the confidence normally required for such effects.

Chapter IV

Chapter IV: The Policy Analysis Matrix (PAM) Model: Methodology, and Applications.

4.1 : Introduction:

The policy analysis matrix approach allows applied economists to analyse policies in terms of their impact on commodity systems - representative chains of farming, marketing, and processing activities - that together produce a marketable product. The PAM is a compromise between the desire for a theoretical model to describe the economy in exacting detail and the need for insightful policy analysis that operates within the inevitable constraints of time and data availability (Pearson et al, 1995).

The theoretical basis of the PAM is a simple partial equilibrium model of international trade and the matrix focuses attention on the identification of efficient patterns of production and prices.

In the empirical application of the PAM, emphasis is placed on budgets for costs and returns, which are chosen to represent commodity systems for different regions, types of farms, and technologies.

Developed by Monke and Pearson (1989), the policy analysis matrix approach is a simple accounting framework from which policy-effect and comparative-advantage measures can be computed simultaneously. The PAM is based on two accounting identities: the first defines profitability as the difference between total (or per unit) sales revenue and cost of production, and the other assesses the effects of distortionary policies and market failure.

According to Monke and Pearson (1989, p. 17), the PAM as a policy analysis tool is relevant to three areas of economic analysis: (1) ***The impact of policies on competitiveness and farm level profits***. Farm budget data for the agricultural system involve both sales revenue and input costs, and so allow the identification of actual profits received by farmers. The PAM thus indicates which crops are currently competitive and how their profits might change if price policy changes. (2) *The impact of investment policy on economic efficiency and comparative advantage.* The PAM indicates the crops that possess (under current policies & agro-climatic zone) a comparative advantage, and how new public investments might change the current efficiency. (3) *The effects of agricultural research policy on steering the processes of technological changes in desirable directions.* New investments that decrease social costs will also increase social profits and as a result, efficiency will improve.

In this chapter, section 2 gives an overview of PAM entries and manipulation strategy. Section 3 describes a number of economic indicators that are estimated in the PAM. Six indicators are of particular interest: (1) the Private Cost Ratio (PCR); (2) The Domestic Resource Cost Ratio (DRC); (3) The Nominal Protection Coefficients on tradable outputs (NPCO) and on tradable inputs (NPCI); (4) The Effective Protection Coefficient (EPC); (5) The Profitability Coefficient (PC); (6) The Subsidy Ratio to Producers (SRP); Net Private Profitability (NPP), Net Social Profitability (NSP); and Social Cost Benefit (SCB). Section 4 illustrates The PAM tables (Input-Output table, Private Prices table, Private Budget table, Social Prices table, Social Budget table and finally the PAM table). Section 5 discusses in detail a numerical example of PAM manipulation. Section 6 gives a brief overview of the various applications of PAMs by academics, practitioners and world organisations.

Section 7 discusses the strengths and weakness of the PAM approach and the ways to overcome these limitations. Section 8 summarises and concludes.

4.2 : PAM Methodology

The policy analysis matrix uses the terms private/social prices, profitability, and cost in the context that, for any tradable product (or input), there is a private price (in the local market) and a world price (in the international market). The latter price is often called the "social" price. Social values of prices, profitability, and cost are the values that would prevail in the absence of any policy distortions. Therefore, "social profitability" is measured

TABLE 4-1: THE POLICY ANALYSIS MATRIX FRAMEWORK.

	Revenues	**Costs**		**Profit**
		Tradable inputs	**Domestic Factors**	
Private Prices	**(A)** *(Revenue based on private profit)* P^DQ	**(B)** *(Costs of tradable inputs based on private prices)* $\sum_i P_i^D q_i$	**(C)** *(Costs of domestic factors based on private prices)* $\sum_j W_j^D I_j$	**(D)** *(Profits based on private prices)* $\pi^D = (A)-[(B)+(C)]$
Social Prices	**(E)** *(Revenue based on social profit)* P^SQ	**(F)** *(Costs of tradable inputs based on social prices)* $\sum_i P_i^S q_i$	**(G)** *(Costs of domestic factors based on social prices)* $\sum_j W_j^S I_j$	**(H)** *(Profit based on social prices)* $\pi^S = (E)-[(F)+(G)]$
Effects of divergences and efficient policy	**(I)** I = (A - E)	**(J)** J = (B - F)	**(K)** K = (C - G)	**(L)** L = D - H = (I - J - K)

Source: Bold letters are adopted from Monke and Pearson (1989, p. 23)

where,

P = price of output , Q = quantity of output. , D = indicates domestic or private prices

P_i = price of tradable input i , q_i = quantity of tradable inputs , S = indicates social or world prices

W_j = price of Domestic input j , I_j = quantity of domestic factors , π = profit not in terms of welfare, but in terms of international prices. However, using world prices may not necessarily provide appropriate reference for social valuation if international prices themselves are distorted by other countries policies. Agricultural policies of the industrial countries (e.g. export subsidies) tend to depress world prices of some agricultural products. However, these distorted world prices may persist for some period and have to be treated as given by the importers and exporters of other countries.

The first row refers to private profitability, which indicates the competitiveness of the agricultural system under the current technology, output values, input costs and policy performance. It is formed from results obtained from a private budget table, i.e., private revenue (A), cost of tradable inputs (B), and costs of domestic factors (C). These variables are used to measure private profitability (D), where private profitability (D) equals actual market revenue (A) minus actual costs [(B)+(C)]. Net private profitability (D) is defined as gross returns at market prices (A) less the tradable input cost (B) and the cost of domestic factors (C).

The second row indicates the comparative advantage or efficiency of the agricultural commodity system. It is formed of results obtained from a social budget table, i.e., social revenue (E), social costs of tradable inputs (F), and social costs of domestic factor (G)). These are used to measure social profitability (H), i.e., social profitability (H) is equal to social market revenue (E) minus social costs [(F) + (G)].

Domestic factors of production (labour, land and capital) do not have world prices because these domestic factors are not traded. So the social valuation of these factors is obtained by estimation of the net income forgone if the factor were allocated to its best alternative. For example, if there are two competitive crops, say X & Y, and one hectare of land is planted to crop X, so that crop Y can not be grown in that crop season, the social opportunity cost of land for the X crop is the net income lost because land can not produce crop Y. The other factors of production (capital & labour) used to produce X can not simultaneously be used in any other activity. The net income foregone from not producing Y is their net social opportunity cost.

The third row of the model measures policy-induced transfers that come into play due to policy-induced market failures or distortions. The divergence between the revenues at private and social prices (I=A-E) is the output transfer; a positive value implies that producers receive a subsidy due to existing policies as they receive a higher price than the world price for the commodity. The input transfer (J= B-F) measures the difference between input costs at private and social prices; a negative value implies that producers are receiving a subsidy, and a positive value implies a tax (i.e., farmers are paying more than they should). The extent of the factor transfer is measured by K=C-G. The net transfer from policy distortions or market failures not corrected by efficient policies is measured by L=D-H. If L>0 (i.e., NPP>NSP), there are net transfers to producers from the government, i.e. a subsidy; L<0 implies a tax on producers.

Any divergence between observed or private (actual market) prices and social (world) prices may be explained by the existence of distorting government policies (such as the predetermined prices of commodities and inputs) and/or by the existence of market failures (such as marketing imperfections, monopolies or monopsonies). Any of these failures of markets to work efficiently can cause inefficient price signals (Monke and Person, 1989).

The presence of such sources of divergence will cause private prices to differ from social prices. The magnitudes of I, J, K and L help to distinguish if there are distorted markets for these commodities or not. If these measures are different from zero, then the commodities concerned are facing an inefficient policy.

Other traditional measures of effects of government policies such as nominal and effective protection coefficients, and of comparative advantage or efficiency, such as the domestic resource cost (DRC), can also be derived from the PAM as will be discussed below.

4.3 :PAM Economic Indicators:

The previous table shows the economic indicators that may be calculated by the PAM approach. It also embodies the rule for calculating each indicator.

4.3.1 : Private Cost Ratio (PCR):

$$PCR = \mathrm{C} / (\mathrm{A-B})$$

where:

C: cost of domestic factors based on private prices
A: revenue based on private prices
B: costs of tradable inputs based on private prices

The Private Cost Ratio is defined as the ratio of the domestic factor cost [C] to the difference between the value of output and the tradables cost valued at private prices [value added (A-B)]. It thus shows the ability of the production system to cover the cost of the domestic factors and still remain competitive.

If the PCR is greater than one then the value of domestic cost is higher than the difference between the value of output and the cost of tradable inputs, implying that the sector is not profitable, and is more likely to contract in the future. If the PCR for a sector is less than one then the cost of domestic factors is less than the difference between total revenues and costs of tradable component valued at domestic or private prices. This indicates that the sector is profitable at prevailing domestic prices or, in other words, it has a competitive advantage domestically. So processors in the sector try to minimise their PCR by minimising factor and tradable input costs (i.e. using better technology, better management, less labour and so on) in order to maximise their profits. This is discussed in greater detail in Chapter 6.

4.3.2 : Domestic Resource Cost Ratio (DRC):

The DRC as a policy tool seeks to answer some important questions. What domestic outputs have international competitiveness given the current domestic resource endowment, production, and cost structures, and the given set of trade opportunities? What pattern of resource allocation is suggested by international competitiveness and static efficiency concerns? Given the expected evolution in domestic resource endowment, production, and cost structures, and given the expected developments in international markets, what domestic outputs are likely to be internationally competitive, in other words, efficient savers of foreign exchange? The domestic resource cost DRC is calculated in the PAM as:

$$DRC = G / (E\text{-}F)$$

where:
G: cost of domestic factors based on social prices
E: revenue based on social prices
F: costs of tradable inputs based on social prices

The Domestic Resource Cost is defined as the ratio of the domestic factor cost [G] to the difference between the value of output and the tradable inputs cost valued at social (world) prices [value added (E-F)]. If a product has a DRC equal to one then it takes a dollar's worth of resources to produce output that could be purchased internationally for one dollar. On the other hand, a comparative advantage is achieved in activities that have a DRC less than one. The lower the ratio, the greater the comparative advantage. For example, if the DRC for a crop = 0.2, then for every $ 0.20 of the cost of producing this crop the country saves $1.00 of imports or gains $1.00 in extra export revenue. In contrast, activities with a DRC greater than one are at a comparative disadvantage.

4.3.2.1 : Modelling of the DRC coefficient.

The Domestic Resource Cost compares the opportunity cost[1] of domestic production to the value added it generates. Both the numerator and denominator components of the DRC may be measured differently depending on whether the Corden or Balassa method of disaggregating value added is used[2].

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[1] The sum of the costs of using land, labour and capital; hence the total costs of domestic resources directly and indirectly applied and of non-traded inputs in the production of the good.

[2] According to Taskok (1990), estimation of value added may rely on :
A- simple Corden method in which, value added = value of output – cost of traded intermediary inputs.
B- simple Balassa method in which, direct value added = value of output – (cost of traded + non-traded intermediary inputs).
C- sophisticated Corden method in which, value added = value of output – (cost of direct traded inputs + traded components of non-traded intermediary inputs).
D- sophisticated Balassa method for domestic prices in which, direct value added = value of output – (cost of direct traded + non-traded intermediary inputs + tariff / subsidy on traded components).
E- sophisticated Balassa method for border prices in which, direct value added = value of output – (cost of direct traded + non-traded intermediary inputs – tariff / subsidy on traded components).

The basic definition is that

$$\text{DRC} = \frac{\text{Opportunity cost of domestic resources used}}{\text{Value added at border prices}} \tag{4.1}$$

However, DRC may either calculated as[3]

$$\text{DRC} = \frac{\sum_{j=k+1}^{n} a_{ij} V_j}{P_i^b - \sum_{j=1}^{k} a_{ij} P_j^b} \tag{4.2}$$

where

a_{ij}, 1 to k =Coefficients of traded inputs.
a_{ij}, k + 1 to n =Coefficients for domestic resources and non-traded intermediary inputs.
V_j = Shadow price of domestic resource or non-traded input.
P_j^b = Border price of traded input.
P_i^b = Border price of traded output.

or alternatively calculating the denominator at foreign prices rather than border prices.

$$\text{DRC} = \frac{\sum_{j=k+1}^{n} a_{ij} V_j}{P_i^f - \sum_{j=1}^{k} a_{ij} P_j^f} \tag{4.3}$$

where
P_i^f = Foreign price of output (i)
P_j^f = Foreign price of input (j)

According to Hassan (1991, Ch. 6, p.5), the following method of estimating the Domestic Resource Cost was used by Bruno (1967 and 1972) and Krueger (1972)

[3] Both numerator and denominator in equation (4.3) are in border price values, while the denominator in equation (4.4) is in foreign currency. (Equation (4.3) is the more widely used)

$$\mathrm{DRC} = \frac{\sum v_{ij}s_i + \sum_h \sum_i d_{hi}v_{hi}s_i}{1 - \sum_i m_{ij} - \sum_f v_{fj}r_f} \qquad (4.4)$$

where

v_{ij} = The amount of primary factor (i) used in producing a unit of (j).

s_i = The social opportunity cost or shadow price of factor (i)

d_{hj} = The amount of non-traded intermediate input (h) used in the production of (j), Valued at shadow price.

v_{fj} = The amount of foreign owned factors of production used in production of (j).

m_{ij} = Primary factors used in production of (j).

r_f = The share of income repatriated by foreign owned factors of production.

The numerator in equation (4.4) is the social opportunity cost of domestic resources employed directly and indirectly in producing a unit of j, while the denominator is the international value added at border prices in activity j adjusted for returns to foreign owned factors. This is discussed in greater detail in Chapter 6.

4.3.3 : Nominal Protection Coefficient (NPC):

4.3.3.1 : Nominal Protection Coefficient on Tradable Outputs (NPCO):

NPCO= A/E

where:

A: revenue based on private prices

E: revenue based on social prices

The Nominal Protection coefficient of a commodity is defined as the ratio of the gross domestic price to its equivalent world price. The NPC indicates whether the gross price of the domestic good is higher or lower at a point of time or over a given period of time than the gross world; it summarises the pattern of incentives or disincentives for a range of domestic goods, and how that has changed over time. In a sector where there are no intermediate inputs the NPC measures the protection given to producers by tariffs, non tariff barriers etc.

If the NPCO equals one, consumers, intermediaries and producers are facing domestic prices that are equal to world prices i.e., there is no divergence in the output price. A NPCO greater than one indicates that producers of this commodity are protected by governmental policy, in which case there is positive protection for domestic producers and intermediaries because they receive a higher price after intervention than they would in the absence of interventions; it is also negative protection for consumers, because they pay a higher price under such an intervention than they would without it. For an NPC less than one, the reverse structure of protection is in force i.e., it means that price-affecting policies tax producers and subsidise consumers.

Whatever numerical value of the NPC, it is an indicator of relative incentives among crops, and may be used to measure changes in relative incentives across years. In general the greater the divergence of the NPC from one, the greater the effect of policy on the price structure and the incentives to producers and consumers. This is discussed in greater detail is in Chapter 7.

4.3.3.2 : Nominal Protection Coefficient on Tradable Inputs (NPCI):

$$NPCI = \mathrm{B/F}$$

where:
B: costs of tradable inputs based on private prices
F: costs of tradable inputs based on social prices

The nominal protection coefficient for a tradable input (NPCI) is defined as the ratio of the domestic value of that input to its equivalent social price. It indicates whether growers are being subsidised or taxed in purchasing their tradable inputs. Unlike the NPCO, a NPCI less than one implies that growers are being protected in that they are paying less for their tradable inputs than they would in the absence of intervention; i.e. it indicates a case of subsidised inputs. In contrast, if the NPCI is greater than one then it indicates that growers are taxed on their purchases of tradable inputs. If it is one then growers are neither taxed nor subsidised in receiving tradable inputs. See chapter 7 for greater detail.

4.3.4 : Effective Protection Coefficient (EPC):

$$EPC = (A - B)/(E - F)$$

where:
A: revenue based on private prices
E: revenue based on social prices
B: costs of tradable inputs based on private prices
F: costs of tradable inputs based on social prices

The EPC is defined as the ratio of value added at private prices to value added at social prices. The Effective Protection Coefficient (EPC) is a more comprehensive indicator of incentives than the NPCO or NPCI economic indicators as it measures the aggregate degree of policy transfers from product market, output and tradable input policies. In other words, it reflects the overall subsidies or taxes on the prices of tradable inputs and outputs.

If the EPC is greater than one there is a positive incentive to produce the commodity under consideration i.e., a subsidy. Conversely, an EPC less than one means discrimination against the commodity i.e., a tax.

The negative EPC indicates that the value added in the sector concerned is actually lower than under free trade conditions. In other words, the value of resources used in producing this product (when valued at world prices) exceeds the price that farmers receive for the product itself in the domestic market. The measurement of negative effective protection is one way to highlight the fallacy that policy makers often introduce interventions on the assumption that they impact only on those sectors to which they are directed. Where negative effective protection is recorded, it signals quite clearly that the activity/industry in question is actually being penalised by the protective structure and illustrates just how costly an 'unplanned' protective regime can be. Incentives in this case draw resources into activities to produce commodities at a very high cost (Greenaway and Milner, 1993).

The EPC is applied in particular to production at farm level, processing and marketing, as it takes into consideration output prices and costs of traded inputs simultaneously. However, both the Nominal Protection Coefficient and the Effective Protection Coefficient are incomplete indicators of incentives, because they ignore the transfer effects of factor market policies.

The formula for the EPC can be written as:

$$\text{EPC} = \frac{\text{value added at domestic prices}}{\text{value added at border prices}} \tag{4.5}$$

or

$$\text{EPC}_i = \frac{P_i^d - \sum_{j=1}^{k} a_{ij} P_j^d}{P_i^b - \sum_{j=1}^{k} a_{ij} P_j^b} \tag{4.6}$$

where

P_i^d = Domestic price of output (i).

a_{ij} = Units of input (j) per unit of output (i).

P_j^d = Domestic price of input (j).

$P_i^b = P_i^f \times ER$, or border price of output equals foreign price $\times$ exchange rate.

$P_j^b = P_j^f \times ER$, or border price of input equals foreign price $\times$ exchange rate.

For intervention affecting output and related traded inputs, the EPC indicates whether the domestic good (i) receives positive or negative protection. Moreover, if the EPC is calculated over a period of time it shows the pattern of the changes in protection, as well as potential incentives / disincentives. Also it illustrates whether the pattern is conducive to efficient resource use or not.

4.3.4.1 : Modelling the Basic Effective Protection Concept[4]

Most policy analysts in the areas of international trade and economic development use the following equation to explain the effective rate of protection; see Balassa (1965,1968,1971,1982), Corden (1966,1971,1985), Greenaway (1986, 1987, 1988a, 1988b), Lewis (1968), Lutz (1980), Pearson (1975), Schweinberger (1975), Siggel (1986), Wipf (1971), Yeats (1976).

$$EPR_j = \frac{VA_j^d - rVA_j^w}{rVA_j^w} = \frac{VA_j^d}{rVA_j^w} - 1 = EPC_j - 1 \qquad (4.7)$$

The components of value added, either in domestic or world market prices, vary from one analyst to another. These variations are due to the way of treating of subsidies, taxes, nominal tariffs, the exchange rate and non-traded inputs.

For Corden's original formula for the effective rate of protection for the activity producing j.

Let:

VA_j^w = Value added per unit of j in activity j in the absence of tariffs

VA_j^d = Value added per unit of j in activity j made possible by the tariff Structure

EPR_j = Effective protective rate for activity j, in other words, the proportional increase in the effective price due to tariffs

P_j^w = Nominal price of a unit of j at free trade prices in domestic currency

P_j^d = Nominal price of a unit of j at domestic prices

a_{ij} = The (fixed) number of units of intermediate input i used in the production of one unit of j.

A_{ij} = The share of intermediate input i in the cost of j in the absence of tariff

T_j = The nominal tariff rate of j

T_i = The nominal tariff rate of i

Therefore

[4] This section relies heavily on Hassan (1991).

$$VA_j^w = P_j^w - \sum_i a_{ij} P_i^w \tag{4.8}$$

$$= P_j^w (1 - \sum_i A_{ij}) \tag{4.9}$$

where by definition

$$A_{ij} = \frac{a_{ij} P_i^w}{P_j^w} \tag{4.10}$$

Similarly,

$$VA_j^d = P_j^d - \sum_i a_{ij} P_i^d \tag{4.11}$$

$$= P_j^w (1 + T_j) - \sum_i a_{ij} P_i^w (1 + T_i) \tag{4.12}$$

$$= P_j^w (1 + T_j) - P_j^w \sum_i A_{ij} (1 + T_i) \tag{4.13}$$

By substitution from equations (4.9) and (4.13) in (4.7) we obtain,

$$EPR_j = \frac{P_j^w T_j - \sum_i a_{ij} P_i^w T_i}{P_j^w - \sum_i a_{ij} P_i^w} \tag{4.14}$$

$$= \frac{T_j - \sum_i A_{ij} T_i}{1 - \sum_i A_{ij}} \tag{4.15}$$

Practically, it may not be able to observe either world prices or input cost shares at those prices (A_{ij}) directly. However, equation (4.15) can be rewritten in terms of domestic input cost shares. Noting that,

$$P_j^w = \frac{P_j^d}{1 + T_j} \tag{4.16}$$

$$P_i^w = \frac{P_i^d}{1 + T_i} \tag{4.17}$$

equation (4.14) can be rewritten as

$$\mathrm{EPR}_j = \frac{\dfrac{P_j^d T_j}{1+T_j} - \sum \dfrac{a_{ij} P_i^d T_i}{1+T_i}}{\dfrac{P_j^d}{1+T_j} - \sum \dfrac{a_{ij} P_i^d}{1+T_i}} \tag{4.18}$$

By letting the domestic input cost share be,

$$A_{ij}^* = \frac{a_{ij} P_i^d}{P_j^d} \tag{4.19}$$

equation (4.18) can be rewritten as

$$\mathrm{EPR}_j = \frac{\dfrac{T_j}{1+T_j} - \sum \dfrac{A_{ij}^* T_i}{1+T_i}}{\dfrac{1}{1+T_j} - \sum \dfrac{A_{ij}^*}{1+T_i}} \tag{4.20}$$

or as,

$$\mathrm{EPR}_j = \frac{1 - \sum A_{ij}^*}{\dfrac{1}{1+T_j} - \sum A_{ij}^* \dfrac{1}{1+T_i}} - 1 \tag{4.21}$$

Bruno (1972), Krueger (1984), Lewis (1968), Pearson (1975) and Siggel (1986) used the formula in equation (4.15). Equation (4.21) is the form used by Greenaway (1988a and 1988b) and Greenaway and Milner (1986 and 1987).

4.3.5 : Profitability Coefficient (PC):

PC = (A- B-C)/(E–F-G)=(D/H)

or

PC = private profitability / social profitability

where
A: revenue based on private prices
E: revenue based on social prices
B: costs of tradable inputs based on private prices
F: costs of tradable inputs based on social prices
C: costs of domestic factors based on private prices
G: costs of domestic factors based on social prices

The Profitability Coefficient is the ratio of private to social profits; i.e. it measures the incentive effects of all policies considered together. Thus it serves as a proxy for the net policy transfer. Although the PC coefficient is theoretically more comprehensive than the EPC because it accounts for both the tradable and non-tradable cost components, it is an incomplete indicator in the case where it has a negative value. It dose not indicate clearly the source of this negative value, i.e. whether it is due to a negative value in social or private profit, unless the analyst refers back to the original calculations. If the PC is greater than one then policy transfers have permitted domestic producers to receive a greater profit on their activities given intervention than they would in the absence of intervention. A PC equal to one implies that the incentive is "neutral"; that is, domestic producers are receiving the same profit as they would have achieved at world prices (i.e. profits valued at private and social prices are equal). If the PC is negative, the economic indicator becomes useless, as it does not indicate the source of this negative value. However, the SRP is an alternative economic indicator that sends the same message (greater detail is given in Chapter 8).

4.3.6 : Subsidy Ratio to Producers (SRP):

$$SRP = (D - H)/E$$

or

$$SPR = (\text{private profitability - social profitability}) / \text{social revenue}$$

where:
D: profits based on private prices
E: revenue based on social prices
H: profits based on social prices

The Subsidy Ratio to Producers[5] is the ratio of the difference between private and social profits to the social revenue. It indicates the proportion of revenues valued in world prices that would be required if a subsidy or tax were substituted for the entire set of commodity and macro economic policies. In other words, it quantifies the level of transfers from divergences as a proportion of the undistorted value of the system's revenue. A positive (negative) value of SRP implies a producer subsidy (tax). The smaller the SRP, the less distorted the agricultural system (see chapter 8 for greater detail).

4.3.7 : Net Private Profitability (NPP), Net Social Profitability (NSP) and Social Cost Benefit (SCB).

There are other alternative economic indicators to the PCR and the DRC that could be derived from the PAM to measure private profitability (such as net private profitability (NPP)), social profitability (such as net social profitability (NSP)) and social competitiveness (social cost benefit (SCB)). The NPP and PCR might be considered alternative measures as their way of calculation is simply an alternative presentation or transformation of the same elements or data involved. Similarly, the DRC and the SCB could be considered alternatives measurements. However, Fang and Beghin (2000); Masters and Winter Nelson (1995) argue that the SCB might be not biased to activities that rely heavily on domestic factors and avoid the errors in disaggregating traded and non-traded components. However, the study employed both analysis tools to confirm the results obtained (greater detail is discussed in chapter 6).

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[5]SPR is an efficient indicator of incentive, as it allows comparisons of the extent to which all policy subsidised agricultural sector Moreover, it can be also classified into components transfer to clarify the effect of output, input, and factor policies solely.

4.3.7.1 Net Private Profitability

$$NPP = A\text{-}B\text{-}C$$

or

$$NPP = \text{private revenue} - \text{private tradable costs} - \text{private domestic cost}$$

where:
A: revenue based on private prices
B: costs of tradable inputs based on private prices
C: cost of domestic factors based on private prices

Net private profitability (NPP) is a direct measure of the incentives to farmers to produce a commodity, and reflects the competitiveness of that commodity at the observed market prices. A positive NPP implies that the commodity system is privately or domestically profitable, given input and output prices, technology level, current government policy and existing market distortions.

4.3.7.2 Net Social Profitability

$$NSP = E\text{-}F\text{-}G$$

or

$$NSP = \text{social revenue} - \text{social tradable costs} - \text{social domestic cost}$$

where:
E: revenue based on social prices
F: costs of tradable inputs based on social prices
G: cost of domestic factors based on social prices

Social profits (H) are an efficiency measure because inputs (F&G) and outputs (E) are valued in prices that reflect scarcity values or social opportunity costs. Internally traded inputs (F) and outputs (E) are valued at world prices – FOB export prices for exportables and CIF import prices for imported goods and services. In other words, net social profitability (NSP) measures revenues valued at social prices less the value of tradable and domestic resources both valued at their respective social prices. If NSP is positive (negative), then the sector may be considered economically efficient (inefficient), with the value of output at world prices being greater (less) than the sum of tradable inputs plus domestic factor costs (Hassan, 1991).

4.3.7.3 Social Cost Benefit (SCB)

SCB = (F+G)/E

or

SCB = (social tradable cost + social domestic cost) social revenue

where:
F: costs of tradable inputs based on social prices
G: cost of domestic factors based on social prices
E: revenue based on social prices

The SCB is defined as traded and non-traded costs divided by total revenue both valued at social prices and in PAM notations as (F+G)/E. The lower values of SCB indicate stronger competitiveness and vice versa.

4.4 : PAM manipulation tables

The Policy Analysis Matrix is an accounting framework that consists of six tables; in other words, to complete the entries of the PAM we have to construct these six tables, which are identified as follows:

4.4.1 : Input/output technical coefficients (I/O) table.

The Input-Output table (as used in the PAM) contains on the input side the coefficients of inputs and factors used for cropping an area of one feddan. For example, to grow one feddan of soybean the farmer needs 350 kg and 150 kg of nitrogenous and phosphate fertiliser, 40 kg of seeds, and so on. On the output side it contains the coefficient of the obtained outputs for main and by-products. (see Table 4-2).

4.4.2 : Private Prices (PP) table.

For any product (or input), there is a private value at which we observe goods and services actually being exchanged in the local market, reflecting actual market prices received or paid by farmers, merchants, or processors in agricultural system, and it is those which we have used in constructing our budgets (for example, the price of soybean, the cost of fuel, the going wage rate, etc.) These are also called market or financial prices. In other words, observed market prices are used to represent the private values. The observed prices of inputs and outputs are tabulated in the corresponding entries in Table 4-2.

4.4.3 : Private Budget (PB) table.

The private budget table is obtained by multiplying the input/output technical coefficient table by the corresponding values in the private prices table. The results obtained in the private budget table are used to complete the first row in the policy analysis matrix, For example, it allows us to calculate the private revenues, tradable and non-tradable private costs[6] and consequently private profits (see the shaded cells in Table 4-2).

4.4.4 : Social Prices (SP) table.

As noted earlier, social prices, profitability, costs, etc are also required. For any tradable product (or input), there is a private price (in the local market) and an international price, the latter price often being called the "social" price[7].

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[6] The basis of differentiating between traded and non-traded inputs is discussed in Chapter 5.
[7] The core point in PAM estimation is the accurate estimation of the equivalent world prices for inputs and outputs. Chapter 5 gives full detail for social valuation for PAM required entries.

TABLE 4-2: INPUT-OUTPUT, PRIVATE PRICES AND PRIVATE BUDGET ESTIMATION FOR SOYBEAN PAM IN 1986

(1) Input /Output Table		Unit	1986
Tradable Inputs			
1-Fertilisers	Nitrogen	Kg/Fed	350.00
	Phosphate	Kg/Fed	150.00
	Potassium	Kg/Fed	0.00
2-Insecticide		Unit	1.00
3-Seed	On Farm	Kg/Fed	0.00
	Off Farm	Kg/Fed	40.00
Domestic Factors			
1-Labour			
	Man	Day/Fed	32.00
	Boy	Day/Fed	12.00
2-Machinery	***Land Prep.***	Hrs/Fed	4.10
	irrigation	Hrs/Fed	19.01
	Pest Control	Hrs/Fed	0.85
	Harvest&Thresh	Hrs/Fed	2.75
	Transportation	Hrs/Fed	2.10
	Compiler	Hrs/Fed	0.00
3-Manure		Ld / Fed	100.01
4-Water		1000M3	2.50
5-Animal Work	***Cow***	Day/Fed	0.17
	Cart	Day/Fed	0.00
	Camel	Day/Fed	0.00
6-Others		£E/Fed	
7-Land		Fed	1.00
Yield			
	Main Product	Ton/Fed	1.22
	By Product	Ton/Fed	0.00

(2) Private Prices Table		Unit	1986
Tradable Inputs			
1-Fertilisers	Nitrogen	£E / Kg	0.07
	Phosphate	£E / Kg	0.04
	Potassium	£E / Fed	0.00
2-Insecticide		£E / Kg	10.71
3-Seed	On Farm	£E / Kg	0.00
	Off Farm	£E / Kg	0.43
Domestic Factors			
1-Labour			
	Man	£E / Day	4.30
	Boy	£E / Day	2.15
2-Machinery	***LandPrep.***	£E / Hr	3.80
	irrigation	£E / Hr	1.00
	Pest Control	£E / Hr	2.00
	Harvest &Thresh	£E / Hr	4.30
	Transportation	£E / Hr	4.00
	Compiler	£E / Hr	0.00
3-Manure		£E / Ld	0.16
4-Water		£E / M3	0.00
5-Animal Work	***Cow***	£E / Day	3.85
	Cart	£E / Day	0.00
	Camel	£E / Day	0.00
6-Others		£E / Fed	17.60
7-Land		£E / Fed	28.36
Yield			
	Main Product	£E / Ton	375.00
	By Product	£E / Ton	0.00

(3) Private Budget Table		Unit	1986	TR (%)*	NTR (%)	TRV	NTRV
Tradable Inputs		£E / Fed	57.29			57.29	0.00
1-Fertilisers	Nitrogen	£E / Fed	23.10	1.00	0.00	23.10	0.00
	Phosphate	£E / Fed	6.30	1.00	0.00	6.30	0.00
	Potassium	£E / Fed	0.00	1.00	0.00	0.00	0.00
2-Insecticide		£E / Fed	10.71	1.00	0.00	10.71	0.00
3-Seed	On Farm	£E / Fed	0.00			0.00	0.00
	Off Farm	£E / Fed	17.18	1.00	0.00	17.18	0.00
Domestic Factors		£E / Fed	282.13			18.30	263.83
1-Labour							
	Man	£E / Fed	137.60	0.00	1.00	0.00	137.60
	Boy	£E / Fed	25.80	0.00	1.00	0.00	25.80
2-Machinery	***Land Prep.***	£E / Fed	15.58	0.30	0.70	4.67	10.91
	irrigation	£E / Fed	19.01	0.21	0.79	3.99	15.02
	Pest Control	£E / Fed	1.70	0.50	0.50	0.85	0.85
	Harvest&Thresh	£E / Fed	11.83	0.53	0.47	6.27	5.56
	Transportation	£E / Fed	8.40	0.30	0.70	2.52	5.88
	Compiler	£E / Fed	0.00	0.75	0.25	0.00	0.00
3-Manure		£E / Fed	0.00	0.00	1.00	0.00	15.60
4-Water		£E / Fed	0.00	0.20	0.80	0.00	0.00
5-Animal Work	***Cow***	£E / Fed	0.65	0.00	1.00	0.00	0.65
	Cart	£E / Fed	0.00	0.00	1.00	0.00	0.00
	Camel	£E / Fed	0.00	0.00	1.00	0.00	0.00
6-Others		£E / Fed	17.60	0.00	1.00	0.00	17.60
7-Land		£E / Fed	28.36	0.00	1.00	0.00	28.36
Yield			456.00				
	Main Product	£E / Fed	456.00				
	By Product	£E / Fed	0.00				

(1) Table 1 numerates input-output coefficients for soybean production in 1986. (2) Table 2 numerates domestic or observed prices for soybean-input costs and output prices in 1986.

(3) Table 3, column (3) is derived as follows: Table 1 column (3) X Table 2 column (3). (4) Table 3, column (3) is desegregated into column 6 (Tradable Value) and column 7 (Non-Tradable Value) according to the ratios shown in columns 4 and 5

* In order to estimate the PAM entry cells B and C, it is essential to separate the costs of inputs and factors into their tradable and non-tradable (domestic) components. To do this step the study relied on the assumption that costs of fertilisers, pesticides and seeds are 100% tradable, while for labour, manure and animal work are 100% non-tradable. For the tradable and non-tradable proportion costs of machinery, the study relied on its own estimate for land preparation and irrigation, while for machinery cost items and water the study adopted the proportions used by other studies such as Yao (1997a) and FAO (1999).

Social prices are the prices which would prevail in the absence of any policy distortions (such as taxes and subsidies) or market failures (such as monopolies). They reflect the value to society as a whole rather than to private individuals, and are the values used in economic analysis. Such prices sometimes called shadow prices, efficiency values or opportunity costs (see Table 4-3).

4.4.5 Social Budget (SB) table.

The same procedure is used as in the private budget table, but here we use social values. The Social Budget table is calculated by multiplying the input/output technical coefficient table by the appropriate social prices. The result of the social budget is entered the second row in the policy analysis matrix, and allows us to calculate the social revenues, tradable and non-tradable social costs and consequently social revenues (see the shaded cells in Table 4-3).

4.4.6 PAM table.

Input - Output, Private Prices, Private Budget, Social Prices and Social Budget tables are formed in linked spreadsheets to obtain the result for any change in any of these tables simultaneously. There are however yet more tables or models used in estimating social price tables (as will be discussed in Chapter 5).

TABLE 4-3: INPUT-OUTPUT, SOCIAL PRICES AND SOCIAL BUDGET ESTIMATION FOR SOYBEAN PAM IN 1986

(4) Input /Output Table		Unit	1986
Tradable Inputs			
1-Fertilisers	Nitrogen	Kg/Fed	350.00
	Phosphate	Kg/Fed	150.00
	Potassium	Kg/Fed	0.00
2-Insecticide		Unit	1.00
3-Seed	On Farm	Kg/Fed	0.00
	Off Farm	Kg/Fed	40.00
Domestic Factors			
1-Labour			
	Man	Day/Fed	32.00
	Boy	Day/Fed	12.00
2-Machinery	*Land Prep.*	Hrs/Fed	4.10
	irrigation	Hrs/Fed	19.01
	Pest Control	Hrs/Fed	0.85
	Harvest&Thresh	Hrs/Fed	2.75
	Transportation	Hrs/Fed	2.10
	Compiler	Hrs/Fed	0.00
3-Manure		Ld / Fed	100.01
4-Water		1000M3	2.50
5-Animal Work	*Cow*	Day/Fed	0.17
	Cart	Day/Fed	0.00
	Camel	Day/Fed	0.00
6-Others		£E/Fed	
7-Land		Fed	1.00
Yield			
	Main Product	Ton/Fed	1.22
	By Product	Ton/Fed	0.00

(5) Social Prices Table		Unit	1986
Tradable Inputs			
1-Fertilisers	Nitrogen	£E / Kg	0.07
	Phosphate	£E / Kg	0.12
	Potassium	£E / Fed	0.12
2-Insecticide		£E / Kg	20.66
3-Seed	On Farm	£E / Kg	
	Off Farm	£E / Kg	0.83
Domestic Factors			
1-Labour			
	Man	£E / Day	4.30
	Boy	£E / Day	2.15
2-Machinery	*LandPrep.*	£E / Hr	4.84
	irrigation	£E / Hr	1.66
	Pest Control	£E / Hr	3.86
	Harvest &Thresh	£E / Hr	8.29
	Transportation	£E / Hr	4.84
	Compiler	£E / Hr	0.00
3-Manure		£E / Ld	0.16
4-Water		£E / M3	11.30
5-Animal Work	*Cow*	£E / Day	3.85
	Cart	£E / Day	0.00
	Camel	£E / Day	0.00
6-Others		£E / Fed	17.60
7-Land		£E / Fed	83.48
Yield			
	Main Product	£E / Ton	327.62
	By Product	£E / Ton	0.00

(6) Social Budget Table		Unit	1986	TR (%)	NTR (%)	TRV	NTRV
Tradable Inputs		£E / Fed	95.79			95.79	0.00
1-Fertilisers	Nitrogen	£E / Fed	24.60	1.00	0.00	24.60	0.00
	Phosphate	£E / Fed	17.40	1.00	0.00	17.40	0.00
	Potassium	£E / Fed	0.00	1.00	0.00	0.00	0.00
2-Insecticide		£E / Fed	20.66	1.00	0.00	20.66	0.00
3-Seed	On Farm	£E / Fed	0.00			0.00	0.00
	Off Farm	£E / Fed	33.13	1.00	0.00	33.13	0.00
Domestic Factors		£E / Fed	396.52			34.98	361.54
1-Labour							
	Man	£E / Fed	137.60	0.00	1.00	0.00	137.60
	Boy	£E / Fed	25.80	0.00	1.00	0.00	25.80
2-Machinery	*Land Prep.*	£E / Fed	19.83	0.30	0.70	5.95	13.88
	irrigation	£E / Fed	31.48	0.21	0.79	6.61	24.87
	Pest Control	£E / Fed	3.28	0.50	0.50	1.64	1.64
	Harvest &Thresh	£E / Fed	22.81	0.53	0.47	12.09	10.72
	Transportation	£E / Fed	10.16	0.30	0.70	3.05	7.11
	Compiler	£E / Fed	0.00	0.75	0.25	0.00	0.00
3-Manure		£E / Fed	15.60	0.00	1.00	0.00	15.60
4-Water		£E / Fed	28.24	0.20	0.80	5.65	22.59
5-Animal Work	*Cow*	£E / Fed	0.65	0.00	1.00	0.00	0.65
	Cart	£E / Fed	0.00	0.00	1.00	0.00	0.00
	Camel	£E / Fed	0.00	0.00	1.00	0.00	0.00
6-Others		£E / Fed	17.60	0.00	1.00	0.00	17.60
7-Land		£E / Fed	83.48	0.00	1.00	0.00	83.48
Yield			398.39				
	Main Product	£E / Fed	398.39				
	By Product	£E / Fed	0.00				

(1) Table 4 numerates input-output coefficients for soybean production in 1986.

(2) Table 5 numerates social or world prices for soybean-input costs and output prices in 1986.

(3) Table 6, column (3) is derived as follows: Table 4 column (3) × Table 5 column (3).

(4) Table 6, column (3) is desegregated into column 6 (Tradable Value) and column 7 (Non-Tradable Value) according to the ratios shown in columns 4 and 5.

4.5 : *A Numerical Example*

After collecting or computing entries for the first and second rows, the final step is to assemble this information inside the matrix. Table 4-4 shows the policy analysis matrix for soybean in 1986.

The first thing we notice is that, with a private profit of 116 £E/Fed, this commodity is profitable. However, we also see from cell H that it lacks comparative advantage, and as such imposes a net drain on the economy. For every feddan planted of soybeans, the country loses 95 £E.

TABLE 4-4: THE SOYBEAN PAM IN 1986

Soybean PAM	Revenues	Costs		Profits
		Tradable	Non Tradable	
Private/ Domestic Prices	(A) 456	(B) 76	(C) 264	(D) 116
Social / World Prices	(E) 398	(F) 131	(G) 362	(H) -95
Divergence	(I) 58	(J) -55	(K) -98	(L) 211

This sector is unlikely to survive without receiving policy-induced transfers. The soybean price is 456 £E, which is greater than the world price of 398 £E, suggesting that the government has raised the price to domestic growers. We see from the profit divergence in cell L, that there is an overall net subsidy of 211 £E for every feddan planted with soybean. In other words, there is a flow from the economy as a whole into this commodity sector as a result of policy.

Further analysis could be carried out using the PAM including what economists call "comparative static" or "partial budgeting" analysis. This involves asking "what if" questions and simulating certain changes in policies that impact upon the parameters used, and therefore on profitability and comparative advantage (Sellen, 2002). Simulation can be applied by adjusting the parameters. For example, if cheaper imports were allowed to enter, private revenue would drop to 398 £E (where A=E), and private profits would then fall to 58 £E. This would have a significant consequence for the industry as the net private profit of planting soybean would fall by 50%. Further analysis could be easily done by eliminating subsidy on tradable inputs such as fertiliser, removing the tax on fuel, liberalising land rent market, etc. However, the PAM can also give an insight into the producing sector by estimating indicators of efficiency and protection as will be discussed in the following section

Constructing the PAM requires a massive effort and time to meet its data requirements. The most important part is the evaluation of social prices for a credible exchange rate, tradable and non-tradable inputs and output. All these issues will be discussed in Chapter 5.

4.6 : Applications of the PAM:

Since its development the Policy Analysis Matrix has been widely used by academics, practitioners and international organisations such as the United Nations, Agricultural Policy Support Services (e.g. Ibrahim, 1993 and FAO, 1999) and the World Bank (e.g. Sellon, 2001), and in a wide range of applications across developing and transition economies (e.g. Bozik et al., 2000 and Michalek, 1995).

The PAM was also used in Indonesia (Nelson and Panggabean, 1991), Tunisia (Abdelkafi, 1998) and more recently in South Africa (Krabbe et al., 2000 and Joubert, 2000) to investigate commercial sugar production. For Thailand and Jamaica, Farell (1990) evaluated the economic impact of an export diversification programme Jamaica and Yao (1997a, 1997b, 1997c and 1999) has applied the PAM to investigate both rice production and the Thai agricultural diversification policy in 1994-96. In North West Asia, Al-Habbab et al., (1996) used the PAM to measure the comparative advantage of using the new cropping pattern technologies in producing tomato crops in the Jordan valley, while Kubrursi (2001) studied the potential of the Lebanese agricultural sectors. In China, Fang et al., (2000) used the PAM in estimating the comparative advantage of the agricultural sector.

Two separate studies for Ethiopia (Winter-Nelson, 1997 and Ayele, 1999) also applied the PAM. The first investigated the effects of rural taxation policy during 1981-89 on household sales and purchases of agricultural products as well as of direct taxes, while the second studied the profitability and the consequent economic returns from adopting the Vertisol[8] innovation for both farm and household levels.

The PAM has increasingly been applied by analysts to commodity systems, such as dairies (Staal et al., 1994, for Kenya; Finan, 1991 for Portugal), the food market sector (in Tanzania, Mbiha, 1993 and Sudan, Gumaa et al., 1994), on maize production technologies in Cameroon (Adesina et al., 1998), on farms producing a range of commodities or crops (El Gendy, 1999, Omran, 1997 and Ghounem, 2000), investment, as in Cupo (1994), on evaluating cattle and wildlife ranch profits in Zimbabwe (Kreuter, 1994). The PAM had also been reviewed by many economists such as Ellis (1996), Lofchie (1996), Thorbecke (1990).

Unlike the majority of the studies, where the PAM is restricted to a single year, there is a more recent set of studies that have constructed the PAM over a period of years in Bulgaria, Poland and Slovakia, such as Ivanova et al., (2000), Czyzewski et al. (2000) and Bozik et al. (2000).

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[8] **Vertisols are fertile soils that support the majority of livestock and human population in Ethiopia.**

There are other practitioners who tried to extend the PAM. For example, Morrison and Balcombe (2002) provided an indicative example as to how policy analysis can be conducted more systematically using existing secondary data in association with bootstrapping techniques. Kydd et al., (1997) extended the PAM to incorporate the environmental costs and benefits of resource use.

Constructing the PAM tables (in which private prices are compiled and social prices are estimated for inputs and outputs) requires the practitioner to be very cautious and careful in the way that the estimates are obtained. For example, one of the studies that used the PAM approach (Mangisoni, 2000) referred the obtained negative DRC results for maize (-0.30) and beans (-0.28) (the sectors under investigation) to the negative value obtained from social valuation of their domestic costs. The case that is completely nonsense simply because in practice there is not any domestic or social valuation for any type of costs with negative value. However, the issue of estimating the equivalent social (world) prices for tradable and non-tradable inputs and outputs will be discussed in greater detail in Chapter 5.

4.7 : PAM strengths and weakness

The policy analysis matrix as a quantitative tool for policy advice has, as many other models, its strengths and weaknesses or limitations. The most common advantages are: (1) it makes it possible to detect the net effect of policy applied; (2) it is very suitable for production and efficiency analysis; (3) it allows the analyst to compute important coefficients related to the level of protection as well as comparative advantage; (4) the PAM results can be used between different types of firms, regions, and products; (5) it provides a valuable framework to measure the efficiency of agricultural systems and sub sectors in particularly.

The PAM is able to identify, in an approximate fashion, which of a country's existing portfolio of commodity systems is likely to be negatively or positively affected by policy reforms in terms of income and viability for the individuals in the system.

Its weakness lies in three main points. First, it is a static partial equilibrium analysis model. This means that it does not allow for dynamic feed back in the system, e.g. it does not model increased productivity over time. Nor does the comparative advantage analysis integrate feedback in a general equilibrium sense, e.g. it does not capture the effect of increased production in one sector on the demand for land, and thus on rent levels. Second, the use of world prices as main set of reference prices. In some instances the international prices themselves are the result of market intervention in the trading country. For example, the international price of cotton may be biased downward due to farm support or export subsidy policies in the originating market. But on the other hand, international prices are taken as "*references*" for tradable inputs, goods and services because they reflect their alternative value to the local economy. If local consumers and producers could pay prices that excluded all effects of local market interventions, quantitative restrictions local taxes or trade duties, licensing requirements, overvalued currencies, then they would pay the local equivalent of international prices, adjusted for transport and market margins (see Taskok, 1989 and Salinger, 2001).

Results of simulations are dependent on estimated parameters, which are usually based on data for one year or a few years. This implies that we can not estimate standard errors for the parameters. To overcome this limitation a sensitivity analysis can be applied as in Yao (1997b), Omran (1997) and El-Guendy et al., (1999). That is, changing the values of certain parameters and observing how that affects the calculated indicators.

Concerning the assumption that world prices can be used as reference prices, as mentioned earlier because world prices represent the government's choice to allow consumers and producers to export, import, or even produce domestic goods and services. In addition, world prices are the prices that the country under concern has to face however, it is either impossible to measure how much the international prices (reference prices) are distorted or to detect the value of governments non-efficiency.

4.8 : Summary and Conclusions

In a context in which the framework of economic policy is changing radically, the policy analysis matrix (PAM) provided a relatively straightforward logical framework for policy analysis, one from which a range of "*policy indicators*" may be estimated. Three sets of indicators are of most interest to policy analysts, first; measures of private and social comparative advantage (PCR and DRC); second, measures of protection (NPCO, NPCI and EPC); and third, measures of net transfers (PC and SRP).

In this chapter, we have demonstrated the theoretical methodology of the PAM along with a detailed illustration for PAM tables (Input-Output table, Private Prices table, Private Budget table, Social Prices table, Social Budget table and finally the PAM table) that allows the analyst to obtain the PAM's first and second rows entries. Furthermore, a numerical example for soybean in 1986 is derived to show the reader how the PAM works. Also, the advantage and critics of using the PAM are addressed.

Chapter V

Chapter V: Estimation of Social Prices for Traded and Non-Traded Inputs & Outputs

5.1 : Introduction

As mentioned earlier, the term social price is used by PAM analysts. As for any tradable product (or input), there is a private price (in the local market) and an international price. The latter price is often called the "social" price because it is the price that the country concerned has to face in the international market, beyond the control of domestic policies. Therefore, the term social profitability is not in terms of welfare but in terms of international prices (Yao, 1997a).

The estimation of social prices for both factor inputs and commodities is one of the most important and difficult tasks in PAM construction. To proceed with this issue, we classify inputs and outputs into traded and non-traded items. Chart 5-1 illustrates tradable and non-tradable production input costs for agricultural products. Tradable inputs mainly include fertiliser (nitrogenous, phosphates and potash), machinery (tractors, tubewells, harvesters and combines), pesticides and seeds, while, non-tradable factor inputs include manure, animal work, water, labour and land.

Tradable summer crop outputs in this study are cotton, maize, sugar cane, rice, soybean and nili potato. Winter outputs are wheat, broad bean, tomato and long and short berseem[1].

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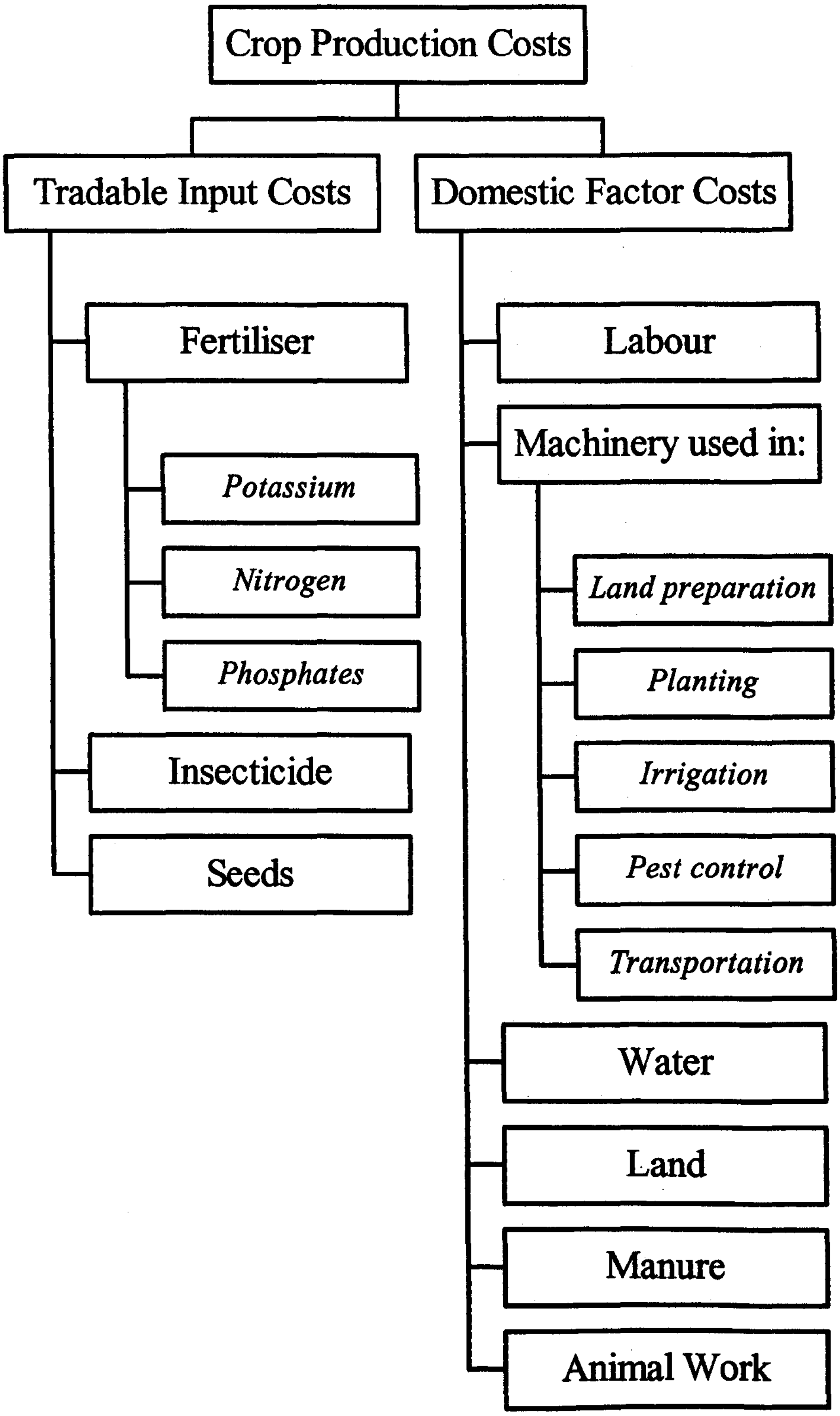
[1] Berseem is the Egyptian clover: long berseem grows for the entire winter season, while short berseem grows for only part of the winter season.

CHART 5-1: THE STRUCTURE OF CROP PRODUCTION COSTS NEEDED FOR THE PAM MANIPULATION



According to the above classification, the second step to calculate the social prices for traded/non-traded inputs and commodities correctly, where world prices are used for traded inputs and commodities, whereas the opportunity cost approach is used for non-traded inputs and factors.

In order to compare prices precisely on an equal basis it is necessary that two important points have been satisfied; first, the commodities under consideration are comparable. In most cases, some deductions or additions for prices recorded on domestic and world markets are required to refer valuations at a specific location and in a specific form. Consequently, a precise account for transport, handling and marketing costs is required. Also, adequate allowance must be made to compensate for any differences in quality. Second, it is also important that the commodities are compared at the same location, and to satisfy this condition[2] we have to work back from world prices to obtain a price that is comparable to farm gate prices. These reference prices are called export or import parity prices (border prices adjusted for domestic transport and marketing costs to the point of production or consumption) (Byerlee and Morris, 1993). Consequently, it is important that a free market or shadow exchange rate is used to convert world prices of traded commodities and inputs into local currency.

In this Chapter, section 2 clarifies the theoretical procedure of estimating export and import parity world prices (reference prices) of tradable inputs and commodities at the farm gate level. Section 3 gives an overview of the different strategies and ways of estimating the shadow exchange rate (SER) to convert the world price of inputs and outputs into domestic currency units in

[2] We can either work back from world prices or work forward from farm prices.

order to achieve a correct import or export parity price. Three main alternative ways of evaluating the SER are of particular interest: the first way is where the premium on foreign exchange is key; the second way, where the standard conversion factor is key; and the third where the real exchange rate is adjusted for foreign currency inflation. This section also gives an overview of the Egyptian foreign exchange market, in which three periods are discussed. The first period is before the liberalisation of foreign exchange in May 1987, where the interbank foreign exchange market was organised into two pools; the second period, from May 1987 until February 1991, was characterised by the continuous devaluation of the central bank pool exchange rate from £E 0.7 to the U.S dollar to £E 3 by the end of 1990; and the third period runs from February 1991 to the present day, where a single free exchange market exists for the Egyptian pound. Moreover, a detailed empirical estimation of the Egyptian shadow exchange rate is carried out in this section. Sections 4 discusses in detail an empirical valuation of social prices of cotton and wheat at the farm gate level (as examples for the main Egyptian exportable and importable crops respectively). Section 5 describes the valuation of social prices for traded input factors such as fertilisers and seeds. Section 6 discusses the methods used in estimating the opportunity cost of non-traded main agricultural inputs such as land, labour, irrigation water, animal work and manure. In addition, this section highlights the particular policies that affected land rent before and after the 1986 agricultural reform policy regime. The social valuation of machinery including tractors and water pumps is discussed in detail in section 7.

5.2 : Social valuation of tradable inputs/commodities

In this study we will evaluate prices at domestic farm gate level. Data on these however are unavailable and must be estimated (see, for example, Scanizzo and Bruce, 1980; Gittinger, 1982). Charts 5-2 and 5-3 illustrate the way of estimating the world prices of tradable factor inputs or commodities at the farm gate level. Chart 5-2 is used in the case of exported commodities or inputs, while chart 5-3 is used for imported ones.

To obtain the reference price for exported products (i.e. the export parity price), the process is to subtract (i) costs incurred in shipping from Alexandria[3] to the foreign port of destination, (ii) the costs of shipping from the mill/gin/factory to Alexandria and (iii) the cost of transport from the farm gate to the mill/gin/factory. For import parity price, the procedure is to import the commodity to Alexandria by adding all the required costs to import the commodity from world market at port of destination to Alexandria then to mill/factory/gin and then to the farm gate level.

Before proceeding with the scheme, it is necessary for the practitioner to be cautious in estimating the appropriate exchange rate to convert the world price of inputs and outputs into domestic currency units in order to obtain a correct import or export parity price. The exchange rate must not undervalue or overvalue the domestic currency; otherwise it will overstate or understate the value of the commodity being considered in the domestic economy.

Once the proper exchange rate is determined, the analyst may use it to value the prices of imports and exports so that domestic prices for various commodities can be compared with their equivalents in the world markets.

[3] Alexandria is considered one of the main ports in Egypt.

CHART 5-2: ESTIMATION OF EXPORT PARITY PRICE

World Price at Port of Destination

- / +

Quality Factor

=

Adjusted World Price

-

Freight & Insurance

=

World Price at Alexandria Port

*

Exchange Rate

=

Border Price at Alexandria Port

-

Transport from Port & Market Margins

=

Price at Mill / Factory / Gin

-

Processing Margins and Transport From Farm

=

Price before Mill / Factory / Gin

*

Coversion Allowance

=

World Price at Farm Gate

CHART 5-3: ESTIMATION OF IMPORT PARITY PRICE

World Price (FOB)

+ / -

Quality Adjustment

=

Adjusted World Price

+

Freight & Insurance & Trans. Costs

World Price at Port, Alexandria

*

Exchange Rate

=

Border Price at Port, Alexandria

+

Transport & Market Margins

=

Price at Mill/ Factory/ Gin
(if needed before domestic sale)

-

Processing Margins & Transport to Farm

=

Price before Mill / Factory/ Gin

*

Conversion Allowance

=

World Price at Farm Gate

5.3 : Valuation of the Shadow Exchange Rate (SER).

5.3.1 : Introduction

As argued above, the official exchange rate can not be used simply because it might undervalue or overvalue the domestic currency due to government intervention, and consequently might overstate or understate the value of the commodity being considered to the domestic economy. So, there is a strong need to estimate an appropriate exchange rate that reflects the real value of the domestic currency, in other words, the shadow exchange rate.

Once an appropriate exchange rate is determined, the analyst may use it to value the prices of imports and exports so that domestic prices for various commodities can be compared with their equivalents in the world markets.

The issue then focuses on what is the appropriate exchange rate? In addition, the following issues are also pertinent: (1) what rate is to be used in converting world prices into domestic currency for social valuation? (2) Given that there are a number of possible ways to estimate the shadow exchange rate which is most appropriate; that is, which best reflects the opportunity cost of foreign exchange?

5.3.2 : The foreign exchange rate

The exchange rate here is defined as the number of units of domestic currency per unit of foreign currency. The willingness of local consumers to obtain foreign currency (in order to buy imports or invest abroad), and the desire of local export suppliers, as well as foreign investors, to convert their foreign currency into local currency, are the main reasons for the presence of the exchange rate market.

5.3.3 : Exchange rate strategies.

There are three main alternative types of exchange rate strategy, classified according to the degree of governmental intervention in the exchange rate market.

5.3.3.1 : Floating or freely fluctuating

There is where the market-determined price fluctuates in line with changes in demand or supply of foreign exchange. Under such a regime, changes in the exchange rate play a key role in adjustments in the levels of exports, imports, and international capital movements. Where this system operates freely, there is no need to estimate a shadow exchange rate.

5.3.3.2 : The fixed exchange rate[4]

The fixed exchange rate is the second type of exchange rate regime, in which there is a high degree of governmental intervention where the nominal value of exchange rate is determined. Typically, the local currency is tied or (pegged) to either one foreign currency[5] usually the one in which most of country's foreign exchange transactions take place or to a basket of currencies according to the importance of the embodied foreign currencies in the country's international transactions. This type of exchange rate policy may lead to an over/under valued exchange rate due to the structural imbalance that may occur in the case where the country does not readjust it to correspond to sustained changes in the balance of demand and supply for foreign exchange. In other word, it should be re-evaluated in order not to insulate the economy from market forces.

[4] This type of regime is adopted in most developing countries and centrally planned economies.
[5] The U.S dollar is the currency that is often chosen as the reference point for fixed rate regimes; it is also weighted heavily in most currency baskets.

When the exchange rate overvalues domestic currency, exporters receive in domestic currency less than they would have received at a higher benchmark rate, and importers pay less in domestic currency than they would have paid at the same higher benchmark rate. In other word, overvaluation of the exchange rate acts as an implicit tax on exports and an implicit subsidy on imports (Taskok, 1990).

5.3.3.3 : The crawling-peg or the adjustable-peg

The *crawling-peg or the adjustable-peg* regime is the third type of exchange rate policy. This type is a mixture of the first and second type regimes, in that it combines the policy and anti-fluctuation controls embodied in the second and the market clearing adjustments of the first. In other words, the crawling-peg regime is a system in which the government announces a schedule of weekly or monthly changes in the rate to follow the expected movements in the exchange rate market that would have obtained if the rate had been allowed to float, but maintains the announced rate in the interim period.

If the country's foreign exchange market is distorted (for example by governmental policies), then the official exchange rate (OER) may not fully reflect the opportunity cost of foreign exchange, and thus the obtained border price will not be free of the distortions induced by the country's foreign exchange market. If this is so, a shadow exchange rate (SER) should be used instead. Hence, where the exchange rate strategies of a fixed rate or a crawling peg are adopted, a shadow exchange rate must be calculated.

The policy analyst must select the exchange rate that best reflects the opportunity cost of foreign exchange use in valuing imports and exports prices, so that various commodities can be properly compared with their equivalents in the world markets.

5.3.4 : Alternative ways of SER estimation.

A theoretical approach, along with some of the practical and applied calculations, are discussed by Bacha and Taylor (1971), Little and Mirrlees (1974), Squire and Vander Tak (1975), Gittinger (1982), Taskok (1990), Ibrahiem (1993), Idris (1993) and Omran (1997).

There are two main ways to estimate the SER, the first of which can be applied using two different formulae (one is the reciprocal of the other), so that they are quite similar in their estimated values. Both use data on the value of imports, the value of exports, import duties (customs duties, import charges), export duties and taxes. The second way accounts for inflation. Both approaches are discussed in greater detail, along with an empirical example, in the following section.

5.3.4.1 : The first way:

5.3.4.1.1 : First Formula (Foreign Exchange Premium).

The first step in estimating the shadow exchange rate is to calculate the foreign exchange premium. According to Gittenger (1982), *'The need to determine the foreign exchange premium arises because in many countries, as a result of national trade polices (including tariffs on imported goods and subsidies on exports), people pay a premium on traded goods. This premium is not adequately reflected when the prices of traded goods are converted to the domestic currency equivalent at the official exchange rate'*. In other words, the premium measures the additional amount that traded goods users are willing to pay in order to have one more unit of these traded good.

The premium on the exchange rate can be calculated as follows (Omran, 1997):

$$\text{Premium on Exchange Rate} = \text{Proportion legal} \times (X) + \text{Proportion informal} \times (Y) \quad (5.1)$$

$$X = \frac{(\text{Value of imports} + \text{Value of exports} + \text{Import duties} + \text{Export duties})}{(\text{Value of imports} + \text{Value of exports})} \quad (5.2)$$

$$Y = \frac{\text{Informal market rate}}{\text{Official exchange rate}} \quad (5.3)$$

But because the proportion of informal trade can not be detected, the assumption must be made that the informal proportion equals zero and the legal proportion equals one, i.e. that there is no smuggling to avoid custom duties. Then the premium on exchange rate will be:

$$\text{Premium on foreign exchange (\$)} = \frac{\text{Value of (imports + exports)} + \text{Import duties} + \text{Export duties}}{\text{Value of (imports + exports)}} \quad (5.4)$$

By applying the premium to traded goods, we are able to compare the values of traded and non-traded goods by the gauge of opportunity cost or willingness to pay.

The second step is to calculate the SER using the following formula[6],

$$\text{Shadow Exchange Rate} = (1 + \text{Premium on foreign exchange}) \times \text{OER} \quad (5.5)$$

5.3.4.1.2 : Second Formula (Standard Conversion Factor).

The second formula allows the estimation of the SER using the Standard Conversion Factor (SCF) approach (Squire et.al, 1975; Taskok, 1990). The SCF is defined as the ratio of the official exchange rate to the shadow exchange rate, thus:

[6] This formula has been used by various World Bank projects and the UNIDO *Guidelines* (1972a).

$$SCF = \frac{OER}{SER} \tag{5.6}$$

Then,
$$SER = \frac{1}{SCF} \times OER \tag{5.7}$$

Alternatively
$$SCF = \frac{1}{1 + Premium} \tag{5.8}$$

The SCF is then calculated by using this estimated premium, or alternatively using the following formula (FAO, 1993 and 1999):

$$SCF = \frac{M + X}{M(1 + T_M) + X(1 + T_X)} \tag{5.9}$$

where

M	=	CIF value of imports	X	=	FOB value of exports
T_M	=	Average tax rate on imports	T_X	=	Average tax rate on exports

5.3.4.2 : The Second Way:

The second way to calculate the shadow exchange rate is to adjust the real exchange rate for inflation; the foreign currency may lose or gain some purchasing power during the same period and therefore, its cost has to be adjusted accordingly. This adjustment can be calculated by three alternative formulae; the first, according to Ibrahiem (1993), takes the Consumer Price Index (CPI) as the measure of inflation, and thus the first step of the calculation is:

$$\text{Real Exchange Rate}_t\ (RER) = OER_t \times \frac{CPIW_t}{CPID_t} \tag{5.10}$$

where:

OER	=	Official exchange rate
$CPIW_t$	=	Consumer price index of world
$CPID_t$	=	Domestic consumer price index
t	=	Year (t)

The second formula, used in many studies, such as Balassa (1990), Cottani et al. (1990), and Edwards (1988 and 1990), employs the U.S price index (WPIUS) as a proxy for the foreign currency price index and the domestic as the proxy for the domestic price index (CPID). Thus,

$$\text{Real Exchange Rate}_{it} = \text{OER}_{it} \times \frac{\text{WPIUS}_{it}}{\text{CPID}_{it}} \tag{5.11}$$

The third formula, used by Ghei and Steven (1999), takes the U.S producer price index (PPIUS) as a proxy for the foreign currency price index and CPID as the proxy for the domestic price index.

Then,

$$\text{Real Exchange Rate}_{t} = \text{OER}_{t} \times \frac{(\text{PPIUS}_{t})}{\text{CPID}_{t}} \tag{5.12}$$

The above formula computes the real cost of one unit of foreign exchange by allowing for domestic and external inflation.

In most countries foreign trade is taxed, and in many countries import and export taxes are important sources of governmental revenues. Foreign trade taxation is also an important instrument for adjusting the exchange rate. For example, an import tax makes imports more expensive and thus exchange rate increases. The overall taxation policy on foreign trade results in an effective exchange rate that is different from the nominal and real exchange rate (Ibrahiem, 1993). This difference, which can be considered as a premium attached by the government to foreign currencies, can be estimated using the formula presented in equation (5.4) Then,

The Real Effective Exchange Rate = Real exchange rate × Premium on exchange rate. (5.13)

However, all of the above ways of estimating the shadow exchange rate are alternatives, and the analyst has to choose which approach to follow, taking into account the availability and accuracy of the data needed for such calculations. The International Monetary Fund (IMF)[7], Food and Agriculture Organisation (FAO)[8] and the United Nations statistics[9] are the main sources of data for this estimation.

5.3.5 : The Egyptian Foreign Exchange Market: An overview

5.3.5.1 : Introduction

The foreign exchange market in Egypt has been subjected to different degrees of governmental influence since its liberalisation on October 8, 1991. These stages can be classified into three main periods; the first before the start of the economic reform policy and the liberalisation of the exchange market in May 1987, the second between May 1987 and February 1991, and the third after February 1991 (Mongardini, 1998). The following discussion portrays the main policies and features of these important stages in the Egyptian foreign exchange market.

5.3.5.2 : First period: Before liberalisation of May 1987.

The interbank foreign exchange market was organised into two pools before May 1987. The first pool, known as the Central Bank pool, was concerned with exports of cotton, rice, Suez Canal dues and petroleum, and with imports of essential foodstuffs such as wheat, wheat flour, edible oils, tea, and sugar. It also handled insecticides and fertilisers and most public sector capital transactions. The second pool, known as the commercial bank pool, was concerned with the proceeds of worker remittances, tourism and non-central

[7] Such as, The Government Financial Statistics Yearbook, The International Financial Statistics Yearbook and The Direction of Trade Statistics Yearbook.
[8] Such as, Trade Yearbook.
[9] Such as, The National Accounts Studies of the ESCWA Region.

bank pool exports, in addition to providing the foreign exchange for any public sectors payments not covered by the Central Bank pool. Both rates were heavily influenced by government intervention and did not reflect market forces.

Central bank pool transactions were mainly at the official exchange rate of £E 0.7 per U.S dollar, but certain aid programmes and bilateral agreement transactions were treated at other rates. For transactions in the non-bank free market[10] exchange rates were negotiated by the parties to the transactions.

5.3.5.3 : Second period: From May 1987 till February 1991

A new bank foreign exchange market was introduced on May 11 1987, run by a committee so as to reflect supply and demand conditions, where all authorised commercial banks, two travel agencies and a limited number of private sector firms were allowed to operate. On the supply side, the new bank market relied for resources mainly on workers remittances, the sale of foreign bank notes and travellers' cheques, tourist expenditure, as well as private and specified public sector export earnings. On the payment side, it was allowed to save foreign exchange for all private imports and specified public sector transactions, all other transactions being financed by either the central bank pool or the own exchange accounts market.

The central bank pool rate was devalued a number of times during this period. For example, on August 15, 1989, the rate was increased from £E 0.7 to £E 1.1 to the U.S dollar. On July 1, 1990 the central bank pool rate was

[10] This market was formally illegal but officially tolerated in which it shared sources of exchange supply along with the commercial bank pool through worker remittances and tourism. Also, this market satisfied the demand of the private sector for foreign exchange.

changed again to £E 2.0 to the U.S dollar and by the end of 1990 reached £E 3.0 to the U.S dollar.

5.3.5.4 : Third period: post February 1991

The multiple exchange rate system that operated ceased on February 27, 1991, and was replaced by a temporary dual exchange system that embodied a primary market and a secondary (free) market. This dual system was intended to operate for one year, whereafter it was to be unified. The unification process happened on October 8, 1991 and since then a single free exchange market has operated for the Egyptian pound (£E).

5.3.6 : Empirical estimation of the Egyptian SER[11]

Although the above ways to estimate the SER have been used, we shall rely on either the first way of estimation[12], using either the exchange rate premium or the standard conversion factor approaches. We are thus implicitly assuming that the inflation rates in Egypt and the world are the same. The second way is not suitable for the prospective analysis, simply because any change (concerning the base year of CPIW, PPIUS, WPIUS and CPID) will change the value of the estimated REER. In other words, there will be more than one value of RER for the same year according to the chosen base year. Unless we assume that CPIW/PPIUS/WPIUS and CPID equals to one, in which case under this assumption the final result of the two ways of estimation will be the same.

[11] The study will rely on the secondary exchange rate that was estimated by the IMF as proxy for the SER for the period 1986-1990. This study's own estimate will be for the period 1991-2000.

[12] The first and the second formula for estimation are the same final results of the estimated SER as they have the same basis but differ in their way of calculation.

The International Financial Statistics Yearbook (IFS), National Account Studies for the ESCWA group and the Government Finance Statistics Yearbook (GFS) are the main sources of data used for the SER estimation.

Tables A5-1 and A5-2 describe the estimated values of the shadow exchange rate during the period (1991-2000), the first table using the premium approach and the second table adopting the standard conversion factor approach. However, all of these approaches yield the same estimated values.

Table A5-3 shows that, under the assumption of being the world and domestic consumer price indices being equal, the final results for the estimated SER does not differ from the result reported in tables A5-1 and A5-2.

Tables A5-4 and A5-5 show that the analysis of the same set of data using two different base years for the world[13] and domestic consumer price indices (1992 and 1995) yields different results for the estimated SER.

In conclusion, as long as the ratio between the world consumer price index and the domestic consumer price index become closer to unity, the symmetrical result of the estimated shadow exchange rate among the ways of estimation illustrated above.

Figure 5-1 shows the differences between the official exchange rate and estimated values of the shadow exchange rate considering the various ways of the above-illustrated regimes. It shows that the first and second approaches and the case where world and domestic inflation are assumed to be the same (CPI U.S = CPID), yields the same estimates of the estimated SER, while different estimates resulted when using different base years for CPI.

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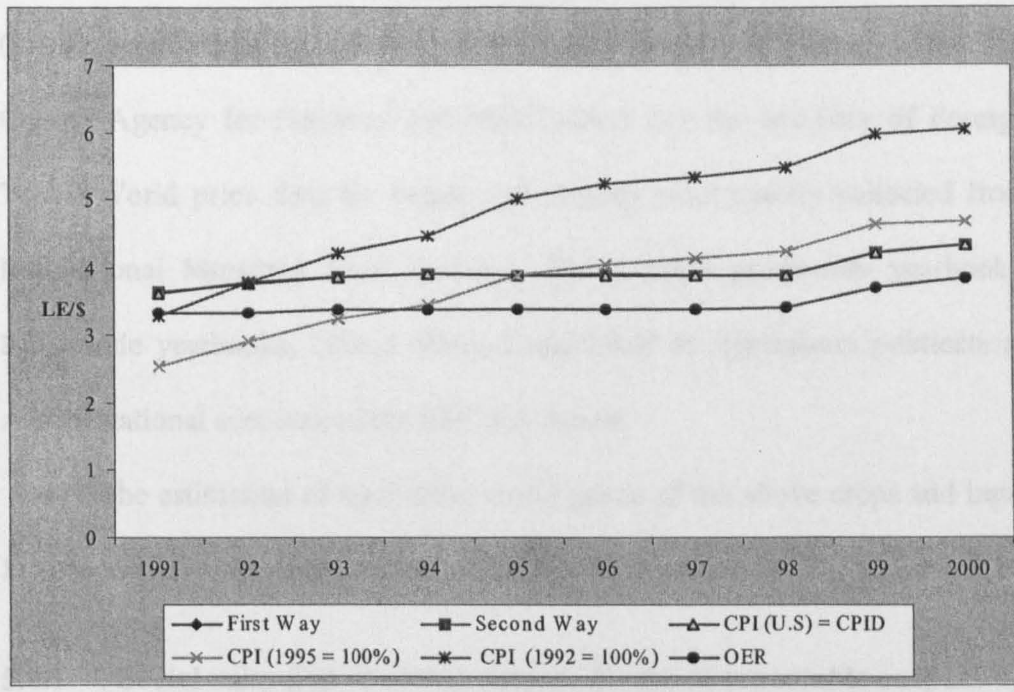
[13] The U.S consumer price index is used as a proxy for the world price index.

FIGURE 5-1: THE SHADOW AND OFFICIAL EXCHANGE RATE



Source: study estimates (tables A5-1, A5-2, A5-3, A5-4 and A5-5 Appendix V:1)

5.4 : Social valuation of world prices for traded outputs

The estimation of equivalent world prices at the farm gate level was carried out to cover all the traded crops using the same procedure of analysis (as stated earlier in charts 5-2 and 5-3) according to whether the commodity is exportable or importable. Egyptian exportable crops are cotton, rice, potatos, and tomatoes. The importable crops are wheat, maize, sugar cane[14], soybeans and broad beans.

Because long and short berseem are not internationally traded, the study will use their domestic prices (private prices) to represent their social prices.

The data needed for this valuation such as freight & insurance, costs of bagging and transportation from factory to mill were collected from a number

[14] Sugar cane is not traded in the world market in its raw form, so refined sugar is used instead (in the analysis) and then converted to sugar cane form by using the appropriate conversion allowance as one ton of raw sugar cane produces about 0.36 ton of sugar.

of sources, such as Omran (1997), (FAO 1993 and 1999) and El-Guendy (1999), private business companies involved in export & import affairs, the Central Agency for Statistics and Mobilisation and the Ministry of Foreign Trade. World price data for inputs and outputs were mainly collected from International Monetary Fund Statistics (IMF), FAO production yearbooks, FAO trade yearbooks, United States Department of Agriculture publications and the national accounts of the ESCWA region.

The estimation of equivalent world prices of the above crops and input factors will be discussed in detail in the following section.

5.4.1 : Social valuation of cotton output: A case of exportable output.

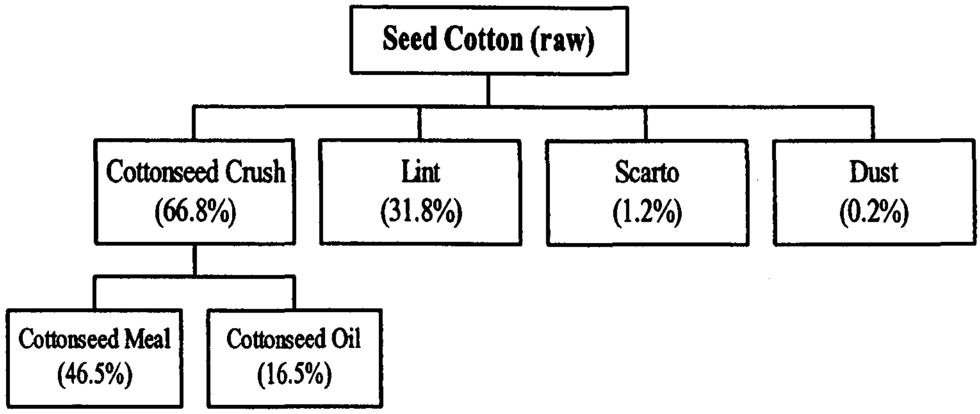
As cotton is one of the most important exportable crops in Egypt, it is worth explaining in detail the method adopted to estimate its export parity price. The principal difficulty is that the price received by farmers is for raw cotton while the world price reflects the processed cotton or lint. Additionally, seed cotton or raw cotton provides three main important tradable outputs[15], cotton lint, cottonseed oil and cottonseed meal (see Chart 5-4). As a result, in order to obtain the social valuation of cotton, adjustments are required to allow for those products that constitute the total product, as well as differences in processing.

Egypt is a net exporter of lint cotton, but does not trade cottonseed meal in the world market, so that its equivalent world price will be based on the assumption that Egypt could export the cottonseed meal to the United

[15] One ton of raw cotton produces about 66.8% cottonseed crush, 31.8% lint, 1.2% scarto and 0.2% dust. Moreover, one ton of cottonseed crushes produces 46.5% cottonseed meal and 16.5% cottonseed oil.

Kingdom, a major importer of cottonseed meal. On the other hand, Egypt is assumed to be a net importer of cottonseed oil.

CHART 5-4: PRODUCTS DERIVED FROM RAW COTTON



So, both the import and export parity price procedures will be used in estimation of the equivalent world price, as shown in Chart 5-5. Table 5-1 illustrates an empirical example of calculating the equivalent world price of cotton at farm gate level. First, we start by calculating the equivalent world price for cottonseed crush, where we have to estimate the export parity price for cottonseed meal, as it is assumed that Egypt will export it to the UK, and the import parity price for cottonseed oil as Egypt is a net importer.

The FOB (free on board) and CIF (cost, insurance and freight) prices for a given commodity serve as reference prices as they represent what the commodity or factor input can earn as an export or what it costs the economy as an import.

To derive the export parity price of cottonseed meal, its world price is collected at the port of destination, in the United Kingdom. Then freight and insurance to Alexandria is deducted to obtain the border price at Alexandria.

CHART 5-5: THE SCHEME OF CALCULATING THE EQUIVALENT WORLD PRICES OF EGYPTIAN COTTON AT FARM GATE LEVEL.

1-Cottonseed meal

World Price of Cottonseed meal, CIF UK
Deduct:
Freight Alex to UK
World Price of Cottonseed meal at Alex
Multiply:
Shadow Exchange Rate
World Price at Alexandria Port
Deduct:
Trans.& Marketing mill to Alex
World Price of Cottonseed meal at Mill

2-Cottonseed Oil

Cottonseed Oil, FOB Rotterdam
Add
Freight Rotterdam to Alex Port
World Price of Cottonseed Oil at Alex
Add
Import Duties (2%) + Fees(8.3%)
World Price of Cottonseed Oil at Alex ($)
World Price of Cottonseed Oil at Alex (£E)
Add
Transportation & Marketing mill to Alex
World Price of Cottonseed Oil at Mill

From 1 & 2, Cottonseed crush

% of Cottonseed Meal (46.5%)
% of Cottonseed Oil (16.5%)
Cottonseed Crush
Deduct:
Cottonseed Crush Margin
World Price of Cottonseed Crush at Mill
Deduct:
Trans.& Marketing Gin to Mill
World Price of Cottonseed at Gin

B- Lint Cotton

World Price of lint at Alex ($)
World Price of lint at Alex (£E)
Deduct:
Trans.& Marketing Gin to Alex port
World Price of lint at Gin

C- Scarto

Domestic Price Scarto
Seed Cotton
Value of all Joint Product at Gin
Deduct:
Cotton Processing Margin
World Price of Seed Cotton at Gin
Deduct:
Trans.& Marketing from Farm to Gin

World Price at Farm Gate

The world price of cottonseed meal at Alexandria is then multiplied by the estimated shadow exchange rate, in order to convert to domestic currency. Transportation costs and the marketing margin of cottonseed meal from the mill to Alexandria are then subtracted to obtain its world price at the mill.

The cottonseed oil FOB price is that at Rotterdam, with freight and insurance in addition to import duties added to obtain its price at Alexandria, and again is converted using the SER into local currency. Then, transportation costs and the marketing margin of cottonseed oil from port to mill are added to obtain its border price at the mill.

One ton of cottonseed crush comprises of 46.6% of cottonseed meal and 16.5% of cottonseed oil. The equivalent world price of cottonseed crush is calculated at the mill. Then, the cottonseed crush marketing margin at the mill and transported from mill to gin is deducted to obtain the cottonseed world price at the gin. For lint cotton, the marketing margin and transport costs from gin to Alexandria port are deducted to obtain the world price of lint cotton at the gin.

The world price of one ton of seed cotton (raw cotton) is calculated using the following ratios[16]: 66.8% cottonseed crush, 31.8% lint, 1.2% scarto. Then the cotton-processing margin and transport from farm gate to gin are deducted to obtain the world price of seed cotton at the farm gate level.

[16] cottonseed crush=(105/157)*100 = 66.8%, lint =(50/157)*100 =31.8 and scarto= (2/157)*100 =1.2%

TABLE 5-1: ESTIMATION OF EXPORT PARITY PRICE FOR COTTON AT FARM LEVEL

Estimation Steps		1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
A																
1-Cottonseed meal																
World Price of Cottonseed meal, CIF UK	$/TON	166.12	144.01	173.69	175.10	179.16	131.75	152.13	161.28	142.00	145.19	164.88	165.56	189.71	82.94	115.19
Deduct: Freight Alex to UK	$/TON	12.65	12.70	13.10	13.25	15.30	15.50	9.60	9.75	10.25	10.65	11.25	12.10	12.97	13.50	14.00
World Price of Cottonseed meal at Alex	$/TON	153.47	131.31	160.59	161.85	163.86	116.25	142.53	151.53	131.75	134.54	153.63	153.46	176.74	69.44	101.19
Multiply: Shadow Exchange Rate	£E/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
World Price at Alexandria Port	£E/TON	207.19	199.60	356.52	407.87	444.05	421.66	537.88	583.74	513.16	521.22	596.99	595.71	685.15	291.64	438.15
Deduct:Trans. & Marketing mill to Alex	£E/TON	15.10	15.25	15.85	18.10	21.75	22.75	23.90	25.00	26.50	27.80	29.00	30.20	31.00	32.56	33.46
World Price of Cottonseed meal at Mill	£E/TON	192.09	184.35	340.67	389.77	422.30	398.91	513.98	558.74	486.66	493.42	567.99	565.51	654.15	259.08	404.69
2-Cottonseed Oil																
Cottonseed Oil, FOB Rotterdam	$/TON	512.75	435.95	511.53	587.51	656.04	673.22	562.62	617.87	768.84	689.44	638.12	575.27	536.98	737.83	514.80
Add: Freight Rotterdam to Alex Port	$/TON	12.50	12.70	13.00	13.20	15.20	15.25	9.20	9.60	10.10	10.60	11.20	11.99	12.50	13.00	13.10
World Price of Cottonseed Oil at Alex	$/TON	525.25	448.65	524.53	600.71	671.24	688.47	571.82	627.47	778.94	700.04	649.32	587.26	549.48	750.83	527.90
Add Import Duties (2%) + Fees(8.3%)	$/TON	52.81	44.90	52.69	60.51	67.57	69.34	57.95	63.64	79.19	71.01	65.73	59.25	55.31	76.00	53.02
World Price of Cottonseed Oil at Alex	$/TON	578.06	493.55	577.21	661.22	738.81	757.81	629.77	691.11	858.14	771.05	715.05	646.51	604.79	826.82	580.92
World Price of Cottonseed Oil at Alex	£E/TON	780.38	750.20	1281.41	1666.28	2002.17	2748.61	2376.68	2662.36	3342.35	2987.21	2778.68	2509.61	2344.52	3472.50	2515.46
Add Trans. & Marketing mill to Alex	£E/TON	15.10	15.25	15.85	18.10	21.75	22.75	23.90	25.00	26.50	27.80	29.00	30.20	31.00	32.56	33.46
World Price of Cottonseed Oil at Mill	£E/TON	795.48	765.45	1297.26	1684.38	2023.92	2771.36	2400.58	2687.36	3368.85	3015.01	2807.68	2539.81	2375.52	3505.06	2548.92
From 1 & 2, Cottonseed crush																
% of Cottonseed Meal (46.5%)	%	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
% of Cottonseed Oil (16.5%)	%	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Cottonseed Crush	£E/TON	220.58	212.02	372.46	459.17	530.32	642.77	635.10	703.23	782.16	726.91	727.38	682.03	696.14	698.81	608.75
Deduct: Cottonseed Crush Margin	£E/TON	26.35	28.60	30.25	35.10	36.56	42.36	44.58	46.85	48.90	50.25	51.10	53.12	55.10	56.40	58.10
World Price of Cottonseed Crush at Mill	£E/TON	194.23	183.42	342.21	424.07	493.76	600.41	590.52	656.38	733.26	676.66	676.28	628.91	641.04	642.41	550.65
Deduct:Trans. & Marketing Gin to Mill	£E/TON	7.55	7.80	7.99	9.10	10.95	11.45	12.00	12.85	13.75	14.05	14.95	15.86	16.45	17.10	17.95
World Price of Cottonseed at Gin	£E/TON	186.68	175.62	334.22	414.97	482.81	588.96	578.52	643.53	719.51	662.61	661.33	613.05	624.59	625.31	532.70
B- Lint Cotton																
World Price of lint at Alex	$/TON	1321.35	1588.28	1433.09	1606.91	1796.85	1766.88	1372.96	1401.26	1854.47	2381.50	1981.98	1767.61	1682.80	1251.96	1407.95
World Price of lint at Alex	£E/TON	1783.83	2414.19	3181.46	4049.41	4869.45	6408.52	5181.42	5398.07	7222.97	9226.40	7701.98	6861.51	6523.54	5257.99	6096.59
Deduct: Trans. & Marketing Gin to Alex	£E/TON	15.10	15.25	15.85	18.10	21.75	22.75	23.90	25.00	26.50	27.80	29.00	30.20	31.00	32.56	33.46
World Price of lint at Gin	£E/TON	1768.73	2398.94	3165.61	4031.31	4847.70	6385.77	5157.52	5373.07	7196.47	9198.60	7672.98	6831.31	6492.54	5225.43	6063.13
C- Scarto																
Domestic Price Scarto	£E/TON	5000.00	5100.00	5600.00	5700.00	6000.00	6100.00	6200.00	6300.00	6500.00	7000.00	7100.00	8000.00	8200.00	8300.00	8500.00
Seed Cotton																
Value of all Joint Product at Gin	£E/TON	751.83	946.41	1303.02	1633.99	1943.18	2505.28	2108.41	2221.81	2855.87	3461.81	2976.36	2687.49	2589.86	2188.08	2395.48
Deduct: Cotton Processing Margin	£E/TON	73.89	81.21	92.36	93.12	93.95	95.54	97.13	101.91	102.55	103.50	108.28	108.92	110.57	114.01	117.83
World Price of Seed Cotton at Gin	£E/TON	677.94	865.20	1210.66	1540.87	1849.23	2409.74	2011.27	2119.90	2753.32	3358.31	2868.08	2578.57	2479.29	2074.07	2277.65
Deduct: Trans & Marketing from Farm to Gin	£E/TON	2.55	2.87	2.99	3.18	3.50	3.82	4.14	4.27	4.46	4.65	4.97	5.10	5.41	5.73	5.92
World Price at Farm Gate	£E/Ton	**675.40**	**862.34**	**1207.67**	**1537.69**	**1845.73**	**2405.92**	**2007.13**	**2115.63**	**2748.86**	**3353.66**	**2863.11**	**2573.48**	**2473.88**	**2068.34**	**2271.72**

5.4.2 : Social valuation of Wheat output: A case of importable output.

Egypt is a net importer for wheat. So the calculation of its equivalent world price at farm gate level will follow chart 3, as shown in Table 5-2. The wheat FOB price is that at the U.S Gulf, then freight and insurance and import duties are added to obtain its price at Alexandria. This is then multiplied by the SER to convert it into local currency. Transportation costs from Alexandria to the central market is added to obtain its world price at the central market. Then, transportation costs from the central market to the farm are deducted to obtain the world price at farm level. Finally, a conversion allowance[17] is used to standardise exported and domestically produced wheat in order for them to be compared on an equal basis.

For the other studied crops, Egypt is a net importer of maize, broad beans, soybean and sugar cane, while a net exporter of rice, nili potatoes, and tomatoes. The valuation of the importable equivalent world price at the farm gate level is illustrated in detail in Tables A5-6, A5-7, A5-8 and A5-9 in which they follow Chart 2. Tables A5-10, A5-11 and A5-12 illustrate the Egyptian main studied exportable crops, rice, tomatoes and nili potatoes.

[17] Because the imported and domestically produced wheat are not the same quality, the study adopted the conversion allowance used by other studies such as Omran (1997); FAO (1999); Guendy (1999) to provide an equal basis of comparison. In this case it is usual to view imported wheat as lower quality to domestically produced wheat, and that the conversion allowance used in Table 5-2 is 95%.

TABLE 5-2: ESTIMATION OF IMPORT PARITY PRICE FOR WHEAT AT FARM GATE LEVEL

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (FOB-US Gulf)	$/TON	115.03	112.82	145.16	169.42	135.61	128.63	151.04	140.39	149.94	177.14	207.27	159.86	126.05	112.09	114.11
Add: **Freight & Insurance**	$/TON	15.25	20.36	20.90	21.00	24.00	24.30	14.35	14.70	14.80	15.00	15.10	15.50	15.40	15.35	16.00
Add: **Import Duties (2%) + Fees(8.3%)**	$/TON	11.85	11.62	14.95	17.45	13.97	13.25	15.56	14.46	15.44	18.24	21.35	16.47	12.98	11.55	11.75
World Price at Alexandria Port (CIF)	$/TON	142.13	144.80	181.01	207.87	173.58	166.17	180.95	169.54	180.18	210.38	243.72	191.83	154.44	138.98	141.86
Multiply: **Shadow Exchange Rate**	£E/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
Border Price at Alexandria Port	£E/TON	191.87	220.10	401.85	523.83	470.39	602.71	682.89	653.14	701.80	815.05	947.09	744.64	598.69	583.70	614.28
Add **Transportation from Port to Market**	£E/TON	7.40	8.50	10.00	13.50	16.00	17.20	18.00	19.00	20.00	21.00	22.30	24.00	25.20	26.00	27.10
World Price at Market	£E/TON	199.27	228.60	411.85	537.33	486.39	619.91	700.89	672.14	721.80	836.05	969.39	768.64	623.89	609.70	641.38
Deduct: **Trans. From Market to Farm**	£E/TON	7.00	8.10	9.60	13.00	15.70	16.50	17.90	18.95	19.55	20.90	22.00	23.85	25.00	26.00	27.00
World Price at Farm Gate	£E/TON	192.27	220.50	402.25	524.33	470.69	603.41	682.99	653.19	702.25	815.15	947.39	744.79	598.89	583.70	614.38
Multiply **Conversion Allowance @ 95%**	£E/Ton	**182.66**	**209.48**	**382.14**	**498.11**	**447.15**	**573.24**	**648.84**	**620.53**	**667.14**	**774.40**	**900.02**	**707.55**	**568.94**	**554.51**	**583.66**

5.5 Social valuation of world prices for traded inputs

5.5.1 : Social valuation of fertilisers

Traded factor inputs are mainly fertilisers, pesticides, and seeds. For fertilisers, Egypt is a net importer of potash and nitrogen fertiliser, while phosphate fertiliser is not traded[18]. Tables 5-3 and 5-4 illustrate the method of calculating the equivalent world price for nitrogen (15.5%) and potash (48%). Nitrogen and potash world prices are those at the port of origin, then freight & insurance and import duties are added to obtain their world price at Alexandria. The result is multiplied by the shadow exchange rate, then transportation from port to factory is added, while the costs of bagging and transportation from factory to farm are deducted.

Table 5-5 shows the procedure that has been carried out for phosphate fertiliser; freight and insurance and export duties are deducted from the phosphate world price at the port of destination then the result is multiplied by the shadow exchange rate. Transportation from port to factory, cost of bagging and transportation from factory to farm is deducted yielding phosphate equivalent world price at farm gate level.

5.5.2 : Social valuation of pesticides and seeds

For every single crop, one has to define the pesticides used in its production then calculate their equivalent world price, which is very difficult

[18] Because phosphate fertilizer is not traded in Egypt, it will be assumed in calculation of its equivalent world price that Egypt will be a net exporter for it.

TABLE 5-3: ESTIMATION OF IMPORT PARITY PRICE FOR NITROGEN FERTILISER (15.5%)

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (FOB-Europe)	$/TON	107.00	116.58	155.00	132.17	130.74	150.95	123.49	94.40	131.39	193.93	187.48	127.93	103.05	77.10	112.10
Add: **Freight & Insurance**	$/TON	12.45	12.73	13.00	13.24	15.25	15.82	9.15	9.60	10.10	10.60	11.10	11.96	12.68	12.90	13.10
Add: **Import Duties**	$/TON	32.10	34.97	46.50	39.65	39.22	45.29	37.05	28.32	39.42	58.18	0.00	0.00	0.00	0.00	0.00
World Price at Alexandria Port (CIF)	$/TON	151.55	164.28	214.50	185.06	185.21	212.06	169.69	132.32	180.91	262.71	198.58	139.89	115.73	90.00	125.20
Multiply: **Shadow Exchange Rate**	£E/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
Border Price at Alexandria Port	£E/TON	204.59	249.71	476.19	466.35	501.92	769.13	640.38	509.74	704.61	1017.79	771.68	543.03	448.64	377.98	542.13
Add **Transportation from Port to Factory**	£E/TON	15.50	16.80	17.00	18.00	21.50	22.70	23.80	25.00	26.30	27.60	29.00	30.10	31.00	31.75	33.00
World Price at Factory	£E/TON	220.09	266.51	493.19	484.35	523.42	791.83	664.18	534.74	730.91	1045.39	800.68	573.13	479.64	409.73	575.13
Deduct: **Trans. From Fac.to Farm & Cost of Bagging**	£E/TON	11.50	11.55	11.50	13.00	18.80	19.35	19.90	20.52	21.15	21.80	22.50	23.45	25.00	27.00	28.90
World Price at Farm Gate	£E/TON	208.59	254.96	481.69	471.35	504.62	772.48	644.28	514.22	709.76	1023.59	778.18	549.68	454.64	382.73	546.23
Multiply **Conversion Allowance***	£E/Ton	70.29	85.91	162.31	158.83	170.04	260.29	217.09	173.27	239.16	344.90	262.21	185.22	153.19	128.96	184.06

* Since the traded Nitrogen fertilizer is 46% conc, and the actually used and distributed among growers is 15.5%, then a conversion allowance is used to adjust the price per ton where world price at farm gate for 15.5% = (world price at farm gate for 46% * 15.5%) / 46%.

TABLE 5-4: ESTIMATION OF IMPORT PARITY PRICE OF POTASH FERTILISER

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (FOB-Vancouver)	$/TON	68.79	69.04	87.54	98.88	98.13	108.85	112.08	107.42	105.72	117.76	116.93	116.53	116.89	121.64	122.50
Add: **Freight & Insurance**	$/TON	16.67	22.25	22.50	22.95	26.35	26.59	15.80	16.15	16.35	16.45	16.90	17.00	18.00	18.28	19.00
Add: **Import Duties**	$/TON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
World Price at Alexandria Port (CIF)	$/TON	85.46	91.29	110.04	121.83	124.48	135.44	127.88	123.57	122.07	134.21	133.83	133.53	134.89	139.92	141.50
Multiply: **Shadow Exchange Rate**	£E/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
Border Price at Alexandria Port	£E/TON	115.37	138.76	244.29	307.01	337.34	491.24	482.61	476.03	475.45	519.96	520.06	518.34	522.91	587.64	612.71
Add **Transportation from Port to Factory**	£E/TON	15.50	16.80	17.00	18.00	21.50	22.70	23.80	25.00	26.30	27.60	29.00	30.10	31.00	31.75	33.00
World Price at Factory	£E/TON	130.87	155.56	261.29	325.01	358.84	513.94	506.41	501.03	501.75	547.56	549.06	548.44	553.91	619.39	645.71
Deduct: **Trans. From Fac.to Farm & Cost of Bagging**	£E/TON	11.50	11.55	11.50	13.00	18.80	19.35	19.90	20.52	21.15	21.80	22.50	23.45	25.00	27.00	28.90
World Price at Farm Gate	£E/TON	119.37	144.01	249.79	312.01	340.04	494.59	486.51	480.51	480.60	525.76	526.56	524.99	528.91	592.39	616.81

TABLE 5-5: ESTIMATION OF EXPORT PARITY PRICE FOR PHOSPHATE

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (U.S-Gulf)	$/TON	121.17	138.00	158.38	144.00	131.82	133.12	120.74	111.95	132.11	149.63	175.83	171.91	173.67	154.50	137.72
Deduct **Freight & Insurance**	$/TON	15.25	20.36	20.90	21.00	24.00	24.30	14.35	14.70	14.80	15.00	15.10	15.50	15.40	15.35	16.00
Deduct **Export Duties**	$/TON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
World Price at Alexandria Port (CIF)	$/TON	105.92	117.64	137.48	123.00	107.82	108.82	106.39	97.25	117.31	134.63	160.73	156.41	158.27	139.15	121.72
Multiply: **Shadow Exchange Rate**	£E/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
Border Price at Alexandria Port	£E/TON	142.99	178.81	305.21	309.96	292.19	394.69	401.51	374.64	456.91	521.58	624.60	607.15	613.55	584.40	527.06
Deduct **Transportation from Port to Factory**	£E/TON	15.50	16.80	17.00	18.00	21.50	22.70	23.80	25.00	26.30	27.60	29.00	30.10	31.00	31.75	33.00
World Price at Factory	£E/TON	127.49	162.01	288.21	291.96	270.69	371.99	377.71	349.64	430.61	493.98	595.60	577.05	582.55	552.65	494.06
Deduct: **Trans. From Fac.to Farm & Cost of Bagging**	£E/TON	11.50	11.55	11.50	13.00	18.80	19.35	19.90	20.52	21.15	21.80	22.50	23.45	25.00	27.00	28.90
World Price at Farm Gate	£E/TON	115.99	150.46	276.71	278.96	251.89	352.64	357.81	329.12	409.46	472.18	573.10	553.60	557.55	525.65	465.16

in practice for many reasons. First; the severe lack of detailed price data[19] on every type of pesticide used in producing each crop in any official source. Second, prices for pesticides and seeds are often not precise guides in commercial sources, because the degree of discounts offered on list prices varies over time and can be very substantial. So the alternative is to use the domestic prices of seeds and pesticides as equivalent to their world prices or to adjust their domestic prices by the following formula, which the study will rely on.

$$\text{Shadow Price of Pesticides} = \frac{\text{Shadow Exchange Rate}}{\text{Official Exchange Rate}} \times \text{Domestic Price of Pesticides} \tag{5.15}$$

5.6 : Social valuation of non traded inputs

5.6.1 : Social valuation of irrigation water.

Water is provided to farmers free of charge; consequently, there is no market or domestic price for irrigation water. However, Abo-Saad (1998) and Abdel-Maksoud (1998) estimated the price of water, at 74.20 £E/1000 M^3 and 67.23 £E/ 1000 M^3 respectively. A study carried out by the FAO (1999) adopted an estimated price of water of 70 £E/1000M^3. The study will rely on an average of these pre-estimated values of irrigation water.

5.6.2 : Social valuation of land

Most of Egypt's land is desert, and only 4.5 percent of the land area is used; i.e. of a total area of one million sq. km., only 4.5 thousand sq. km. are under usage. Only about 3.3% percent of the used land area is cultivated, and that is generally restricted to the Nile Valley and Delta area. Although the area

[19]Even for domestic prices of pesticides and seeds, the valid data is the aggregate cost of pesticides used per feddan per crop. In other word, there is no detailed data that can help in proceeding with the estimation process.

of arable land in Egypt is small, it is highly fertile and provides the basis of the agricultural sector, still the core sector in the Egyptian economy.

Land in general, and agricultural land in particular, is highly valued by the Egyptians, not only for its productive potential, but also for being a basic depository for value. Consequently, its value is difficult to assess as it is both a production input and an asset; moreover, *its related markets are often thin, unreliable and complex* (Hassan, 1991).

The land rent value has been strongly influenced by the government since the 1952 rebellion. Its rental value was controlled (until the introduction of the reform policy regime), this value being determined at seven times the agricultural land tax[20]. This tax tends to remain at the same nominal level over a long period of time (about a decade) before it is revised. Thus the value of the land rent is also revised every ten years. This method of valuation lasted for about thirty-four years, ignoring the massive changes in the physical and financial relationships that occurred during this period. The consequence was that the landowner was not encouraged to make any improvement to his existing land or to invest in more land.

Finally, the system of land tenancy has been reorganised after the adoption of the reformed policy regime in 1986, which achieved a remarkable shift towards liberalisation and free market operation. Within the reform policy period, the land rent was raised to twenty-two times the agricultural land tax, and then at the end of a five years transition period, it was allowed to operate completely freely in September 1997.

[20] The agricultural land tax is determined to each piece of land according to fertility, location zone and its close to irrigation water source. For example, if the agriculture land tax for feddan in zone (x) is £L 20 in year (t), according to the formula calculated by the Ministry of Agriculture the rent will be £L 140 in that year.

In the competitive market for renting or leasing land it can be assumed that land rental reflects its marginal productivity. Consequently, there is no problem in obtaining its social value, simply because the rental value represents the net value of production of land. But, if land or rental markets do not exist then the social rental value will be the foregone production in its best alternative use for a crop that competes directly for that land. The foregone production in our case is the social net return to land for the best competitive crop valued at social prices. In this task, the net return to land is defined as the social revenue after subtracting all other social costs except for land rent.

If there is a competitive market of renting or leasing land, it can be assumed that the land rental reflects its marginal productivity. Consequently, there is no problem in determining its social value, simply because the rental value represents the net social value of production of land. But, if land or rental markets do not exist then the social rental value must be estimated.

The net return to land is defined as the social revenue after subtracting all other social costs except for land rent. Rent is thus a residual in the social accounting framework. As such it suffers from the problems of all residual measures. Alston (1986, p.5), in his criticism of the residual income measure, argues that it is likely to be imperfect due to empirical and conceptual problems.

> *'This (residual) measure incorrectly treats land as the residual claimant for agricultural production and suffers from sever measurement problems, particularly relating to imputing costs for capital equipment and management'.*

Melichar (1979), Haushen and Herr (1980), Dobbins et al. (1981), Phipps (1984), Hassan (1991) and Abdel-Aziz (1993), in addition to a number of other empirical studies, used the residual income/return to measure returns to land. This return to land is obtained by deducting costs from total farm income.

However, our study will rely on the opportunity cost approach to derive the social value rent of land. The opportunity cost of land in its existing use is derived by taking the alternative crop with the highest return excluding land rent (valued at social prices), then adjusted to account for the time period that each crop effectively occupies the land. For example, cotton, maize and rice are alternative summer crops, where cotton stays on the land for eight months while rice for five and maize for four months only. If we are concerned to estimate the social price of land for cotton in year (t) and it is found that the best alternative to cotton in that year is rice, then,

$$\text{Land Rent of Cotton} = \text{Net Social Profit of Rice (excluding land rent)} \times \frac{8}{4} \qquad (5.16)$$

The bullets in Table 5-6 show the alternatives for each crop. These alternatives are selected from the crops that are actually grown. For example, the competing crops to rice (as a summer crop) are cotton, corn and soybean while, for short season clover (short berseem) as a winter crop are broad bean, long season clover (long berssem) and wheat.

However, in some cases a better alternative may be selected even though it might be physically impossible to grow. For example, cotton is grown in summer and wheat in winter, the opportunity cost price for cotton is the residual return to land (valued in world prices) in the alternative use, wheat. This is because cotton and wheat preclude each other since, wheat is not yet ripe when cotton has to be planted (Hassan, 1991). The same procedure is adopted for winter tomatoes and nili potatoes on the basis that both crops are not included in the agriculture period[21] rotation.

TABLE 5-6: SUMMARY OF CROP ALTERNATIVES

	Cotton	Rice	Nili Potatoes	W. Tomatoes	Corn	Broad bean	Soy bean	Long berseem	Short berseem	Sugar cane	Weat
Cotton		⇦			⇦		⇦			⇦	⇦
Rice	⇦				⇦		⇦				
Nili Potatoes				⇦	⇦		⇦				
Winter Tomatoes			⇦			⇦					⇦
Corn	⇦	⇦	⇦				⇦				
Broad Bean				⇦							⇦
Soy Bean	⇦	⇦			⇦						
Long .Ber						⇦			⇦		⇦
Short Ber						⇦		⇦			⇦
Sugar Cane	⇦										
Wheat	⇦			⇦		⇦		⇦	⇦		

Source: Computer Analysis Result

5.6.3 : Social valuation of labour

Labour is one of the important inputs in the production process. In case of hiring labour, the actual wage rate is the private price. But if labour comes from within the family, the private price would be then the opportunity cost of family labour. Theoretically, the opportunity cost of family labour should equal the wage rate of the best alternative employment opportunity apart from farming. But practically it is often very difficult to measure this opportunity cost, so for simplicity the study will deal with family labour in the same way as

[21] The agriculture period is a system that regulate the consequence of crop planting on the basis that aim to prevent the damage that might happen to soil due to the successive growing of the same crop year after year.

hired labour. In other words, the prevailing wage rate will be used as a proxy for the private price of family labour.

The market wage rate in Egyptian agriculture was considered to be the appropriate measure of the shadow price of labour for all commodities. The reason for using the market wage was that labour is fully employed in the agricultural sector and acts as a reservoir for supplying demand in construction, services and other sectors. In other words, a reserve army of unemployed labour does not exist (Greenaway and Milner, 1993). Thus, the agricultural labour market can be assumed to be fairly competitive and wages presumably reflect fairly accurately the vale of labour's marginal product. Therefore, the estimates of the social price of labour will depend on the best alternative wage prevailing in the season, as shown in Table 5-7.

TABLE 5-7: SOCIAL WAGE RATE FOR WINTER AND SUMMER SEASONS THROUGH THE PERIOD (1986-2000)

Year	Winter Season		Summer Season	
	£E/Man/Day	£E/Wo-B[22]/Day	£E/Man/Day	£E/Wo-B/Day
1986	4.27	2.26	4.30	2.15
87	4.81	2.33	4.80	2.15
88	4.88	2.75	4.93	2.34
89	5.15	2.75	5.50	2.97
90	5.2	3.00	5.50	3.00
91	6.01	3.00	6.03	3.00
92	6.49	3.00	7.00	3.07
93	7.25	3.50	7.00	3.50
94	7.30	3.65	7.53	3.70
95	7.81	3.90	7.54	3.70
96	8.00	3.90	7.60	3.71
97	8.73	4.05	8.00	4.00
98	9.18	4.23	8.48	4.00
99	9.50	4.30	9.00	4.38
2000	10.00	4.30	9.70	4.50

Source: Ministry of Agriculture and Land Reclamation, Bulletin of Agricultural Economics, Cairo, Egypt.

[22] Wo-B, means Women or boy

5.6.4 : Social valuation of animal work and manure

Animal work and manure are of course non-traded inputs, in other words not traded internationally, meaning that there are no international prices for these factors. The domestic prices of such factors are determined in the domestic markets. In the absence of distortions in those markets, the social prices of these inputs will be equal to their private prices.

5.7 : Social valuation of machinery

5.7.1 : Tractors

Tractors[23] and water pumps are two of the most important input factors in the agricultural production process, and estimating their social prices is one of the most difficult tasks in obtaining the data needed for the PAM. As their prices differ according to the country of manufacture, their power and discounts that vary from one supplier to another, detailed data on world prices are not found in official publications. So the approach used is to take the average price as the best estimate.

Data used for this purpose were mainly collected from the Central Authority for Public Mobilisation and Statistics (CAMPAS). The following formula was used to obtain the world price of a tractor:

$$\text{Value of the Tractor}_t = \frac{TV_t}{NT_t} \tag{5.16}$$

where,

TV = Total value of tractors
NT = Number of tractors
t = Year

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[23] It is assumed that the markup is 10%, savage value is 20%, use life is 10 years, maintenance is 5% per year, oil consumption is 4% per year and hours of use per year are 1500. These coefficients are comparable or similar to those used by (Yao. S., 1996), FAO (1999) and the United Nation (1993).

CHART 5-6: VALUATION FOR TRACTORS AND WATER PUMPS SOCIAL COSTS/HOUR

1-Fixed Cost

World Price at Port, Alexandria

Multiply

Shadow Exchange Rate

=

World Price at Port, Alexandria

+

Port Fees + Handling + Trasport to Warehouse + Markup @ 10%

=

Price at Warehouse

+

Transport to Farm

=

Total Price at Farm

-

Salvage Value @ 20%

=

Initial Capital Cost

Since

Use Life (10 Years)

Rate of Interest (%)

Hours of Use/Year (1500)

Therefore we can calculate

Depreciation

Capital Cost

Therefore

Sub Total Cost (1) = Depreciation + Capital Cost

2-Variable Cost

Maintenance cost @ 5% / 1500

+

Mobile Oil cost @ 2% / 1500

+

Feul cost + Tractor Driver cost

=

Sub Total Cost (2)

Therefore

Total Cost = Sub Total Cost (1) + Sub Total Cost (2)

The procedure for estimating the equivalent world price for a tractor/hour is illustrated in Chart 5-6 and calculated in Table A5-14, where costs are divided into fixed and variable components.

The fixed cost is composed of the CIF price plus port fees and handling, multiplied by the appropriate shadow exchange rate. Then a 10% mark-up, transport costs to the farm and a 20% salvage value are added to obtain the initial capital cost. Annual depreciation is based on an estimated life of ten years and a salvage value of 20% of the purchase price. The calculations are as follows:

$$\text{Annual depreciation cost} = \frac{\text{Total price at farm - Salvage value}}{\text{Years of use life}} \tag{5.17}$$

The calculations of annual capital cost can be derived as follows:

$$\text{Annual capital cost} = \left(\frac{\text{Total price at farm}}{2}\right) \times \text{Interest rate} \tag{5.18}$$

Then, by dividing the above equations by the number of hours of use in a year, the hourly rates of depreciation and capital cost are obtained.

The variable costs include maintenance, oil, fuel and driver wages. Yao (1996) and the FAO (1993 and 1999) relate the estimate of maintenance and oil cost to the total value of the tractor at the farm gate level (normally 5% and 2% respectively). For example, if we wish to estimate the maintenance and oil cost in 1990 and the value of the tractor at the farm gate level in that year is $10,000 then the maintenance cost for this year is estimated at $500 and the oil cost at $200. But is more reasonable to relate the maintenance and oil costs to the average value of the tractor stock in use in the country in 1990, not on its value in that particular year.

That is, the value of a tractor in year (t) in the country does not only depend on the value of a new tractor in year (t) but also on the values of the tractor stock in years (t-1), (t-2)...(t-10), on the assumption that the normal life of a tractor is 10 years. So we have to adjust the price of the tractor in year (t) taking into account the valuation of the tractor stock in the previous years of its life.

Then, we can link the maintenance and oil cost to that estimated value price as illustrated in table A5-13; and the following formula gives the total cost

$$\text{Total cost} = \text{Fixed cost} + \text{Variable cost} \tag{5.19}$$

The details of the estimation process for the social valuation of the tractor rent per hour, as well as the methodology used in calculating maintenance costs are illustrated numerically in tables A5-13 and A5-14.

5.7.2 : Water pumps

The social valuation of water pumps follows the procedure adopted in table A5-14 for tractors.

5.8 : Summary and Conclusion

The estimation of equivalent social (world) prices for input factors and output commodities is one of the most important and difficult issues for the derivation of the PAM. The analyst must first select the proper SER to convert imported or exported inputs and commodities traded in foreign currency into domestic currency. The selected SER is then used in calculating the import and export parity prices. Once these reference prices have been constructed then the PAM model may be constructed.

As noted earlier, the practitioner has to collect for the sector concerned the following. First, data for constructing the input/output table. Second, private or domestic price data for inputs and output to construct the private prices table. Third, the private budget table is then obtained by multiplying the entries in the input/output table by the corresponding entries in private prices table. Fourth, after estimating social or equivalent world parity prices for inputs and outputs, the social prices table is derived. Finally, the social budget table is obtained by multiplying the entries of the input/output table by the corresponding entries in the social prices table.

Now the PAM model can be constructed by substituting for the entries of PAM matrix, as illustrated in Chapter 4.

Chapter VI

Chapter VI: Measures of Private and Social Comparative Advantage: Private Cost Ratio (PCR) and Domestic Resource Cost (DRC) Results

6.1 : Introduction

In this chapter we report results from the estimation of the PAM using data for the period 1986 to 2000, and the methods set out in Chapter 5. Attention focuses in this chapter on the two criteria presented to assess the private profitability and economic efficiency of crops within the Egyptian agricultural sector. These criteria are the private cost ratio (PCR) and domestic resource cost (DRC).

As noted in Chapter 4, the private cost ratio and domestic resource cost are similar in their way of calculation, except that the first is calculated using private prices while the later uses social or world prices. This chapter reports on and analyses the results of the PCR and DRC estimates. These criteria are calculated annually for each crop, both separately and as part of a rotation. Although the alternative measurements for private and social profitability and comparative advantage such as net private profitability (NPP), net social profitability (NSP) and social cost benefit (SCB) that do not in the present context provide additional information they are presented for completeness.

Our principal motivation is to evaluate the effect of Egyptian agricultural policy reforms, as discussed in Chapter 4, in which we have characterised the period of study 1986-2000 as three distinct periods. The first period, 1986-89 represents the very early stages of reform; the actual reform period, running from 1990 to 2000 is (according to the availability of data) divided into two periods, 1990-95 and 1996-2000, to evaluate the performance of these economic indicators over time.

Section 2 presents measures of private profitability and the empirical results for net private profit and private cost ratio. Section 3 reports the results of the domestic resource cost, net social profitability and social cost-benefit indicators. It also analyses the consistency of the results obtained from these three indicators. Section 4 discusses the implications for private profitability, and comparative advantage in Egyptian major crop outputs and exports throughout the reform era. Section 5 is devoted to a summary and to conclusions.

6.2 : Measures of Private Profitability

6.2.1 : Net Private Profitability.

In PAM notations, net private profitability (D) is defined as gross returns at market prices (A) less the tradable input cost (B) and the cost of domestic factors (C). Net private profitability (NPP) is a direct measure of the incentives to farmers to produce a commodity, and reflects the competitiveness of that commodity at the observed market prices.

CONSTRUCTION OF PAM ANALYSIS

PAM	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A Revenue based on private profit	B Costs of tradable inputs based on private prices	C Costs of domestic factors based on private prices	D Profit based on private profit D = (A - B - C)
Social Prices	E Revenue based on social profit	F Costs of tradable inputs based on social prices	G Costs of domestic factors based on social prices	H Profit based on social profit H = (E - F- G)
Effects of divergences and efficient policy	I I = (A - E)	J J = (B - F)	K K = (C - G)	L L = D - H = (I - J - K)

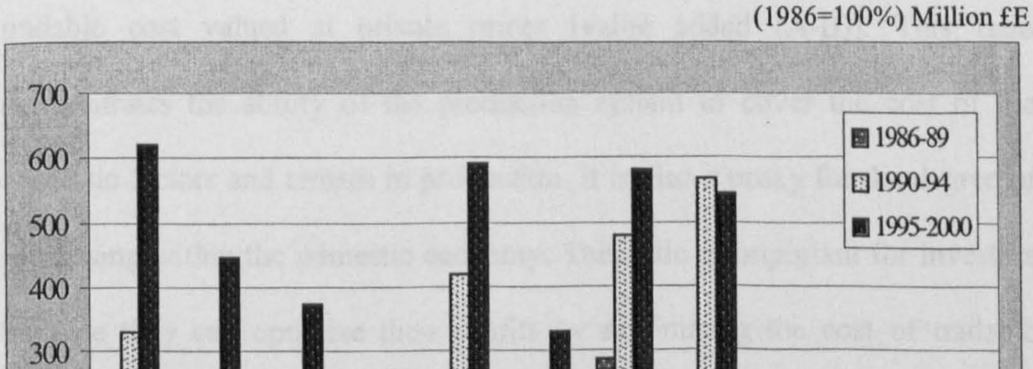
A positive NPP implies that the commodity system is privately or domestically profitable, given input and output prices, technology level, current government policy and existing market distortions.

A positive value of profits at prevailing market prices confirms the private profitability of the business. Positive profits also provide a stimulus for existing firms to increase output and for other firms to start production of the crop. But we have to be very cautious with this indicator because when the market prices of inputs or outputs are distorted by either market failure or by taxes or subsidies, then private profits alone could provide misleading signals.

The total net private profitability of a sector can be calculated by multiplying the NPP per feddan by total planted area of that sector. The results of total NPP values obtained from the PAM during the period 1986-2000 are presented in Figure 6-1. From this figure we may observe that potatoes and soybean, where gross profitability is falling over time, seem to be the least profitable products during the period 1995-2000.

FIGURE 6-1: NET PRIVATE PROFITABILITY FOR MAJOR CROPS IN THE PERIOD 1986-2000

(1986=100%) Million £E



Source: Table A6-1.

In contrast, production of field crops (such as rice and wheat), fodder crop (such as long and short berseem) and vegetable crops (such as tomatoes) represents a sound of higher private profitability in national economic terms with positive gross NPPs (constant Egyptian million pounds) of about 1213, 817 and 268 respectively.

6.2.2 : The Private Cost Ratio (PCR)

6.2.2.1 : Introduction

To recap on the discussion in Chapter 4, profits valued at private prices can be used for comparing the competitiveness of systems producing identical outputs under existing policies, but are not sufficient for comparisons among systems producing different outputs. As residuals in the calculations, a given level of profits may be obtained from systems using different levels of inputs to yield outputs with widely varying prices. The private cost ratio (PCR) can overcome the ambiguity in comparisons of private profits of systems producing different commodities (Monke and Pearson, 1989).

As discussed in Chapter 4, the PCR is defined as the ratio of the domestic factor cost [C] to the difference between the value of output and the tradable cost valued at private prices [value added (A-B)]. This ratio demonstrates the ability of the production system to cover the cost of the domestic factors and remain in production. It is also a proxy for the degree of processing within the domestic economy. This ratio is important for investors because they can optimise their profits by minimising the cost of tradable inputs and factors (Kubursi, 2001).

If the PCR for a sector is less than one this means that the cost of domestic factors is less than the difference between total revenues and costs of tradable component valued at domestic or private prices. It indicates that the sector is profitable domestically or, in other words, it has a competitive advantage domestically. If the PCR is greater than one, then the domestic cost is higher than the difference between the value of output and the cost of tradable inputs then that sector is not profitable and it is more likely to contract in the future.

Since the PCR in our context is advocated as an indicator of which agricultural sector should expand and which should contract following liberalisation. The private cost ratio is affected by many factors that are related to government policies on either the input or output side. For example, forcing producers to grow certain crops, at predetermined (controlled) output levels and prices (and other forms of government controls) will directly affect farm revenue. On the other hand, if the government controls the prices and distribution of inputs, this also affects farm costs, and consequently the PCR. In addition, the PCR may be affected by the level of technology used by farmers, since they might adopt better technologies and then obtain higher yield and/or lower cost and thus higher revenue and consequently a lower PCR.

Before reporting the PCR results, it is useful to investigate whether it is necessarily true that minimising the PCR ratio is equivalent to maximising excess profits as stated in Monke and Pearson 1989 (p.26): "*The entrepreneurs in the system prefer to earn excess profits (D>0), and they can achieve this result if their private factor costs (C) are less than their value added in private prices (A-B). Thus they try to minimise the private cost ratio by holding down factor and tradable input costs in order to maximise excess profits*"

If we assume a 'normal profit' (i.e. the wage to the farmers) then maximising excess profits must be equivalent to maximising total profit from the activity in question. It seems sensible to treat profits as the reward to the operator's own contribution to the process, which is a factor of production. In other words, if the profits are to be treated as the reward to the operator's own contribution to the process then profits are necessarily = 0. Suppose that we specify non-tradable input 1 as the operator's own contribution, so that he receives a payment w_1 per unit of his total input, c_1. If we define profit per unit of output as the difference between the value of the output and the cost of traded inputs and of all non-traded inputs *other than the operator's own efforts* then we have

$$\pi = p - \sum_{i=1}^{m} r_i b_i - \sum_{j=2}^{n} w_j c_j$$

But the definition of profit as the reward to the operator's own efforts (c_1) implies that

$$\pi = w_1 c_1$$

where w_1 is the operator's 'wage' per unit of effort (time)

It then follows that

$$p - \sum_{i=1}^{m} r_i b_i - \sum_{j=1}^{n} w_j c_j = 0$$

This is the result we would get if there were freedom of entry/exit (i.e., price = average cost).

A- The conventional approach

Suppose we have a producer seeking to maximise the profit per unit of output, where output is produced by a set of tradable inputs $b_1,..b_m$, and a set of non-tradable inputs, $c_1,..\ c_n$, according to a production function that may be written

$$Q=f(g(b_1,..b_m),\ h(c_1,..\ c_n)) \tag{6.1}$$

If the (exogenously determined) prices of the tradable inputs are $r_1,..r_m$, those of the non-tradable inputs are $w_1,..w_n$, and the price of the output is p then we may write the problem as:

$$\text{Max } \pi = p-\sum_{1}^{m} r_i b_i - \sum_{1}^{n} w_j c_j \text{ subject to } f(g(b_1,..b_m),\ h(c_1,..\ c_n))=1 \tag{6.2}$$

Writing it as a Lagrangean problem:

$$\text{Max } L = p-\sum_{1}^{m} r_i b_i - \sum_{1}^{n} w_j c_j + \lambda\,[\,f(g(b_1,..b_m),\ h(c_1,..\ c_n) - 1\,] \tag{6.3}$$

The first order conditions are then

$$-r_i + \lambda \frac{\partial f}{\partial g}\frac{\partial g}{\partial b_i} = 0 \qquad i = 1\ldots m \tag{6.4}$$

$$-w_j + \lambda \frac{\partial f}{\partial h}\frac{\partial h}{\partial c_j} = 0 \qquad i = 1\ldots n \tag{6.5}$$

$$f(g(b_1,..b_m),\ h(c_1,..\ c_n))=1 \tag{6.6}$$

These may be rewritten as

$$\frac{r_i}{r_1} = \frac{\partial g}{\partial b_i}\Big/\frac{\partial g}{\partial b_1} \quad i = 2\ldots m$$

$$\frac{w_j}{r_1} = \frac{\partial f}{\partial h}\frac{\partial h}{\partial c_j}\Big/\frac{\partial f}{\partial g}\frac{\partial g}{\partial b_1} \quad j = 1\ldots n$$

$$f\left(g\left(b_1,\ldots,b_m\right),\left(c_1,\ldots,c_n\right)\right) = 1$$

Suppose that the operator's own input is c_1, and that w_1 is the 'normal' return. We might then increase (decrease) w_1 appropriately if the profits in the solution are positive (negative).

B- the PCR approach

Value added is, in terms of the proceeding PAM notation, A-B $= p - \sum_{1}^{m} r_i b_i$, and the cost of domestic factors (including the operator's input) is given by C = $\sum_{1}^{n} w_j c_j$.

The approach recommended by Monke and Pearson for PCR is:

$$\text{Min } \frac{\sum_{1}^{n} w_j c_j}{p - \sum_{1}^{m} r_i b_i} \text{ subject to } f(g(b_1,..b_m),\ h(c_1,..\ c_n))=1 \tag{6.7}$$

which yields the Lagrangean

$$\text{Min } \frac{\sum_{1}^{n} w_j c_j}{p - \sum_{1}^{m} r_i b_i} - \mu\ [1 - f(g(b_1,..b_m),\ h(c_1,..\ c_n)] \tag{6.8}$$

The first order conditions are then,

$$r_i \frac{\sum_{1}^{n} w_j c_j}{\left[p - \sum_{1}^{m} r_i b_i\right]^2} + \mu \frac{\partial f}{\partial g}\frac{\partial g}{\partial b_i} = 0 \qquad i = 1 \ldots m \tag{6.9}$$

$$w_j \frac{1}{p - \sum_{1}^{m} r_i b_i} + \mu \frac{\partial f}{\partial h}\frac{\partial h}{\partial c_j} = 0 \qquad j = 1 \tag{6.10}$$

$$f(g(b_1,..b_m),\ h(c_1,..\ c_n)) = 1 \tag{6.11}$$

But $p-\sum_{i=1}^{m} r_i b_i - \sum_{j=1}^{n} w_j c_j = 0$ implies $p-\sum_{i=1}^{m} r_i b_i = \sum_{j=1}^{n} w_j c_j$, so we may rewrite them as

$$r_i \frac{1}{\sum w_j c_j} + \mu \frac{\partial f}{\partial g}\frac{\partial g}{\partial b_i} = 0 \qquad i = 1 \ldots m \tag{6.12}$$

$$w_j \frac{1}{\sum w_j c_j} + \mu \frac{\partial f}{\partial h}\frac{\partial h}{\partial c_j} = 0 \qquad j = 1 \ldots n \tag{6.13}$$

$$f\left(g\left(b_1,\ldots,b_m\right),\left(c_1,\ldots,c_n\right)\right) = 1 \tag{6.14}$$

and then some manipulation gives

$$\frac{r_i}{r_1} = \frac{\partial g}{\partial b_i}\bigg/\frac{\partial g}{\partial b_1} \quad i = 2 \ldots m$$

$$\frac{w_j}{r_1} = \frac{\partial f}{\partial h}\frac{\partial h}{\partial c_j}\bigg/\frac{\partial f}{\partial g}\frac{\partial g}{\partial b_1} \quad j = 1 \ldots n$$

$$f\left(g\left(b_1,\ldots,b_m\right),\left(c_1,\ldots,c_n\right)\right) = 1$$

which are in fact the same FOCs as obtained in the 'conventional' approach. We must then deduce that the two approaches are identical in their outcomes.

As discussed in Chapter 3, Egyptian agricultural policy has undergone significant liberalisation since 1986, the effects of which should appear in the PCRs. The reform has generally increased private input costs and product prices, and indirectly impacted on the technologies adopted. We shall discuss in the next section the trend and estimates of the PCRs for major importable crops such as wheat, maize, sugar cane, soy and broad beans. The PCRs for exportable crops, such as cotton, rice, potatoes and tomatoes, and for fodder crops, such as long and short berseem, will also be evaluated from the early period of reform until the latest available data point (1986-2000).

6.2.2.2 : Empirical Results

The main results of the PCR estimates for the main crops and their associated fourteen main rotations during the period 1986-2000 are summarised in Table 6-1. The overall picture[1] for the estimates indicate that all the studied crops and crop rotations had a PCR less than one, implying that they are domestically profitable (i.e. pay a positive reward to the average farmer). The estimated PCR coefficients have gradually increased over time (for most crops); broadly, their levels increased in the third period of reform compared to the second and first periods. This was mainly due to the gradual increase in the cost of the domestic factor component (the numerator), which in turn reflected the increase in land rent, which within the reform policy period was raised from seven times to twenty-two times the agricultural land tax, and finally at the end of a five years transition period, was determined in a free market (from September 1997). The average private cost ratio during the second period of reform fell for cotton and rice by 32% and 18% respectively compared to the first period. This fall may largely be explained by productivity changes and a greater intensity of input use that led to yield and area growth. For example, production of rice and cotton increased in the second stage of reform policy relative to the first by 25% and 11% respectively. Consequently, the farmers total private revenues increased by 142% and 350% (so that the denominator increased), and therefore the PCR decreased.

The estimated PCR coefficients for crop rotations are also reported in Table 6-1. These generally indicate that the private cost ratio increased over

[1] Except for soybeans in 1993 and 98 and broad beans in 1999.

TABLE 6-1: PRIVATE COST RATIO (PCR) FOR MAIN CROPS & CROP ROTATIONS IN THE PERIOD 1986-2000.

Crop	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat	0.50	0.45	0.48	0.29	**0.4**	0.29	0.34	0.35	0.52	0.55	**0.4**	0.53	0.46	0.49	0.63	0.58	0.57	**0.5**	**0.5**
Maize	0.65	0.54	0.45	0.39	**0.5**	0.39	0.44	0.48	0.67	0.63	**0.5**	0.68	0.59	0.51	0.70	0.59	0.59	**0.6**	**0.5**
Sugar cane	0.54	0.55	0.51	0.46	**0.5**	0.41	0.53	0.55	0.60	0.57	**0.5**	0.56	0.56	0.54	0.64	0.71	0.66	**0.6**	**0.6**
Soybeans	0.69	0.58	0.70	0.51	**0.6**	0.56	0.55	0.72	1.12	0.95	**0.7**	0.96	0.82	0.82	1.06	0.98	0.99	**0.9**	**0.8**
Broad beans	0.43	0.35	0.44	0.39	**0.4**	0.45	0.53	0.57	0.77	0.77	**0.6**	0.59	0.55	0.50	0.79	1.05	0.73	**0.7**	**0.6**
Cotton	0.77	0.76	0.73	0.58	**0.7**	0.52	0.42	0.37	0.43	0.65	**0.5**	0.40	0.40	0.43	0.86	0.83	0.80	**0.6**	**0.6**
Rice	0.53	0.72	0.57	0.39	**0.5**	0.37	0.40	0.43	0.57	0.47	**0.4**	0.44	0.42	0.44	0.55	0.54	0.55	**0.5**	**0.5**
Tomatoes	0.26	0.28	0.28	0.36	**0.3**	0.29	0.26	0.33	0.40	0.35	**0.3**	0.27	0.25	0.27	0.33	0.32	0.33	**0.3**	**0.3**
Potatoes	0.51	0.59	0.40	0.28	**0.4**	0.66	0.56	0.52	0.64	0.35	**0.5**	0.66	0.63	0.62	0.97	0.89	0.93	**0.8**	**0.6**
Long Berseem	0.41	0.28	0.34	0.36	**0.3**	0.41	0.42	0.43	0.47	0.49	**0.4**	0.46	0.41	0.36	0.42	0.44	0.41	**0.4**	**0.4**
Short Berseem	0.46	0.31	0.38	0.39	**0.4**	0.48	0.46	0.45	0.60	0.58	**0.5**	0.54	0.47	0.46	0.44	0.49	0.46	**0.5**	**0.5**
Crop Rotations	**1986**	**87**	**88**	**89**	**86-89**	**90**	**91**	**92**	**93**	**94**	**90-94**	**95**	**96**	**97**	**98**	**99**	**2000**	**95-2000**	**1986-2000**
Wheat & Maize	0.57	0.49	0.46	0.34	**0.5**	0.34	0.39	0.41	0.58	0.59	**0.5**	0.59	0.52	0.50	0.66	0.58	0.58	**0.6**	**0.5**
Wheat & Rice	0.52	0.57	0.52	0.33	**0.5**	0.33	0.37	0.39	0.54	0.50	**0.4**	0.48	0.44	0.46	0.59	0.56	0.56	**0.5**	**0.5**
Wheat & Soybean	0.58	0.51	0.57	0.37	**0.5**	0.39	0.43	0.48	0.71	0.70	**0.5**	0.68	0.59	0.61	0.76	0.70	0.70	**0.7**	**0.6**
Wheat & Pot	0.51	0.52	0.43	0.28	**0.4**	0.45	0.45	0.44	0.58	0.41	**0.5**	0.60	0.55	0.56	0.78	0.72	0.73	**0.7**	**0.5**
Broad bean & Maize	0.53	0.44	0.44	0.39	**0.5**	0.41	0.48	0.52	0.71	0.69	**0.6**	0.64	0.57	0.51	0.74	0.75	0.65	**0.6**	**0.6**
Broad bean & Rice	0.48	0.51	0.51	0.39	**0.5**	0.40	0.45	0.48	0.65	0.57	**0.5**	0.50	0.47	0.47	0.64	0.69	0.62	**0.6**	**0.5**
Broad bean & Potatoes	0.48	0.48	0.41	0.31	**0.4**	0.56	0.55	0.54	0.69	0.44	**0.6**	0.63	0.60	0.57	0.88	0.95	0.84	**0.7**	**0.6**
Broad bean & Soybean	0.54	0.44	0.55	0.45	**0.5**	0.50	0.54	0.64	0.91	0.86	**0.7**	0.74	0.66	0.62	0.89	1.01	0.83	**0.8**	**0.7**
S.Berseem & Cotton	0.68	0.60	0.62	0.53	**0.6**	0.51	0.43	0.39	0.46	0.63	**0.5**	0.43	0.42	0.44	0.66	0.68	0.65	**0.5**	**0.5**
L.Berseem & Rice	0.47	0.44	0.45	0.38	**0.4**	0.39	0.41	0.43	0.52	0.48	**0.4**	0.45	0.41	0.40	0.48	0.49	0.47	**0.5**	**0.4**
L.Berseem & Maize	0.52	0.38	0.39	0.38	**0.4**	0.40	0.43	0.46	0.55	0.55	**0.5**	0.55	0.48	0.42	0.52	0.50	0.48	**0.5**	**0.5**
L.Berseem & Soybean	0.53	0.38	0.48	0.43	**0.5**	0.48	0.48	0.54	0.66	0.65	**0.6**	0.62	0.54	0.49	0.57	0.57	0.55	**0.6**	**0.5**
Tomatoes & Soybean	0.33	0.32	0.34	0.39	**0.3**	0.34	0.31	0.41	0.52	0.45	**0.4**	0.36	0.33	0.35	0.43	0.41	0.42	**0.4**	**0.4**
Tomatoes & Maize	0.33	0.33	0.31	0.36	**0.3**	0.31	0.30	0.37	0.47	0.42	**0.4**	0.34	0.32	0.32	0.42	0.39	0.40	**0.4**	**0.4**

Source: PAM analysis results.

time for the majority of rotations. As before, the rise in domestic factor costs and tradable inputs might explain this increment.

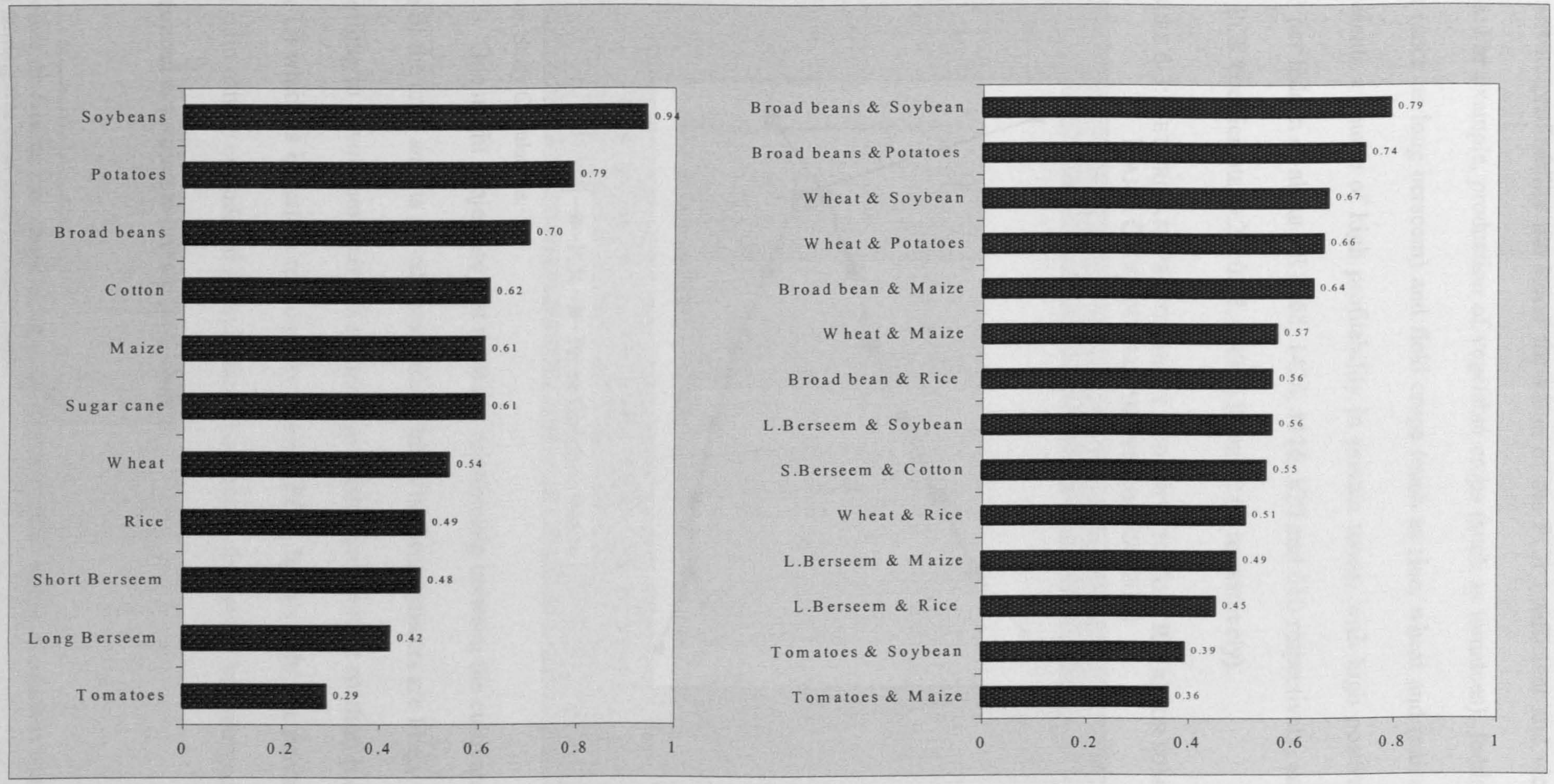
Using the average estimates for PCRs during the period 1995-2000, Figure 6-2 summarises the preferable crops and crop rotations from the private (domestic) profitability point of view, i.e. the lowest private cost ratio. Tomatoes had the lowest ratio (0.29) and soybeans the highest (0.94). Other crops showed some variation; for example, long and short berseem reached 0.42 and 0.48 respectively, followed by rice (0.49), wheat (0.54), sugar cane and maize the same ratio (0.61) and finally cotton (0.62), broad beans (0.70) and potatoes (0.79).

Considering different crop rotations, the results indicate that tomatoes followed by maize have the lowest PCR (0.36) while broad beans followed by soybean have the highest (0.79). Other preferable rotations ranked according to the lowest PCR are as follows: tomatoes followed by soybeans (0.39), long berseem followed by rice (0.45), long berseem followed by maize and wheat followed by rice were about 0.50. Next come short berseem followed by cotton, broad beans followed by rice, long berseem-followed by soybeans and wheat followed by maize, all about 0.56. Finally, the least preferable rotations are (all about 0.67) broad beans followed by maize, wheat followed by potatoes or soybeans and broad beans followed by potatoes.

6.2.3 : Net Private Profitability, PCR and Area

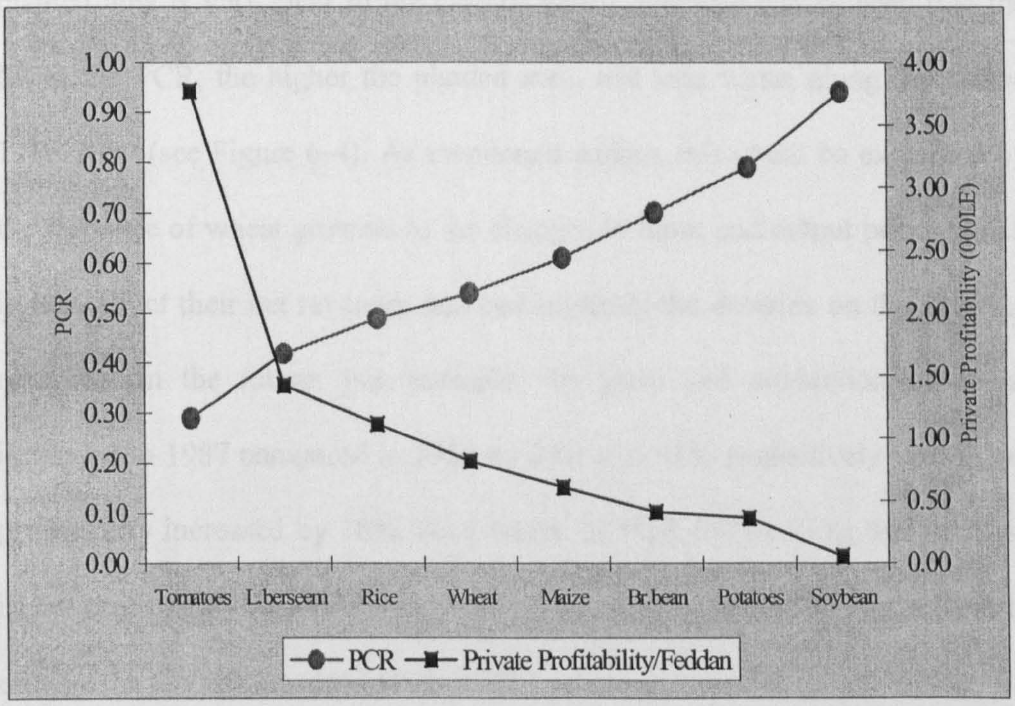
The results of NPP values obtained from the PAM during the period 1995-2000 for major crops along with their associated PCR coefficients are portrayed in Figure 6-3. From this figure we may observe that the higher the

FIGURE 6-2: PCR ESTIMATES FOR CROP AND CROP ROTATIONS (1995-2000)



net private profitability the lower the value of the PCR coefficient and vice versa. For example, production of vegetable crops (such as tomatoes), fodder crop (such as long berseem) and field crops (such as rice, wheat and maize) represents a source of high profitability in private terms, with high positive NPP per feddan of about £E 3768, 1426, 1116, 820 and 610 respectively, and low PCR coefficients (0.29, 0.42, 0.49, 0.54 and 0.61 respectively).

FIGURE 6-3: NET PRIVATE PROFITABILITY AND PRIVATE COST RATIO FOR SOME MAJOR CROPS DURING THE PERIOD 1995-2000



Source: Study Calculations.

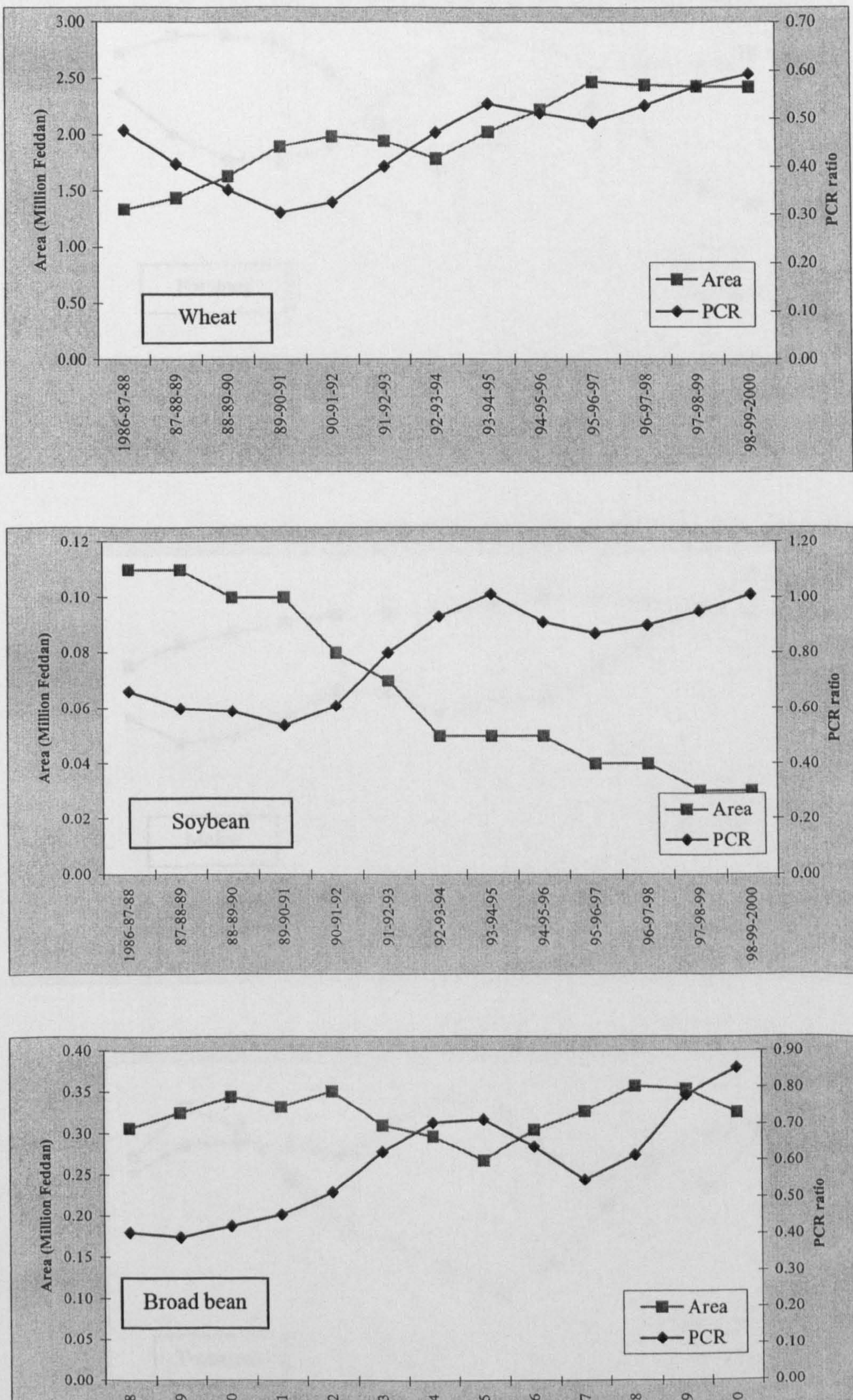
One might conjecture that there is a relationship between the cultivated area of the crop and its private cost ratio. This is because growers are likely to be willing to devote more area to the most profitable crop and/or rotation (i.e., max D) which is in turn is reflected by a lower PCR. In this light, the private cost ratio can be considered as an indicator of sectors that might be enlarged [2] or reduced according to private profitability.

[2] Because the farming area cannot be expanded, growers will be willing to substitute within their farming area other more profitable crops.

To investigate this conjecture Figures 6-4 illustrates the trends in the cultivated area and the private cost ratio using a three-year moving average. This suggests a number of conclusions about the growers' responses to profitability (taking in consideration the changes in farm input/output prices). Planted areas for crops such as wheat, soybean, broad bean and potatoes show generally high but variable response in relation to the private cost ratio. The inversely proportional relationship between the private cost ratio and the planted area is very clear in the case of wheat, where it can be seen that the lower the PCR, the higher the planted area, and vice versa, along the period 1986-2000 (see Figure 6-4). As mentioned earlier, this could be explained by the response of wheat growers to the changes in input and output prices which in turn affect their net revenues and consequently the decision on the growing of wheat in the future. For example, the yield and production of wheat increased in 1987 compared to 1986 by 24% and 41% respectively and its net profitability increased by 18%. As a result, its PCR fell by 11%; this increase in net profitability (the fall in private cost ratio) encouraged wheat growers to enlarge the planted area by 14% in 1987.

Soy and broad beans and potatoes also showed a high response to the lower PCR in terms of their planted area. For example, the PCR for soybean increased from 0.62 in the first stage to 0.78 and 0.94 in the second and third stages respectively, and its cultivated area decreased from 0.10 to 0.06 and 0.03 million feddan in the same periods.

FIGURE 6-4: TRENDS OF PCR AND PLANTED AREA FOR SOME MAJOR CROPS IN THE PERIOD 1986-2000



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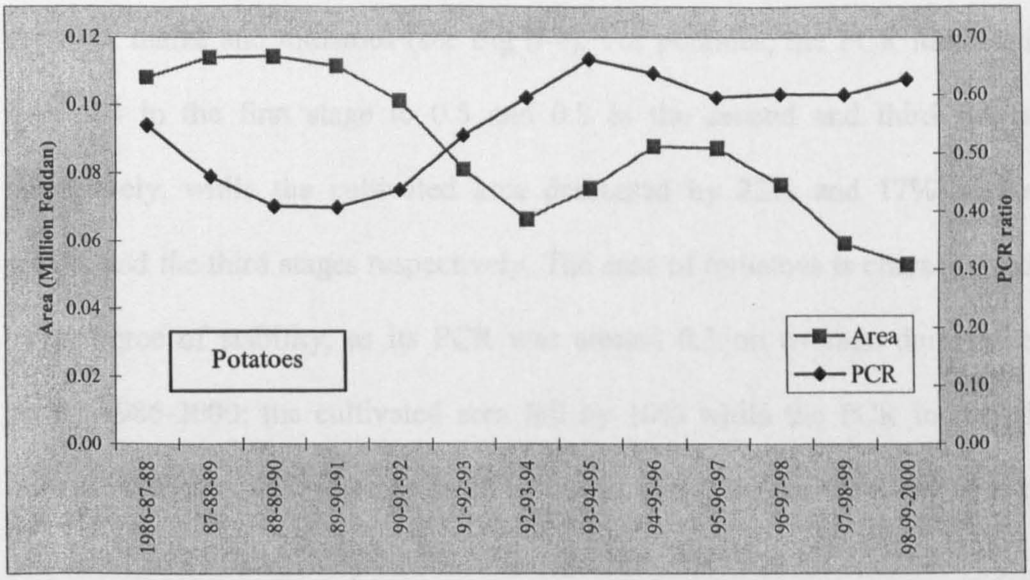
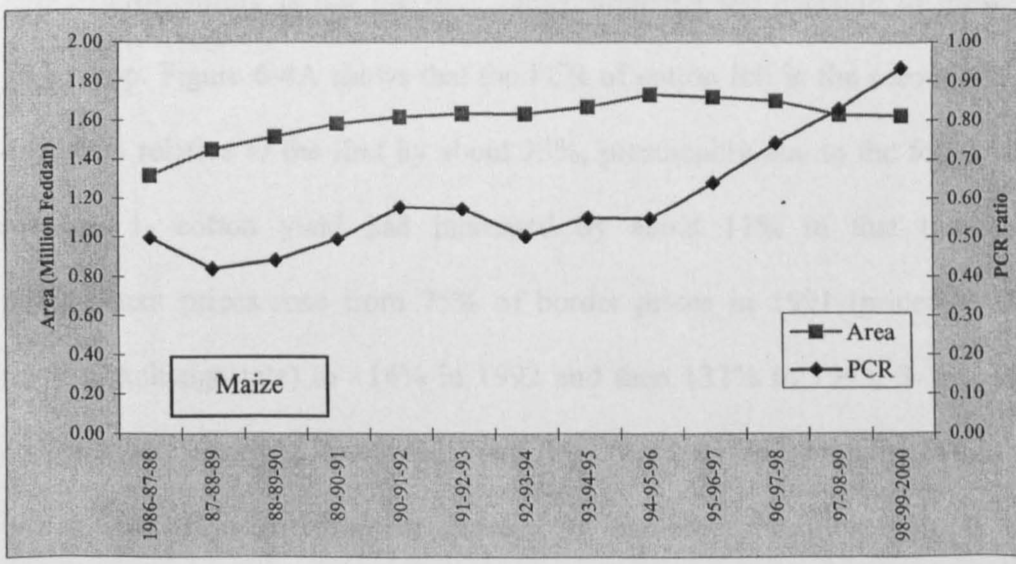
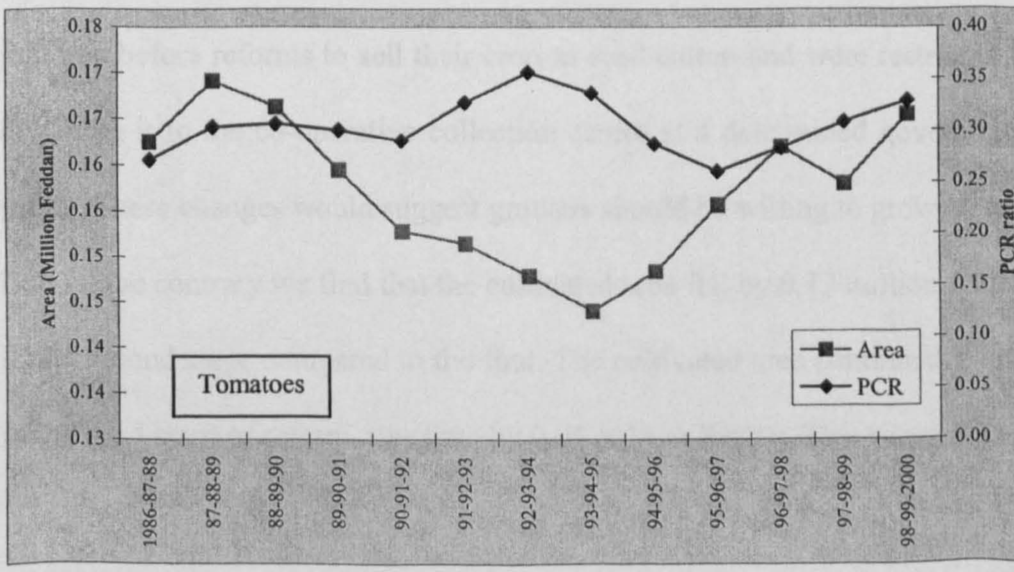

Area (Million Feddan)
PCR ratio
Potatoes
Area
PCR
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
1986-87-88
87-88-89
88-89-90
89-90-91
90-91-92
91-92-93
92-93-94
93-94-95
94-95-96
95-96-97
96-97-98
97-98-99
98-99-2000

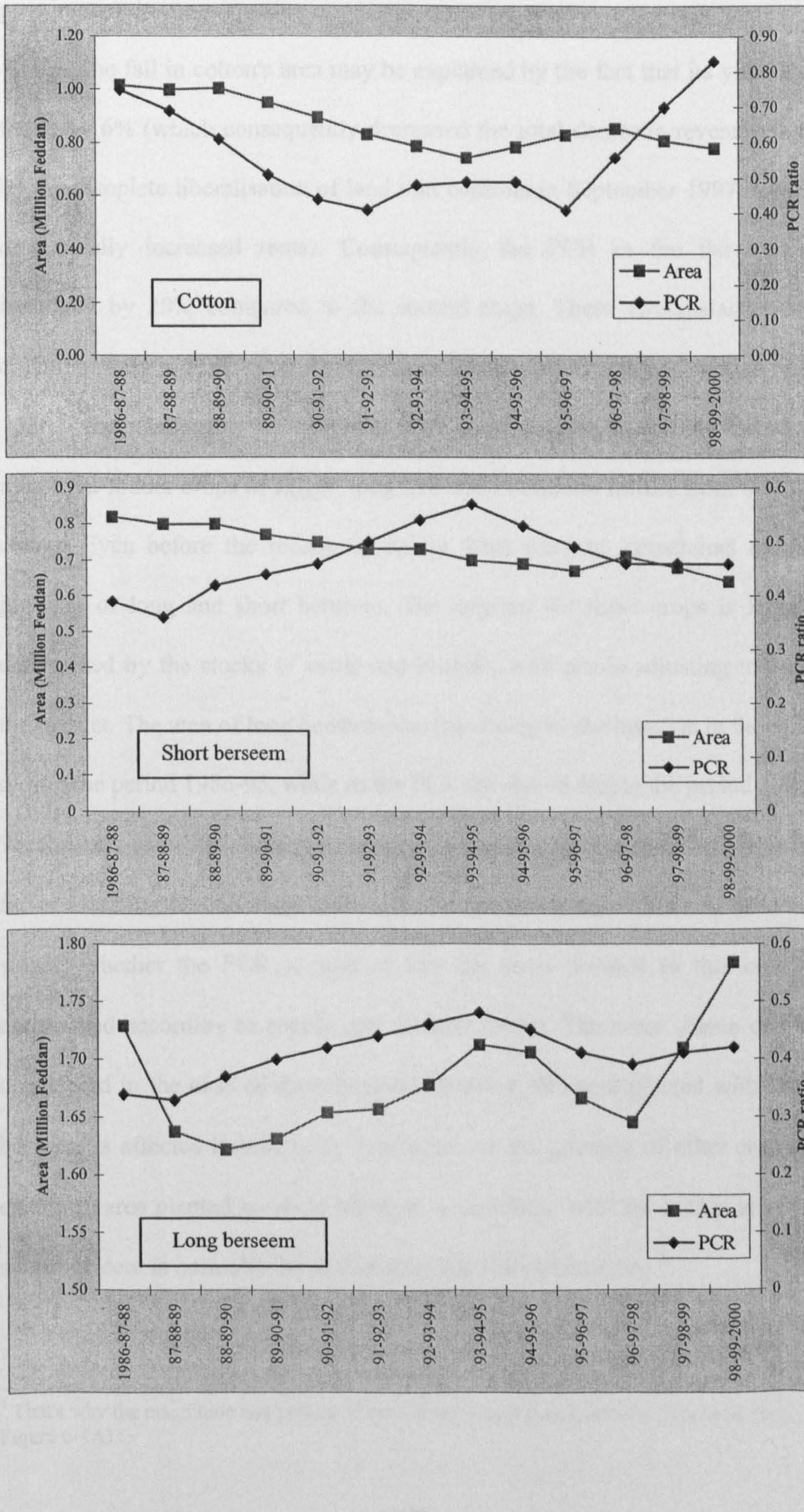

Area (Million Feddan)
PCR ratio
Maize
Area
PCR
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
1986-87-88
87-88-89
88-89-90
89-90-91
90-91-92
91-92-93
92-93-94
93-94-95
94-95-96
95-96-97
96-97-98
97-98-99
98-99-2000


Area (Million Feddan)
PCR ratio
Tomatoes
Area
PCR
0.13
0.14
0.14
0.15
0.15
0.16
0.16
0.17
0.17
0.18
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
1986-87-88
87-88-89
88-89-90
89-90-91
90-91-92
91-92-93
92-93-94
93-94-95
94-95-96
95-96-97
96-97-98
97-98-99
98-99-2000

The same relation between planted area and PCR can be seen for potatoes, maize and tomatoes (see Fig 6-4). For potatoes, the PCR increased from 0.4 in the first stage to 0.5 and 0.8 in the second and third stages respectively, while the cultivated area decreased by 22% and 17% in the second and the third stages respectively. The case of tomatoes is characterised by a degree of stability, as its PCR was around 0.3 on average during the period 1986-2000; the cultivated area fell by 10% while the PCR increased from 0.29 in the first stage to 0.34 in the second. In the third period the cultivated area increased by 7.66 % while the PCR fell to 29%.

Profitability is not the only factor affecting the decision to grow a given crop. Figure 6-4A shows that the PCR of cotton fell in the second stage of reform relative to the first by about 23%, presumably due to the following reasons: 1- cotton yield had increased by about 11% in that time, 2- procurement prices rose from 75% of border prices in 1991 (priced at the market exchange rate) to 114% in 1992 and then 132% in 1993, 3- acreage controls were removed for the 1992 and 1993 crops, 4- the marketing of cotton was liberalised in 1994 where decrees for eliminating market controls on farmers, merchants and exporters introduced for the 1994 crop (growers were required before reforms to sell their crop as seed cotton and were restricted to disposing it to the co-operative collection centre at a determined government price). These changes would suggest growers should be willing to grow cotton. But, on the contrary we find that the cultivated area fell by 0.17 million feddan in the second stage compared to the first. The cultivated area continued its fall in the third stage of reform, this time by 0.04 million feddan. This suggests that

FIGURE 6-4A: TRENDS OF PCR AND PLANTED AREA FOR SOME MAJOR CROPS IN THE PERIOD 1986-2000



there were factors other than prices affecting the farmers' decision about growing cotton.

The fall in cotton's area may be explained by the fact that its yield had fallen by 6% (which consequently decreased the total domestic revenue), and by the complete liberalisation of land rent controls in September 1997 (which dramatically increased rents). Consequently the PCR in the third stage increased by 20% compared to the second stage. These circumstances led cotton growers to plant other alternative and more profitable crops such as rice.

The relationship between the PCR and the planted area for the most important fodder crops in Egypt, long and short berseem, differs from that for cotton. Even before the reform of policy there were no constraints on the growing of long and short berseem. The demand for these crops is largely determined by the stocks of cattle and buffalo, with prices adjusting to clear the market. The area of long berseem increased despite the increase in the PCR during the period 1986-95, while as the PCR decreased during the period 1996-98, the area also fell. This result may be explained by the fact that the main factor affecting its cultivated area is the cattle and buffalo livestock. In other words, whether the PCR is high or low the areas devoted to this crop is determined according to supply and demand forces. The same reason can be considered in the case of short berseem however, the area planted with short berseem is affected indirectly by constraints on the growing of other crop for example; area planted by short berseem is correlated with the cotton area (as short berseem is normally the winter crop that precedes cotton).[3]

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[3] That's why the magnitude and pattern of short berseem and cotton area are very close (see Figure 6-4A)

In short, the relatively high NPPs of wheat, rice and maize may explain the willingness of field crop growers to plant them. For example, wheat and rice area has increased in the third period of reform (1995-2000) above its level in 1986 by 77%, 54% and 22 % respectively. Similarly, the relatively low NNPs of soybean and potatoes may also explain why farmers reduced their planted area by 68% and 35% respectively over the same period.

6.3 : Measures of Efficiency and Resource Allocation

6.3.1 : Domestic Resource Cost (DRC) Results

6.3.1.1 : Introduction

As defined in Chapter 4, The starting point of international competitiveness evaluation is to derive the actual costs of production by adjusting domestic costs and tradable products for taxes, subsidies and other price distortions. Once the real costs of production are estimated, competitiveness, will be evaluated along the lines initially developed by Bruno (1967) in his measurement of domestic resource cost and the various refinements that subsequently have been introduced (Corden, 1974; Ingram and Pearson, 1981; Pearson et al., 1987; Monke and Pearson, 1989). The domestic resource cost is the ratio of domestic factors valued at social prices to the difference between the gross benefit and the costs of tradable inputs. It has been widely used in developing countries to measure efficiency or comparative advantage and guide policy reforms (World Bank, 1991; Appleyard, 1987; Morris, 1990; Gonzales et al., 1993; Alpine and Pickett, 1993). It compares the opportunity costs of domestic factors to the value added at border prices. If the DRC is less than one then the implication is that the value of domestic resources used in the production of the commodity is less than the value added at social prices and the production of the commodity represents an efficient use of domestic resources. If the DRC is greater than one then the implication is that the economy is incurring costs in excess of value added at social prices and foreign exchange is lost by producing the commodity under that technology set. If the DRC equals to one then it is indicated that the economy on balance neither gains nor saves foreign exchange through production (Adesina and Coulibaly, 1998; Adesina et al., 2002).

6.3.1.2 : Empirical Results

The main results of our DRC estimates using the PAM matrix analysis for main crops and their associated fourteen main rotations during the period 1986-2000 are summarised in Table 6-2. It indicates a comparative advantage in most commodities studied for 1986-2000. Egypt appears to have had a comparative advantage in tomatoes and potatoes (0.60), wheat and rice (0.87) and long berseem (0.94). However, the domestic resource cost coefficients for sugar cane and short berseem and soybean are more than one (1.18 and 1.28 respectively) that suggests Egypt faces a comparative disadvantage in their production. At the same time, Egypt appears to have a neutral comparative advantage in producing cotton, broad beans and maize whereas their DRC estimate values are nearly one.

As mentioned earlier, the lower the coefficient of the DRC of the product the more comparative advantage the product enjoys. The estimates suggest a number of conclusions about comparative advantage within agriculture in the period 1986-2000. In the import crops, for example, sugar cane has a DRC coefficient, in some years, below one. These coefficients substantially reflect the drastic changes that occurred in the world market. Sugar prices were 133 U.S $ and 148 U.S $ per ton, in 1986 and 1987 respectively in which this was reflected on higher DRC coefficients 1.58 and

TABLE 6-2: DOMESTIC RESOURCE COST (DRC) FOR MAIN CROPS & CROP ROTATIONS IN THE PERIOD 1986-2000.

Crop	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat	0.92	0.92	0.76	0.66	**0.82**	0.84	0.87	0.91	0.99	0.98	**0.92**	0.97	0.78	0.97	0.75	0.76	0.84	**0.85**	**0.86**
Maize	1.24	1.32	0.83	0.95	**1.08**	0.98	0.84	0.93	0.98	0.97	**0.94**	1.06	0.84	0.99	1.23	0.99	0.94	**1.00**	**1.01**
Sugar cane	1.58	1.60	0.76	0.64	**1.14**	0.72	1.21	1.21	1.19	0.95	**1.06**	1.05	1.12	1.09	1.17	2.14	1.41	**1.33**	**1.19**
Soybeans	1.35	1.36	0.91	1.22	**1.21**	1.25	1.19	1.32	1.35	1.28	**1.28**	1.90	1.19	1.15	1.13	1.25	1.31	**1.32**	**1.28**
Broad beans	0.98	0.64	0.85	0.74	**0.80**	0.78	0.85	0.99	1.36	1.45	**1.09**	1.09	0.97	0.90	0.85	1.42	0.94	**1.00**	**0.99**
Cotton	0.97	0.94	0.96	0.95	**0.96**	0.95	0.91	1.09	0.95	0.97	**0.97**	0.97	1.27	1.00	1.32	1.41	1.29	**1.21**	**1.06**
Rice	1.59	1.50	0.81	0.66	**1.14**	0.71	0.70	0.78	0.96	0.86	**0.80**	0.81	0.71	0.77	0.57	0.68	1.00	**0.76**	**0.87**
Tomatoes	0.45	0.76	0.76	0.53	**0.62**	0.37	0.55	0.52	0.30	0.37	**0.42**	0.70	0.68	1.12	0.95	0.47	0.35	**0.71**	**0.59**
Potatoes	0.42	0.44	0.52	0.61	**0.50**	0.98	0.52	0.52	0.70	0.53	**0.65**	0.47	0.73	0.74	0.70	0.58	0.48	**0.62**	**0.60**
Long Berseem	0.85	0.64	0.98	1.29	**0.94**	1.18	1.22	1.20	0.97	1.01	**1.12**	0.98	0.93	0.84	0.69	0.70	0.67	**0.80**	**0.94**
Short Berseem	0.47	0.77	1.14	1.43	**0.95**	1.51	1.60	1.77	1.42	1.37	**1.54**	1.44	1.49	0.95	0.77	0.77	0.75	**1.00**	**1.22**
Crop Rotations	**1986**	**87**	**88**	**89**	**86-89**	**90**	**91**	**92**	**93**	**94**	**90-94**	**95**	**96**	**97**	**98**	**99**	**2000**	**95-2000**	**1986-2000**
Wheat & Maize	1.05	1.08	0.79	0.79	**0.93**	0.91	0.85	0.92	0.99	0.98	**0.93**	1.01	0.81	0.98	0.98	0.87	0.89	**0.92**	**0.93**
Wheat & Rice	1.17	1.15	0.79	0.66	**0.94**	0.77	0.77	0.84	0.98	0.92	**0.86**	0.88	0.74	0.86	0.65	0.71	0.92	**0.79**	**0.85**
Wheat & Soybean	1.08	1.08	0.83	0.84	**0.96**	0.99	1.00	1.06	1.13	1.10	**1.06**	1.25	0.92	1.04	0.89	0.92	1.00	**1.00**	**1.01**
Wheat & Pot	0.55	0.58	0.60	0.63	**0.59**	0.92	0.60	0.64	0.81	0.66	**0.73**	0.60	0.75	0.82	0.72	0.63	0.60	**0.69**	**0.67**
Broad bean & Maize	1.10	0.86	0.84	0.84	**0.91**	0.88	0.84	0.96	1.14	1.17	**1.00**	1.07	0.90	0.94	1.03	1.16	0.94	**1.00**	**0.98**
Broad bean & Rice	1.25	0.92	0.83	0.70	**0.92**	0.75	0.76	0.86	1.11	1.06	**0.91**	0.91	0.82	0.83	0.69	0.93	0.97	**0.86**	**0.89**
Broad bean & Potatoes	0.54	0.51	0.61	0.65	**0.58**	0.89	0.60	0.63	0.88	0.71	**0.74**	0.59	0.81	0.79	0.75	0.75	0.63	**0.72**	**0.69**
Broad bean & Soybean	1.14	0.85	0.88	0.91	**0.95**	0.95	1.00	1.14	1.35	1.36	**1.16**	1.39	1.06	1.00	0.95	1.34	1.07	**1.14**	**1.09**
S.Berseem & Cotton	0.76	0.89	1.00	1.05	**0.93**	1.08	1.05	1.23	1.06	1.07	**1.10**	1.08	1.33	0.98	1.08	1.12	1.06	**1.11**	**1.06**
L.Berseem & Rice	1.12	0.90	0.89	0.89	**0.95**	0.91	0.89	0.95	0.97	0.92	**0.93**	0.88	0.81	0.81	0.64	0.69	0.78	**0.77**	**0.87**
L.Berseem & Maize	1.00	0.84	0.90	1.10	**0.96**	1.08	1.01	1.06	0.97	0.99	**1.02**	1.02	0.88	0.91	0.88	0.81	0.76	**0.88**	**0.95**
L.Berseem & Soybean	1.03	0.84	0.94	1.26	**1.02**	1.21	1.20	1.26	1.12	1.12	**1.18**	1.28	1.02	0.95	0.80	0.83	0.81	**0.95**	**1.04**
Tomatoes & Soybean	0.51	0.83	0.78	0.60	**0.68**	0.47	0.61	0.59	0.39	0.43	**0.50**	0.79	0.76	1.13	0.98	0.53	0.41	**0.77**	**0.66**
Tomatoes & Maize	0.51	0.83	0.77	0.59	**0.68**	0.48	0.59	0.57	0.38	0.42	**0.49**	0.74	0.72	1.08	1.02	0.54	0.42	**0.75**	**0.64**

Source: PAM analysis results.

1.60 respectively. But when world prices increased to 224 U.S $, 281 U.S $ and 275 U.S $ per ton for years 1988, 1989 and 1990, the DRC coefficients fell to 0.76, 0.64 and 0.72 respectively. And again when sugar world prices fell to 138 U.S $ and 178 U.S $ in 1999 and 2000 the corresponding DRC coefficients rose to exceed one. The increased comparative advantage of wheat in the period 1998-2000 is due to the fall in the opportunity cost of land by 44% (compared with its average in 1995-1997), which in turn lowered the numerator, and hence the DRC coefficient decreased.

For export crops, it is clear that Egypt had a strong comparative advantage in producing tomatoes and potatoes during the period 1986-2000 with DRC coefficients around 0.60. Other export crops such as rice have an increasing comparative advantage while cotton has nearly a neutral comparative advantage during the same period. Rice showed a significant increase in its comparative advantage, estimated at 30%, in the second period compared to its level in the first period and further by of 5% during the third period. This increased comparative advantage is mainly due to the fall in cotton residual that lowered the opportunity cost of land and from the other side, the rise of rice world prices during the second period.

The cotton results show that its estimated DRC coefficients increased during the third period to around 1.21, which indicates that cotton has lost its comparative advantage since 1996[4]. This result is mainly due to the fall in the world price from 866 U.S $ per ton in 1995 to 737 U.S $, 663 U.S $, 638 U.S $ and 492 U.S $ in 1996, 1997, 1998 and 1999 respectively.

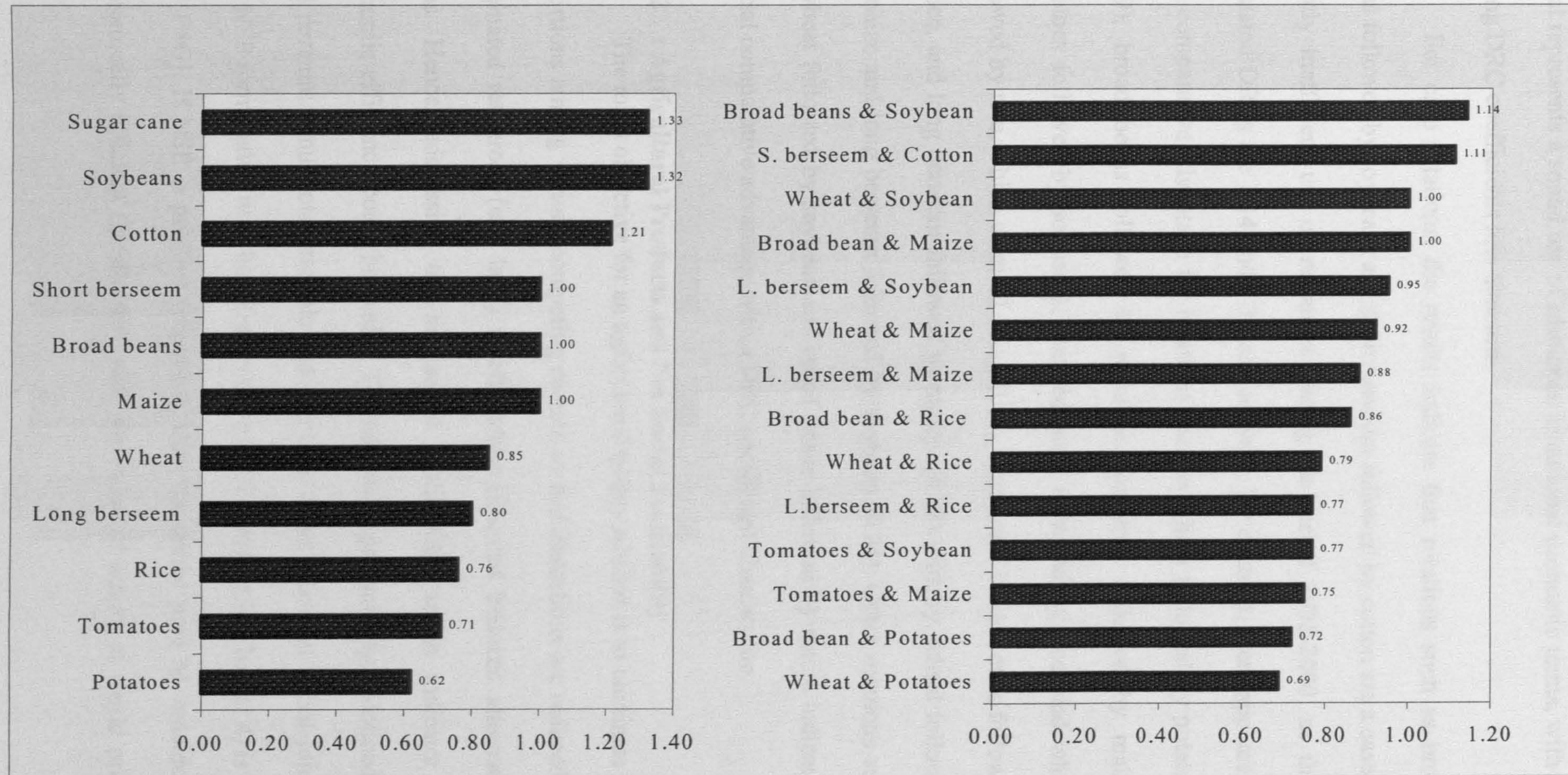
[4] Except for 1997, cotton reached neutral comparative advantage of DRC=1.

Although fodder crops are not traded internationally, it is useful to consider their DRC coefficients as this might help the policy adviser in his decision about producing, importing or exporting fodder alternatives, such as concentrates. For example, if the country has no comparative advantage in producing short berseem then it would be useful (from the social point of view) to advise growers to plant another competitive crop in which the country does have a comparative advantage; and on the other hand it might be useful to extend the production of non-traditional fodder such as concentrates. It appears that Egypt had a comparative advantage in long berseem rather than short berseem in the period 1986-2000. This was mainly due to the higher value added of long berseem, as its yield per feddan is nearly triple that of short berseem.

In short, most of the changes in the domestic resource cost coefficients are explained by changes in world prices, which in turn affect the value added for the crop itself or the opportunity cost of land (through the competitive crops).

Using the average estimates for DRCs during the period 1995-2000, Figure 6-5 summarises the results of estimated coefficients for crop and crop rotations. From these results we may conclude that sugar cane, soybeans and cotton are produced despite a comparative disadvantage. Their DRC coefficients are well in excess of unity (average 1.28), indicating that the present levels of their production represent an uneconomic use of resources. Wheat, maize and broad bean have a neutral comparative advantage, as their DRC is close to one. Production of potatoes, tomatoes, rice, long berseem and

FIGURE 6-5: DRC ESTIMATES FOR CROP AND CROP ROTATIONS (1995-2000)



wheat represents a sound use of resources in national economic terms, with all having DRC coefficients less than one.

For crop rotations, the results indicate that rotations such as broad beans followed by soybeans and short berseem followed by cotton are a case of slightly inefficient use of resources during the period 1995-2000, as their estimated DRCs are 1.14 and 1.11 respectively. By contrast, there appears to be a comparative advantage for rotations such as wheat followed by potatoes (0.69), broad beans followed by potatoes, tomatoes followed by maize, tomatoes followed by soybeans, long berseem followed by rice, and wheat followed by rice, which were all about 0.76. Next come broad beans followed by rice, and long berseem followed by maize (0.87). Finally, wheat followed by maize and long berseem followed by soybean (0.94). Other rotations such as wheat followed by soybean and broad beans followed by maize indicate a neutral comparative advantage with a DRC coefficient close to one.

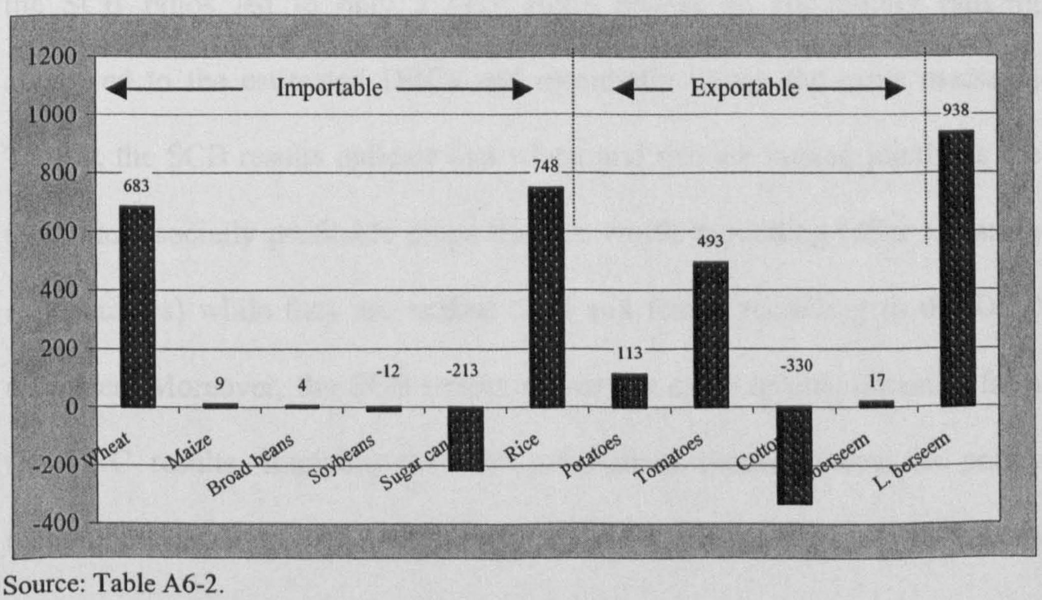
6.3.2 : Agricultural Products and Net Social Profitability

The main objective for an agricultural policy advisor is to eliminate the distortions among various competing sectors so that distortions are reduced as eliminated resources (e.g. land) is efficiently allocated between alternative crops. Hence, addressing the net social profitability as an indicator of economic efficiency could be useful. The net social profitability is defined as total revenue minus total tradable and domestic costs valued at social prices. The NSP formulation used here (referring to PAM notation in Chapter 4) is H= E - [F+G]. If NSP is positive (negative), then the sector may be considered economically efficient (inefficient), with the value of output at world prices being greater (less) than the sum of tradable inputs plus domestic factor costs (Hassan, 1991).

The gross net social profitability of a sector can be calculated by multiplying the NSP per feddan by total planted area of that sector. The results for the NSP values obtained from the PAM during the period 1995-2000 are presented in Figure 6-6. From this figure we may consider that cotton and sugar cane face an acute disadvantage. The DRC coefficients are well above unity while the NSPs are extremely negative. These two crops represents 97% of the total deficit in the imported and exported crops studied. The main reason for this result is the high opportunity cost of land on one side and the low world prices for their products (as discussed earlier) on the other side. According to the results obtained, the current level of production of these two important crops represents an inefficient use of resources. In addition, soybeans have a DRC coefficient more than one, so that its existing level of output appears to be uneconomic at the given NSP estimate.

FIGURE 6-6: NET SOCIAL PROFITABILITY FOR MAJOR CROPS IN THE PERIODC 1995-2000

(Million £E)



Source: Table A6-2.

In contrast, production of field crops (such as rice and wheat), vegetable crops (such as tomatoes and potatoes) and fodder crop (such as long berseem) represents a sound use of resources in national economic terms, with DRC coefficients less than one, and positive NSPs of about 748, 683, 493, 113 and 938 million Egyptian pounds respectively.

6.3.3 : The domestic resource cost (DRC) and the social cost benefit (SCB).

However, the DRC may be biased against activities that rely heavily on domestic non-traded factors, i.e., land and some subsets of labour (Fang and Beghin, 2000). A good alternative to the DRC is the social cost-benefit ratio (SCB), which accounts for all costs and avoids classification errors (in classifying traded and non-traded components) in the calculation of DRC (Masters and Winter Nelson, 1995). The SCB is defined as traded and non-traded costs divided by total revenue both valued at social prices and in PAM notations as (F+G)/E. The lower values of SCB indicate stronger competitiveness and vice versa.

Table 6-3 shows the results of the SCB analysis. Using the values of the SCB ratios led to only a very slight change in commodity ranking compared to the estimated DRCs and essentially brings the same message. That is, the SCB results indicate that wheat and rice are ranked jointly as the third most socially profitable crops that are worth expanding (after tomatoes and potatoes) while they are ranked third and fourth according to the DRC estimates. Moreover, the SCB results mirror the same results, obtained from the DRC results, implying that the government should review its policy towards cotton, sugar cane, short berseem and soy bean if its objective is to encourage activities that earn foreign exchange.

TABLE 6-3: DRC AND SCB RESULTS AND RANKING

	DRC					SCB				
	1986-89	1990-94	1995-2000	1986-2000	Rank*	1986-89	1990-94	1995-2000	1986-2000	Rank*
Tomatoes	0.62	0.42	0.71	0.59	1	0.68	0.47	0.74	0.63	1
Potatoes	0.50	0.65	0.62	0.60	2	0.73	0.77	0.74	0.75	2
Wheat	0.82	0.92	0.85	0.86	3	0.85	0.93	0.87	0.89	3
Rice	1.14	0.80	0.76	0.87	4	1.07	0.84	0.80	0.89	3
Long berseem	0.94	1.12	0.80	0.94	5	0.94	1.10	0.82	0.95	4
Broad bean	0.80	1.09	1.03	0.99	6	0.85	1.06	1.02	0.99	5
Maize	1.08	0.94	1.00	1.01	7	1.06	0.95	1.01	1.00	6
Cotton	0.96	0.97	1.21	1.06	8	0.96	0.98	1.18	1.05	7
Sugar cane	1.14	1.06	1.33	1.19	9	1.07	1.04	1.23	1.12	8
Short berseem	0.95	1.54	1.00	1.22	10	1.07	1.47	1.02	1.19	9
Soybean	1.21	1.28	1.32	1.28	11	1.14	1.21	1.23	1.20	10

Source: PAM results.
* Ranked according to 1986-2000 results.

6.3.4 : Consistency/Inconsistency of DRC Coefficients Estimated by This Study and Other Studies.

Tables 6-4, 6-4A and 6-4B summarise the results of DRC coefficient estimated by other researchers for Egypt throughout the period 1965-2000. They show that despite the differences in the methodology and periods of study, a few of the estimated coefficients are very similar throughout the three studies. For example, the DRC coefficient of rice was less than one during the periods 1965-76 and 1980-87 with an average 0.62 and 0.92 respectively. In the study, the DRC coefficient of rice is less than one with an average 0.87. Soybean and sugar cane appeared to be activities of comparative disadvantage, meanwhile tomatoes and potatoes indicate a comparative advantage throughout the 1980s and 1990s, with average DRCs of 1.42, 1.26, 0.48 and 0.66 respectively. Also it is noticeable that the DRC coefficient of cotton increased from 0.31 during the period 1965-76 to 0.56 during 1980s and further to 1.06 in the 1990s the case that indicate that Egypt is currently experiencing a comparative disadvantage in that sector.

TABLE 6-4: DRC COEFFICIENTS OF MAJOR CROPS IN EGYPT ESTIMATED BY CODDIHY

	1965	68	71	72	73	74	75	76	1965-76
Cotton	0.21	0.28	0.39	0.35	0.47	0.37	0.26	0.25	**0.31**
Wheat	4.30	3.10	1.90	2.40	1.30	2.00	3.40	3.70	**2.58**
Rice	0.72	0.46	1.30	1.16	0.98	0.30	0.28	0.56	**0.62**
Maize	1.40	2.30	0.86	0.73	0.77	3.40	3.80	1.80	**1.57**

Source: Hassan, R. "Economic Efficiency of the Use of Agricultural Resources." Ph.D., Nottingham University, 1991, Chapter 6 p.31.

TABLE 6-4A: DRC COEFFICIENTS OF MAJOR CROPS IN EGYPT ESTIMATED BY HASSAN

	1980	81	82	83	84	85	86	87	1980-87
Cotton	0.47	0.55	0.75	0.74	0.56	0.53	0.47	0.43	**0.56**
Wheat	2.51	2.04	1.57	1.61	2.26	2.42	2.84	3.60	**2.36**
Rice	0.99	0.82	0.56	0.68	1.19	1.14	0.91	1.07	**0.92**
Maize	2.89	2.53	2.93	3.57	2.01	3.06	4.76	8.42	**3.77**
Sugar cane	0.70	0.53	0.60	1.39	1.74	2.07	1.19	2.38	**1.33**
Soybean	1.04	0.99	0.76	1.29	1.14	1.24	2.67	3.37	**1.56**
Broad beans	1.55	1.55	1.08	0.86	1.17	1.51	1.19	1.21	**1.27**
Potatoes	0.76	0.69	0.72	0.75	0.47	0.76	1.01	0.59	**0.72**
Tomatoes	0.29	0.40	0.39	0.34	0.58	0.47	0.30	0.27	**0.38**

Source: Hassan, R. "Economic Efficiency of the Use of Agricultural Resources." Ph.D., Nottingham University, 1991, Chapter 6 p.31.

TABLE 6-4B: DRC COEFFICIENTS OF MAJOR CROPS IN EGYPT

Crop	1986	88	90	92	94	96	98	2000	86-2000
Cotton	0.97	0.96	0.95	1.09	0.97	1.27	1.32	1.29	**1.06**
Wheat	0.92	0.76	0.84	0.91	0.98	0.78	0.75	0.84	**0.86**
Rice	1.59	0.81	0.71	0.78	0.86	0.71	0.57	1.00	**0.87**
Maize	1.24	0.83	0.98	0.93	0.97	0.84	1.23	0.94	**1.01**
Sugar cane	1.58	0.76	0.72	1.21	0.95	1.12	1.17	1.41	**1.19**
Soybeans	1.35	0.91	1.25	1.32	1.28	1.19	1.13	1.31	**1.28**
Broad beans	0.98	0.85	0.78	0.99	1.45	0.97	0.85	0.94	**0.99**
Potatoes	0.42	0.52	0.98	0.52	0.53	0.73	0.70	0.48	**0.60**
Tomatoes	0.45	0.76	0.37	0.52	0.37	0.68	0.95	0.35	**0.59**

Source: Table 6-2.

In contrast, the comparative advantage of the competitive crops as rice and maize has improved. DRC coefficients of maize, for instance, fell from 1.57 and 3.77 in the period 1965-76 and 1980s to nearly one during the 1990s.

6.4 : Private Profitability, Efficiency and Reform.

In this section we try to answer very briefly some of the fundamental questions such as: (a) whether reform has generally improved private profitability and efficiency of agricultural product (b); whether production of crops with the greatest private profitability (or lower PCR) has increased during the reform era; (c) have exports of products with the greatest comparative advantage have expanded during the reform era; (d) do the estimated measures of profitability and efficiency tell a unambiguous story?

As mentioned in earlier discussions (see Table 2-8 and Figure 6-1), both private profitability and its rate of change have improved over time for most crops during the period 1986-2000. Net private profitability increased (for most crops[5]) during the second and third periods compared to its original level in the first stage of reform by on average 74% and 125% respectively.

The DRC measure of efficiency of resource allocation reveals that soybean and cotton are losing comparative advantage over time, with their DRCs increasing from 1.21 and 0.96 to 1.28 and 0.97 and further to 1.32 and 1.21 during the first, second and third periods, respectively. In contrast, the comparative advantage of rice improved from a high DRC of 1.14 to 0.80 and 0.76 respectively.

Crops with higher private profitability attracted farmers to growing them. For example, crops with a rise in their profitability during the third

[5] However, potatoes and soybean private profitability fell by 46% and 70% at the same time of measurement.

period compared to their level in the first, such as wheat (275%), rice (152%) and tomatoes (98%) (see Tables 2-4 and 2-8) and a low PCR (average 0.4, see Table 6-1). Their areas have increased by 83%, 52% and 9% respectively and consequently their production has increased significantly, by 190%, 126% and 103% respectively over the three periods. These high volumes of production had a great impact on their trade performance. For example, the import volume of wheat fell (despite the high population growth rate of 2.8%) in the third period compared to its original level in the first by 51,0000 ton saving the country, in constant price terms, about 25.5 million £E. In contrast, the fall in soybean and potatoes profitability by 70% and 46%, with a relatively high PCR of 0.8 (on average), reduced their production sharply by about 76% and 33% respectively.

On the international trade level, Table 6-5 shows the improvement in the value of exports (in constant price terms) for major crops; these almost doubled during the period 1995-2000 compared with their original level in 1986-89. Despite the fall in potato production, exports increased remarkably; the fall in output was absorbed by the domestic market, its domestic supply falling from 0.82 to 0.46 to 0.31 million ton during the first, second and third stage respectively. Moreover, despite the rise in domestic production of importable crops such as maize, broad beans and sugar cane, their import values increased dramatically, to as much as seven times their value in the first period.

TABLE 6-5: PERFORMANCE OF AGRICULTURAL EXPORTS AND IMPORTS DURING THE REFORM ERA (1986-2000)

Product	1986-89		1995-2000	
	Quantity	Value	Quantity	Value
Export Products				
Rice	6.1	127.3	30.3	604.6
Potatoes	13.8	119.3	26.6	243.5
Cotton	10.4	78.9	6.2	33.4
Tomatoes	1.8	80.2	1.0	25.8
Total		**405.8**		**907.3**
Import Products				
Wheat	688.3	118.9	616.8	93.4
Maize	174.0	81.7	329.1	176.3
Broad bean	0.8	330.4	11.7	2183.3
Soybean	4.6	105.1	17.1	397.7
Sugar	5.6	440.5	53.2	4228.9
Total		**1076.5**		**7079.6**

Calculated from Table A6-3.
Quantity in 0000 ton and Values in constant terms 1986=100%

6.5 : Summary and Conclusion.

In this Chapter we have tried to measure domestic profitability and comparative advantage in Egyptian agriculture using the private cost ratio for the first and domestic resource cost, net social profitability and social cost benefit indicators for the latter. Computations were carried out for 11 crops and 14 crop rotations for 16 years, making this more comprehensive and unexpurgated than any previous study. The PCR results during the period 1986-2000 suggest that tomatoes had the lowest ratio (0.3) and soybeans the highest (0.8) while other crops showed some variation in between. Moreover, PCR results for crops are consistent, along with planted areas, in identifying activities that are privately profitable at domestic prices. They indicate a high response of planted area to private profitability for most crops. The PCR estimates for crop rotations varied between the lowest of 0.36 for tomatoes followed by maize and the highest of 0.69 for broad beans followed by soybean during the same period.

The three measures of comparative advantage showed consistent results in identifying activities that are socially profitable at world prices. The DRC results suggest that Egypt, during the period 1986-2000, had a comparative advantage in producing tomatoes, potatoes, wheat, rice and long berseem, and a comparative disadvantage in cotton, short berseem, sugar cane and soybean, and a neutral comparative advantage in broad beans and maize. These results are confirmed by the NSP and SCB measures, which show that wherever there is a net social loss there is a comparative disadvantage.

Chapter VII

7 Chapter VII: Measures of Protection: Nominal and Effective Protection Coefficients (NPC and EPC) Results.

7.1 : Introduction

Protection coefficients can characterise the policy setting in broad quantitative terms. They are diagnostic and prescriptive. They are prescriptive, however, only in the sense that the divergence between a domestic price and the system of reference prices has efficiency implications. At the simplest level, nominal protection coefficients focus only on output or input prices. At a more comprehensive level, the effective protection coefficient expands to capture protection of the entire productive activity (Taskok, 1990). Major questions raised by policy interventions are (1) What are the net effects of economic policies for different sectors? (2) To what extent are different sectors protected or disprotected in relation to other sectors? (3) Are those sectors that the government seeks to promote being in fact promoted? (Tyler, 1985). Our principal motivation in this chapter is to answer such questions by reporting and analysing the results of nominal and effective protection coefficients obtained from the estimation of the PAM using data from the period 1986 to 2000, and the methods set out in Chapter 5. These criteria are calculated annually for each crop, both separately and as part of a rotation.

Our intention is to evaluate the effect of agricultural policy reforms (or market failures not corrected via efficient policies) in output and factor markets, as discussed in Chapter 4, in which we have categorised the period of study 1986-2000 as three distinct periods as noted in Chapter 6.

This Chapter is organised as follows. Section 1 gives a brief introduction. Section 2 presents the results for Nominal Protection for outputs and inputs for crops and crop rotations. In section 3, the results of the effective protection coefficient estimations for crops and crop rotations are discussed. A comparison between the results of this study and other earlier studies is given in section 4. Section 5 summaries and concludes the main findings.

7.2 : Nominal Protection Coefficients.

7.2.1 : Nominal Protection Coefficients for Outputs (NPCO).

7.2.1.1 : Introduction

To recap on the discussion in Chapter 4, a NPCO is calculated in the PAM matrix by dividing the revenue valued at private prices [A] by revenue valued at social prices [E]. The objective of calculating the NPCO is to measure the actual divergences or distortions between the domestic and international prices of output (at the farm gate level). If the NPCO is less than one, it implies that producers are receiving less (for their products) than the prevailing world prices i.e., it confirms the presence of taxes on outputs. An NPCO greater than one shows the presence of subsidies where producers are getting (for their products) more than the prevailing social prices. An NPCO equal to one (in the absence of market failure) reveals the absence of intervention.

The estimated NPCs for different products and sectors can provide a comparison for the relative incentive structure. When the estimated NPC for a product (or sector), say x, exceeds that for another product (sector), say y, it implies that producers of product (in sector) x are receiving better incentives than the producers of product (in sector) y. Such discriminatory interventions transfer resources from one use to others and frequently lead to inefficient use (Shilpi, 1996). Moreover, from a strictly trade theoretic point of view, the welfare (and efficiency) of the economy can be improved by letting domestic prices anchor around the appropriately adjusted world prices (Corden, 1979, and Timmer, 1989).

7.2.1.2 Empirical Results

The calculated NPCOs for the 11 crops and their associated 14 crop rotations during the period 1986-2000 are summarised in Table 7-1. The principal result for crop analysis during the period 1986-2000 is that, on average, the market prices for all the studied crops (except for sugar cane and fodder crops) have been set at levels less than those prevailing on world markets, thus implying a tax on those crops; the all-crop average over the entire sample has an NPCO of 0.90. However, variation exists both across time and by crop type. For example, the NPCO value (average 1995-2000) of 0.60 for potatoes means that potatoes producers are only receiving 60 percent of the equivalent potatoes world price. If the Egyptian agricultural trade policy for potatoes were allowed to operate in absence of intervention, producers could export their products and receive more than 1.6 as much. In contrast, an NPCO for sugar cane of 1.25 (average 1995-2000) shows that policies are increasing the market price to a level 25 percent higher than the world price. And thus, in the absence of barriers or government protection, the model predicts that sugar cane producers would have received only 80% of the price they had during that period.

The results also reveal, first, that the level of governmental taxes imposed on exportable outputs[1] is higher than those on importable outputs[2] throughout the three distinct periods.

[1] Export crops are cotton, rice, tomatoes and potatoes.
[2] Import crops are wheat, maize, sugar cane, soybean and broad bean.

TABLE 7-1: NOMINAL PROTECTION COEFFICIENT RESULTS FOR CROP AND CROP ROTATION OUTPUTS (NPCO) IN THE PERIOD 1986-2000.

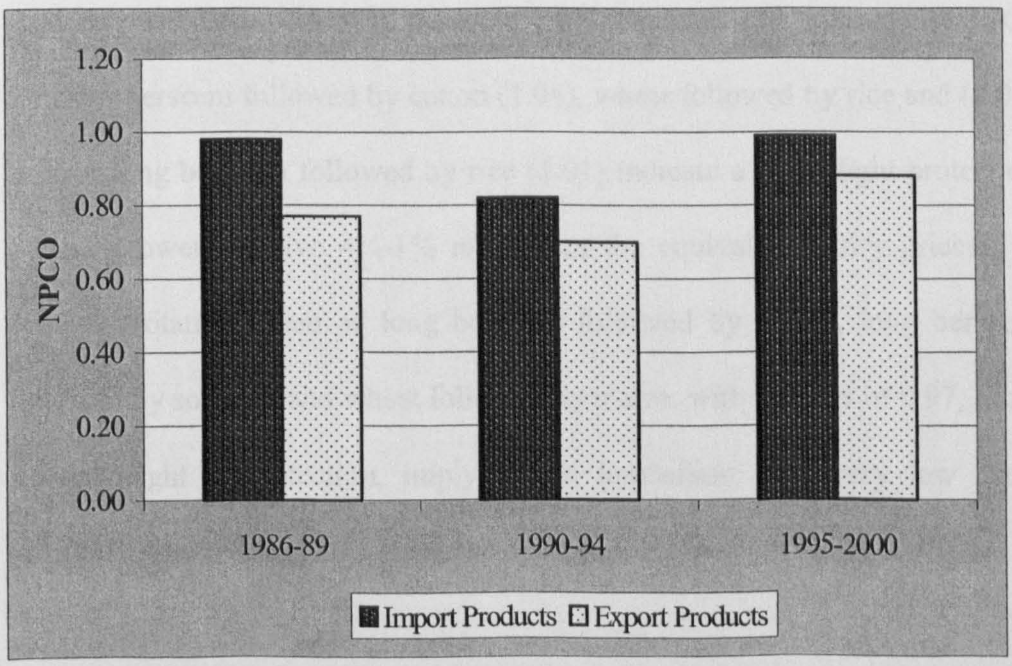
Crop	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat	1.12	1.03	0.71	0.90	**0.94**	1.05	0.90	0.81	0.89	0.84	**0.90**	0.77	0.75	0.95	1.15	1.19	1.15	**0.99**	**0.95**
Maize	1.27	1.41	0.96	1.01	**1.16**	0.99	0.78	0.83	0.86	0.84	**0.86**	0.80	0.65	0.90	1.06	1.13	1.18	**0.95**	**0.98**
Sugar cane	1.39	1.26	0.66	0.61	**0.98**	0.69	0.72	0.74	0.85	0.78	**0.76**	0.80	0.91	1.02	1.44	1.93	1.40	**1.25**	**1.01**
Soybeans	1.14	1.11	0.65	1.00	**0.98**	1.03	0.84	0.83	0.71	0.78	**0.84**	0.91	0.78	0.80	0.96	1.07	1.01	**0.92**	**0.91**
Broad beans	1.22	0.82	0.70	0.65	**0.85**	0.71	0.64	0.67	0.92	0.86	**0.76**	0.87	0.75	0.86	0.89	0.93	0.88	**0.86**	**0.82**
Cotton	0.92	0.85	0.77	0.84	**0.84**	0.91	0.85	1.03	1.12	0.76	**0.93**	1.03	1.14	1.16	0.91	1.06	0.99	**1.05**	**0.96**
Rice	1.56	1.05	0.67	0.76	**1.01**	0.84	0.65	0.74	0.88	0.91	**0.81**	0.83	0.85	0.9	0.94	1.12	1.30	**1.04**	**0.96**
Tomatoes	0.57	0.88	0.74	0.42	**0.65**	0.62	0.46	0.36	0.34	0.32	**0.42**	0.56	0.83	1.36	1.15	0.60	0.48	**0.83**	**0.65**
Potatoes	0.60	0.51	0.51	0.69	**0.58**	0.71	0.47	0.55	0.72	0.80	**0.65**	0.45	0.61	0.69	0.61	0.60	0.63	**0.60**	**0.61**
Long Berseem*	1.00	1.00	1.00	1.00	**1.00**	1.00	1.00	1.00	1.00	1.00	**1.00**	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**
Short Berseem*	1.00	1.00	1.00	1.00	**1.00**	1.00	1.00	1.00	1.00	1.00	**1.00**	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**	**1.00**
Average	**1.07**	**0.99**	**0.76**	**0.81**	**0.91**	**0.87**	**0.76**	**0.78**	**0.84**	**0.81**	**0.81**	**0.82**	**0.84**	**0.97**	**1.01**	**1.06**	**1.00**	**0.95**	**0.90**
Crop Rotation	**1986**	**87**	**88**	**89**	**86-89**	**90**	**91**	**92**	**93**	**94**	**90-94**	**95**	**96**	**97**	**98**	**99**	**2000**	**95-2000**	**1986-2000**
Wheat & Maize	1.18	1.18	0.82	0.95	**1.03**	1.02	0.84	0.82	0.87	0.84	**0.88**	0.78	0.70	0.92	1.11	1.16	1.16	**0.97**	**0.96**
Wheat & Rice	1.31	1.04	0.69	0.83	**0.97**	0.94	0.75	0.78	0.88	0.88	**0.85**	0.80	0.81	0.97	1.06	1.17	1.29	**1.02**	**0.95**
Wheat & Soybean	1.13	1.07	0.68	0.94	**0.95**	1.04	0.87	0.82	0.81	0.81	**0.87**	0.82	0.76	0.89	1.08	1.15	1.10	**0.96**	**0.93**
Wheat & Pot	0.71	0.62	0.55	0.75	**0.66**	0.81	0.56	0.61	0.77	0.81	**0.71**	0.52	0.65	0.77	0.76	0.76	0.77	**0.70**	**0.69**
Broad bean & Maize	1.24	1.02	0.83	0.81	**0.97**	0.84	0.72	0.75	0.88	0.85	**0.81**	0.84	0.70	0.88	0.97	1.05	1.02	**0.91**	**0.89**
Broad bean & Rice	1.38	0.91	0.69	0.70	**0.92**	0.78	0.65	0.71	0.89	0.90	**0.79**	0.85	0.81	0.93	0.95	1.07	1.16	**0.96**	**0.89**
Broad bean & Potatoes	0.71	0.59	0.55	0.68	**0.63**	0.71	0.51	0.57	0.76	0.81	**0.67**	0.53	0.65	0.74	0.69	0.67	0.69	**0.66**	**0.66**
Broad bean & Soybean	1.18	0.92	0.68	0.79	**0.89**	0.83	0.73	0.74	0.82	0.82	**0.79**	0.89	0.76	0.83	0.91	0.99	0.93	**0.89**	**0.85**
S.Berseem & Cotton	0.75	0.90	0.83	0.88	**0.84**	0.93	0.88	1.02	1.09	0.82	**0.95**	1.02	1.10	1.11	0.94	1.04	0.99	**1.04**	**0.95**
L.Berseem & Rice	1.24	1.02	0.81	0.85	**0.98**	0.90	0.77	0.84	0.94	0.95	**0.88**	0.90	0.92	0.99	1.00	1.07	1.17	**1.01**	**0.96**
L.Berseem & Maize	1.11	1.14	0.98	1.01	**1.06**	1.00	0.87	0.91	0.93	0.92	**0.93**	0.90	0.81	0.95	1.02	1.05	1.07	**0.97**	**0.98**
L.Berseem & Soybean	1.06	1.04	0.81	1.00	**0.98**	1.01	0.92	0.92	0.87	0.90	**0.92**	0.97	0.91	0.93	0.99	1.02	1.00	**0.97**	**0.96**
Tomatoes & Soybean	0.63	0.92	0.72	0.49	**0.69**	0.68	0.50	0.41	0.38	0.36	**0.47**	0.60	0.83	1.22	1.12	0.65	0.53	**0.82**	**0.67**
Tomatoes & Maize	0.64	0.95	0.78	0.51	**0.72**	0.70	0.50	0.43	0.40	0.38	**0.48**	0.59	0.79	1.21	1.13	0.68	0.57	**0.83**	**0.69**
Average	**1.02**	**0.95**	**0.74**	**0.80**	**0.88**	**0.87**	**0.72**	**0.74**	**0.81**	**0.79**	**0.79**	**0.79**	**0.80**	**0.95**	**0.98**	**0.97**	**0.96**	**0.91**	**0.86**

Source: PAM analysis results.

*It is assumed that domestic price for fodder crops (long and short berseem) equals to its world price because they are not traded internationally and consequently they do not have a world reference price.

The average NPCO for exportable outputs is lower than that of importable outputs throughout the three periods, implying that producers of export products are receiving less for their output than those for import products during the first, second and third periods by 21%, 12% and 11% respectively. Second, governmental taxes imposed on export and import outputs reached their highest levels of 18% and 30% respectively, during the second period of reform. Third, producers for export were almost getting the equivalent world prices for their commodities during the third period of reform, implying that the government was taking serious steps toward free market operation. The same could be seen in case of import products (at the same time of measurement); presumably the government aimed to encourage exports and imports by setting private prices closer to their social prices. (see Figure7-1).

FIGURE (7-1): NPCO AVERAGE FOR MAJOR IMPORTED AND EXPORTED AGRICULTURAL PRODUCTS DURING THE PERIOD 1986-2000

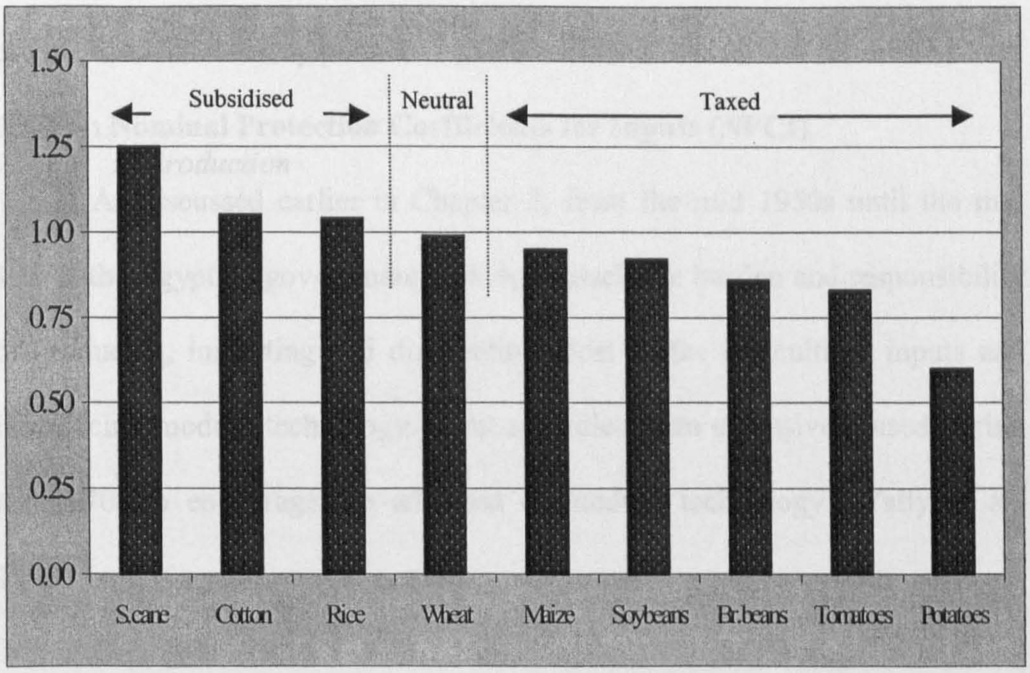


Source: Table 7-1.

Using the average estimates for NPCOs during the period 1995-2000, Figure 7-2 summarises the level of incentives received for the production of major importable and exportable crops in Egypt. From the protection point of view, sugar cane, cotton and rice had the highest NPCOs (1.25, 1.05 and 1.04 respectively) implying that their producers are receiving 25%, 5% and 4% more through their output prices than they would at prevailing world prices. Wheat showed a neutral NPCO implying that its producers are receiving the prevailing prices in the world market (i.e., neither taxed nor subsidised). The estimated NPCOs for other crops showed various levels of disprotection. For example, the estimated NPCOs for maize and soybean reached 0.95 and 0.92 respectively, followed by broad beans (0.86), tomatoes (0.83) and finally potatoes (0.60) implying the imposition of taxes or (tariffs) on their output, with their producers getting 5%-40% less than their world equivalent prices.

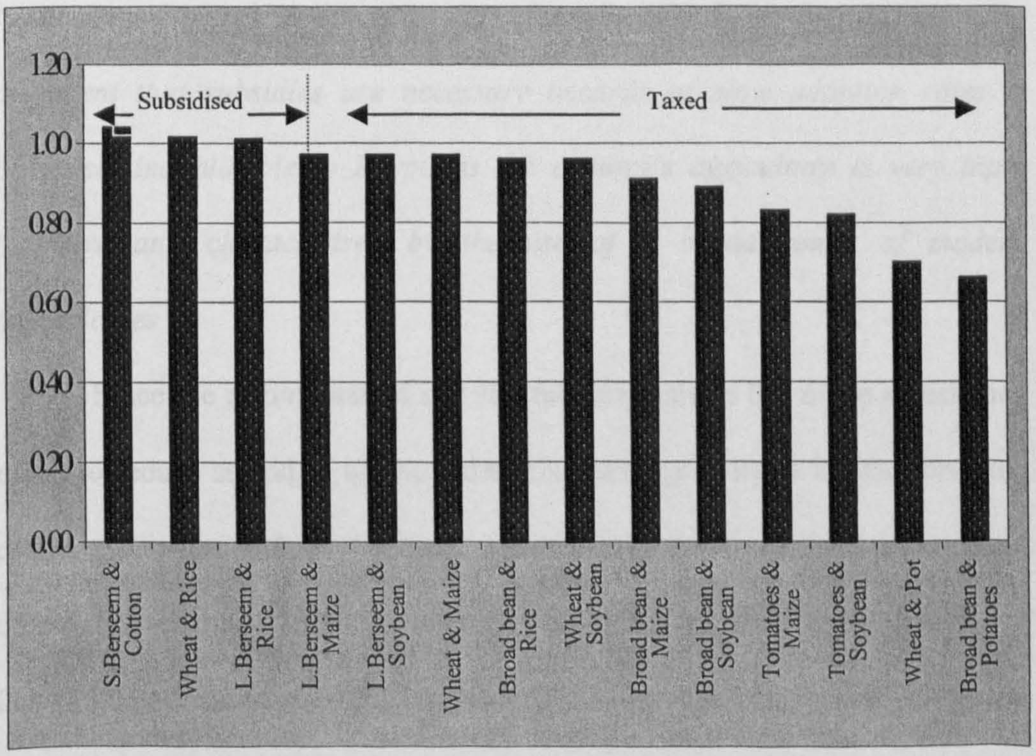
Using the average estimates for NPCOs during the period 1995-2000, Figure 7-3 shows the level of protection (disprotection) gained (suffered) by producers from the following different crop rotations. The estimated NPCOs for short berseem followed by cotton (1.04), wheat followed by rice and (1.02) and for long berseem followed by rice (1.01) indicate a very slight protection (where growers receive 4%-1% more than the equivalent parity prices). In contrast, rotations such as long berseem followed by maize, long berseem followed by soybean and wheat followed by maize, with NPCOs of 0.97, show a very slight disprotection, implying the imposition of a very low taxes (tariffs). Other rotations are disprotected at various levels, with the NPCOs

FIGURE (7-2): NPCOs FOR MAJOR AGRICULTURAL OUTPUTS DURING THE PERIOD 1995-2000



Source: Table 7-1.
Note: as we move toward the right hand side the level of protection falls.

FIGURE (7-3): NPCOs FOR MAJOR CROP ROTATIONS DURING THE PERIO 1995-2000



Source: Table 7-1.
Note: as we move toward the right hand side the level of protection increases.

for broad beans followed by maize or soybean estimated at nearly 0.90 and for tomatoes followed by maize or soybean at about 0.82, and finally wheat or broad beans followed by potatoes by 0.68.

7.2.2 : Nominal Protection Coefficients for Inputs (NPCI).

7.2.2.1 : Introduction

As discussed earlier in Chapter 2, from the mid 1950s until the mid 1980s, the Egyptian government took upon itself the burden and responsibility of producing, importing and distributing most of the agricultural inputs and introducing modern technology. Input subsidies were extensively used during the 1970s to encourage the adoption of modern technology (Wally et al., 1983).

Owing to (Goletti, 1996) "*when agricultural technology is not well developed and markets are weak, there is a rationale for input subsidies. However, as modern technology spreads and modern input use increases, input subsidies are often maintained as a means of compensating farmers for lower output prices, a situation that characterised Egypt up to 1986. The argument that subsidies are necessary because of slow adoption rates is obviously inapplicable to Egypt, as the country's agriculture is very input intensive and characterised by the use of a broad range of modern technologies*".

Since the reform started in 1986 the government has made a sustained effort to reduce subsidies on the most important agricultural inputs: fertiliser, cotton pesticides and applications, agricultural equipment, and agricultural credit. For example, fertiliser subsidies supplied by the Principal Bank of Development and Agricultural Credit (PBDAC), the major state enterprise involved in input distribution, declined (in real terms) from an average 100 million £E during the period 1989-91 to 41 million £E in 1992 and further to 18 million £E in 1993.

It might be useful to the policy advisor to measure the effects of government policy in tradable input markets. The NPCI was calculated annually for each crop, both separately and as part of a rotation during the period 1986-2000.

7.2.2.2 : Empirical Results

Referring to the discussion in Chapter 4, the NPCI is calculated in the PAM matrix by dividing the costs of tradable inputs valued at private prices [B] by its equivalent valued at social prices [F]. The aim of calculating the NPCI is to measure the actual divergences or distortions between domestic and international prices of tradable inputs (at the farm gate level). If NPCI is less than one, then it confirms the presence of subsidies (protection) on tradable inputs because producers are paying less (for using tradable inputs) than their equivalent world prices. An NPCI greater than one shows the presence of taxes (tariffs) because growers are paying more than their parity prices. An NPCI equal to one (in the absence of market failure) reveals the absence of distortions. The estimated NPCIs for different products and sectors can provide a comparison for the relative incentive structure for tradable inputs.

The main results of our NPCI estimates[3] using the PAM matrix analysis for main crops and their associated fourteen main rotations during the period 1986-2000 are summarised in Table 7-2. The estimates suggest a number of conclusions about government protection within agriculture in the

[3] This estimate is in terms of the average tax/subsidy on inputs, but of course the tax/subsidy on specific inputs do vary.

TABLE 7-2: NOMINAL PROTECTION COEFFICIENT RESULTS FOR TRADABLE INPUTS FOR CROP AND CROP ROTATIONS (NPCI) IN THE PERIOD 1986-2000

NPCI	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat	0.55	0.49	0.32	0.43	**0.45**	0.56	0.60	0.74	0.93	0.84	**0.73**	0.75	0.82	0.91	1.00	1.04	0.93	**0.91**	**0.73**
Maize	0.63	0.58	0.36	0.44	**0.50**	0.54	0.54	0.74	0.90	0.84	**0.71**	0.72	0.84	0.96	1.03	1.06	0.97	**0.93**	**0.74**
Sugar cane	0.58	0.52	0.33	0.42	**0.46**	0.53	0.55	0.72	0.88	0.80	**0.69**	0.77	0.88	1.02	1.10	1.13	1.07	**0.99**	**0.75**
Soybeans	0.58	0.52	0.37	0.46	**0.48**	0.63	0.62	0.79	0.90	0.83	**0.76**	0.76	0.77	0.85	0.88	0.93	0.89	**0.85**	**0.72**
Broad beans	0.47	0.43	0.29	0.39	**0.40**	0.56	0.64	0.75	0.81	0.73	**0.70**	0.75	0.74	0.76	0.76	0.80	0.81	**0.77**	**0.65**
Cotton	0.56	0.51	0.33	0.42	**0.46**	0.54	0.54	0.74	0.87	0.77	**0.69**	0.73	0.80	0.94	0.95	0.93	0.86	**0.87**	**0.70**
Rice	0.55	0.50	0.35	0.45	**0.46**	0.63	0.70	0.81	0.86	0.83	**0.77**	0.80	0.84	0.89	0.89	0.90	0.90	**0.87**	**0.73**
Tomatoes	0.51	0.46	0.32	0.43	**0.43**	0.62	0.67	0.78	0.93	0.81	**0.76**	0.75	0.80	0.87	0.90	0.96	0.95	**0.87**	**0.72**
Potatoes	0.53	0.47	0.32	0.44	**0.44**	0.69	0.82	0.86	0.88	0.86	**0.82**	0.84	0.87	0.90	0.93	0.95	0.94	**0.91**	**0.75**
Long Berseem	0.49	0.45	0.32	0.41	**0.42**	0.54	0.58	0.72	0.76	0.71	**0.66**	0.71	0.73	0.77	0.81	0.93	0.90	**0.81**	**0.66**
Short Berseem	0.50	0.47	0.34	0.44	**0.44**	0.64	0.75	0.78	0.83	0.81	**0.76**	0.84	0.84	0.84	0.84	0.87	0.86	**0.85**	**0.71**
Average	**0.54**	**0.49**	**0.33**	**0.43**	**0.45**	**0.59**	**0.64**	**0.77**	**0.87**	**0.80**	**0.73**	**0.77**	**0.81**	**0.88**	**0.92**	**0.95**	**0.92**	**0.88**	**0.71**

NPCI	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat & Maize	0.58	0.53	0.33	0.44	**0.47**	0.55	0.57	0.74	0.92	0.84	**0.72**	0.74	0.83	0.94	1.02	1.05	0.95	**0.92**	**0.73**
Wheat & Rice	0.55	0.50	0.34	0.44	**0.46**	0.60	0.65	0.78	0.89	0.83	**0.75**	0.78	0.83	0.89	0.93	0.95	0.91	**0.88**	**0.73**
Wheat & Soybean	0.56	0.50	0.35	0.45	**0.47**	0.59	0.61	0.77	0.92	0.84	**0.75**	0.76	0.79	0.88	0.94	0.99	0.91	**0.88**	**0.72**
Wheat & Pot	0.53	0.47	0.32	0.44	**0.44**	0.67	0.79	0.84	0.89	0.85	**0.81**	0.83	0.86	0.91	0.94	0.96	0.94	**0.91**	**0.75**
Broad bean & Maize	0.54	0.49	0.32	0.41	**0.44**	0.55	0.59	0.75	0.85	0.79	**0.71**	0.73	0.79	0.86	0.89	0.91	0.89	**0.85**	**0.69**
Broad bean & Rice	0.52	0.47	0.32	0.42	**0.43**	0.60	0.67	0.78	0.84	0.79	**0.74**	0.78	0.80	0.83	0.84	0.85	0.86	**0.83**	**0.69**
Broad bean & Potatoes	0.52	0.46	0.32	0.43	**0.43**	0.67	0.80	0.84	0.87	0.84	**0.80**	0.83	0.85	0.88	0.90	0.92	0.92	**0.88**	**0.74**
Broad bean & Soybean	0.53	0.47	0.33	0.42	**0.44**	0.60	0.63	0.77	0.86	0.78	**0.73**	0.75	0.75	0.80	0.82	0.85	0.85	**0.80**	**0.68**
S.Berseem & Cotton	0.54	0.50	0.34	0.43	**0.45**	0.56	0.58	0.75	0.86	0.78	**0.71**	0.75	0.81	0.92	0.93	0.92	0.86	**0.86**	**0.70**
L.Berseem & Rice	0.53	0.49	0.34	0.43	**0.45**	0.60	0.67	0.78	0.83	0.80	**0.74**	0.78	0.81	0.86	0.87	0.91	0.90	**0.85**	**0.71**
L.Berseem & Maize	0.57	0.52	0.34	0.43	**0.46**	0.54	0.55	0.74	0.86	0.80	**0.70**	0.72	0.80	0.90	0.95	1.00	0.95	**0.89**	**0.71**
L.Berseem & Soybean	0.54	0.50	0.36	0.44	**0.46**	0.60	0.61	0.77	0.86	0.80	**0.73**	0.75	0.75	0.82	0.85	0.93	0.90	**0.83**	**0.70**
Tomatoes & Soybean	0.53	0.47	0.33	0.43	**0.44**	0.62	0.66	0.78	0.92	0.81	**0.76**	0.76	0.79	0.87	0.90	0.95	0.94	**0.87**	**0.72**
Tomatoes & Maize	0.54	0.48	0.33	0.43	**0.44**	0.60	0.63	0.77	0.92	0.81	**0.75**	0.74	0.81	0.90	0.94	0.98	0.96	**0.89**	**0.72**
Average	**0.54**	**0.49**	**0.33**	**0.43**	**0.45**	**0.60**	**0.64**	**0.78**	**0.88**	**0.81**	**0.74**	**0.76**	**0.81**	**0.88**	**0.91**	**0.94**	**0.91**	**0.87**	**0.71**

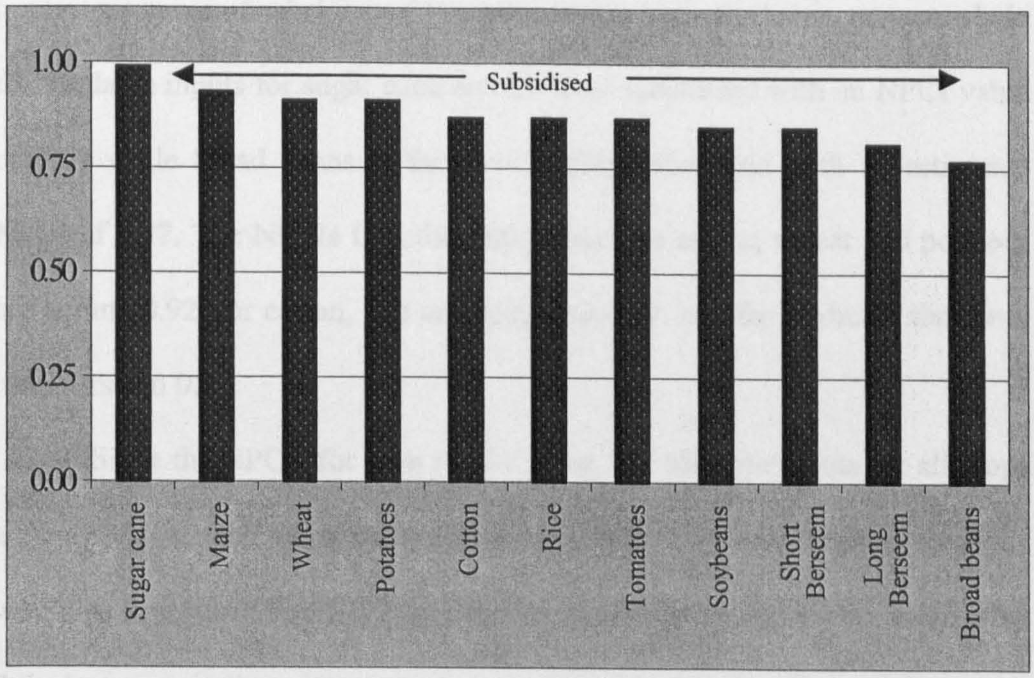
Source: PAM analysis results

period 1986-2000. With estimated NPCIs less than one in all years during the period 1986-2000, the results indicate that the widespread subsidisation of tradable inputs implying that producers are paying less for using tradable inputs than they would have paid in the absence of government subsidies. However, there has been considerable liberalisation of input markets during the sample period as evidenced by the doubling of the average all-crop NPCI (from 0.45 in 1986-89 to 0.88 in 1995-2000).

As mentioned earlier, the higher the coefficient of the NPCI of the product, the less protection (subsidy) the product enjoys. Thus, the gradual increases in NPCIs over time for all crops and crop rotations suggest that the level of protection or governmental subsidy in tradable inputs is falling over time. For example, the average estimated NPCI coefficients during the first, second and third period of reform, 0.45, 0.73 and 0.88 respectively, imply that the level of subsidies on tradable inputs fell from 55% during 1986-89 to 27% in 1990-94 and further to 12% during 1995-2000. As mentioned earlier, this fall in protection level is a direct result of government policy introduced in the 1986 reforms to decrease input subsidies and transfer to a free market situation. Unlike protection of outputs (NPCO), which tends to be crop specific, every crop seems to have been subsidised to about the same degree. Moreover most, if not all, crops have been affected equally (the exception being broad beans) by liberalisation.

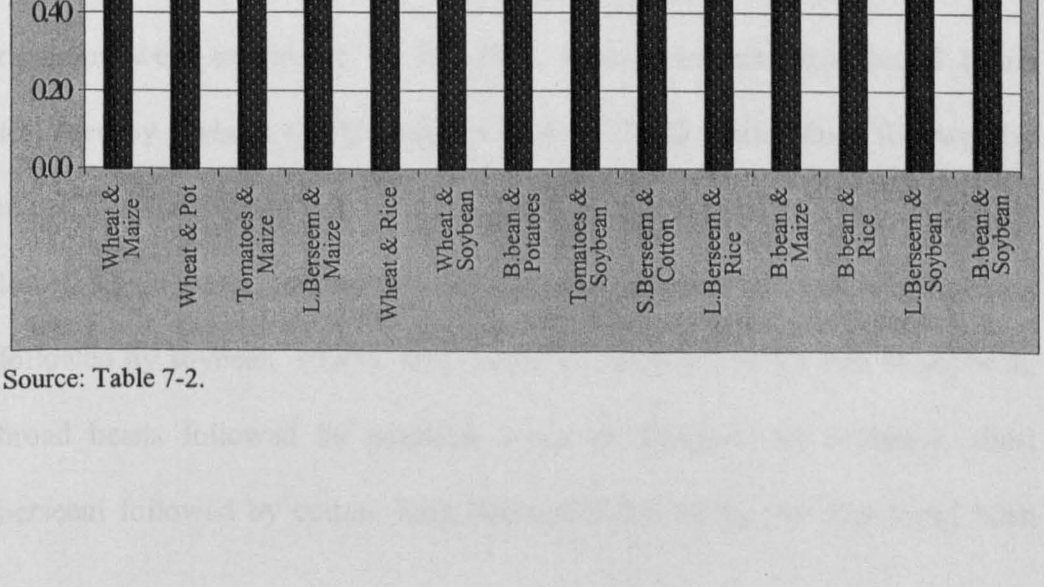
Figure 7-4 shows the ranking of major crops according to the level of tradable input protection (measured by the NPCI economic indicator) during the period 1995-2000. The overall picture shows that the tradable inputs for all

FIGURE (7-4): NPCI FOR MAJOR CROPS DURING THE PERIOD 1995-2000



Source: Table 7-2.

FIGURE (7-5): NPCI FOR MAJOR CROP ROTATIONS DURING THE PERIOD 1995-2000



Source: Table 7-2.

crops are protected (subsidised) with various levels with NPCIs less than one, implying a range of subsidies of 1%-23%. From these results we may conclude that tradable inputs for sugar cane are the least subsidised with an NPCI value of 0.99 while broad beans is the most highly subsidised with an estimated NPCI of 0.77. The NPCIs for other crops, such as maize, wheat and potatoes are around 0.92, for cotton, rice and tomatoes 0.87, and for soybean, short and long berseem 0.83.

Since the NPCIs for crop results show that tradable inputs for all crops are subsidised, then we should expect that tradable inputs for crop rotations would be subsidised as well. The crop rotation NPCIs results presented in table 7-2 shows a similar picture to that for individual crops. For example, the average NPCIs for crop rotations during the three distinct periods 1986-89, 1990-94 and 1995-2000 are estimated to be 0.45, 0.74 and 0.87 respectively, and are closely similar to those estimated for crop level. This similarity is mainly because the government eliminated all input subsidies over time on a gradual basis.

Considering different crop rotations, the results for NPCIs during the period 1995-2000 confirmed our expectation that tradable inputs for all crop rotations were subsidised by 8%-20%. Results indicate that broad beans followed by soybean has the highest subsidy (20%) while wheat followed by maize has the lowest (8%). Other subsidised rotations ranked according to the lowest NPCI are as follows: broad beans followed by rice and long berseem followed by soybean (0.83). Next come wheat followed by rice or soybean, broad beans followed by potatoes, tomatoes followed by soybeans, short berseem followed by cotton, long berseem followed by rice and broad bean followed by maize, all about 0.86. Finally, the least subsidised rotations in tradable inputs are (all about 0.90) wheat followed by potatoes, and tomatoes or long berseem followed by maize.

7.3 : Effective Protection Coefficients (EPC).

7.3.1 : Introduction

The effective protection coefficient[4] (EPC) reflects the complete pattern of incentives to farmers in the tradable commodities markets, combining the separate influences of polices represented by the NPCO and NPCI measures. It allows the assessment of the net effects of subsidies, taxes and overvalued (or undervalued) exchange rate taking in consideration both the product and input markets. The effective protection coefficient is measured in the PAM matrix as the revenue less costs of tradable inputs [A-B], both valued at private prices, divided by revenue less costs of tradable inputs [E-F], both valued at social prices. In other words, it quantifies the net effect of protection on inputs as well as outputs by measuring the domestic value added resulting from the imposition of tariff and other protective measures on the product and its inputs as a proportion of foreign or world value added calculated using domestic market prices to value added calculated using social prices (Hassan, 1992).

If the EPC is greater than one, it implies that domestic producers are enjoying positive protection. If the EPC is less than one, it implies that producers would have received a higher return if they had faced world prices instead of domestic prices on both output and inputs i.e. they are receiving negative protection.

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[4] Partial equilibrium structure of effective protection has been criticised as being inappropriate for commenting upon general equilibrium resource allocation effect. This theoretical critique is

However, unlike the NPC, the EPC can also be negative. A positive (negative) EPC denotes a potential incentive (disincentive) not an actual one. The fact that producers are facing net price levels higher than those they would have faced without intervention (a potential disincentive) does not ensure that those levels are translated into concrete resource allocation decisions (actual disincentives). If the EPC is equal to one, it implies that the structure of protection is neutral i.e. producers are neither favoured nor discriminated against. The EPC can have a negative value in two cases: first; if the value added in domestic prices is negative (i.e. [A-B] is negative), in which case producers would not stay in the business unless they are subsidised by the government (to remain in an unprofitable business). Second, if the value added at social prices is negative (i.e. [E-F] is negative) where the economy is losing foreign exchange by producing the commodity because the costs of traded inputs is higher than the gross value of output. A change in domestic price policy is needed to solve the first problem while an improvement in productivity is required to solve the second. However, it is important to remember that EPCs are indicative of relative incentives in production (Taskok, 1990).

7.3.2 : Empirical Results

The calculated EPCs for the 11 crops and their associated 14 crop rotations during the period 1986-2000 are summarised in Table 7-3. The principal result from the crop analysis is that export crops had EPCs less than

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discussed in greater details in Greenaway and Milner (1993, p.163-164); Bhagwati and Srinivasan (1973); Taylor and Black (1974); De Melo (1980 and 1978)

TABLE 7-3: EFFECTIVE PROTECTION COEFFICIENT RESULTS FOR CROP AND CROP ROTATIONS (EPC) IN THE PERIOD 1986-2000.

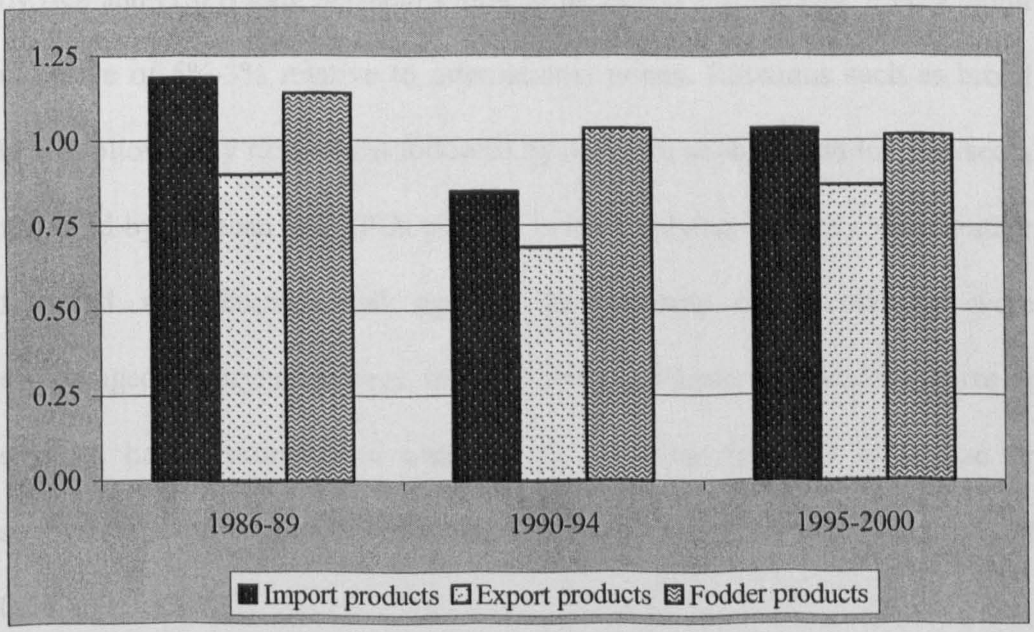
Crop	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat	1.28	1.19	0.84	1.01	**1.08**	1.15	0.96	0.83	0.88	0.83	**0.93**	0.77	0.74	0.96	1.18	1.22	1.19	**1.01**	**1.00**
Maize	1.46	1.68	1.14	1.17	**1.36**	1.09	0.84	0.85	0.85	0.84	**0.89**	0.83	0.62	0.88	1.07	1.15	1.22	**0.96**	**1.05**
Sugar cane	1.86	1.66	0.77	0.66	**1.24**	0.73	0.77	0.75	0.84	0.77	**0.77**	0.81	0.92	1.02	1.54	2.38	1.51	**1.36**	**1.13**
Soybeans	1.42	1.45	0.78	1.31	**1.24**	1.19	0.90	0.84	0.65	0.76	**0.87**	0.99	0.78	0.78	0.98	1.12	1.05	**0.95**	**1.00**
Broad beans	1.47	0.93	0.89	0.72	**1.00**	0.74	0.64	0.65	0.95	0.90	**0.78**	0.90	0.75	0.88	0.92	0.99	0.90	**0.89**	**0.88**
Cotton	0.97	0.90	0.86	0.91	**0.91**	0.96	0.88	1.06	1.14	0.76	**0.96**	1.07	1.18	1.20	0.89	1.09	1.02	**1.08**	**0.99**
Rice	2.13	1.35	0.80	0.84	**1.28**	0.88	0.65	0.73	0.89	0.94	**0.81**	0.84	0.86	1.01	1.02	1.22	1.64	**1.10**	**1.05**
Tomatoes	0.58	0.96	0.86	0.42	**0.71**	0.62	0.44	0.33	0.30	0.28	**0.39**	0.54	0.84	1.51	1.21	0.57	0.45	**0.85**	**0.66**
Potatoes	0.65	0.54	0.72	0.90	**0.70**	0.75	0.32	0.40	0.61	0.77	**0.57**	0.30	0.46	0.55	0.44	0.44	0.47	**0.44**	**0.55**
Long Berseem	1.08	1.07	1.18	1.14	**1.12**	1.06	1.05	1.04	1.02	1.03	**1.04**	1.03	1.03	1.02	1.01	1.01	1.01	**1.02**	**1.05**
Short Berseem	1.13	1.10	1.25	1.17	**1.16**	1.06	1.03	1.03	1.02	1.02	**1.03**	1.02	1.02	1.02	1.01	1.01	1.01	**1.01**	**1.06**
Average	**1.28**	**1.17**	**0.92**	**0.93**	**1.07**	**0.93**	**0.77**	**0.77**	**0.83**	**0.81**	**0.82**	**0.83**	**0.84**	**0.98**	**1.03**	**1.11**	**1.04**	**0.97**	**0.95**
Crop Rotations	**1986**	**87**	**88**	**89**	**86-89**	**90**	**91**	**92**	**93**	**94**	**90-94**	**95**	**96**	**97**	**98**	**99**	**2000**	**95-2000**	**1986-2000**
Wheat & Maize	1.36	1.38	0.98	1.08	1.20	1.12	0.90	0.84	0.86	0.84	0.91	0.80	0.68	0.92	1.13	1.19	1.21	**0.99**	**1.02**
Wheat & Rice	1.60	1.25	0.82	0.92	1.15	1.01	0.77	0.78	0.88	0.89	0.86	0.81	0.80	0.99	1.09	1.22	1.40	**1.05**	**1.02**
Wheat & Soybean	1.34	1.28	0.82	1.10	1.13	1.16	0.93	0.83	0.79	0.80	0.90	0.84	0.75	0.89	1.11	1.19	1.14	**0.99**	**1.00**
Wheat & Pot	0.82	0.72	0.76	0.93	0.81	0.93	0.47	0.52	0.71	0.79	0.68	0.42	0.57	0.69	0.68	0.68	0.70	**0.62**	**0.69**
Broad bean & Maize	1.47	1.17	1.01	0.93	1.14	0.90	0.75	0.76	0.89	0.87	0.83	0.87	0.68	0.88	0.99	1.09	1.06	**0.93**	**0.95**
Broad bean & Rice	1.76	1.07	0.84	0.78	1.11	0.81	0.64	0.70	0.91	0.93	0.80	0.86	0.81	0.96	0.98	1.14	1.25	**1.00**	**0.96**
Broad bean & Potatoes	0.83	0.67	0.77	0.84	0.78	0.75	0.40	0.45	0.70	0.80	0.62	0.41	0.56	0.67	0.59	0.56	0.60	**0.56**	**0.64**
Broad bean & Soybean	1.45	1.08	0.84	0.92	1.07	0.90	0.76	0.73	0.80	0.83	0.80	0.93	0.76	0.84	0.94	1.05	0.95	**0.91**	**0.92**
S.Berseem & Cotton	0.78	0.97	0.96	0.97	0.92	0.98	0.91	1.05	1.11	0.82	0.98	1.06	1.14	1.14	0.95	1.06	1.01	**1.06**	**0.99**
L.Berseem & Rice	1.47	1.15	0.97	0.95	1.14	0.95	0.79	0.85	0.95	0.98	0.90	0.92	0.94	1.02	1.02	1.09	1.21	**1.03**	**1.02**
L.Berseem & Maize	1.23	1.25	1.16	1.16	1.20	1.08	0.93	0.94	0.94	0.94	0.97	0.94	0.81	0.96	1.03	1.06	1.08	**0.98**	**1.03**
L.Berseem & Soybean	1.21	1.17	0.98	1.22	1.15	1.11	0.98	0.95	0.88	0.92	0.97	1.02	0.94	0.94	1.01	1.03	1.02	**0.99**	**1.02**
Tomatoes & Soybean	0.64	1.02	0.85	0.50	0.75	0.69	0.48	0.38	0.33	0.32	0.44	0.57	0.83	1.33	1.17	0.61	0.49	**0.83**	**0.68**
Tomatoes & Maize	0.65	1.06	0.92	0.53	0.79	0.71	0.49	0.39	0.36	0.34	0.46	0.57	0.79	1.30	1.18	0.65	0.54	**0.84**	**0.70**
Average	**1.19**	**1.09**	**0.91**	**0.92**	**1.02**	**0.94**	**0.73**	**0.73**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.97**	**0.99**	**0.97**	**0.97**	**0.91**	**0.90**

Source: PAM analysis results.

one throughout the period 1986-2000,with an average value of 0.90, 0.68 and 0.87 during the first, second and third periods respectively, indicating negative effective protection and thus potential disincentives. In contrast, fodder and import products (except for the second period for the latter) all enjoyed positive protection, with EPCs more than one. In other words, their producers are enjoying positive incentives (see Figure 7-6). This result confirms the NPCOs results shown in Figure 7-1, which indicate the general policy theme of the government of Egypt (as well as most developing countries) in accomplishing self sufficiency and reducing dependency on imported agricultural products particularly wheat and other grain commodities.

The estimated EPC values show that the government is encouraging domestic production of import products by setting producer prices higher than parity prices. On the other hand, export crops are "taxed" in net terms relative to their equivalent world prices.

FIGURE (7-6): EPC FOR MAJOR IMPORTED AND EXPORTED AGRICULTURAL PRODUCTS DURING THE PERIOD 1986-2000

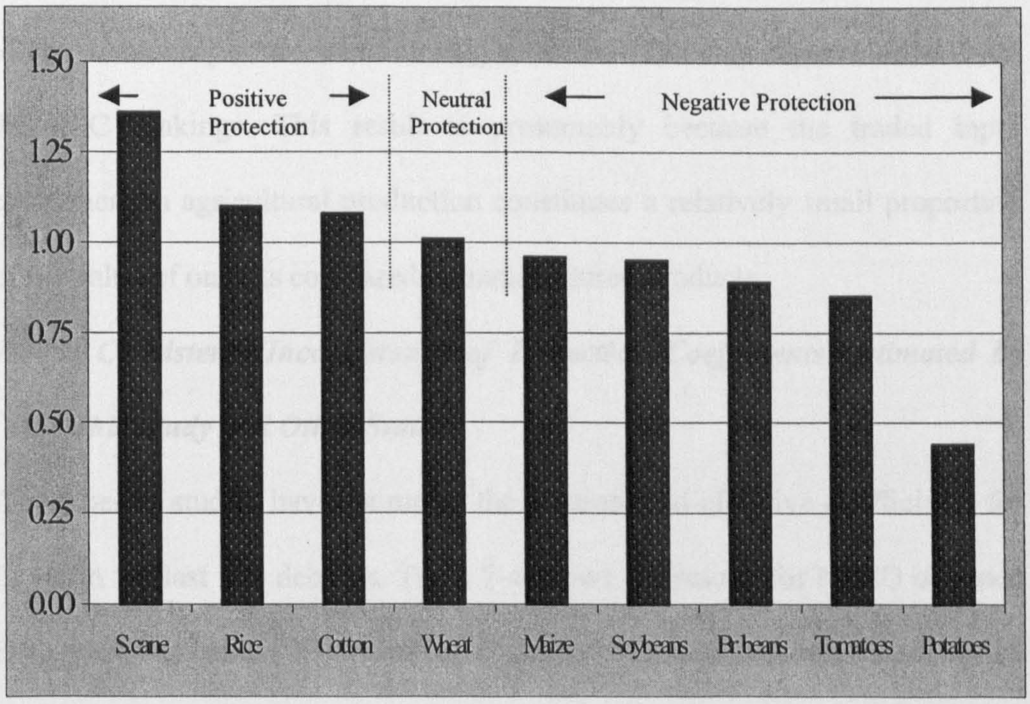


Source: Table 7-3

Using the average estimates for EPCs during the period 1995-2000, Figure 7-7 presents the ranking of the major importable and exportable agricultural products in Egypt according to the level of incentives (disincentives). Sugar cane, rice and cotton had the highest EPCs (1.36, 1.10 and 1.08 respectively) implying that their producers were enjoying an incentive of 36%, 10% and 8%. Other crops showed neutral EPC; for example, wheat reached almost unity, implying that its producers were neither favoured nor discriminated against. The estimated EPCs for other crops showed various levels of disincentive, with some variation in. For example, the estimated EPC for maize and soybean reached about 0.95, followed by broad beans (0.89), tomatoes (0.85) and finally potatoes (0.45), implying that trade policies were taxing them relative to international prices.

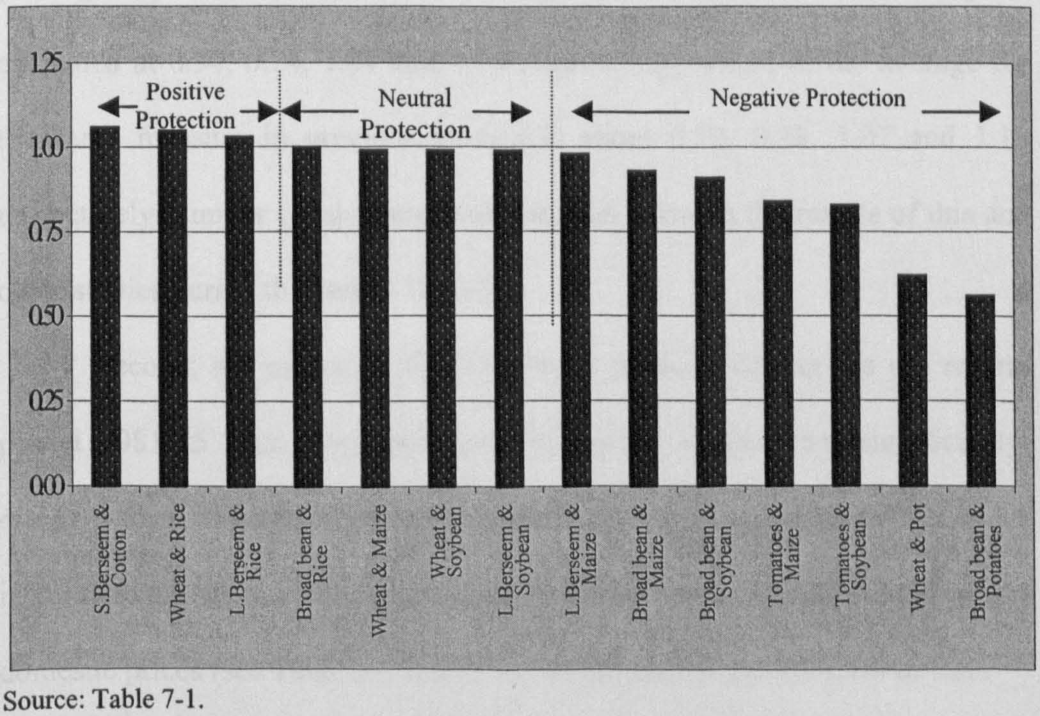
Figure 7-8 ranks different crop rotations during the period 1995-2000 according to incentives (disincentive) enjoyed (suffered) by rotations. The estimated EPCs for short berseem followed by cotton (1.06), wheat followed by rice and (1.05) long berseem followed by rice (1.03) indicate a very slight incentive of 6%-3% relative to international prices. Rotations such as broad beans followed by rice, wheat followed by maize or soybean and long berseem followed by soybean had EPCs close to unity, implying that they were neither favoured nor discriminated against. In contrast, other rotations were discouraged to varying degrees, the EPC for broad beans followed by maize or soybean being estimated at nearly 0.92, tomatoes followed by maize or soybean at about 0.83 and finally wheat or broad beans followed by potatoes at 0.58.

FIGURE (7-7): EPC ESTIMATES FOR MAJOR AGRICULTURAL OUTPUTS DURING THE PERIOD 1995-2000



Source: Table 7-1.
Note: as we move toward the right hand side the level of disincentives increases.

FIGURE (7-8): EPC ESTIMATES FOR MAJOR CROP ROTATIONS DURING THE PERIOD 1995-2000



Source: Table 7-1.
Note: as we move toward the right hand side the level of disincentives increases.

As discussed earlier, and shown for crops in Figures 7-2 and 7-7 and for crop rotations in Figures 7-3 and 7-8, it may be concluded that the rankings of crops and crop rotations according to the NPCO results do not differ from the EPC rankings. This result is presumably because the traded input component in agricultural production constitutes a relatively small proportion of the value of outputs compared to manufactured products.

7.4 : Consistency/Inconsistency of Protection Coefficients Estimated by This Study and Other Studies.

A number of studies have estimated the nominal and effective coefficients for Egypt in the last two decades. Table 7-4 shows the results for NPCO obtained from previous studies compared to this study. Despite the differences in the methodology of the obtained results, they reveal two main findings.

First, the study results are consistent with the results estimated by other researchers during the periods 1986-89 and 1990-96. For example, the NPCOs (during the period 1986-89) for wheat, cotton, rice and maize in this study are estimated at 0.94, 0.84, 1.01 and 1.16 respectively, where as the average for the same measure in previous studies is about 0.92, 0.78, 1.07 and 1.13 respectively. Similar consistency could be seen between the results of this and other studies during the period 1990-96.

Second, the estimated NPCOs for all products during the pre reform period 1981-85 (that were estimated by earlier studies) are significantly[5] different from those estimated by this study during the period 1986-00, which is consistent with the economic reform having started in 1986 and reforming domestic prices (see Table 2-7 which shows the annual growth rates of farm

[5] Statistically significant at 5%.

TABLE 7-4: NOMINAL PROTECTION COEFFICIENT RESULTS OF MAJOR CROPS IN EGYPT DURING THE PRE AND POST REFORM PERIOD

Year	Source	Wheat	Cotton	Rice	Maize	B. beans	Soybeans	Short berseem	Long berseem	Potatoes	Tomatoes	Sugar cane
						NPCO						
1981-85	Khiedr et al.,	0.76	0.53	0.76	0.92	Na	Na	Na	Na	Na	Na	Na
	El-Amir and Siam	0.64	Na	1.06	0.89	Na	Na	Na	Na	Na	Na	0.76
	Hassan, R.	0.50	0.48	0.43	0.70	Na	Na	Na	Na	Na	Na	0.64
	Average	**0.63**	**0.51**	**0.75**	**0.84**	**Na**	**Na**	**Na**	**Na**	**Na**	**Na**	**0.70**
1986-89	Khiedr et al.,	0.89	0.38	0.78	1.07	Na	Na	Na	Na	Na	Na	Na
	El-Amir	0.95	Na	1.36	1.18	Na	Na	Na	Na	Na	Na	0.82
	Average	**0.92**	**0.78**	**1.07**	**1.13**	**Na**	**Na**	**Na**	**Na**	**Na**	**Na**	**0.82**
	This Study	**0.94**	**0.84**	**1.01**	**1.16**	**0.77**	**0.98**	**1.00**	**1.00**	**0.58**	**0.65**	**0.98**
1990	Ibrahim, A.	0.99	0.55	0.97	1.04	0.72	Na	1.09	Na	Na	Na	0.58
1993-95	Omran, M.	0.86	1.02	0.76	0.90	0.85	0.84	1.14	1.14	1.03	0.60	Na
1996	FAO	0.77	1.13	0.79	0.67	0.89	Na	1.66	1.66	Na	Na	1.09
1996	El-Guendy, M.	0.77	1.51	0.79	0.68	0.89	0.82	1.00	1.00	Na	Na	0.92
1990-96	**Average**	**0.85**	**1.05**	**0.83**	**0.82**	**0.84**	**0.83**	**1.22**	**1.27**	**1.03**	**0.60**	**0.86**
1990-96	**This Study**	**0.86**	**0.98**	**0.87**	**0.82**	**0.77**	**0.84**	**1.00**	**1.00**	**0.82**	**0.50**	**0.78**
1986-2000	**This Study**	**0.95**	**0.96**	**0.96**	**0.98**	**0.82**	**0.91**	**1.00**	**1.00**	**0.61**	**0.65**	**1.01**
						EPC						
1980-85	Hassan, R.	0.74	0.51	0.31	0.84	0.91	0.73	Na	Na	0.53	0.46	0.76
1990	Ibrahim, A.	1.05	0.61	1.01	1.15	0.74	Na	1.06	Na	Na	Na	0.59
1993	Abo-Saad	0.81	0.40	0.29	0.90	1.01	Na	Na	1.10	Na	Na	0.60
1993-95	Omran, M.	0.85	1.04	0.74	0.92	0.84	0.85	1.14	1.17	1.02	0.58	Na
1996	FAO	0.74	1.15	0.81	0.61	0.88	Na	1.96	1.84	Na	Na	1.19
1996	El-Guendy, M.	0.78	1.62	0.79	0.66	0.92	0.82	1.00	1.01	Na	Na	0.97
1990-96	**Average**	**0.85**	**1.02**	**0.73**	**0.85**	**0.88**	**0.84**	**1.29**	**1.28**	**1.02**	**0.58**	**0.84**
1990-96	**This Study**	**0.88**	**1.01**	**0.83**	**0.85**	**0.79**	**0.87**	**1.03**	**1.04**	**0.52**	**0.48**	**0.80**
1986-2000	**This Study**	**1.00**	**0.99**	**1.05**	**1.05**	**0.88**	**1.00**	**1.06**	**1.05**	**0.55**	**0.66**	**1.13**

gate prices for major agricultural commodities during the period 1986-2000, e.g. annual price growth rate of wheat, cotton, rice, maize and sugar cane are 8.1%, 9.5%, 9.3%, 6.4% and 8.7% respectively). In other words the nominal protection coefficients for wheat, cotton, rice, maize and sugar cane in this study during the post reform period (1986-2000) are estimated to be about 0.95, 0.96,0.96, 0.98 and 1.01 but the average for the same measure in previous studies during the pre reform period (1981-85) is about 0.63, 0.51, 0.75, 0.84 and 0.70 respectively. The same outcome is observed when the estimates of effective protection coefficient in this study are compared with those from other studies during the period 1996, or with earlier studies throughout the period 1980-85 (see Table 7-4).

As noted in Karayiannis-Bacon (1976) '*The main expectation that one might have from the literature on effective protection would be that the effective rates would be generally above the nominal rates and in some cases would be much higher. One might also expect that the two methods could produce a very different ranking of the industries*'. But for the agricultural sector in Egypt there was no significant difference between the ranking of crops by nominal or by effective protection. The majority of crops throughout the three distinct periods had rates of nominal protection close to the level of effective protection, implying that the weighted tariffs (subsidy) on inputs offset the protection (tax) on outputs.

7.5 : Protection Measures, Area and Production

In this section we examine very briefly the relationship between the falling/increasing of protection during the beginning and late phases of reform (the distinct periods 1995-2000 and 1986-89) and changes in area or output across crops.

As mentioned in earlier discussions, the structure of incentives for most crops has changed in the late phase of reform compared to its original level during the first period. For example, the NPCI (averages) for all crops has increased over time from 0.45 during the first period to 0.73 and then to 0.88 during the second and third periods respectively (see Table 7-2). This implies that the subsidy on tradable inputs received by the farmers had fallen by nearly one half in the late episode of reform than its beginning the case that should affected area and production of crops that intensely use tradable inputs such as potatoes. Since the tradable input cost for potatoes constitutes nearly 60% of the total cost, reducing the tradable input subsidy by nearly 50% during the reform era negatively affected its planted area and production.

The gradual fall in the EPC values for potatoes from 0.70 to 0.57 and further to 0.44 during the first, second and third periods of reform indicates that its growers suffer from continuing disincentives. The area planted fell by 33%, and consequently production by 32%, during the late phase of reform compared to its level in the first period.

Crops enjoying a rise in their domestic farm gate prices (becoming closer to the world price) attracted farmers. For example, the NPCO results reveal that the output prices for crops such as wheat and tomatoes were effectively taxed during the early stage of reform 1986-89 by about 6% and 35% respectively. The reduction of these disincentives during the third period, to only 1% for wheat and 17% for tomatoes, led farmers to grow more of them (see Tables 2-4 and 7-1). Their areas have increased by 83% and 9%

respectively, and consequently their production has increased significantly, by 190%and 103% respectively. These high volumes of production had a great impact on their trade performance (see Table 6-5).

The NPCO measure of protection also reveals that soybean output has been taxed over time, but with the NPCO decreasing from 0.98 to 0.92 during the first and third periods respectively. The case that simulated (with other factors) its ignorance of being planted where its area fell from 0.12 million feddan in 1986-89 to about only 0.03 million feddan. In contrast, the NPCO estimates for cotton increased gradually throughout the reform era, from 0.84 in the first period to 0.93 and further to 1.05 in the second and third periods respectively. The government not only changed the cotton's pricing policy toward free market operation, but actually subsidised its output during the third period by about 5%. However, its cultivated area fell from 1.06 million feddan in 1986-89 to only 0.83 million feddan in 1985-2000. This suggests that there were factors other than prices affecting the farmers' decision about growing cotton. The EPC calculations mirror these results (obtained from the NPCO), with the EPC for cotton estimated in the three distinct periods as 0.91, 0.96 and 1.08 respectively, which essentially tells the same story.

7.6 : Summary and Conclusions:

In the analysis of trade and price policy incentives, it has become customary to estimate the Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC). In general, most of the crops studied have distorted prices for their output and/or their inputs. The NPCO results during the third period reveal that the market prices for five of the nine traded crops (maize, soybean, broad bean, tomatoes and potatoes) have been set at levels less than those prevailing in world markets, thus implying a tax on those crops. In the remainder (sugar cane, cotton and rice), the NPCO results showed different levels of output subsidy. In contrast, the NPCI results show that the input prices for most crops and crop rotations are subsidised. But the average level of input subsidy has gradually fallen from 55% in 1986-89 to 27% in 1990-94 and further to 12% in 1995-2000. The effective protection coefficient results confirmed the results obtained from the NPCO estimates for crop and crop rotation rankings according to the incentives (disincentives) enjoyed (suffered) by producers; the sugar cane, rice and cotton EPCs results indicating that their producers were enjoying an incentive of 36%, 10% and 8%. Other crops showed neutral EPCs, as in wheat, implying that their producers were neither favoured nor discriminated against. The estimated EPCs for maize, soybean, broad beans tomatoes and potatoes showed various levels of disincentive, implying that trade policies are taxing them relative to international prices.

Although the results generally revealed that EPCs and NPCOs coefficients were very close for the majority of sectors, this was not the case for potatoes during the third period 1995-2000, where the EPC and NPCO were estimated to be 0.44 and 0.60 respectively. The reason for the EPC coefficient being lower than the NPCO is mainly that the value added calculated using social prices (E-F) is much higher than the value added calculated using private prices (A-B), consequently denominator increases and as a result the EPC decreases.

Chapter VIII

Chapter VIII: Measures of Net Transfers: Profitability Coefficient (PC) and Subsidy Ratio to Producer (SRP) Results.

8.1 : *Introduction*

The last row of the PAM model (calculated as the difference between the private and social valuations of revenues, costs and profits) measures the policy-induced transfers that result from policy-induced market failures or distortions. Hence, four types may be calculated from the PAM matrix: output transfers, input transfers, factor transfer and net transfers.

CONSTRUCTION OF PAM ANALYSIS

PAM	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	**A** Revenue based on private profit	**B** Costs of tradable inputs based on private prices	**C** Costs of domestic factors based on private prices	**D** Profit based on private profit D = (A - B - C)
Social Prices	**E** Revenue based on social profit	**F** Costs of tradable inputs based on social prices	**G** Costs of domestic factors based on social prices	**H** Profit based on social profit H = (E - F- G)
Effects of divergences and efficient policy	**I** I = (A - E)	**J** J = (B - F)	**K** K = (C- G)	**L** L = D - H = (I - J - K)

The *output transfer,* is expressed in PAM notation as I= A-E. A positive value of I (private revenues [A] greater than social revenues [E]) implies that producers receive a subsidy due to current policies as they get a higher price than the world price for the commodity. Similarly, a negative value of I indicates that producers are taxed as they get prices lower than world prices for their output under existing policies.

The *input transfers,* calculated as J= B-F, measure the difference between input costs at private and social prices. A positive value of J implies that producers are taxed (i.e. producers are paying more than if they would purchase at world prices), while a negative value implies that producers are subsidised (i.e. producers are paying lower prices for their tradable inputs than they would have to pay in the absence of government intervention).

The factor transfers is calculated as K= C-G; a positive value indicates that producers are paying more for their domestic factors than their opportunity cost, while a negative value implies a case of subsidised factors.

The net transfers, expressed by L, equal output transfers (I) minus input transfers (J) minus factor transfers (K); i.e. L=D-H. The value of L measures the net transfers from all policy distortions and/or from market failures not corrected by efficient policies. If L is greater than zero (i.e. NPP>NSP), it indicates that there is a net transfer to producers from government, i.e., a subsidy. In contrast, if L is less than zero, it implies the existence of a net tax on producers.

The profitability coefficient (PC) and the subsidy ratio to producers (SRP) are two main measures for tracing net policy transfer effects. However, we should be very cautious with the PC economic indicator, particularly if it has a negative value (discussed in greater detail below). So we shall just report the PC results along with a short comment on the obtained results, and mainly focus in our study on the SRP, especially as it will address the same issues as would the PC.

8.2 : *Profitability Coefficient*

8.2.1 : Introduction

The profitability coefficient (PC), defined as PC= D/H, is a measure of the degree to which net transfers have caused private profits to exceed social profits, where D= A-B-C and H= E-F-G. The PC extends the effective protection coefficient EPC [defined in Chapter 7 as (A-B)/(E-F)] to include factor transfers. Although the PC is considered more comprehensive than the EPC because it provides an indication of the total incentive effect of policies (including those influencing factor markets), it is an incomplete economic indicator. Its usefulness is restricted when private or social profits are negative[1]. For example, an obtained negative PC result does not tell us whether it is negative due to a negative value in private or social profits, and we must refer back to the original PAM matrix for that information.

8.2.2 : Empirical Results

A profitability coefficient of unity implies that the structure of profits is "neutral"; that is, domestic producers are receiving the same profit, as they would have achieved at world prices, i.e. profits valued in private and social prices are the equal. If the PC is greater than one, it implies that policy transfers have permitted domestic producers to receive a greater profit for their resources given intervention than they would in the absence of intervention.

[1] If the PC value is negative because of private profits being negative, this implies that the sector under consideration is not privately profitable while it is socially profitable and consequently the sector is losing foreign exchange in its production. In contrast, if the PC value is negative because of social profits being negative, this implies that the sector is privately profitable while it is socially not profitable i.e. it is heavily subsidised.

TABLE 8-1: PROFITABILITY COEFFICIENT (PC) FOR MAIN CROPS & CROP ROTATIONS IN THE PERIOD 1986-2000.

Crop	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat	7.82	8.50	1.86	2.09	5.07	5.15	4.77	6.16	61.90	22.16	20.03	14.39	1.81	16.48	1.77	2.14	3.29	6.65	10.69
Maize	-2.16	-2.44	3.61	14.83	3.46	38.63	2.87	6.34	11.93	10.80	14.11	-4.07	1.61	46.01	-1.42	91.31	7.92	23.56	15.05
Sugar cane	-1.48	-1.25	1.56	0.98	-0.05	1.54	-1.75	-1.59	-1.79	6.75	0.63	-7.85	-3.41	-5.09	-3.33	-0.61	-1.24	-3.59	-1.24
Soybeans	-1.24	-1.67	2.57	-2.92	-0.81	-2.04	-2.18	-0.74	0.23	-0.13	-0.97	-0.04	-0.74	-0.94	0.45	-0.09	-0.03	-0.23	-0.63
Broad beans	48.88	1.65	3.23	1.71	13.87	1.90	1.97	30.50	-0.61	-0.46	6.66	-4.30	12.25	4.21	1.29	0.11	4.45	3.00	7.12
Cotton	9.12	3.78	5.94	7.53	6.59	8.49	5.80	-7.75	13.10	10.56	6.04	24.61	-2.62	-2.43	-0.40	-0.47	-0.70	3.00	4.97
Rice	-1.68	-0.75	1.85	1.50	0.23	1.94	1.31	1.92	9.85	3.53	3.71	2.45	1.75	2.47	1.08	1.72	-2.15	1.22	1.79
Tomatoes	0.78	2.94	2.60	0.58	1.72	0.70	0.73	0.46	0.26	0.29	0.49	1.29	1.99	-9.00	15.10	0.73	0.46	1.76	1.33
Potatoes	0.55	0.40	0.90	1.66	0.88	11.43	0.30	0.40	0.72	1.08	2.79	0.19	0.63	0.80	0.04	0.11	0.06	0.31	1.28
Long Berseem	4.32	2.14	32.49	-2.49	9.11	-3.43	-2.81	-2.92	19.08	-81.03	-14.22	30.54	8.31	4.18	1.91	1.90	1.77	8.10	0.93
Short Berseem	-21.38	3.31	-5.59	-1.64	-6.32	-1.08	-0.93	-0.73	-0.96	-1.14	-0.97	-1.08	-1.10	10.05	2.52	2.28	2.18	2.48	-1.02
Crop Rotations	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat & Maize	-12.16	-9.23	2.54	3.33	-3.88	8.21	3.71	6.23	25.07	15.43	11.73	-25.74	1.73	23.7	21.92	3.87	4.52	5.00	4.88
Wheat & Rice	-4.56	-3.57	1.86	1.79	-1.12	3.01	2.11	3.03	17.72	5.27	6.23	3.62	1.78	3.79	1.28	1.89	7.4	3.29	3.09
Wheat & Soybean	-6.87	-7.74	2.02	4.27	-2.08	71.88	-133.49	-6.78	-1.75	-2.4	-14.51	-1.07	3.76	-8.23	2.3	4.27	228.99	38.34	9.94
Wheat & Pot	0.9	0.82	1.08	1.8	1.15	6.08	0.65	0.8	1.56	1.39	2.10	0.42	1.04	1.68	0.52	0.52	0.47	0.78	1.32
Broad bean & Maize	-6.75	4.55	3.43	3.52	1.19	4.32	2.45	8.91	-1.81	-1.61	2.45	-4.2	2.93	7.83	-8.47	-1.63	6.26	0.45	1.32
Broad bean & Rice	-3.69	6.76	2.42	1.58	1.77	1.92	1.48	2.68	-2.82	-6.82	-0.71	4.78	2.42	2.93	1.12	5.23	17.53	5.67	2.50
Broad bean & Potatoes	0.95	0.72	1.16	1.67	1.13	2.94	0.44	0.57	1.81	1.54	1.46	0.37	1.18	1.38	0.28	0.11	0.26	0.60	1.03
Broad bean & Soybean	-4.62	4.1	3	5.48	1.99	8.76	72.84	-1.89	-0.19	-0.33	15.84	-0.62	-4.3	714.71	1.99	0.04	-2.27	118.26	53.11
S.Berseem & Cotton	1.06	3.47	-120.74	-8.42	-31.16	-6.32	-10.98	-2.81	-10.64	-4.33	-7.02	-7.29	-1.99	37.85	-4.13	-2.74	-6.33	2.56	-9.62
L.Berseem & Rice	-6.48	6.81	4.79	5.43	2.64	6.47	4.08	9.3	13.71	6.77	8.07	4.26	2.88	3.19	1.46	1.82	2.86	2.75	4.49
L.Berseem & Maize	-148.89	4.9	6.87	-7.2	-36.08	-8.58	-105.79	-8.57	16.15	40.67	-13.22	-22.13	3.63	6.01	4.3	2.76	2.31	-0.52	-14.24
L.Berseem & Soybean	-16.48	4.53	9.03	-2.65	-1.39	-2.74	-2.53	-1.71	-2.48	-2.71	-2.43	-1.39	-17.91	8.91	2.14	2.53	2.42	-0.55	-1.40
Tomatoes & Soybean	0.89	4.09	2.6	0.76	2.09	0.86	0.86	0.54	0.26	0.31	0.57	1.74	2.32	-6.69	28.34	0.76	0.48	4.49	2.54
Tomatoes & Maize	0.9	4.24	2.75	0.82	2.18	0.94	0.84	0.57	0.31	0.34	0.60	1.46	1.93	-11.2	-38.42	0.87	0.55	-7.47	-2.21

Source: PAM analysis results.

For example, a PC of 7.92[2] means that policy transfers have permitted private profits nearly eight times greater than social profits. If PC is less than one (but positive), it implies that domestic producers would have received higher profits if they faced world prices instead of domestic prices on both output and inputs. A negative PC denotes a loss in either private or social profits and hence implies a drain on the economy's resources.

Table 8-1 shows the calculated PCs for the 11 crops and their associated 14 crop rotations during the period 1986-2000. In general, the PC results for crop and crop rotations reveal continuous government intervention either in output or input and factor prices, this being reflected in the divergence between private and social profits in all years throughout the three distinct periods (1986-89, 1990-94 and 1995-2000). For 55 of the 165 crop analysis results and 60 of the 165 crop rotation analysis results, throughout the period 1986-2000, we have a negative PC (PC<0). In all of the 115 negative PC results for crop and crop rotations, it was found that D>0>H, which means that these economic activities were privately profitable but socially not profitable, which indicates a misuse of the Egyptian economy's resources.

8.3 : *Subsidy Ratio to Producers (SRP)*

8.3.1 : Introduction

The subsidy ratio to producers (SRP) is another ratio indicator used to measure net transfers across different sectors. The SRP is defined as the ratio of the net transfers to revenues valued at social prices, i.e. in PAM notation as L/E. The aim of this indicator is to show the level of transfers from divergences as a proportion of the undistorted value of the system revenues. In other words, it

[2] The PC result for maize in 2000

TABLE 8-2: SUBSIDY RATIO TO PRODUCER (SRP) FOR MAIN CROPS & CROP ROTATIONS IN THE PERIOD 1986-2000.

Crop	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat	0.44	0.45	0.15	0.31	0.34	0.54	0.41	0.38	0.36	0.30	0.40	0.28	0.15	0.38	0.16	0.23	0.30	0.25	0.32
Maize	0.57	0.82	0.35	0.52	0.56	0.53	0.25	0.30	0.21	0.22	0.30	0.25	0.08	0.35	0.44	0.39	0.35	0.31	0.38
Sugar cane	0.91	0.86	0.10	-0.01	0.47	0.12	0.43	0.43	0.42	0.23	0.33	0.33	0.41	0.46	0.55	1.18	0.69	0.60	0.48
Soybeans	0.53	0.62	0.10	0.55	0.45	0.55	0.46	0.42	0.20	0.24	0.37	0.62	0.26	0.23	0.05	0.20	0.23	0.27	0.35
Broad beans	0.62	0.19	0.24	0.14	0.30	0.16	0.12	0.21	0.42	0.49	0.28	0.36	0.25	0.27	0.03	0.27	0.15	0.22	0.26
Cotton	0.18	0.14	0.16	0.28	0.19	0.36	0.38	0.67	0.55	0.21	0.43	0.54	0.86	0.59	0.37	0.50	0.42	0.55	0.41
Rice	1.01	0.56	0.11	0.14	0.45	0.22	0.08	0.16	0.27	0.29	0.21	0.23	0.18	0.27	0.03	0.19	0.54	0.24	0.28
Tomatoes	-0.11	0.39	0.30	-0.17	0.10	-0.17	-0.11	-0.24	-0.49	-0.42	-0.28	0.08	0.27	0.94	0.61	-0.13	-0.33	0.24	0.03
Potatoes	-0.16	-0.18	-0.02	0.14	-0.05	0.10	-0.24	-0.19	-0.05	0.03	-0.07	-0.31	-0.06	-0.03	-0.19	-0.26	-0.32	-0.20	-0.12
Long Berseem	0.43	0.37	0.60	0.82	0.55	0.71	0.75	0.70	0.47	0.48	0.62	0.49	0.49	0.46	0.26	0.25	0.24	0.36	0.50
Short Berseem	0.50	0.44	0.66	0.88	0.62	0.92	1.03	1.18	0.75	0.72	0.92	0.82	0.94	0.45	0.31	0.27	0.27	0.51	0.68
Crop Rotations	1986	87	88	89	86-89	90	91	92	93	94	90-94	95	96	97	98	99	2000	95-2000	1986-2000
Wheat & Maize	0.49	0.59	0.24	0.4	0.43	0.54	0.33	0.34	0.29	0.26	0.35	0.27	0.12	0.37	0.3	0.31	0.33	0.28	0.35
Wheat & Rice	0.68	0.5	0.13	0.22	0.38	0.38	0.22	0.26	0.31	0.29	0.29	0.25	0.17	0.32	0.08	0.21	0.42	0.24	0.30
Wheat & Soybean	0.48	0.52	0.13	0.4	0.38	0.54	0.43	0.39	0.29	0.27	0.38	0.4	0.19	0.32	0.12	0.22	0.27	0.25	0.33
Wheat & Pot	-0.03	-0.05	0.02	0.19	0.03	0.23	-0.1	-0.05	0.07	0.09	0.05	-0.17	0.01	0.08	-0.09	-0.13	-0.15	-0.08	-0.01
Broad bean & Maize	0.59	0.4	0.29	0.32	0.40	0.34	0.19	0.26	0.31	0.34	0.29	0.3	0.16	0.31	0.23	0.34	0.25	0.27	0.31
Broad bean & Rice	0.8	0.33	0.17	0.14	0.36	0.19	0.10	0.18	0.33	0.36	0.23	0.28	0.21	0.27	0.03	0.22	0.35	0.23	0.26
Broad bean & Potatoes	-0.01	-0.08	0.03	0.14	0.02	0.12	-0.16	-0.11	0.06	0.11	0.00	-0.19	0.02	0.05	-0.12	-0.15	-0.19	-0.10	-0.03
Broad bean & Soybean	0.58	0.34	0.17	0.3	0.35	0.31	0.27	0.3	0.31	0.36	0.31	0.47	0.25	0.25	0.04	0.24	0.18	0.24	0.29
S.Berseem & Cotton	0.01	0.24	0.29	0.42	0.24	0.49	0.51	0.78	0.59	0.33	0.54	0.6	0.88	0.55	0.34	0.4	0.36	0.52	0.45
L.Berseem & Rice	0.68	0.44	0.32	0.39	0.46	0.42	0.31	0.37	0.36	0.37	0.37	0.33	0.31	0.36	0.15	0.22	0.36	0.29	0.36
L.Berseem & Maize	0.49	0.52	0.47	0.65	0.53	0.61	0.46	0.49	0.35	0.35	0.45	0.37	0.27	0.41	0.33	0.3	0.28	0.33	0.42
L.Berseem & Soybean	0.47	0.45	0.33	0.68	0.48	0.63	0.6	0.56	0.35	0.37	0.50	0.54	0.39	0.37	0.2	0.23	0.24	0.33	0.43
Tomatoes & Soybean	-0.05	0.42	0.26	-0.08	0.14	-0.06	-0.05	-0.17	-0.41	-0.36	-0.21	0.14	0.27	0.77	0.51	-0.1	-0.28	0.22	0.05
Tomatoes & Maize	-0.05	0.45	0.31	-0.06	0.16	-0.03	-0.06	-0.17	-0.4	-0.35	-0.20	0.1	0.22	0.75	0.57	-0.06	-0.24	0.22	0.07

Source: PAM analysis results.

shows the extent to which a sector's revenues have been increased or decreased because of government policy. The smaller the SRP, the less distorted the agricultural sector, with a positive (negative) value of SRP implying a producer subsidy (tax). The SRP, converted to a percentage, also indicates the equivalent output tariff required to maintain current private profits if all other policies are removed. For example, the SRP of 0.48 (average 1986-2000) for sugar cane means that the divergences have increased the gross revenues of the sector by nearly one half. If hypothetically, all distortion policies and market failures on tradable inputs and factors were eliminated, the sugar cane sector's NPCO would have to be increased from 1.01 to 1.48 to permit its growers to maintain the same level of private profits. It thus shows how much incentive or disincentive the sector is receiving from all the effects of divergences.

8.3.2 : Empirical Results

The calculated SRPs for the 11 crops and their associated 14 crop rotations during the period 1986-2000 are summarised in Table 8-2. The principal results for crop analysis are as follows:

(1) Long and short berseem received on average the highest SRP (0.60) of all the studied sectors throughout the period 1986-2000; next come import[3] and export[4] commodities with average of 0.36 and 0.15 respectively. Implying that: first, export commodities are less distorted than import and fodder commodities; and second, policy divergences have increased the gross revenues for fodder crops by

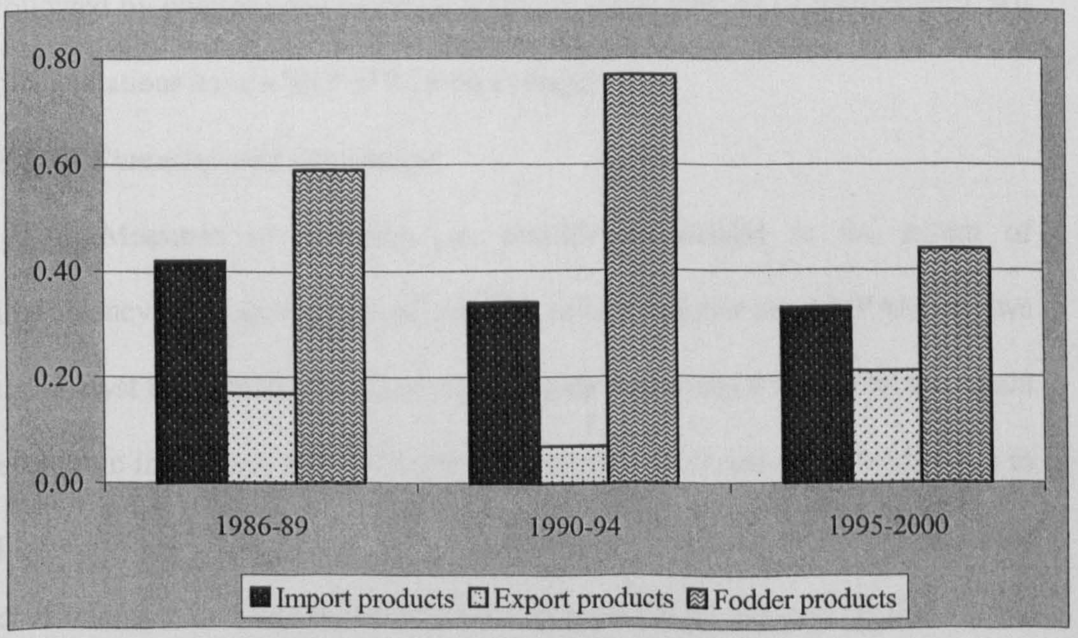
[3] Import commodities are wheat, sugar cane, broad bean, soybean and maize.
[4] Export commodities are cotton, potatoes, tomatoes and rice.

more than one-half, and for import and export sectors by one-third and one-quarter respectively.

(2) The SRP values for import commodities are higher than those for exports throughout the first, second and third periods by 25%, 26% and 12% respectively, indicating that export commodities are less protected than import commodities (see Figure 8-1). These results confirm the NPCO and EPC results reported in Chapter 7 (see Figures 7-1 and 7-6).

(3) The NPCO and EPC results obtained earlier are confirmed again by the SRP estimate for potatoes, tomato and cotton. For example, the SRP results for potatoes indicate that producers are heavily taxed in most years throughout the three distinct periods, with negative SRPs of 0.05, 0.07 and 0.20 respectively (the same picture can be seen for tomatoes). In contrast, cotton producers received an increasingly high level of subsidy during the periods 1986-89, 1990-94 and 1995-2000 with SRPs of 0.19, 0.43 and 0.55 respectively (see Table 8-2).

FIGURE (8-1): SRP FOR MAJOR PRODUCTS DURING THE PERIOD 1986-2000



Source: Table 8-2

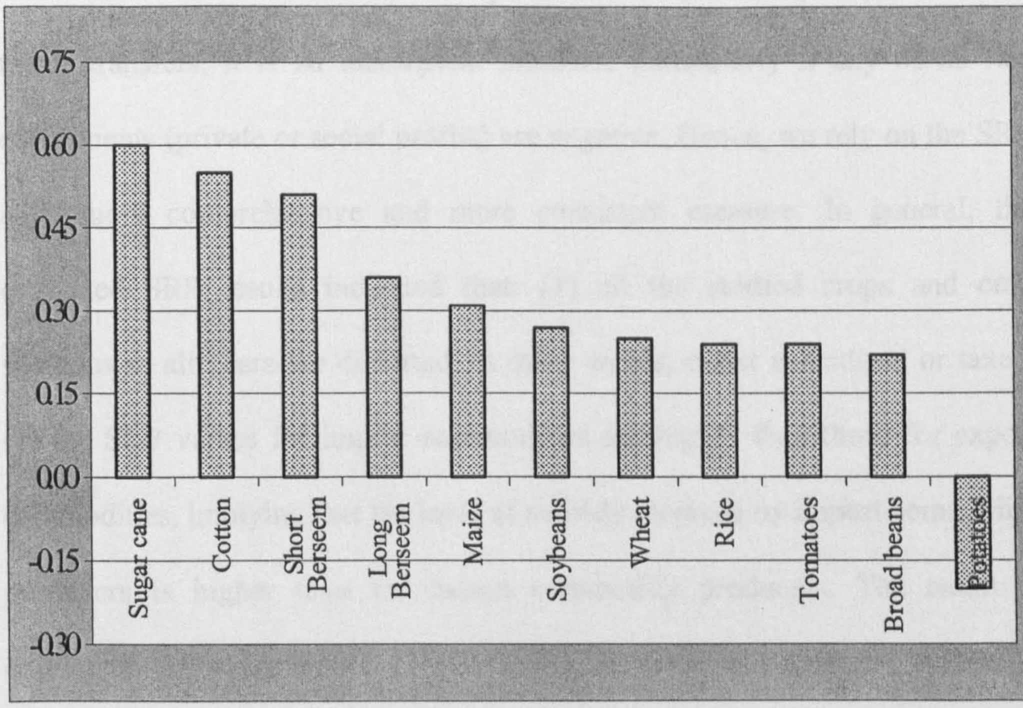
Using the average estimates for SRPs during the period 1995-2000, Figure 8-2 presents the ranking of the major importable, exportable and fodder products in Egypt according to the level of subsidy (tax). Sugar cane, cotton and fodder crops (long and short berseem) had the highest SRPs (0.60, 0.55 and 0.43 respectively) implying that divergences have increased the gross revenues by two-thirds for sugar cane and nearly by one-half for cotton and fodder crops. The estimated SRPs for other crops showed various levels of subsidy, with some variation. For example, the estimated SRPs for maize and soybean are about 0.31 and 0.27 respectively, followed by wheat, rice, tomatoes and broad beans (0.24.). In contrast, potatoes showed a negative SRP (-0.20) implying that divergences have decreased its gross revenues by about one-fifth.

Figure 8-3 ranks different crop rotations during the period 1995-2000 according to the extent to which a sector's revenues have been increased or decreased by governmental policies. The short berseem followed by cotton rotation reached the highest SRP of 0.52. In contrast, wheat or broad beans followed by potatoes had negative SRPs of -0.08 and –0.10 respectively. All other rotations have a SRP of 0.26 on average.

8.4 : *Summary and conclusion*

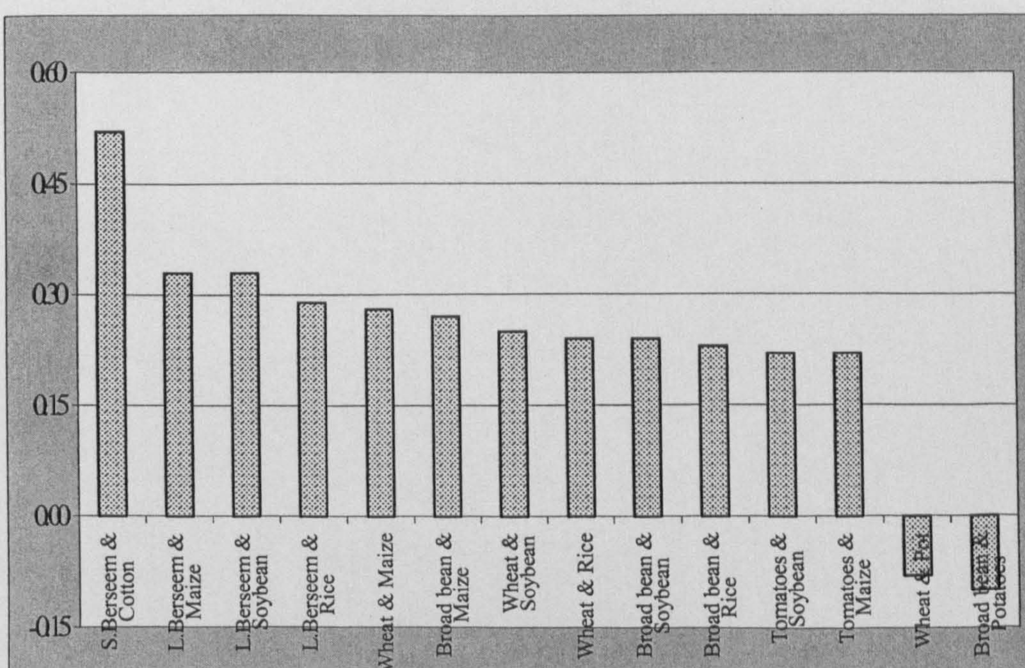
Measures of transfers can provide an insight to the extent of inefficiency in an agricultural sector. The policy analysis matrix (PAM) allows the analyst to estimate the value and magnitude of these transfers by two main economic indicators, the profitability coefficient (PC) and the subsidy ratio to producers (SRP). In this chapter we have estimated both of the PC and SRP coefficients to measure the effect of policy transfers for Egyptian major

FIGURE (8-2): SRP ESTIMATES FOR MAJOR CROPS DURING THE PERIOD 1995-2000



Source: Table 7-1.
Note: as we move toward the right hand side the level of subsidy decreases.

FIGURE (8-3): SRP ESTIMATES FOR MAJOR CROP ROTATIONS DURING THE PERIOD 1995-2000



Source: Table 7-1.
Note: as we move toward the right hand side the level of subsidy decreases.

agricultural commodities. Although the profitability coefficient (PC) measurement extends the effective protection coefficient (EPC) to include factor transfers, it is an incomplete measure, particularly if any of its two components (private or social profits) are negative. Hence, we rely on the SRP as a more comprehensive and more consistent measure. In general, the estimated SRP results indicated that: (1) all the studied crops and crop rotations in all years are distorted, in other words, either subsidised or taxed. (2) the SRP values for import commodities are higher than those for export commodities, implying that the level of subsidy received by import commodity producers is higher than for export commodity producers. The result is consistent and is confirmed by NPCO and EPC results estimated in Chapter 7.

Chapter IX

Chapter IX: Policy Implications: The Policy Analysis Matrix (PAM) and Planted Area Predictions

9.1 Introduction

The policy analysis matrix analysis is static and partial equilibrium in nature. The PAM model can detect the impact of changes in production, profitability or costs on sector (x) but it cannot measure the impact of these changes on other sectors. For example, if wheat profitability increased (say, due to a rise in the wheat price or the use of an improved seed variety), the PAM can measure the impact of these changes on the wheat sector[1] but is unable to capture the indirect impact on other sectors simultaneously. Assessing the relationships between sectors has some appeal as sectors compete for resources. Consequently, we attempt to bridge the gap in the partial equilibrium nature of the analysis by linking the PAM for each commodity together. Linking of PAMs in this way allows us to analyse the effect of changes in policy on the profitability and hence the area planted to each crop in Egyptian agriculture. Whilst there are many scenarios that could be evaluated, we focus attention on the sectoral impacts of a water charge.

Section 2 presents a theoretical methodology for modelling the statistical relationships between the calculated PCRs and the planted areas of major crops. Section 3 reports the empirical results for general and specific models for the area and PCRs relationships using both levels and first differences data. Section 4 discusses the implications of the introduction of

[1] By estimating economic indicators (PCR, DRC, NPCO, NPCI and SRP) using the new set of data.

irrigation water charges on areas of major crops. Section 5 summarises and concludes.

9.2 Methodology

In this section, we attempt to estimate statistical relationships between the PCRs and the planted area of each crop. This will allow us to make predictions of the outcomes of policy simulations across Egyptian agriculture. The PCR was selected because it reflects the domestic competitiveness and profitability of the crops through the relationship between the PCR and profitability (the lower the PCR, the higher the profitability[2]) on the grounds that profitability is one of the most important motivations for growers in allocating their land among competing crops.

We assume that the planted area for crop x in year t is affected by the PCR of crop x and other competing and following summer crops in year $(t\text{-}1)$. i.e., $Area\ X_t = f(PCRX_{t-1},\ PCRW_{t-1}, PCRC_{t-1}....)$

While we propose no explicit structural economic model for the relationship between the area planted and profitability (as measured by the PCR), it seems reasonable to expect the following a priori. (1) A negative sign for the relationship between a crop's area in year t and its PCR in year t-1 because higher profitability in year t-1 (i.e. a lower PCR) will encourage growers to devote more land to that crop in year t. (2) A negative relationship between a winter crop area (such as wheat) and the PCRs for summer crops that follow wheat, such as maize and rice, because higher profitability in t-1 in these crops would encourage growers to expand their area and consequently the preceding wheat area. (3) A positive relationship between the area of a

[2] This issue has been discussed in greater detail in chapter 6.

winter crop and the PCRs of competing crops such as broad beans, short and long berseem, and tomatoes. This is because the lower profitability in *t*-1 of these crops (i.e. higher PCR) the more reluctant the growers will be to extend their area in year *t* and consequently they will direct at least some of their area to competing crops such as wheat.

In order to detect the impact of the changes to the PCRs on the area of crops it is necessary to model areas planted to crops as a function of those PCRs. Four different models have been estimated for each crop, using *MicroFIT.4*. Area data are reported in Table A4-2 and the PCRs are reported in Table 6-1. The estimated models are: (1) a 'general' model using levels data in logs; (2) a 'specific' model using levels data in logs; (3) a 'general' model using first differences of the log levels and (4) a 'specific' model using first differences of the log levels. In this context the general models are those that include the PCRs of all summer and winter crops, irrespective of the statistical significance of the coefficients. The 'specific' models are those in which statistically insignificant regressors have been excluded

9.2.1 Type I models : general models for major crops using levels data in logs

In the first model we work in terms of the (natural) logarithms of the data in levels, specifying the logarithm of the area planted to the crop under consideration as a linear function of the logarithms of the PCRs of that and other competitive crops. The intercept coefficient is then a measure of the scale effect of the explanatory variables, and the coefficients of the explanatory variables are the elasticities of the area planted with respect to those variables. Since the data display strong trends (i.e. are probably non-stationary), the statistical significance of the coefficients is likely to be inflated. However, since the main cause of that inflation is the underestimation of the residual variance, we would expect the ranking of the variables in terms of the significance of their coefficients to be unaffected by any non-stationarity, and thus the calculated t statistics will be a useful guide in the determination of the corresponding 'specific' models. However, we should not expect to observe much statistical significance given the small sample size (15 observations).

In this model we assume that the area of a crop (say wheat) may be described by a simple linear econometric model, using the PCRs for wheat and other competitive and rotational following crops in year t-1. Applying logs will yield

$$LAW_t = \beta_0 + \beta_1 LPW_{t-1} + \beta_2 LPBB_{t-1} + \beta_3 LPLB_{t-1} + \beta_4 LPSB_{t-1} + \beta_5 LPT_{t-1}$$

$$+ \beta_6 LPM_{t-1} + \beta_7 LPC_{t-1} + \beta_8 LPR_{t-1} + \beta_9 LPS_{t-1} + \beta_{10} LPP_{t-1} + \mu_t \quad (9.1)$$

where the variables are denoted according to,

A	=	area	L	=	natural logarithms
P	=	PCR	β_0	=	Logarithms of scale parameter
W	=	wheat	β_1	=	elasticity for wheat PCR in year t-1
BB	=	broad beans	β_2	=	elasticity for broad bean PCR in year t-1
LB	=	long berseem	β_3	=	elasticity for long berseem PCR in year t-1
SB	=	short berseem	β_4	=	elasticity for short berseem PCR in year t-1
T	=	tomatoes	β_5	=	elasticity for tomatoes PCR in year t-1
M	=	maize	β_6	=	elasticity for maize PCR in year t-1
C	=	cotton	β_7	=	elasticity for cotton PCR in year t-1
R	=	rice	β_8	=	elasticity for rice PCR in year t-1
S	=	soybean	β_9	=	elasticity for soybean PCR in year t-1
P	=	potatoes	β_{10}	=	elasticity for potatoes PCR in year t-1

9.2.2 Type II Models: specific models for major crops using levels data in logs

In this model the results obtained from Model I are refined by excluding variables where that exclusion does not reduce $\overline{R}^2$, in order to improve the model specification. For example, in the results that follow in the potatoes model, eliminating the PCR variables for wheat, long berseem, tomatoes, maize, rice and soybean improved the specification of the model since its $\overline{R}^2$ increased from 0.63 (in the general model) to 0.85 (in the specific model), and the remaining explanatory variables (broad bean, short berseem and cotton) became significant at the 10% level.

Introducing another explanatory variable to a regression equation estimated by ordinary least squares cannot reduce the sum of squared errors, since the coefficients are estimated by minimising that sum, and will reduce the sum of squared errors if the estimated coefficient of the new regressor is non-zero. Thus a reduction in the sum of squared errors (an increase in R^2) is not a reliable indicator of an improvement in the explanatory power of that equation. To correct for this problem we adjust R^2 by taking account of the degrees of freedom in the model, $n-k$, which are reduced by the inclusion of an additional regressor, the adjusted measure being known as $\overline{R}^2$. More formally, $\overline{R}^2$ is defined by

$$1-\overline{R}^2 = (n-1)\left(\frac{1-R^2}{n-k}\right) \tag{9.1}$$

where k is the number of regressors. Adding a new regressor will only decrease $1-\overline{R}^2$ (i.e. increase $\overline{R}^2$) if the proportionate decrease in $1-R^2$ is greater than the proportionate decrease in the degrees of freedom, and indeed adding a new regressor may decrease $\bar{R}^2$. Thus $\bar{R}^2$ is a better guide to whether the addition of another variable has indeed improved the explanatory power of an equation

Modelling of the Adjusted Coefficient of Determination ($\bar{R}^2$)

$$\text{We can define } R^2 = 1 - \frac{\sum e_i^2}{\sum y_i^2} \tag{9.2}$$

$$\text{or, } \sum e_i^2 = \sum y_i^2 \,(1 - R^2) \tag{9.3}$$

i.e., Unexplained Sum of Squares = Total Sum of Squares (1- R^2).

We define $\bar{R}^2$ as the '*Adjusted Coefficient of Determination*' by dividing both sides of equation (9.3) by their respective degrees of freedom to make the equality true.

$$\frac{\text{Unexplained SS}}{n-k} = \frac{\text{Total SS}}{n-1}(1-\bar{R}^2) \tag{9.4}$$

where, n = total number of observations, k = number of parameters to be estimated.

$$\bar{R}^2 = 1 - \left(\frac{n-1}{n-k}\right)\left(\frac{\text{Unexplained SS}}{\text{Total SS}}\right) \tag{9.5}$$

by substituting equation (9.3) in equation (9.5) we get

$$\bar{R}^2 = 1 - \left(\frac{n-1}{n-k}\right)\left(1-R^2\right) = 1 - \left(\frac{n-1}{n-k}\right)\left(\frac{\sum e_i^2}{\sum y_i^2}\right) \tag{9.6}$$

Note that unlike R^2, $\bar{R}^2$ can be negative when $\left(\frac{n-1}{n-k}\right)\left(\frac{\sum e_i^2}{\sum y_i^2}\right)$ is greater than one. This means that the regression model explains a very small fraction of the total sum of squares. For example, in the regression model for tomatoes using differenced data, n = 13, k = 11 and R^2 = 0.62259, then $\overline{R}^2$ = 1- [(13-1)/(13-11)](1-0.62259) = -1.2645.

9.2.3 Type III Models: general models for major crops using differences in the logs of the data.

As argued in Chapter 2, it is often better to work with differenced data rather than with data in levels. The reason is that the errors in the levels equation often have variances increasing over time, and consequently the properties of the least squares estimators (*OLS*) are non-standard, and the values of the standard test statistics for significance are inflated. Hence, although models in first differences will tend to have lower explanatory power, they offer a more reliable guide to the statistical significance of variables. They will also suffer less from the consequences of multicollinearity – there is often a common trend in levels data, especially with small samples. Therefore, applying first differences to the logs of the levels data for wheat will yield

$$DLAW_t = \gamma_0 + \gamma_1 DLPW_{t-1} + \gamma_2 DLPBB_{t-1} + \gamma_3 DLPLB_{t-1} + \gamma_4 DLPSB_{t-1} + \gamma_5\, DLPT_{t-1} + \gamma_6 DLPM_{t-1} + \gamma_7 DLPC_{t-1} + \gamma_8 DLPR_{t-1} + \gamma_9 DLPS_{t-1} + \gamma_{10} DLPP_{t-1} + v_t \quad (9.2)$$

where the variables are denoted as in Equation (9-1) except that we are using here the first differences of the logarithms; for example, DLAW means the change in the logarithm of the wheat area.

9.2.4 Type IV Models: specific models for major crops using differences in the logs of the data.

In the same way as we did in Model II, in this model we refine the results obtained from Model III by eliminating variables where that exclusion does not decrease $\bar{R}^2$ in order to improve our model specification. For example, the exclusion of the explanatory variable for soybean (whose probability value [0.768]) from the wheat model led to an increase in the value of $\bar{R}^2$ from 0.93 to 0.95 and statistical significance for the other explanatory variable coefficients (at the 10% level).

9.3 Testing

9.3.1 Testing the general models in levels

Table 9-1 reports the results from testing the significance of possible explanatory variables in levels for the major crops used in this study. In general, the majority of explanatory variables in most crop models do not show statistical significance at conventional levels, but the full set has relatively high explanatory power (as indicated by $\bar{R}^2$). Such results suggest the presence of multicollinearity. For example, in the equations for soybean, rice, long berseem, short berseem, wheat and potatoes there were insignificant coefficients for many variables on the basis of t ratios, although the equations showed high values for $\bar{R}^2$ at 0.96, 0.95, 0.84, 0.63, 0.63 and 0.63 respectively. In contrast, the regression models for maize, tomatoes, and broad beans reported negative values for $\bar{R}^2$ estimated at –0.16, -0.26 and –0.40 respectively implying that those models explain a very small fraction of the total sum of squares.

Figure 9-1 shows the plot of the actual and fitted values of the general models of area using levels data. It illustrates the results of the models reported in Table 9-1. As noted above, the results do not appear to be significant in levels but the sign and magnitude for the majority of coefficients are consistent with the economic logic. Moreover, the actual and fitted plots of values are very close implying that the specified model fits the data well.

9.3.2 Testing the general models in first differences

In general, the results show that the significance levels and the values of $\overline{R}^2$ in the first differences model are higher than of those for the model in levels for the majority of crops. Moreover, the magnitudes and signs for the coefficients in first differences are quite similar to those estimated in levels for the majority of crops (see Tables 9-1 and 9-2). For example, in the wheat model, although the coefficients γ_0, $\gamma_1 \ldots \gamma_{10}$ are not statistically significant at conventional levels, their probability values are remarkably less than for those for β_1, β_2, $\ldots \beta_{10}$ (see Table A9-1). At the same time, the coefficients' signs and magnitudes are similar to those estimated using levels data, and the value of $\overline{R}^2$ has improved from 0.63 in levels to 0.93 in first differences. A similar result can be observed for short berseem[3] (see Table 9-2). The results from the *t* tests indicate that the statistical significance of coefficients improved in the cases of soybean, maize, potatoes and broad beans, but that there was no improvement for rice, long berseem, cotton and tomatoes (see Table 9-2 and Figure 9-2).

[3] Where its $\overline{R}^2$ has increased from 0.63 in levels to 0.97 in first differences.

TABLE 9-1: AREA MODELLING USING DATA IN LEVELS FOR MAJOR CROPS IN EGYPT (GENERAL *MODELS*)

Crop	Regressor											R^2	$\bar{R}^2$
	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)		
Wheat	11.2 [0.011]	-1.1 [0.518]	0.9 [0.180]	2.8 [0.145]	0.70 [0.466]	0.60 [0.585]	1.00 [0.303]	0.37 [0.366]	-1.57 [0.052]	1.02 [0.440]	-0.17 [0.574]	0.91	0.63
Short berseem	13.81 [0.001]	0.06 [0.945]	-0.45 [0.161]	0.48 [0.533]	-0.03 [0.951]	0.05 [0.920]	0.22 [0.591]	-0.09 [0.603]	-0.36 [0.233]	0.06 [0.919]	-0.02 [0.908]	0.92	0.63
Long berseem	15.27 [0.000]	0.65 [0.050]	-0.04 [0.568]	0.21 [0.339]	-0.07 [0.571]	0.50 [0.028]	-0.09 [0.443]	-0.04 [0.436]	-0.23 [0.040]	-0.50 [0.045]	0.12 [0.045]	0.96	0.84
Rice	12.46 [0.000]	-0.86 [0.191]	0.77 [0.019]	-0.66 [0.248]	-0.29 [0.354]	-0.53 [0.185]	0.64 [0.084]	0.06 [0.637]	-0.57 [0.038]	0.76 [0.136]	-0.11 [0.292]	0.99	0.95
Tomatoes	11.64 [.003]	0.32 [.778]	0.06 [.872]	0.30 [.775]	-0.46 [.468]	-0.27 [.706]	-0.22 [.700]	0.0006 [.998]	-0.06 [.863]	-0.03 [.967]	-0.04 [.848]	0.71	-0.26
Maize	14.02 [0.001]	0.04 [0.964]	0.15 [0.637]	-0.49 [0.587]	0.33 [0.531]	0.001 [0.999]	-0.08 [0.874]	-0.09 [0.685]	-0.15 [0.630]	0.04 [0.953]	-0.02 [0.908]	0.73	-0.16
Cotton	12.62 [0.004]	-0.67 [0.617]	-0.21 [0.631]	0.25 [0.837]	-0.40 [0.574]	-0.60 [0.477]	0.18 [0.788]	0.20 [0.509]	0.17 [0.682]	0.57 [0.564]	-0.13 [0.589]	0.84	0.30
Soybean	12.72 [0.008]	-1.03 [0.550]	-2.12 [0.024]	-0.03 [0.986]	3.54 [0.022]	-0.13 [0.896]	-0.58 [0.500]	0.57 [0.189]	2.30 [0.018]	-0.14 [0.910]	-0.46 [0.185]	0.99	0.96
Potatoes	12.36 [0.035]	0.51 [0.860]	-1.24 [0.247]	0.16 [0.951]	1.66 [0.319]	0.01 [0.998]	-0.21 [0.884]	0.33 [0.606]	0.31 [0.737]	-0.55 [0.797]	-0.35 [0.497]	0.92	0.63
Broad beans	12.50 [0.019]	1.19 [0.609]	0.11 [0.883]	-1.92 [0.388]	1.07 [0.404]	0.46 [0.742]	0.19 [0.863]	-0.16 [0.751]	-0.85 [0.296]	-1.20 [0.494]	0.14 [0.728]	0.68	-0.40

Source: Tables A31-A35.
Note: Figures in parentheses are probability values.

FIGURE 9-1: ACTUAL AND FITTED VALUES OF AREA IN LEVELS FOR SOME MAJOR CROPS IN EGYPT (*GENERAL MODEL*).

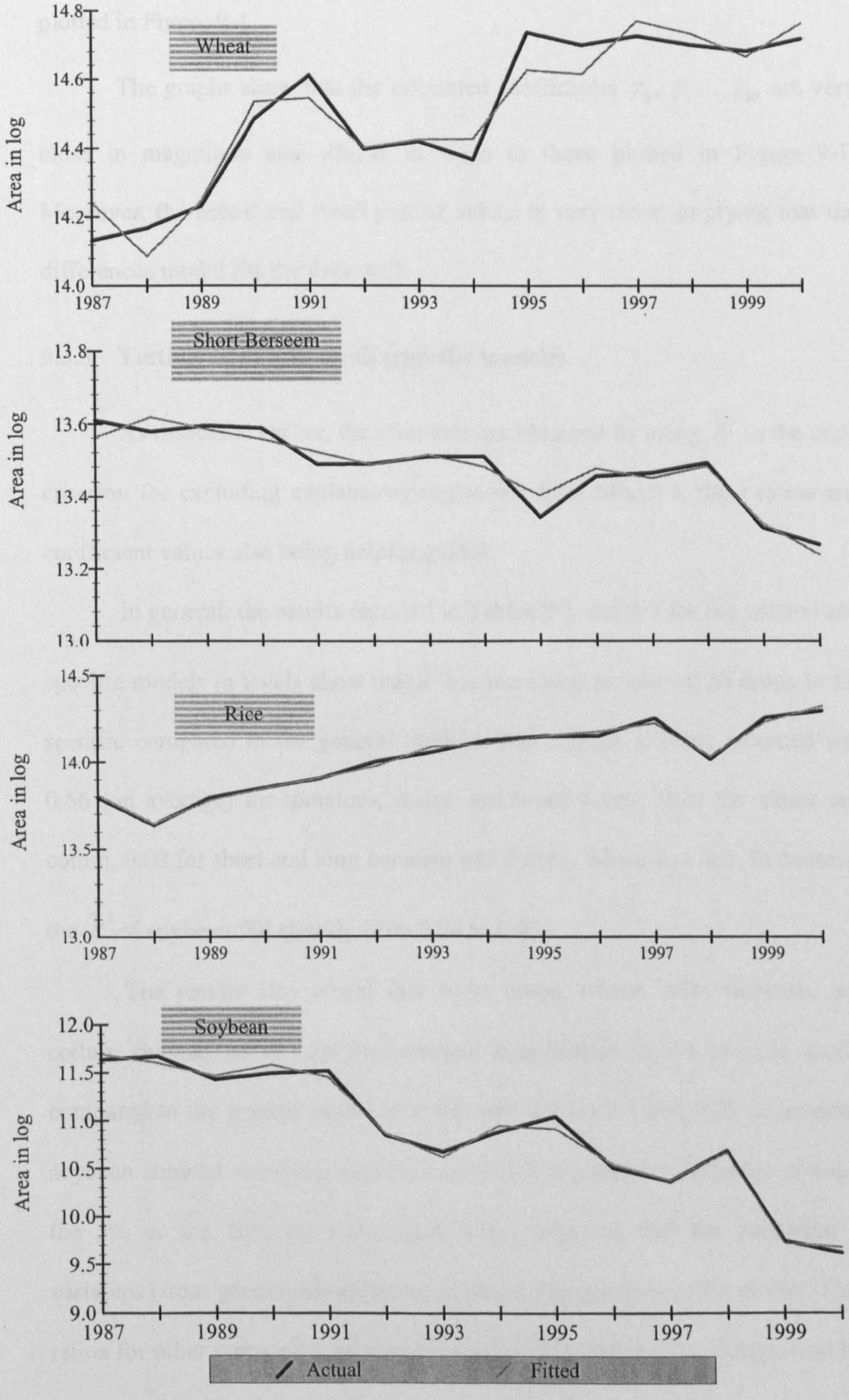


Figure 9-2 shows the actual and fitted values for the first differenced models for wheat, short berseem, rice and soybean, the same crops previously plotted in Figure 9-1.

The graphs show that the estimated coefficients γ_0, $\gamma_1 \ldots \gamma_{10}$ are very close in magnitude and similar in signs to those plotted in Figure 9-1. Moreover, the actual and fitted plot of values is very close, implying that the differences model fits the data well.

9.3.3 Testing models in levels (specific models)

As discussed earlier, these models are obtained by using $\overline{R}^2$ as the main criterion for excluding explanatory regressors from Model I, the *t* ratios and coefficient values also being helpful guides.

In general, the results reported in Tables 9-1 and 9-3 for the general and specific models in levels show that $\overline{R}^2$ has increased for almost all crops in the specific compared to the general models. The highest increase recorded was 0.66 (on average) for tomatoes, maize and broad beans, 0.20 for wheat and cotton, 0.08 for short and long berseem and 0.01for wheat and rice. In contrast, the $\overline{R}^2$ of soybean fell slightly from 0.96 to 0.93.

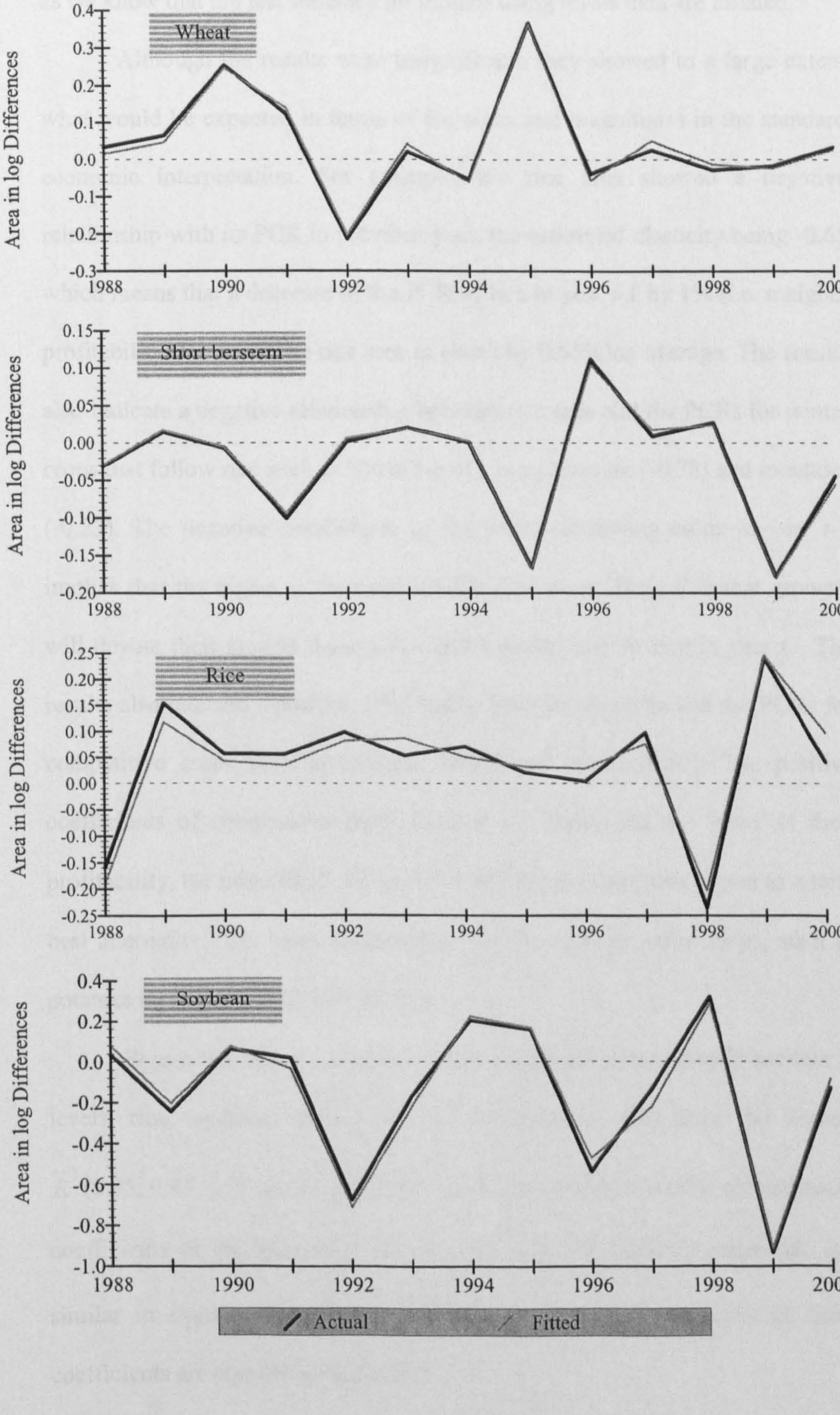
The results also reveal that some crops, wheat, short berseem, and cotton, showed no change in statistical significance in the specific model compared to the general model in levels (see Tables 9-1 and 9-3). In contrast, soybean showed statistical significance for all explanatory variables at either the 5% or the 10% level of significance, implying that the exclusion of variables (from general model) led to a better specification to the model. The *t* ratios for other crops such as tomatoes, maize and potatoes have improved but

TABLE 9-2: AREA MODELLING USING DATA IN FIRST DIFFERENCES FOR MAJOR CROPS IN EGYPT (GENERAL *MODELS*)

Crop	Regressor											R^2	$\bar{R}^2$
	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)		
Wheat	0.26 [0.022]	-2.02 [0.026]	3.01 [0.034]	5.69 [0.050]	0.59 [0.066]	-1.01 [0.040]	0.97 [0.097]	0.77 [0.012]	-4.20 [0.042]	0.09 [0.768]	-.518 [0.031]	0.99	0.93
Short berseem	-0.13 [0.011]	0.58 [0.036]	-1.44 [0.018]	3.62 [0.015]	-0.01 [0.865]	0.32 [0.045]	0.71 [0.023]	-0.33 [0.007]	-2.46 [0.014]	0.44 [0.036]	0.17 [0.032]	0.99	0.97
Long berseem	0.01 [0.731]	0.55 [0.146]	-0.22 [0.640]	0.61 [0.582]	-0.07 [0.595]	0.46 [0.092]	-0.21 [0.465]	-0.02 [0.769]	0.05 [0.948]	-0.48 [0.119]	0.09 [0.321]	0.94	0.64
Rice	-0.06 [0.521]	-0.70 [0.384]	1.67 [0.263]	-2.69 [0.394]	-0.25 [0.498]	-0.51 [0.329]	1.19 [0.192]	0.04 [0.825]	-1.88 [0.381]	0.95 [0.189]	-0.03 [0.886]	0.94	0.65
Tomatoes	-0.01 [0.952]	0.75 [0.616]	0.15 [0.950]	0.23 [0.968]	-0.53 [0.476]	0.07 [0.942]	-0.33 [0.815]	-0.24 [0.537]	-0.36 [0.926]	-0.23 [0.837]	0.04 [0.930]	0.62	-1.3
Maize	0.12 [0.150]	-0.27 [0.618]	-1.67 [0.165]	3.47 [0.192]	0.28 [0.328]	-0.15 [0.655]	-0.95 [0.163]	0.09 [0.524]	2.51 [0.172]	-0.48 [0.300]	-0.16 [0.335]	0.85	0.08
Cotton	-0.08 [.685]	0.23 [.885]	0.95 [.731]	-2.16 [.733]	-0.46 [.565]	-0.05 [.956]	0.70 [.659]	-0.16 [.692]	-1.73 [.687]	0.40 [.748]	0.10 [.816]	0.56	-1.6
Soybean	0.24 [0.179]	-2.41 [0.140]	-5.79 [0.079]	7.88 [0.187]	3.51 [0.018]	-0.87 [0.302]	-2.41 [0.134]	1.12 [0.048]	7.87 [0.100]	-0.60 [0.524]	-0.90 [0.085]	0.98	0.90
Potatoes	0.38 [0.241]	-0.13 [0.954]	-6.97 [0.173]	12.76 [0.239]	1.42 [0.267]	-0.18 [0.895]	-3.14 [0.240]	0.67 [0.308]	8.56 [0.241]	-2.36 [0.258]	-0.74 [0.304]	0.90	0.38
Broad beans	-0.12 [0.715]	1.94 [0.515]	2.12 [0.668]	-6.43 [0.578]	1.15 [0.433]	0.71 [0.691]	1.55 [0.586]	-0.24 [0.737]	-3.81 [0.621]	-1.14 [0.609]	0.42 [0.600]	0.72	-0.7

Source: Tables A31-A35.
Note: Figures in parentheses are probability values.

FIGURE 9-2: ACTUAL AND FITTED VALUES OF AREA IN FIRST DIFFERENCES FOR SOME MAJOR CROPS IN EGYPT (*GENERAL MODEL*).



remain insignificant. However, we have to deal with these results with caution, as we know that the test statistics for models using levels data are inflated.

Although the results were insignificant, they showed to a large extent what would be expected in terms of the signs and magnitudes in the standard economic interpretation. For example, the rice area showed a negative relationship with its PCR in previous year, the estimated elasticity being -0.65 which means that a decrease in the PCR of rice in year t-1 by 1% (i.e. a higher profitability) increases the rice area in year t by 0.65% on average. The results also indicate a negative relationship between rice area and the PCRs for winter crops that follow rice such as wheat (-0.41), long berseem (-0.78) and tomatoes (-0.23). The negative coefficients of the winter following crops in year t-1 implies that the higher is their profitability, the more likely it is that growers will devote their area to those crops and consequently to rice in year t. The results also indicate a positive relationship between rice area and the PCRs for competitive crops such as soybean (0.35) and maize (0.53). The positive coefficients of competitive crops in year t-1 imply that the lower is their profitability, the more likely the growers will devote their area to rice as a next best alternative. The same relationships can be seen for other crops, such as potatoes and tomatoes (see Table 9-3).

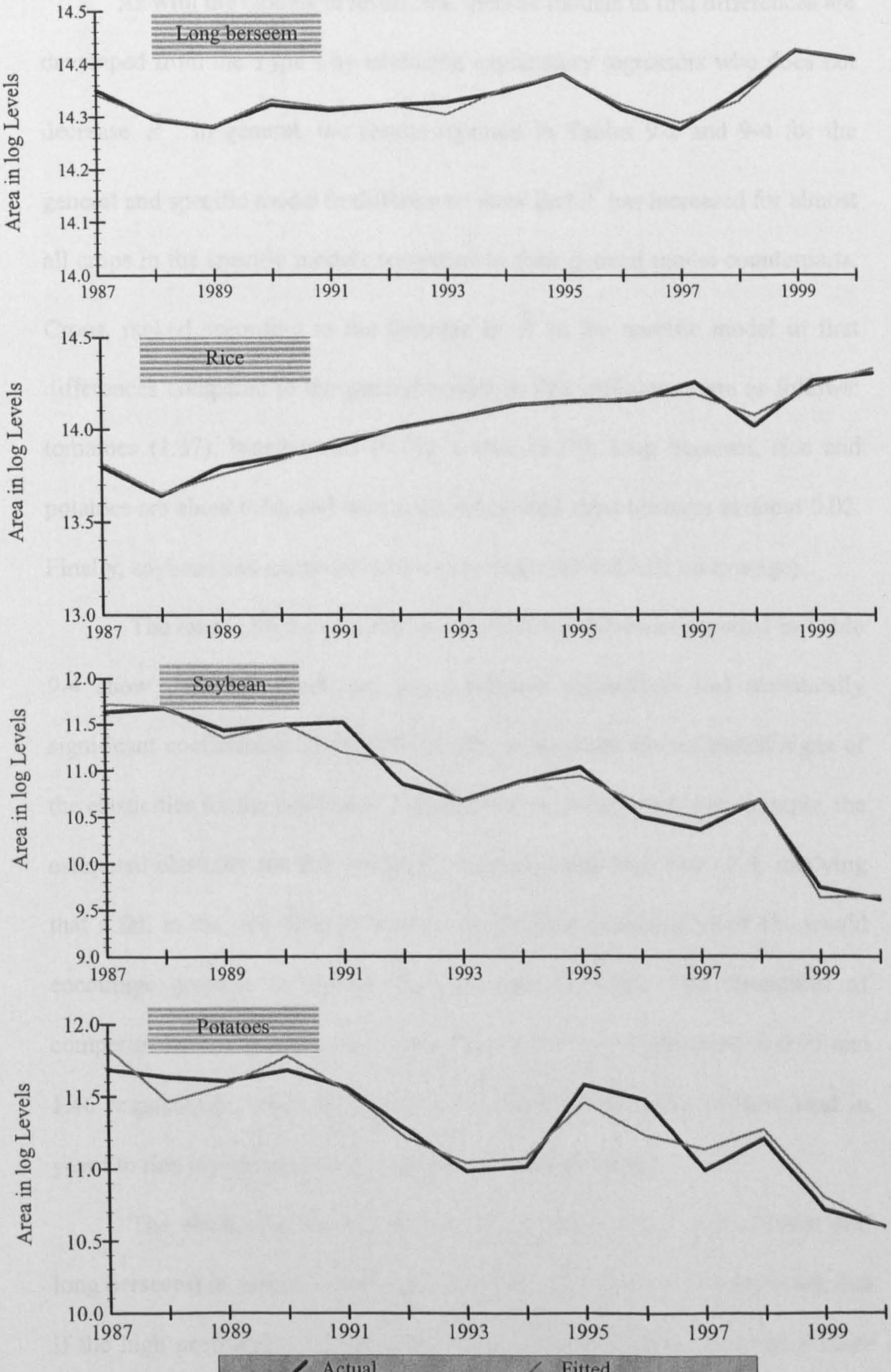
Figure 9-3 shows actual and fitted values for those specific models in levels, rice, soybean, long berseem, and potatoes, that have the highest $\overline{R}^2$ (0.95, 0.93, 0.91 and 0.85 respectively). The graphs show that the estimated coefficients of the regressors $\beta_0, \beta_1 \ldots \beta_{10}$ are very close in magnitude and similar in signs to those plotted in Figure 9-1, but the majority of these coefficients are significant at the 10%.

TABLE 9-3: AREA MODELLING USING DATA IN LEVELS FOR MAJOR CROPS IN EGYPT (*SPECIFIC MODELS*)

Crop	Regressor											R^2	$\bar{R}^2$
	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)		
Wheat	12.7 [.000]	0.10 [.896]	0.75 [0.189]	2.36 [0.145]	0.60 [0.492]	0.14 [0.779]	0.69 [0.377]	0.11 [0.583]	-1.75 [0.017]	-	-0.003 [0.989]	0.89	0.65
Short berseem	13.79 [0.000]	0.04 [0.953]	-0.45 [0.077]	0.44 [0.288]	-	0.04 [0.920]	0.21 [0.506]	-0.09 [0.524]	-0.36 [0.159]	0.07 [0.897]	-0.02 [0.872]	0.92	0.73
Long berseem	15.04 [0.000]	0.47 [0.000]	-	0.06 [0.250]	-	0.41 [0.000]	-	-	-0.23 [0.002]	-0.40 [0.000]	0.09 [0.000]	0.95	0.91
Rice	13.05 [0.000]	-0.41 [0.098]	0.69 [0.001]	-0.78 [0.018]	-	-0.23 [0.174]	0.53 [0.032]	-	-0.65 [0.007]	0.35 [0.102]	-	0.98	0.95
Tomatoes	11.77 [0.000]	0.33 [0.044]	-	0.44 [0.193]	-0.49 [0.100]	-0.25 [0.065]	-0.31 [0.128]	-	-	-	-	0.70	0.50
Maize	14.02 [0.000]		0.17 [0.081]	-0.57 [0.150]	0.40 [0.162]	-	-0.02 [0.859]	-0.08 [0.261]	-0.15 [0.391]	-	-	0.72	0.47
Cotton	12.37 [0.000]	-0.83 [0.374]	-0.14 [0.550]	-	-0.29 [0.446]	-0.68 [0.291]	0.28 [0.450]	0.23 [0.307]	0.16 [0.651]	0.64 [0.426]	-0.15 [0.369]	0.84	0.47
Soybean	13.23 [0.000]		-1.60 [0.001]	-	3.14 [0.001]	-	-	-	2.19 [0.001]	-1.64 [0.005]	-0.55 [0.014]	0.96	0.93
Potatoes	11.76 [0.000]	-	-1.32 [0.000]	-	1.47 [0.006]	-	-	0.51 [0.011]	-	-	-0.35 [0.034]	0.90	0.85
Broad beans	11.85 [0.000]	0.75 [0.175]	0.16 [0.622]	-1.77 [0.102]	0.99 [0.236]	-	-	-0.8 [0.717]	-0.60 [0.172]	-0.65 [0.318	-	0.63	0.20

Source: Tables A31-35.
Note: Figures in parentheses are probability values.

FIGURE 9-3: ACTUAL AND FITTED VALUES OF AREA IN LEVELS FOR SOME MAJOR CROPS IN EGYPT (*SPECIFIC MODEL*).



9.3.4 Testing the specific models in first differences

As with the models in levels, the specific models in first differences are developed from the Type I by exclusion explanatory regressors who does not decrease $\overline{R}^2$. In general, the results reported in Tables 9-2 and 9-4 for the general and specific model in differences show that $\overline{R}^2$ has increased for almost all crops in the specific models compared to their general model counterparts. Crops, ranked according to the increase in $\overline{R}^2$ in the specific model in first differences compared to the general model in first differences are as follows: tomatoes (1.37), broad beans (0.79), cotton (0.70); long berseem, rice and potatoes are about 0.14, and next come wheat and short berseem at about 0.02. Finally, soybean and maize showed a very slight fall (of 0.02 on average).

The results for the specific models in first differences reported in Table 9-4 show that the wheat and short berseem regressions had statistically significant coefficients (at the 10% level). In addition, the estimated signs of the elasticities for the explanatory variables were as expected. For example, the estimated elasticity for the rice PCR in the previous year was –2.4, implying that a fall in the rice PCR in year *t*-1 (i.e. higher profitability) of 1% would encourage growers to expand the rice area by 2.4%. The elasticities of competitive crops (soybean and maize) in year *t*-1 were estimated at 0.95 and 1.46 respectively, implying that growers would divert some of their land in year t to rice if profitability of soybean and maize declined.

The elasticities for its common proceeding winter crops (wheat and long berseem) in year t-1 were estimated to be –0.62 and –3.75, implying that if the high profitability of wheat and long berseem in year *t*-1 became more profitable i.e. then growers would devote more area in year t to grow them, and consequently planting rice (a common summer crop that commonly follows wheat and long berseem) would become more attractive.

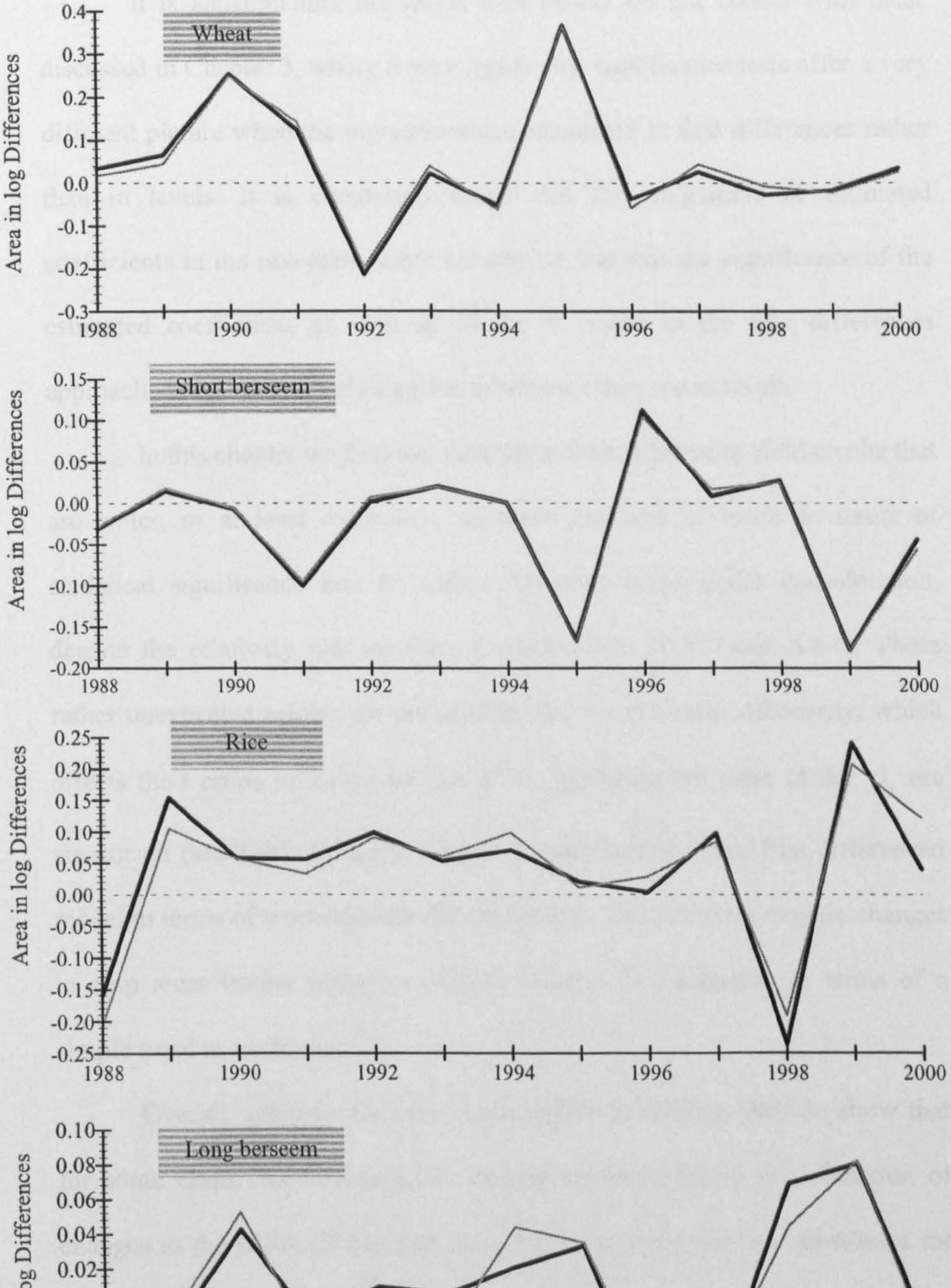
A similar picture can be seen for wheat. In contrast, the elasticities in the cotton and soybean models do not show any major changes compared to those in the first difference general model. The statistical significance of the estimated elasticities for long berseem, tomatoes, maize has improved but they are still not significant (see Table 9-1). Figure 9-4 shows the actual and fitted values for wheat, short berseem, rice and long berseem. The graphs show that the estimated coefficients of the regressors, γ_0, $\gamma_1 \ldots \gamma_{10}$, are very close in magnitude and similar in sign to those plotted in Figure 9-2. But the significance level of these coefficients has improved compared to those in the original model in differences and for some crops (such as wheat) they are statistically significant at the 10% level. Moreover, the actual and fitted plots of values are very close, implying that the differences model is a good fit to the data.

TABLE 9-4: AREA MODELLING USING DATA IN FIRST DIFFERENCES FOR MAJOR CROPS IN EGYPT (*SPECIFIC MODELS*)

Crop	Regressor											R^2	$\bar{R}^2$
	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)		
Wheat	0.27 [0.003]	-1.97 [0.004]	3.11 [0.005]	5.95 [0.007]	0.57 [0.021]	-0.98 [0.007]	1.04 [0.014]	0.76 [0.001]	-4.33 [0.007]	-	-0.52 [0.007]	0.99	0.95
Short berseem	-0.13 [0.001]	0.59 [0.006]	-1.43 [0.003]	3.60 [0.002]	-	0.33 [0.008]	0.70 [0.004]	-0.33 [0.000]	-2.46 [0.002]	0.44 [0.008]	0.17 [0.006]	0.99	0.98
Long berseem	-0.0007 [0.912]	0.47 [0.003]	-	0.01 [0.943]	-	0.39 [0.001]	-	-	-0.27 [0.029]	-0.36 [0.003]	0.08 [0.018]	0.91	0.81
Rice	-0.08 [0.095]	-0.62 [0.036]	2.07 [0.018]	-3.75 [0.039]	-	-0.47 [0.036]	1.46 [0.015]	-	-2.42 [0.031]	0.95 [0.043]	-	0.91	0.78
Tomatoes	0.003 [0.901]	0.21 [0.311]	-	0.33 [0.377]	-0.31 [0.330]	-0.24 [0.205]	-0.31 [0.239]	-	-	-	-	0.45	0.07
Maize	0.03 [.237]	-	-0.32 [.368]	0.31 [.687]	0.25 [.241]	-	-0.30 [.300]	0.04 [.604]	0.35 [.395]	-	-	0.53	0.05
Cotton	-0.08 [.685]	0.23 [.885]	0.95 [.731]	-2.16 [.733]	-0.46 [.565]	-0.05 [.956]	0.70 [.659]	-0.16 [.692]	-1.73 [.687]	0.40 [.748]	0.10 [.816]	0.56	-0.90
Soybean	-0.01 [0.903]	-	-1.65 [0.024]	-	2.82 [0.018]	-	-	-	1.77 [0.052]	-1.04 [0.192]	-0.45 [0.095]	0.65	0.88
Potatoes	0.02 [0.771]	-	-1.49 [0.012]	-	1.36 [0.021]	-	-	0.63 [0.052]	-	-	-0.23 [0.142]	0.90	0.49
Broad beans	0.08 [0.396]	0.73 [0.284]	-0.89 [0.365]	0.46 [0.797]	1.12 [0.181]	-	-	0.01 [0.961]	1.06 [0.381]	-1.47 [0.108]	-	0.62	0.09

Source: Table A9-1.

FIGURE 9-4: ACTUAL AND FITTED VALUES OF AREA IN FIRST DIFFERENCES FOR SOME MAJOR CROPS IN EGYPT (*SPECIFIC MODEL*).



Discussion

It is apparent that the levels data results do not concur with those discussed in Chapter 3, where it was argued that significance tests offer a very different picture when the regressions are conducted in first differences rather than in levels. It is commonly found that the magnitude of estimated coefficients in the two approaches are similar, but that the significance of the estimated coefficients as well as of the R^2 value in the first differences approach are not statistically significant whereas they are in levels.

In this chapter we find that data using first differences yield results that are better, or at least equivalent, to those obtained in levels in terms of statistical significance and R^2 values for most crops under consideration, despite the relatively low number of observations (see Table A9-1). These rather unexpected results are presumably due to: (1) multicollinearity, which affects the t ratios in levels, so that R^2 is significant but none of the β_s are significant (see Table 9-1); (2) the better specification of the first differenced model in terms of working with the explanatory variables that explain changes in crop areas (rather trying to explain changes in production in terms of a simple trend as in chapter 3).

Overall, although the results are subject to caveats, they do show that for some crops the modelling of changes in area planted as a function of changes in the PCRs of the crop in question, of crops that are substitutes for the focus crop, and of crops that are complementary to the focus crop in that they are part of a common rotation, is satisfactory. For such crops, such as short berseem and wheat, the estimated elasticities are significant (although often only at the 10% level) and have the expected sign, so that the economic interpretation is straightforward. However, for other crops, such as cotton and maize, the results are less satisfactory.

9.4 Policy Changes and Prediction of Crop Areas

In this section we attempt to use the specific models (in general and first differences data) constructed in section 9.3 to estimate the expected changes in crop areas under the assumption that the government has decided to charge the growers for irrigation water at its shadow price (see chapter 5).

Charging for irrigation water would obviously increase the PCR for all crops due to the rise in domestic factor costs, i.e. the numerator (cell C in PAM notation) and consequently the PCR value. Thus 60 new PAMs were constructed to cover the period[4] 1995-2000 in order to estimate the impact of policy changes (introducing the water charge) on the PCR value.

Table 9-5 shows the PCR estimates for the main crops during the period 1995-2000 for the base scenario (without the water charge) and the alternative scenario 1 (with the water charge). The over-all picture for scenario 1 estimates concur with what we would expect since the values of PCR coefficients have increased for all crops (with some variations) compared to the base scenario i.e, profitability is lower. For example, broad beans, cotton, soybean and rice are affected the most, profitability (as measured by PCR) is falling by nearly 14%. Next comes wheat, short berseem, maize, long berseem and potatoes by about 10% and finally tomatoes by 5%.

[4] Although the choice of a period or a single year to be the year t-1 is arbitrary, we chose the average for 1995-2000 assuming that this period reflected a more sustainable period of reform besides it represents the latest available.

TABLE 9-5: VALUES OF PCR COEFFICIENTS FOR PRE AND POST WATER CHARGING IN THE PERIOD 1995-2000

		1995	1996	1997	1998	1999	2000	Average
Wheat	*Base Scenario* *	0.53	0.46	0.49	0.63	0.58	0.57	**0.54**
	Scenario 1	0.58	0.59	0.59	0.69	0.63	0.73	**0.64**
Tomatoes	*Base Scenario*	0.27	0.25	0.27	0.33	0.32	0.33	**0.30**
	Scenario 1	0.28	0.26	0.28	0.35	0.34	0.35	**0.31**
Broad beans	*Base Scenario*	0.59	0.55	0.5	0.79	1.05	0.73	**0.70**
	Scenario 1	0.67	0.64	0.59	0.88	1.2	0.84	**0.80**
Short berseem	*Base Scenario*	0.54	0.47	0.46	0.44	0.49	0.46	**0.48**
	Scenario 1	0.59	0.52	0.51	0.49	0.54	0.51	**0.53**
Long berseem	*Base Scenario*	0.46	0.41	0.36	0.42	0.44	0.41	**0.42**
	Scenario 1	0.52	0.46	0.41	0.46	0.49	0.46	**0.47**
Rice	*Base Scenario*	0.44	0.42	0.44	0.55	0.54	0.55	**0.49**
	Scenario 1	0.50	0.48	0.51	0.61	0.61	0.63	**0.56**
Cotton	*Base Scenario*	0.40	0.40	0.43	0.86	0.83	0.80	**0.62**
	Scenario 1	0.45	0.46	0.49	1.00	0.95	0.93	**0.71**
Maize	*Base Scenario*	0.68	0.59	0.51	0.70	0.59	0.59	**0.61**
	Scenario 1	0.75	0.66	0.58	0.77	0.66	0.66	**0.68**
Soybean	*Base Scenario*	0.96	0.82	0.82	1.06	0.98	0.99	**0.94**
	Scenario 1	1.07	0.93	0.94	1.20	1.12	1.15	**1.07**
Potatoes	*Base Scenario*	0.66	0.63	0.62	0.97	0.89	0.93	**0.78**
	Scenario 1	0.71	0.69	0.68	1.05	0.97	1.02	**0.85**

*Source: Table 6-1

9.4.1 Methodology

Four different models are estimated for each crop by using *MicroFIT.4*. The first and second models (using the specific model in levels) aimed to detect the impact of the changes in the PCR on the proportional change in area of crops, in which the first model uses PCR results obtained in the base scenario while the second model uses results obtained in scenario 1. The impact of the changes in the PCR on area is obtained as the difference between the second and first model.

The third and fourth models are estimated (using specific model in first differences) to measure the change in growth rate of area. The third model uses the data of the base scenario (without the water charge) while the fourth model uses the data of scenario 1 (with the water charge). The change in growth rate of area is obtained as the difference between the fourth and third model.

9.4.2 Results

Table 9-6 shows the results for the estimatedf percentage change in area and growth rate in area for major crops, following the introduction of water charges. In general and as might be expected, most of the crops appear to be negatively affected by the new water charge, with a total fall in total crop area of about 660, 000 feddan.

The most affected crops in terms of area are broad beans and wheat, with an expected fall in their areas of nearly 500,000 and 71,000 feddan respectively. Maize and rice are the next most susceptible, their areas falling by 46,000 and 36,000 feddan respectively. Next comes cotton (9,700 feddan), tomatoes (2,800 feddan) soybean (1,900 feddan) and long berseem (63 feddan). In contrast, short berseem and potatoes areas are expected to expand by 5,800 and 670 feddan respectively.

TABLE 9-6: ESTIMATED EFFECT ON THE PROPORTIONAL AND GROWTH RATE CHANGE IN AREA FOR MAJOR CROPS OF WATER CHARGE

Crop	% Change in Area	Area (Feddan)	Change in Growth Rate of Area
Wheat	-20	-499,538	-8.60E-04
Broad beans	-26	-70,778	-1.06E-02
Tomatoes	-2	-2,776	-1.19E-03
Long berseem	-3.E-03	-63	-1.72E-03
Short berseem	1	5,863	1.07E-03
Maize	-3	-46,235	-7.60E-04
Rice	-2	-36,086	-8.89E-03
Cotton	-1	-9,669	-5.10E-04
Soybean	-13	-1,878	-1.06E-02
Potatoes	2	667	4.38E-03
Total		**-660492**	

Source: own calculations.

Crops with an intensive water requirement such as rice (3,500 M^3/feddan) might be expected to show the largest decline in area in response to the water charge, while crops with less water requirement such as wheat (2,500 M^3/feddan) might be expected to be less affected. However, the results show a different picture. This result may be explained through the ability of the sector's net private profitability to cover the cost of water. For example, the net private profitability for rice and wheat (after applying water charge) is estimated at £E 956 and £E 706 per feddan respectively, that might let rice growers are more able to pay for the charge than wheat growers. This explanation could be seen also for other crops such as cotton and maize.

Moreover, the change in growth rate of area results mirror the same results, obtained from the proportional change in area results implying that all crops (except for potatoes and short berseem) have achieved negative growth rates in response to charging for irrigation water.

These results however, with a large 'predicted' total fall in the area planted, are an example of the well-known shortcomings of partial equilibrium analysis when applied to the issue of a general equilibrium reallocation of a resource that is in fixed supply. Our knowledge of the general equilibrium effects of a policy change (for example in the theory of international trade) tells us that a given change will lead to both a reallocation of inputs, and changes in the relative prices of those inputs, such that all resources will be fully employed.

The preceding results should provide the 'basis' for an analysis of the likely changes in the allocation of the full land area between crops. The theory of comparative advantage 'chains' predicts that the production of the good at the top of the chain will increase (since it will be exported) and that production of the good at the bottom of the chain will contract (since it will be imported). However, whether the good next to the top *will* be exported (or whether that next to the bottom *will* be imported) depends on the endogenous changes in the prices of other goods (e.g. through substitution in consumption) and in the prices of other inputs (e.g. through substitution in production).

It would have been preferable to have estimated the system of equations discussed earlier subject to the constraint that the total land area would be planted. Better still would have been to estimate a system of equations which included specifically the unit cost equations, factor demand equations, factor allocation constraints etc that are familiar from general equilibrium modelling. However the shortage of data precluded the first, let alone the second.

Nevertheless, the estimated elasticities of planted areas to changes in the PCRs could in principle be incorporated as parameters in a simultaneous, but not general, computable equilibrium model. Such a model would endogenise changes in prices of goods and factors, some of these being subject to quantity constraints (e.g. total planted area), the others being specified according to exogenous supply/demand functions. If this were done then the policy analysis matrix would become more akin to the social accounting matrix underlying almost all computable general equilibrium modelling. However, where a sequence of 'micro-consistent' PAMs can be constructed, as here, the modeller has an advantage over the CGE modeller in being able to estimate certain parameters that are consistent with the data, as here. Constructing such a model for Egyptian agriculture is the obvious next step.

9.5 Summary and Conclusion

In this Chapter we have estimated the statistical relationships between the PCRs and the planted areas of major crops. This was done for 4 different models, two of which are for general and specific models using data in levels, the other two being for general and specific models using first differenced data. The specific models in levels and first differences were used to indicate the impact of charging for irrigation water on crop areas. Sixty new PAMs were estimated to measure the implications of policy changes on sector competitiveness. An increase in the new PCRs results (scenario 1) is generated for all crops through the negative effect of a new water charge on private profitability. The results obtained from specific models in levels and first differences for measuring the impact of policy changes in crop areas indicated that there is a high response of the change in planted area to water charges.

Chapter X

10 Chapter X: Summary of Conclusions and Recommendations for Egypt's Agricultural Future

10.1 : Introduction.

As discussed in Chapter 2, the Egyptian agricultural sector was severely burdened by unfavourable government intervention policies during the pre-reform period. This era was characterised by government dominance in all activities, both on the input and the output side, through what were known as '*Agricultural Co-operatives*'. Areas for most crops were specified on a regional basis, mandatory delivery quotas were enforced, producer prices were predetermined at levels below world prices, and the bigger enterprises in processing, marketing and trade were state-owned. Moreover, the overvalued exchange rate implicitly taxed agricultural exports and subsidised competing imports.

These policies had a negative effect on the performance of the agricultural sector. The weak performance of the Egyptian economy in general and the agricultural sector in particular, plus the cost of servicing the massive international debt, left the government of Egypt no option other than to seek comprehensive structural reforms.

Many of the policy changes adopted in the reform period affected, directly and/or indirectly, grower's revenues, incomes and profits. The most significant of these were: (1) the elimination the system of predetermined and fixed prices for agricultural products, (although the government did provide voluntary guarantee prices for certain strategic crops from time to time); (2) the removal of crop area controls and compulsory delivery quotas; (3) the elimination of subsidies on inputs such as fertilisers and pesticides; (4) the decontrol of the role of the Principal Bank for Development and Agricultural

Credit (PBDAC) in input and output marketing; (5) reductions in consumer and industrial subsidies; (6)reductions in certain services for farmers, such as agricultural credit at lower interest rates and the provision of machinery; (7) the liberalisation of foreign trade and reductions in non-tariff barriers to imports and exports and a move towards the tariff as the only trade instrument; (8) the unification of exchange rates and the devaluation of the Egyptian currency; (9) reductions in the growth of the money supply and the fiscal deficit; (10) the deregulation of interest rates; (11) the restructuring of public enterprises and their gradual privatisation; (12) giving private investment an opportunity to play an effective role (WTO, 1999).

The agricultural sector was the pioneer in implementing and applying the comprehensive structural reforms that started in 1986. Since then, growers have had the freedom to choose what and how much to grow. They are allowed to buy fertiliser, seeds, pesticides and all other inputs from the private sector (who assumed a greater role in the reform era) at market prices that are much closer to the equivalent world prices (as discussed in Chapter 3).

The aim of this thesis is to examine the impact of agricultural policies on the protection/disprotection (at the farm gate level) on the efficiency of resource allocation and private profitability for the major crops and/or rotations in Egypt from the start of the reform era in 1986 until 2000 (the latest available data). The policy analysis matrix (PAM) approach has been used as a policy tool to accomplish that aim (as discussed in Chapter 4).

The major crops in Egypt are cotton, rice, maize, sugar cane, wheat, broad beans, soybeans, tomatoes, potatoes and Egyptian clover (long and short season berseem). The main crop rotations are: 1- wheat or broad beans followed by any of the summer crops, such as maize, rice, soybean or potatoes; 2- short berseem followed by cotton; 3- long berseem followed by rice, maize or soy bean; 4-tomatoes followed by soybean or maize.

A PAM matrix was constructed for each crop and crop rotation for each year, constituting 375 PAMs, 165 for crops and the remainder for crop rotations. Each PAM allows us to estimate six economic indicators; the private cost ratio (PCR), the domestic resource ratio (DRC), the nominal protection coefficient for outputs (NPCO), the nominal protection coefficient for inputs (NPCI), the profitability coefficient (PC) and the subsidy ratio to producer (SRP). The PAM methodology approach and an illustrative example for soybean in 1986 were illustrated in detail in Chapter 4. Chapter 5 gives a detailed illustration for estimating the PAM entries, such as evaluating the social prices for tradable and non-tradable inputs and factors and the shadow exchange rate (SER). The PAM results are reported and discussed in Chapters 6, 7 and 8.

10.2 : Summary of Conclusions

The volume of production for most major crops (such as wheat, rice and maize) increased remarkably in the reform era, owing to growth in both the planted area and in productivity. Wheat was a remarkably positive example of the high response from farmers to the reformed pricing policies and the elimination of governmental controls (quotas and area restrictions); its area increased by 83%, and its productivity by 60%, so that total production increased from 2.2 million tons in 1986-89 to 6.4 million tons in 1995-2000. In contrast, crops such as cotton, potatoes and soybean showed a remarkable decrease in their volumes of production. For example, cotton production fell decrease in their volumes of production. For example, cotton production fell by 27% in effect due to declines of its planted area and productivity of 22% and 6% respectively; many farmers chose not to grow cotton (after the elimination of governmental controls and penalties) because of market price uncertainty.

The costs of land, fertiliser and pesticides (as a percentage of total cost) showed a gradual increase during the reform era as a result of the freeing of land rents and the elimination of input subsidies. For example, the cost of land rent, fertiliser and pesticides for cotton increased from 13%, 5% and 2% in 1986-89 to about 34%, 9% and 3% respectively in 1996-2000.

Agricultural profitability increased during the reform period for most crops at various rates. For example, wheat profitability almost doubled (in real terms), which encouraged its area expansion (as noted earlier). In contrast, soybean profitability fell by an estimated 80% throughout the reform period.

The private cost ratio (PCR), a measure of private profitability, has been estimated for the major agricultural commodities by dividing the costs of domestic factors valued at private prices (C) by the difference between revenues and the costs of tradable inputs valued at private prices (A-B). Generally, the results reveal that the PCR increased over time for most crops, owing largely to the increase in domestic factor costs (mainly land rent), and the domestic cost of tradable inputs (such as chemical fertilisers). The results also indicate that tomatoes had the lowest PCR (0.29) while soybean had the highest PCR value (0.94) during the period 1995-200, implying that the first was the most privately profitable whereas the latter was the least privately profitable crop.

The PCR results for crop rotations indicated that tomatoes followed by maize was the most preferable rotation, with the lowest PCR (0.36), while broad beans followed by soybean was the least preferable, with the highest PCR (0.79).

Net private profitability (NPP) was estimated for the major crops by subtracting the costs of tradable and domestic inputs from total revenues, all valued at private prices. The results reveal a rise in NPP over time for most products, and there was an inverse relationship between the net private profitability (NPP) and the PCR; that is, the higher the NPP, the lower the value of the PCR coefficient, and vice versa.

The domestic resource cost (DRC), a measure of the comparative advantage of agricultural commodities during the period 1986-2000, was estimated by dividing the costs of domestic factors valued at social prices by the difference between revenues and costs of tradable inputs valued at social prices. Potatoes, tomatoes, rice and wheat showed a favourable comparative advantage during the period 1995-2000, implying that their production should have been extended. For maize and broad beans the estimates indicated a neutral comparative advantage. Cotton, soybean and sugar cane showed a distinct comparative disadvantage.

The DRC estimates for crop rotations indicate that broad beans followed by soybeans and short berseem followed by cotton had a comparative disadvantage, with DRCs greater than one. In contrast, wheat followed by potatoes indicated the highest comparative advantage, with the lowest DRC of 0.69, and then, as a group, broad beans followed by potatoes, tomatoes followed by maize, tomatoes followed by soybeans, long berseem followed by rice, wheat followed by rice, all at about 0.76. Next came broad beans followed by rice, and long berseem followed by maize (0.87). Finally, wheat followed by maize and long berseem followed by soybean (0.94).

The net social profitability (NSP) was estimated as total revenues minus tradable and domestic costs of production, all valued at social prices. The results reveal that the NSPs for cotton and sugar cane were extremely negative, implying a comparative disadvantage and thus that the existing level of output was uneconomic.

The social cost benefit ratio (SCB) was estimated for major crops as another alternative for the DRC, and was calculated by dividing traded and non-traded total revenue, all valued at social prices. The SCB results mirror the results obtained by the DRCs, implying that the government should have reviewed its policy for cotton, sugar cane and soybean as they suffered low levels of competitiveness.

The nominal protection coefficients for major agricultural crops (NPCO) were estimated by comparing the output value at private prices with its equivalent value at world prices (at the farm gate level). The results reveal that the producers of export commodities were notably taxed when compared to those for import products over each of the three distinct periods 1986-89, 1990-94 and 1995-2000, by about 21%, 12% and 11% respectively. The NPCO results for 1995-2000 imply that sugar cane, cotton and rice should be categorised as subsidised products, while wheat producers are almost getting the equivalent world price. In contrast, all the remaining products were taxed, at different levels, the most highly taxed being potatoes and tomatoes.

The NPCO results for crop rotations indicated that 79% of rotations were taxed, the most taxed being wheat or broad beans followed by potatoes, with an NPCO of 0.68.

Nominal protection coefficients for tradable inputs (NPCI) were estimated by comparing tradable costs valued at private prices with their values at the equivalent world price (at farm gate level). The principal result was that the tradable inputs supplied to producers were subsidised throughout the period 1986-2000 for all crops and crop rotations. There was a gradual increase in NPCIs over time for all crops and crop rotations, suggesting that the level of protection or input subsidy was falling over time. This fall was mainly a direct result of the government policy introduced in the reform era, the gradual elimination of input subsidies and the move to a free market.

The NPCI results for crop rotations indicate that tradable inputs provided for all rotations were subsidised. The lowest subsidy was for wheat followed by maize or potatoes, and the highest for broad beans followed by soybean.

Estimates of the effective protection coefficient (EPC), which estimates the effects of governmental policies on both tradable input costs and output prices, show a similar picture to the nominal protection coefficient, specifically:

- Sugar cane, rice and cotton all had positive effective protection, while maize, soybean, broad beans, tomatoes and potatoes were subject to negative effective protection;

- Export crops (on average) had EPCs less than one over the period 1986-2000, thus implying potential disincentives, while import crops (on average) were subsidised (i.e. had EPCs greater than one);
- The Egyptian pricing policy in the reform era still encouraged domestic production of import products by setting their prices above parity prices, while export products were taxed relative to their equivalent world prices.

The consistency between the nominal and effective protection results indicates that the policies affecting the prices of agricultural products are the main factor in effective protection.

The EPC results for crop rotations confirms those obtained from the NPCO analysis, i.e. that wheat or broad beans followed by potatoes had the most negative protection (tax) while other rotations were subsidised. Short berseem followed by cotton enjoys the highest positive protection (subsidy).

The rankings of agricultural products according to the NPCO or the EPC do not differ from each other, presumably because the component of traded inputs in agricultural production is a relatively small proportion of the value of outputs.

The comparative advantage and protection results for sugar cane and cotton indicate that the government incentive polices were equivocal and in direct opposition to the attainment of economic efficiency. According to the NPCO and EPC results, those products that received the highest levels of subsidy were those with a clear comparative disadvantage, having DRCs of 1.33 and 1.22 respectively. On the other hand, products with a high comparative advantage, such as potatoes and tomatoes, were highly taxed, with NPCOs of 0.60 and 0.83 and EPCs of 0.44 and 0.85 respectively. This conflict in pricing policies was presumably because the government of Egypt sought to guarantee cotton and sugar cane growers a suitable return (as they were considered strategic crops), regardless of the fluctuations in output price that accompanied their operation in a free market.

The subsidy ratio to producer (SRP) was estimated for major crops and crop rotations. The results reveal that the SRPs coefficients for import commodities were higher than those for exports throughout the period 1986-2000, indicating that import commodities are more protected (subsidised) than export commodities. These results confirm the NPCO and EPC results obtained earlier. The average estimated SRPs for the period 1995-2000 reveal that sugar cane, cotton and fodder crops had the highest SRPs, implying that policy divergences had increased the gross revenues for these sectors by nearly 60%, 55% and 43% respectively. In contrast, potatoes showed a negative SRP (-0.20) implying that divergences had reduces its gross revenues by about one-fifth.

As noted above, most of the positively protected (subsidised) products were import competing, while those negatively protected (taxed) were export crops. This indicates that incentives were aimed as import substitution.

The results obtained from specific models in levels and first differences for measuring the impact of policy changes in crop areas indicated that there is a high response of change in planted area to water charges with an expected fall in the planted areas for the majority of the crops under investigation.

10.3 Recommendations for Egypt's Agricultural Future

There are numerous macroeconomic, trade, management, privatisation, and agricultural sector policies that should be continually monitored and adjusted to the realities of a market economy. Hereby, we make some recommendations that would benefit the Egyptian agribusiness.

1. *Privatisation, Efficiency and Agribusiness*[1]

Promoting private management and private investment in agri-industries: That is, in activities such as cotton ginning, spinning and weaving, rice marketing and processing and fertiliser manufacturing and marketing. Economic studies[2] carried out during the period 1994-96 revealed that these agri-industries suffer gross inefficiencies in public sector enterprises compared to private sector firms in similar operations, so that privatising their management and investment may be expected to yield gross savings in marketing and processing costs. For example, Egyptian rice production amounted to 4.2 million tons in 1993, 2.4 million tons of which was sold to private sector merchants, 1.2 million tons was consumed on farm, 0.3 million tons was sold to public holding companies and 0.3 million tons was traded for production input. Only 12% of the 2.4 million tons sold to private sector was milled by public mills. There are about 1971 rice mills in Egypt. The 52 public and 37 commercial mills, with annual capacity 2.2 million-tons and 98,000 tons respectively accounts for 89% of total paddy milling capacity. The remaining (1882 mill) are village mills with an annual capacity 287,000 ton of

[1] Farmers and the firms that provide inputs to farmers, as well as those firms that buy, process, market and sell commodities in the food and fibre system, are called agribusiness.
[2] For more information refer to Khedr et.al., 1996.

paddy. Public mills received a total of 550,000 ton of paddy[3] which amounts only one-quarter of the rated capacity, with a total milling cost was £E 253/ton. There was a potential saving of £E 143/ ton if those public mills had been operated with organised and efficient management; at 87.5% capacity, the milling cost is only £E110/ton, saving the sector about £E 79 million per annum. In 1994, the results of a sample for private commercial rice mills showed and average cost for white rice milling of about only £E 27/ton (about 18.5% of the 87.5% capacity costs for public mills). Thus another £E 64 million per year could have been saved at full capacity. This example indicates that increasing the utilised capacity and more efficient management might have saved the sector about £E 143 million per year.

Another striking example may be seen in the cotton sector. There are 27 companies in the spinning sector in Egypt (25 of which are owned and managed by the public sector while the reminders are privately operated), spinning around 942,000 ton of raw cotton per year at an average cost about £E 3752 per ton. Assessments of efficiency measures in the spinning operation have revealed that public mills are operating at 20%-25% less than the global average efficiency. Thus there may be scope of saving £E 707 million per annum if operating efficiency in public mills rose by 20%. Furthermore, studies have shown that achieving global rates of efficiency in weaving, by both improving the management and introducing competitive conditions in ginning could save the economy £E 302 million and £E 60 million per annum respectively for a crop of 942,000 ton. Similar possible

[3] 61% of which was purchased directly, while the reminder (39%) was custom milled for the private sector.

reductions have been estimated for the costs of fertiliser production and distribution, £E 750 million and £E 60 million per annum respectively.

It appears that, privately owned companies are better equipped to manage agribusiness effectively and efficiently. Thus, privatising the management of public-sector firms should be accelerated as fast as possible. Or at least, public-sector managers who have worked mostly in state owned enterprises under bureaucratic conditions (in the past) should be trained to meet competitive market challenges.

2. *Rational use of irrigated water*:

Recent water studies[4] reveal that there is a pressing need to use scarce resources, especially water, more efficiently. In other words, in the absence of appropriate water pricing or allocation policies, farmers will not consider the full opportunity costs or scarcity values of water.

For example, farmers in the Nile Delta have little incentive to consider the opportunity cost of water in municipal and industrial uses if their only expense for water is the cost of pumping it from a below grade tertiary canal. Theoretically, allocating irrigation water using a rationing system based on differential cost allocation may create savings in the agricultural sector. Irrigation studies reveal that about 20% of water could be saved by investment in canal–level improvement (which would be adopted more willingly if water had a cost to farmers). This percentage could amount about £E 440 million per year[5]. Moreover, there is a need to introduce and develop a plan for new water

[4] See for example, Abo-Saad, 1998; Kotb et.al., 2000; and Wichelns 2002.
[5] At a shadow price of water of 0.056/cu. meter.

saving irrigation systems (such as drip rather than flood furrows irrigation system) especially in the New Lands.

3. *New Land Reclamation*:

It is crucial for Egypt to encourage the private sector to invest in and pursue the New Land reclamation programme, as the ratio between the arable land in the Nile Valley and the population is relatively very small[6]. In particular, studies[7] have shown that the potential increase in productivity in the Old Land exceeds or matches that from the reclamation of new lands in desert areas outside the Nile Valley. At the same time Egypt should place more emphasis on higher value, export oriented crop production in future agricultural development.

Moreover, efforts to develop new production areas, such as northern Sinai and the southern desert must be evaluated with regard to: (1) the competing demands for limited scarce resources, such as capital and water supplies, and (2) the urgent need to employ more new workers in the future to reduce unemployment (Abo- Saad, 1996; World Bank, 1998; Handoussa and Kheir EL-Din, 1998).

4. *Market News and Information*

The government of Egypt should take serious steps toward restructuring the market news and information sector, to overcome the severe lack in the availability of relevant information in the agricultural sector. The availability of market information to all participants would be a way to

[6] The arable land per person (in hectares) during the last decade is about 0.05 in Egypt while it accounts 0.32 for France and 0.11for the U.K.
[7] See, for example, Nassar et al., 1996.

maintain production incentives and reduce the impact of risk and uncertainty. Only very basic farm level data and crop budgets are collected annually and published in '*Agricultural Economics Bulletin*' (produced by the under-secretariat of Agricultural Economics); these data are based on monetary values, and do not give a breakdown of the cost into quantities and prices. It is recommended that a farm data handbook be produced for all agricultural crops on a regional basis. As seasonal analysis is crucial in agricultural studies, the data handbook should assess monthly data as well. A previous analysis of sub-sector studies[8] recommended that the Egyptian agri-business urgently needs easy access to decision-making information on domestic production, imports, existing stocks, consumption patterns and prices as well as on international markets, at least for their major export markets or input supply markets. Such information should be as accurate as possible, regularly updated, credible and available to all market participants. Moreover, the market news service should be developed and extended to include the gathering, analysis, interpretation and dissemination of news. Furthermore, there is a need to provide appropriate training programmes to complement this effort.

10.4 Suggestion For Further Research

The analysis presented in this thesis has covered the impact of agricultural policy reforms on major crops at the farm gate level only. Further research is needed to investigate other different levels of the commodity system i.e. farm to processor level, processing level, processor to wholesale market level. A commodity may be produced efficiently at the farm level but

[8] See Harrison, 1996.

have may be inefficiencies in transport, marketing and/or processing that reduce value added.

Appendixes

Appendix 2

TABLE A2-1: LIVESTOCK PRODUCTION INDEX IN EGYPT DRUING THE PERIOD (1990-2000)

(1989-91 = 100)

Year	Production Index
1961	42
1962	44
1963	43
1964	44
1965	45
1966	46
1967	48
1968	57
1969	57
1970	57
1971	59
1972	60
1973	60
1974	62
1975	63
1976	64
1977	65
1978	66
1979	66
1980	67
1981	69
1982	73
1983	77
1984	80
1985	85
1986	89
1987	93
1988	97
1989	97
1990	98
1991	105
1992	108
1993	112
1994	117
1995	123
1996	136
1997	155
1998	157
1999	162
2000	160

Source: World Development Indicators CD-ROM 2002, The World Bank.

TABLE A2-1: GEOGRAPHICAL DISTRIBUTION OF EGYPTIAN IMPORTS AND EXPORTS (1990-2000)

	Imports		Exports	
	1990	**2000**	**1990**	**2000**
Arab World	**187.0**	**1453.9**	**268.4**	**600.0**
ESCWA	137.9	1291.6	193.9	449.7
Europe	**5241.1**	**6158.4**	**1601.9**	**1889.5**
EU	3861.2	4760.2	991.7	1837.0
America*	**1637.2**	**2618**	**247.6**	**455.9**
USA	1298.7	2087.8	221.6	404.4
Canada	66.7	84.2	6.4	10.7
Asia*	**1195.3**	**2451.2**	**421.9**	**903.9**
Japan	342.4	427.7	70.2	93.8
India	68.5	229.4	1.9	156.2
Africa	**69.1**	**150.5**	**3.2**	**49.1**
Oceania	**455.5**	**511.2**	**1.1**	**3.0**
Not specified	**417.3**	**619.5**	**33.9**	**805.1**
Total ($ Mn)	***9202.5***	***13963.7***	***2578.0***	***4706.5***

*Note: Components may not sum 100 percent because of unclassified trade.
Source: ESCWA 2002

TABLE A2-2: AREA OF MAJOR FIELD CROPS DURING 1980-2000

(FEDDAN)

Crop	Wheat	Broad Beans	Long Berseem	Short Berseem	Winter Tomato	Maize	Rice	Cotton	Potatoes	Sugar	Soybean
1980	1,326,179	244,746	1,721,655	989,792	135,920	1,432,727	970,096	1,244526	82,779	254,001	82,767
1981	1,399,595	237,731	1,756,343	1,022,015	138,155	1,434,341	954,142	1,178420	85,183	251,011	109,420
1982	1,373,613	274,091	1,790,631	914,479	136,696	1,451,846	1,023,956	1,065841	84,382	254,010	144,355
1983	1,320,045	289,530	1,866,461	870,258	133,375	1,396,630	1,011,266	998,277	74,226	249,005	147,155
1984	1,178,372	270,857	1,971,967	834,971	144,550	1,449,037	983,458	983,560	86,092	244,004	124,535
1985	1,185,923	284,712	1,922,634	917,815	145,930	1,396,150	923,971	1,081,009	96,167	250,001	119,048
1986	1,206,346	270,205	1,865,692	870,281	156,644	1,122,129	1,007,794	1,054,860	92,484	262,004	109,705
1987	1,373,009	286,308	1,707,255	814,366	166,826	1,352,730	981,060	979,793	118,916	268,001	113,241
1988	1,421,719	362,825	1,614,393	789,782	164,082	1,480,018	837,050	1,013,960	112,865	275,006	117,397
1989	1,517,719	325,819	1,591,174	801,664	176,382	1,533,354	977,144	1,005,533	110,184	274,004	92,319
1990	1,954,696	344,643	1,660,333	796,209	158,273	1,545,556	1,034,830	993,047	119,014	263,007	98,523
1991	2,215,070	326,082	1,643,192	720,161	143,662	1,675,262	1,094,608	851,283	105,240	267,008	100,718
1992	1,788,480	382,045	1,659,374	721,090	156,309	1,642,111	1,209,141	840,296	78,947	271,004	51,475
1993	1,829,212	220,098	1,668,846	735,861	154,251	1,593,684	1,276,295	800,310	59,035	278,001	43,294
1994	1,737,542	286,688	1,704,571	736,314	133,089	1,669,282	1,371,017	721,443	60,924	301,006	52,983
1995	2,511,814	294,662	1,762,352	623,580	144,705	1,751,379	1,400,020	710,207	106,614	306,005	62,012
1996	2,420,918	329,329	1,649,571	697,458	167,376	1,768,259	1,405,268	921,012	96,113	300,010	36,215
1997	2,486,131	355,010	1,586,206	703,947	154,770	1,636,014	1,549,872	859,006	59,240	291,014	31,519
1998	2,421,131	384,911	1,699,627	723,422	163,662	1,697,529	1,224,955	788,812	73,473	291,464	43,366
1999	2,379,450	318,579	1,842,144	605,329	155,520	1,560,957	1,559,095	780,800	44,966	307,257	17,053
2000	2,463,265	270,524	1,810,387	578,928	177,225	1,612,340	1,624,255	775,522	40,243	319,023	15,023

Calculated from data obtained from Agricultural Statistics Bulletin, Ministry of Agriculture and Land Reclamation, Statistics Unit, Several issues.

TABLE A2-3: YIELD PER FEDDAN OF MAJOR CROPS 1980-2000

(TON PER FEDDAN)

Crop	Wheat	Broad Beans	Long Berseem	Short Berseem	Winter Tomato	Maize	Rice	Cotton	Potatoes	Sugar	Soybean
1980	1.35	0.87	23.64	9.06	6.12	1.84	2.46	1.13	7.04	34.48	1.12
1981	1.38	0.88	23.68	9.19	6.13	1.86	2.34	1.12	7.05	35.24	1.19
1982	1.47	0.94	24.17	8.83	7.40	1.87	2.38	1.13	7.37	34.50	1.15
1983	1.51	1.01	24.14	8.76	7.41	1.96	2.41	1.06	7.80	33.68	1.10
1984	1.54	1.00	24.01	9.85	8.63	2.02	2.27	1.07	7.69	37.57	1.15
1985	1.58	1.06	24.61	9.93	9.12	2.08	2.50	1.07	8.07	38.97	1.17
1986	1.60	1.04	24.50	9.25	10.95	2.02	2.43	1.03	8.30	41.78	1.22
1987	1.98	1.13	24.50	9.42	11.58	2.15	2.45	0.97	9.13	40.33	1.18
1988	1.99	1.00	25.75	10.13	10.55	2.28	2.55	0.84	8.91	40.74	1.10
1989	2.08	1.23	26.20	9.42	8.86	2.44	2.72	0.79	9.01	40.61	0.99
1990	2.30	1.23	26.00	9.75	9.41	2.61	3.06	0.82	7.54	42.16	1.08
1991	2.13	0.96	26.00	10.70	11.08	2.62	3.14	0.92	7.59	43.55	1.19
1992	2.37	0.91	25.50	10.50	10.28	2.66	3.18	1.13	7.80	43.75	1.17
1993	2.43	1.10	26.00	10.50	12.48	2.70	3.25	1.22	6.56	44.92	1.16
1994	2.34	0.97	25.55	11.00	17.06	2.81	3.33	0.94	8.07	46.04	1.23
1995	2.46	1.28	25.75	11.30	16.40	2.62	3.43	0.90	8.43	46.18	1.04
1996	2.56	1.32	25.47	11.67	16.78	2.93	3.49	0.98	8.10	46.73	1.11
1997	2.35	1.33	25.80	10.89	15.85	3.19	3.54	1.07	8.64	47.90	1.11
1998	2.66	1.36	26.99	11.86	16.36	3.23	3.64	0.79	8.09	49.50	1.11
1999	2.81	0.95	27.90	12.50	16.59	3.32	3.74	0.96	8.12	47.14	1.11
2000	2.80	1.29	28.56	12.34	16.41	3.30	3.76	0.98	8.15	48.90	1.13

Calculated from data obtained from Agricultural Statistics Bulletin, Ministry of Agriculture and Land Reclamation, Statistics Unit, Several issues.

TABLE A2-4: TOTAL PRODUCTION OF MAJOR CROPS IN 1980-2000

(TON)

Crop	Wheat	Broad Beans	Long Berssem	Short Berssem	Winter Tomato	Maize	Rice	Cotton	Potatoes	Sugar	Soybean
1980	1,790,342	212,929	40,699,924	8,967,516	831,830	2,636,218	2,386,436	1,406,314	582,764	8,757,954	92,699
1981	1,931,441	209,203	41,590,202	9,392,318	846,890	2,667,874	2,232,692	1,319,830	600,540	8,845,628	130,210
1982	2,019,211	257,646	43,279,551	8,074,850	1,011,550	2,714,952	2,437,015	1,204,400	621,895	8,763,345	166,008
1983	1,993,268	292,425	45,056,369	7,623,460	988,309	2,737,395	2,437,151	1,058,174	578,963	8,386,488	161,871
1984	1,814,693	270,857	47,346,928	8,224,464	1,247,467	2,927,055	2,232,450	1,052,409	662,047	9,167,230	143,215
1985	1,873,758	301,795	47,316,023	9,113,903	1,330,882	2,903,992	2,309,928	1,156,680	776,068	9,742,539	139,286
1986	1,930,154	281,013	45,709,454	8,050,099	1,715,252	2,266,701	2,448,939	1,086,506	767,617	10,946,527	133,840
1987	2,718,558	323,528	41,827,748	7,671,328	1,931,845	2,908,370	2,403,597	950,399	1,085,703	10,808,480	133,624
1988	2,829,221	362,825	41,570,620	8,000,492	1,731,065	3,374,441	2,134,478	851,726	1,005,627	11,203,744	129,137
1989	3,156,856	400,757	41,688,759	7,551,675	1,562,745	3,741,384	2,657,832	794,371	992,758	11,127,302	91,396
1990	4,495,801	423,911	43,168,658	7,763,038	1,489,349	4,033,901	3,166,580	814,299	897,366	11,088,375	106,405
1991	4,718,099	313,039	42,722,992	7,705,723	1,591,775	4,389,186	3,437,069	783,180	798,772	11,628,198	119,854
1992	4,238,698	347,661	42,314,037	7,571,445	1,606,857	4,368,015	3,845,068	949,534	615,787	11,856,425	60,226
1993	4,444,985	242,108	43,389,996	7,726,541	1,925,052	4,302,947	4,147,959	976,378	387,270	12,487,805	50,221
1994	4,065,848	278,087	43,551,789	8,099,454	2,270,498	4,690,682	4,565,487	678,156	491,657	13,858,316	65,169
1995	6,179,062	377,167	45,380,564	7,046,454	2,373,162	4,588,613	4,802,069	639,186	898,756	14,131,311	64,492
1996	6,197,550	434,714	42,014,573	8,139,335	2,808,569	5,180,999	4,904,385	902,592	778,515	14,019,467	40,199
1997	5,842,408	472,163	40,924,115	7,665,983	2,453,105	5,218,885	5,486,547	919,136	511,834	13,939,571	34,986
1998	6,440,208	523,479	45,872,933	8,579,785	2,677,510	5,483,019	4,458,836	623,161	594,397	14,427,468	48,136
1999	6,686,255	302,650	51,395,818	7,566,613	2,580,077	5,182,377	5,831,015	749,568	365,124	14,484,095	18,929
2000	6,897,142	348,976	51,704,653	7,143,972	2,908,262	5,320,722	6,107,199	760,012	327,980	15,600,225	16,976

Calculated from data obtained from Agricultural Statistics Bulletin, Ministry of Agriculture and Land Reclamation, Statistics Unit, Several issues.

TABLE A2-5: FARM GATE PRICES OF MAJOR CROPS IN 1980-2000

(LE/TON)

Crop	Wheat	Broad Beans	Long Berssem	Short Berssem	Winter Tomato	Maize	Rice	Cotton	Potatoes	Sugar	Soybean
1980	88.00	199.10	9.87	9.87	86.50	122.90	81.29	299.68	79.61	9.60	210.00
1981	91.80	234.71	12.03	12.03	103.57	93.90	98.80	362.48	84.50	14.90	230.00
1982	81.73	240.13	14.20	14.20	113.36	124.90	130.12	380.70	79.08	15.50	260.00
1983	109.93	251.29	16.82	16.82	132.00	167.60	130.25	413.52	110.00	18.20	260.00
1984	124.33	277.48	17.46	17.46	150.00	172.80	130.56	470.10	131.00	20.20	285.00
1985	171.73	318.06	19.35	19.35	176.30	194.30	211.50	614.98	131.08	27.20	285.00
1986	225.00	459.64	21.91	29.01	194.65	219.47	247.25	617.73	147.94	30.50	375.00
1987	220.59	550.00	34.46	44.81	200.27	255.35	206.00	725.86	135.00	34.00	425.00
1988	237.40	554.02	29.51	37.51	247.58	324.57	256.50	913.96	196.23	38.00	500.00
1989	436.57	579.90	29.67	41.27	256.00	405.13	362.00	1284.05	275.00	50.00	800.00
1990	473.84	694.10	37.23	49.60	327.74	427.86	376.00	1669.14	290.21	58.00	800.00
1991	499.90	883.12	43.38	52.70	395.18	441.57	435.80	2026.90	353.71	58.00	850.00
1992	506.31	956.30	49.72	59.00	330.00	443.09	475.20	2061.00	398.94	58.20	840.00
1993	535.00	1005.80	63.12	73.30	287.00	457.77	504.24	2366.60	473.70	72.50	800.00
1994	535.00	1005.80	63.12	73.30	253.10	477.82	605.40	2071.59	585.70	81.00	875.00
1995	562.30	1050.40	70.83	80.70	352.91	512.55	655.80	3455.55	402.10	90.00	1050.00
1996	640.40	1116.03	85.20	93.00	372.30	537.03	702.17	3266.73	423.20	90.00	1050.00
1997	665.00	1227.80	95.96	113.68	389.13	550.25	717.89	3005.98	434.73	95.00	1050.00
1998	681.40	1248.90	106.30	120.90	387.80	579.59	723.83	2230.25	411.70	100.00	1050.00
1999	690.60	1258.30	108.62	121.21	395.10	606.41	729.80	2206.04	414.80	95.00	1050.00
2000	695.00	1262.24	113.72	131.60	390.50	645.49	745.60	2250.60	420.00	100.00	1075.00

Calculated from data obtained from Agricultural Statistics Bulletin, Ministry of Agriculture and Land Reclamation, Statistics Unit, Several issues

Appendix Chapter 3

TABLE A3-1: AGRICULTURAL POLICIES BEFORE AND AFTER POLICY REFORMS

Crop/Policy	Before Policy Reform (1981-86)	After Policy Reform (1987-94)
A. Minor Crops	♦ Eight minor crops were affected by various degrees of quotas, price controls, marketing controls, input subsidies, and exchange rate and trade controls during 1981-86. These crops were broad beans, lentils, sesame, ground nuts, onions, garlic, soybeans and potatoes. ♦ Neither acreage restrictions nor delivery quotas were applied to these eight crops during 1981-86. Government procurement prices were in effect but delivery was not obligatory. Intergovernmental transport was restricted and would have had some impact on geographical price pattern and efficiency distribution by areas.	♦ All crop area, quota and price restrictions were eliminated by 1987, except that floor prices were introduced. Marketing restrictions were eliminated in 1987, except for rice, cotton and sugarcane.
B. Wheat and Maize	♦ Area restrictions were imposed on wheat but not maize. Quota and fixed procurement price applied but only nominally to maize and to less than 10% of wheat procured. Real farm gate prices increased 52% for wheat and 45% for maize from 1981 to 1986. Farm gate prices averaged 85% of world price for maize and 80% for wheat, from 1984 to 1986. ♦ Marketing, processing and imports were controlled by the government.	♦ Area restrictions, quotas and fixed procurement prices were removed for wheat and maize, in March 1987. Marketing and processing were controlled for approximately 50% of production by public sector firms. Consumer subsidies on bread depressed farm prices, as did subsidies on maize to feed manufactures. Private sector was allowed to import maize in 1991. Private wheat flour imports were allowed in 1992. Wheat prices increased between 1987 and 1992.
C. Rice	♦ The full range of (procurement quotas) and fixed procurement control of marketing, processing and exports applied throughout the period. Over 50% of milling capacity was owned by the government. There was no transport or export by private sector. ♦ Official prices increased 94% over this period; average farm price increased 150%.	♦ Area was still controlled for anti -salination and water allocation purposes. ♦ Procurement quota was eliminated for the 1991 crop. Prices from 1987-90 were between 75% and 90% of world prices. During 1991 market prices remained at 82-89% of world prices. ♦ All controls on price

	♦ Government procured 48% of production ♦ Weighted average market price was 45%of world price between 1981 and 1984.	procurement, marketing and exports were removed in 1991. ♦ Rice milling capacity was still over 50% publicly owned. ♦ Strong political pressure was exerted to reduce rice area by 30% in 1987 and 13.3% more in 1988. Acreage was stable at about 1.1 million feddan in 1989-93. ♦ Consumer subsidy was high and was removed in April 1993. ♦ Domestic market restrictions on private trade were removed in 1991 and 1992.
D. Cotton	♦ Strict acreage controls were enforced by fines; 100% quota delivery of fixed prices at less than 50% of the border price equivalent; prohibition of transport, ginning, domestic trade and foreign trade by private sector; and strict cropping pattern controls by region and by variety of cotton. ♦ Procurement prices averaged 52% of border prices during the period and fell to 40% during 1987-90.	♦ 1981-86 policies continued as constraints through 1991, except procurement price was gradually increased to approximately 75% of the 1991 border price. ♦ Procurement price was 114% of border price in 1992 and 132% in 1993, priced at market exchange rate. ♦ Acreage controls were removed for the 1992 and 1993 crop. ♦ All marketing restrictions and quota requirements remained the same. The marketing of cotton was liberalized in 1994.
E. Input prices, distribution and subsidies	♦ Fertilizer subsidy averaged about 50% in 1981-86 and 24% in 1987-88. ♦ Fertilizer subsidy was over 50% and pest control subsidy was 100% for cotton ♦ All fertilizer was distributed by the Principle Bank for Development and Agricultural Credit. Credit was tied to subsidized fertilizer purchases. ♦ No explicit water charges. Implicit water subsidy was approximately double for rice compared with other crops. ♦ Imported yellow maize was subsidized to feed mills.	♦ Input subsidies of 50-60% applied to minor crops, although the link between fertilizer distribution subsidies and credit allocation may have distorted the pattern of subsidy actually received by farmers, as the Principle Bank for Development and Agricultural Credit distributed fertilizer by providing credit in kind, which credit was allocated according to priorities set on a crop basis. ♦ General fertilizer subsidy was increased 13% in 1986-88 and declined to zero in 1992. ♦ In 1985-88, land reclamation programs were allocated almost 100% to private individuals. ♦ Ex-factory prices of fertilizer

	♦ Prior to 1985, most newly reclaimed land was allocated to public enterprises.	reached 105-112% of border prices. ♦ Cotton fertilizer subsidy was removed by 1991. ♦ Cotton pest control subsidy was reduced by 25% in 1992, further reduced in 1993, and removed for the 1994 crop.
F. Exchange rate and trade policies	♦ Wheat and maize were imported by the government only. There were import subsidies and consumer subsidies. ♦ Exchange rate was highly overvalued, depressing farm gate prices relative to import prices and favoring imports over exports. ♦ Exchange rate over valuation caused LE 55 million out of agriculture during this period. ♦ No private rice exports were allowed. ♦ Cotton, both for exports and for domestic mills, was traded at administrated prices by the public sector only. ♦ Cotton was exported only at the official rate. Mill prices, for example, during 1981/82-1986/87 for Giza were virtually identical to the farm gate price. Thus, mills were subsidized by the amount of domestic ginning and marketing, and procured raw materials at the depressed farm gate price of about 50% of the export prices. ♦ The market exchange rate increased from LE 0.90/$ in 1981 to 2.30/$ in 1991, while the official exchange rate remained constant at LE 0.70/$. ♦ The policy of taxing farmers through low procurement prices was enforced by fixed prices and monopoly marketing through the public trading companies.	♦ The government adjusted the official exchange rate from LE 0.70/$ in 1988, then increased to LE 2.30/$ in 1991. The rate was freed in 1991. ♦ The subsidy on maize was decreased by 81% in 1986-88. The private sector was allowed to process domestic and imported wheat. ♦ Real wheat prices increased less than 2% in 1987-92. Real maize prices declined 25%. ♦ The fertilizer subsidy was 24% until 1988 and was eliminated in 1992. ♦ Implicit subsidies on maize and wheat imports were caused by overvaluation of the exchange rate, eliminated in 1991. Bias was extreme and in favor of imports of wheat and maize during 1987-89 and against major export crops, including cotton, fruits, vegetables and rice. ♦ 1990 domestic prices were close to border price for both wheat and maize. ♦ An import subsidy (US, EU) of about 20% affected both grains during the entire period. ♦ The consumer subsidy for wheat and bread was continued the subsidy on wheat bran was reduced by 50% in 1991 and to zero in 1992 ♦ Minimum export prices were set in 1991 but eliminated in 1992. Rice exports were opened to the private sector in 1991. ♦ Cotton exports were made at the official rate, the official asking price was much higher than the true border price, and the procurement price therefore did not fully reflect the overvalued exchange rate.

		procurement prices would have been less than 20-30% of the true border price if the full impact of exchange rate overvaluation had ben passed to farmers.
G. Agricultural land tenancy system	♦ Land rental value was controlled and being determined at seven times the agricultural land tax	♦ Land rent was raised to twenty two times the agricultural land tax in 1992, and then at the end of a five years transition period, it was set allowed operate completely free in September 1997.

Source for A, B, C, D, E and F: Lehman, Fletcher "Egypt's Agriculture in a Reform Era", Iowa State University Press, Ames, Iowa, USA, 1996, Ch. 4, p.63-64

Source for G: compiled by author from documents of the MOF.

TABLE A3-2: COMPARISON BETWEEN OLD AND NEW PUBLIC ENTERPRISES LAWS IN EGYPT

Features	Law 97 (old)	Law 203 (new)
1. Autonomy	Company mangers are nder the control of their respective public sector organisations (PSOs) and technical ministry that has supervisory authority.	Company managers are autonomous and free to decide on all business matters; they have no links to technical ministries.
2. Company Objectives	Companies are supposed to help realise the State's economic and social objectives, regardless of the impact upon their own efficiency.	Companies have only one objective: to maximise profits and, as a result, their value.
3. Financial Status	Companies are dependent upon the Government for operational subsidies and financing of capital expenditure, out of captive sources of funds on subsidised terms.	Companies are financially independent of the Government and parent holding companies; the latter would not be allowed to routinely subsidise their affiliates. Company investments should be financed on commercial terms through capital markets
4. Corporate Form	Public enterprises established under Law No. 97 of 1983	Joint-Stock company listed on the stock exchange in Egypt
5. Privatisation	Not allowed	Allowed
6. Liquidation	Not allowed, except under very special circumstances.	Allowed
7. Bankruptcy	Not allowed	Allowed
8. Employment	Companies are uniformly subject to the provision of Law 48 on PSE employment	Law 48 is repealed, and companies are free to set their own terms and conditions of employment

Source: Abdel-Khalel (2001, p. 48)

Appendix Chapter 5

TABLE A5-1: ESTIMATING THE SHADOW EXCHANGE RATE USING THE PREMIUM APPROACH

Years	Imports $Million	Exports $Million	Official Exchange Rate LE/$	Import Duties LE Million	Import Duties $ Million	Export Duties LE Million	Export Duties $ Million	Import Duties + Export Duties $Million	Premium on Exchange Rate %	Shadow Exchange Rate LE/$
	1	2	3	4	5	6	7	8	9	10
1991	7914.60	3692.50	3.33	3422.00	1026.95	0.00	0.00	1026.95	0.09	3.63
92	8292.90	3049.90	3.34	4941.00	1480.09	0.00	0.00	1480.09	0.13	3.77
93	8187.00	3109.60	3.37	5428.00	1609.82	0.00	0.00	1609.82	0.14	3.85
94	9592.00	3474.80	3.39	6585.00	1941.91	0.00	0.00	1941.91	0.15	3.89
95	11738.90	3444.10	3.39	7352.00	2168.73	0.00	0.00	2168.73	0.14	3.87
96	13038.20	3539.60	3.39	8255.00	2436.54	0.00	0.00	2436.54	0.15	3.89
97	13211.00	3921.00	3.39	8460.00	2497.05	0.00	0.00	2497.05	0.15	3.88
98	16166.00	3130.00	3.41	9100.00	2672.54	0.00	0.00	2672.54	0.14	3.88
99	16022.00	3559.00	3.69	9983.00	2705.42	0.00	0.00	2705.42	0.14	4.20
2000	13963.70	4706.50	3.84	10408.00	2710.42	0.00	0.00	2710.42	0.15	4.40

Sources:

1-National Accounts Studies of the ESCWA Region, United Nations, Several issues. {columns (1), (2)}

2-International Monetary Fund, International Financial Statistics, The World Bank, Several issues. { columns (3) }

3-International Monetary Fund, Government Finance Statistics Yearbook, The World Bank, Several issues. {columns (4), (6) }

N.B:

1- Column (5) = Column (4) / Column (3). 2- Column (7) = Column (6) / Column (3). 3- Column (8) = Column (5) + Column (7)

4- Column (9) = {[Column (8) + Column (1) + Column (2)] / [Column (1) + Column (2)] } – 1.

5- Column (11) = [1 + Column (9)] × Column (3)

TABLE A5-2: ESTIMATING THE SHADOW EXCHANGE RATE USING THE SCF APPROACH

Years	Imports $Million	Exports $Million	Official Exchange Rate LE/$	Import Duties LE Million	Import Duties $ Million	Export Duties LE Million	Export Duties $ Million	Standard Conversion Factor ratio	Shadow Exchange Rate LE/$
	1	2	3	4	5	6	7	8	9
1991	7914.60	3692.50	3.33	3422.00	1026.95	0.00	0.00	0.92	3.63
92	8292.90	3049.90	3.34	4941.00	1480.09	0.00	0.00	0.88	3.77
93	8187.00	3109.60	3.37	5428.00	1609.82	0.00	0.00	0.88	3.85
94	9592.00	3474.80	3.39	6585.00	1941.91	0.00	0.00	0.87	3.89
95	11738.90	3444.10	3.39	7352.00	2168.73	0.00	0.00	0.88	3.87
96	13038.20	3539.60	3.39	8255.00	2436.54	0.00	0.00	0.87	3.89
97	13210.00	3908.00	3.39	8460.00	2497.05	0.00	0.00	0.87	3.88
98	16537.00	3207.00	3.41	9100.00	2672.54	0.00	0.00	0.88	3.87
99	16022.00	3559.00	3.69	9983.00	2705.42	0.00	0.00	0.88	4.20
2000	13963.7	4706.50	3.84	10408.00	2710.42	0.00	0.00	0.87	4.40

Sources:

1-National Accounts Studies of the ESCWA Region, United Nations, Several issues. {columns (1), (2)}

2-International Monetary Fund, Interantional Financial Statistics, The World Bank, Several issues. { columns (3) }

3-International Monetary Fund, Government Finance Statistics Yearbook, The World Bank, Several issues. {columns (4), (6)}

N.B:

1- Column (5) = Column (4) / Column (3). 2- Column (7) = Column (6) / Column (3).

3- Column (8) = 1 / 1 + {[Column (7) + Column (5) + Column (1) + Column (2)] / [Column (1) + Column (2)] } – 1.

4- Column (9) = Column (3) /Column (8).

TABLE A5-3: ESTIMATING THE REER ASSUMING CPI (U.S) = CPID

Years	Imports $Million	Exports $Million	Official Exchange Rate LE/$	Import Duties LE Million	Import Duties $ Million	Export Duties LE Million	Export Duties $ Million	CPIW	CPID	CPIW/CPID	RER	PRIM	REER
	1	2	3	4	5	6	7	8	9	10	11	12	13
1991	7914.60	3692.50	3.33	3422.00	1026.95	0.00	0.00	1.00	1.00	1.00	3.33	1.09	3.63
92	8292.90	3049.90	3.34	4941.00	1480.09	0.00	0.00	1.00	1.00	1.00	3.34	1.13	3.77
93	8187.00	3109.60	3.37	5428.00	1609.82	0.00	0.00	1.00	1.00	1.00	3.37	1.14	3.85
94	9592.00	3474.80	3.39	6585.00	1941.91	0.00	0.00	1.00	1.00	1.00	3.39	1.15	3.89
95	11738.90	3444.10	3.39	7352.00	2168.73	0.00	0.00	1.00	1.00	1.00	3.39	1.14	3.87
96	13038.20	3539.60	3.39	8255.00	2436.54	0.00	0.00	1.00	1.00	1.00	3.39	1.15	3.89
97	13211.00	3921.00	3.39	8460.00	2497.05	0.00	0.00	1.00	1.00	1.00	3.39	1.15	3.88
98	16166.00	3130.00	3.41	9100.00	2672.54	0.00	0.00	1.00	1.00	1.00	3.41	1.14	3.88
99	16022.00	3559.00	3.69	9983.00	2705.42	0.00	0.00	1.00	1.00	1.00	3.69	1.14	4.20
2000	13963.7	4706.5	3.84	10408.00	2710.42	0.00	0.00	1.00	1.00	1.00	3.84	1.15	4.40

Sources:

1- National Accounts Studies of the ESCWA Region. United Nations, Several issues. {columns (1), (2), (8), (9)}

2- International Monetary Fund, Interantional Financial Statistics, The World Bank, Several issues. { columns (3) }

3- International Monetary Fund, Government Finance Statistics Yearbook, The World Bank, Several issues. {columns (4), (6) }

N.B:

1- Column (5) = Column (4) / Column (3).   2- Column (7) = Column (6) / Column (3).

3- Column (10) = Column (8) / Column (9)

4- Column (11) = Column (10) × Column (3).

5- Column (12) = Column (1) + Column (2) + Column (5) + Column (7) / Column (1) + Column (2)

6- Column (13) = Column (11) × Column (12).

TABLE A5-4: ESTIMATING THE REER USING CPI (1995 = 100%)

Years	Imports $Million	Exports $Million	Official Exchange Rate LE/$	Import Duties LE Million	Import Duties $ Million	Export Duties LE Million	Export Duties $ Million	CPI (U.S)	CPID	CPI (U.S) /CPID	RER	PRIM	REER
	1	2	3	4	5	6	7	8	9	10	11	12	13
1991	7914.60	3692.50	3.33	3422.00	1026.95	0.00	0.00	62.70	89.40	0.70	2.34	1.09	2.54
92	8292.90	3049.90	3.34	4941.00	1480.09	0.00	0.00	71.30	92.10	0.77	2.58	1.13	2.92
93	8187.00	3109.60	3.37	5428.00	1609.82	0.00	0.00	79.90	94.80	0.84	2.84	1.14	3.25
94	9592.00	3474.80	3.39	6585.00	1941.91	0.00	0.00	86.40	97.30	0.89	3.01	1.15	3.46
95	11738.90	3444.10	3.39	7352.00	2168.73	0.00	0.00	100.00	100.00	1.00	3.39	1.14	3.87
96	13038.20	3539.60	3.39	8255.00	2436.54	0.00	0.00	107.20	102.90	1.04	3.53	1.15	4.05
97	13211.00	3921.00	3.39	8460.00	2497.05	0.00	0.00	112.10	105.30	1.06	3.61	1.15	4.13
98	16166.00	3130.00	3.41	9100.00	2672.54	0.00	0.00	116.80	107.00	1.09	3.72	1.14	4.23
99	16022.00	3559.00	3.69	9983.00	2705.42	0.00	0.00	120.40	109.30	1.10	4.06	1.14	4.63
2000	13963.70	4706.50	3.84	10408.00	2710.42	0.00	0.00	123.10	114.00	1.08	4.15	1.15	4.75

Sources:

1- National Accounts Studies of the ESCWA Region, United Nations, Several issues. {columns (1), (2), (8), (9)}

2- International Monetary Fund, Interantional Financial Statistics, The World Bank, Several issues. { columns (3) }

3- International Monetary Fund, Government Finance Statistics Yearbook, The World Bank, Several issues. {columns (4), (6) }

N.B:

1- Column (5) = Column (4) / Column (3). 2- Column (7) = Column (6) / Column (3).
3- Column (10) = Column (8) / Column (9)
4- Column (11) = Column (10) × Column (3).
5- Column (12) = Column (1) + Column (2) + Column (5) + Column (7) / Column (1) + Column (2)
6- Column (13) = Column (11) × Column (12).

TABLE A5-5: ESTIMATING THE REER USING U.S CPI (1992 = 100%)

Years	Imports $Million	Exports $Million	Official Exchange Rate LE/$	Import Duties LE Million	Import Duties $ Million	Export Duties LE Million	Export Duties $ Million	CPI (U.S)	CPID	CPI (U.S) /CPID	RER	PRIM	REER
	1	2	3	4	5	6	7	8	9	10	11	12	13
1991	7914.60	3692.50	3.33	3422.00	1026.95	0.00	0.00	87.94	97.07	0.91	3.02	1.09	3.29
92	8292.90	3049.90	3.34	4941.00	1480.09	0.00	0.00	100.00	100.00	1.00	3.34	1.13	3.77
93	8187.00	3109.60	3.37	5428.00	1609.82	0.00	0.00	112.06	102.93	1.09	3.67	1.14	4.19
94	9592.00	3474.80	3.39	6585.00	1941.91	0.00	0.00	121.18	105.65	1.15	3.89	1.15	4.47
95	11738.90	3444.10	3.39	7352.00	2168.73	0.00	0.00	140.25	108.58	1.29	4.38	1.14	5.00
96	13038.20	3539.60	3.39	8255.00	2436.54	0.00	0.00	150.35	111.73	1.35	4.56	1.15	5.23
97	13211.00	3921.00	3.39	8460.00	2497.05	0.00	0.00	157.22	114.33	1.38	4.66	1.15	5.34
98	16166.00	3130.00	3.41	9100.00	2672.54	0.00	0.00	163.81	116.18	1.41	4.80	1.14	5.47
99	16022.00	3559.00	3.69	9983.00	2705.42	0.00	0.00	168.86	118.68	1.42	5.25	1.14	5.98
2000	17335.20	3900.00	3.84	10408.00	2710.42	0.00	0.00	172.65	123.78	1.39	5.36	1.15	6.13

Sources:

1-National Accounts Studies of the ESCWA Region, United Nations, Several issues. {columns (1), (2), (8), (9)}

2-International Monetary Fund, Interantional Financial Statistics, The World Bank, Several issues. { columns (3) }

3-International Monetary Fund, Government Finance Statistics Yearbook, The World Bank, Several issues. {columns (4), (6) }

N.B:

Column (5) = Column (4) / Column (3). 2- Column (7) = Column (6) / Column (3).

3- Column (10) = Column (8) / Column (9)

4- Column (11) = Column (10) × Column (3).

5- Column (12) = Column (1) + Column (2) + Column (5) + Column (7) / Column (1) + Column (2)

6- Column (13) = Column (11) × Column (12).

TABLE A5-6: ESTIMATION OF IMPORT PARITY PRICE FOR SOYBEAN AT FARM LEVEL

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (Rotterdam)	$/TON	208.42	215.75	303.50	275.00	246.75	239.56	235.52	255.25	252.83	259.25	304.50	295.42	245.42	199.58	211.80
Add: **Freight & Insurance**	$/TON	12.50	12.70	13.00	13.20	15.20	15.25	9.20	9.60	10.10	10.60	11.20	11.99	12.50	13.00	13.10
Add: **Import Duties (2%) + Fees(8.3%)**	$/TON	21.47	22.22	31.26	28.33	25.42	24.67	24.26	26.29	26.04	26.70	31.36	30.43	25.28	20.56	21.82
World Price at Alexandria Port (CIF)	$/TON	242.39	250.67	347.76	316.53	287.37	279.48	268.98	291.14	288.97	296.55	347.06	337.84	283.20	233.14	246.72
Multiply: **Shadow Exchange Rate**	LE/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
Border Price at Alexandria Port	LE/TON	327.22	381.02	772.03	797.64	778.76	1013.70	1015.10	1121.56	1125.52	1148.90	1348.69	1311.42	1097.85	979.13	1068.31
Add **Transportation from Port to Fact**	LE/TON	7.40	8.50	10.00	13.50	16.00	17.20	18.00	19.00	20.00	21.00	22.30	24.00	25.20	26.00	27.10
World Price at Fact	LE/TON	334.62	389.52	782.03	811.14	794.76	1030.90	1033.10	1140.56	1145.52	1169.90	1370.99	1335.42	1123.05	1005.13	1095.41
Deduct: **Trans. From Market to Fact**	LE/TON	7.00	8.10	9.60	13.00	15.70	16.50	17.90	18.95	19.55	20.90	22.00	23.85	25.00	26.00	27.00
World Price at Farm Gate	LE/TON	327.62	381.42	772.43	798.14	779.06	1014.40	1015.20	1121.61	1125.97	1149.00	1348.99	1311.57	1098.05	979.13	1068.41
Multiply **Conversion Allowance**	LE/Ton	**327.62**	**381.42**	**772.43**	**798.14**	**779.06**	**1014.40**	**1015.20**	**1121.61**	**1125.97**	**1149.00**	**1348.99**	**1311.57**	**1098.05**	**979.13**	**1068.41**

TABLE A5-7: ESTIMATION OF IMPORT PARITY PRICE FOR MAIZE AT FARM LEVEL

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (FOB-US Gulf)	$/TON	87.77	75.57	107.06	111.39	109.42	107.45	104.30	101.94	107.85	123.59	164.52	117.29	101.55	90.13	88.56
Add:																
Freight & Insurance	$/TON	15.25	20.36	20.90	21.00	24.00	24.30	14.35	14.70	14.80	15.00	15.10	15.50	15.40	15.35	16.00
Add:																
Import Duties (2%) + Fees(8.3%)	$/TON	9.04	7.78	11.03	11.47	11.27	11.07	10.74	10.50	11.11	12.73	16.95	12.08	10.46	9.28	9.12
World Price at Alexandria Port (CIF)	$/TON	112.06	103.72	138.99	143.86	144.69	142.82	129.40	127.14	133.75	151.32	196.57	144.87	127.41	114.77	113.68
Multiply:																
Shadow Exchange Rate	LE/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
Border Price at Alexandria Port	LE/TON	151.29	157.65	308.55	362.53	392.11	518.01	488.33	489.79	520.96	586.24	763.87	562.37	493.91	482.00	492.26
Add																
Transportation from Port to Market	LE/TON	7.40	8.50	10.00	13.50	16.00	17.20	18.00	19.00	20.00	21.00	22.30	24.00	25.20	26.00	27.10
World Price at Market	LE/TON	158.69	166.15	318.55	376.03	408.11	535.21	506.33	508.79	540.96	607.24	786.17	586.37	519.11	508.00	519.36
Deduct:																
Trans. From Market to Farm	LE/TON	7.00	8.10	9.60	13.00	15.70	16.50	17.90	18.95	19.55	20.90	22.00	23.85	25.00	26.00	27.00
World Price at Farm Gate	LE/TON	151.69	158.05	308.95	363.03	392.41	518.71	488.43	489.84	521.41	586.34	764.17	562.52	494.11	482.00	492.36
Multiply																
Conversion Allowance @ 110%	LE/Ton	**166.85**	**173.85**	**339.84**	**399.34**	**431.65**	**570.58**	**537.28**	**538.83**	**573.55**	**644.98**	**840.59**	**618.77**	**543.52**	**530.20**	**541.59**

TABLE A5-8: ESTIMATION OF IMPORT PARITY PRICE FOR SUGAR CANE AT FARM LEVEL

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (FOB- Caribian)	$/TON	133.10	148.72	224.18	281.82	275.22	197.56	199.54	220.44	266.42	292.16	263.12	250.80	197.56	137.94	177.76
Add: **Freight & Insurance**	$/TON	25.15	31.36	35.10	36.21	36.10	36.20	25.10	25.80	25.95	25.50	25.12	25.15	25.75	25.90	26.00
Add: **Import Duties (0%) + Fees(0%)**	$/TON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
World Price at Alexandria Port (CIF)	$/TON	158.25	180.08	259.28	318.03	311.32	233.76	224.64	246.24	292.37	317.66	288.24	275.95	223.31	163.84	203.76
Multiply: **Shadow Exchange Rate**	LE/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.40
Border Price at Alexandria Port	LE/TON	213.64	273.72	575.60	801.44	843.68	847.85	847.77	948.59	1138.75	1230.68	1120.10	1071.18	865.68	688.10	896.54
Add **Transportation from Port to Factory (Hawamdia)**	LE/TON	17.25	17.75	18.50	21.00	21.90	23.00	24.36	25.00	25.48	26.10	26.98	27.52	28.43	29.68	30.10
World Price at Market	LE/TON	230.89	291.47	594.10	822.44	865.58	870.85	872.13	973.59	1164.23	1256.78	1147.08	1098.70	894.11	717.78	926.64
Deduct: **Trans. From Fact. To Farm**	LE/TON	32.00	45.32	69.64	82.60	105.96	135.99	160.25	196.35	215.60	240.36	246.90	250.98	260.90	270.00	275.00
World Price at Farm Gate	LE/TON	198.89	246.15	524.46	739.84	759.62	734.86	711.88	777.24	948.63	1016.42	900.18	847.72	633.21	447.78	651.64
Multiply **Conversion Allowance @ 0.11%**	**LE/Ton**	**21.88**	**27.08**	**57.69**	**81.38**	**83.56**	**80.83**	**78.31**	**85.50**	**104.35**	**111.81**	**99.02**	**93.25**	**69.65**	**49.26**	**71.68**

TABLE A5-9: ESTIMATION OF IMPORT PARITY PRICE FOR BROAD BEANS AT FARM LEVEL

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World PriceAT ALEX INC. ALL FEES	$/TON	269.50	450.50	371.50	370.00	371.10	393.27	390.74	286.81	303.83	314.72	391.04	371.92	366.40	323.01	335.36
Add: Freight & Insurance	$/TON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Add: Import Duties (2%) + Fees(8.3%)	$/TON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
World Price at Alexandria Port (CIF)	$/TON	269.50	450.50	371.50	370.00	371.10	393.27	390.74	286.81	303.83	314.72	391.04	371.92	366.40	323.01	335.36
Multiply: Shadow Exchange Rate	LE/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
Border Price at Alexandria Port	LE/TON	363.83	684.76	824.73	932.40	1005.68	1426.39	1474.63	1104.86	1183.39	1219.30	1519.57	1443.72	1420.38	1356.59	1452.15
Add Transportation from Port to Market	LE/TON	7.40	8.50	10.00	13.50	16.00	17.20	18.00	19.00	20.00	21.00	22.30	24.00	25.20	26.00	27.10
World Price at Market	LE/TON	371.23	693.26	834.73	945.90	1021.68	1443.59	1492.63	1123.86	1203.39	1240.30	1541.87	1467.72	1445.58	1382.59	1479.25
Deduct: Trans. From Market to Farm	LE/TON	7.00	8.10	9.60	13.00	15.70	16.50	17.90	18.95	19.55	20.90	22.00	23.85	25.00	26.00	27.00
World Price at Farm Gate	LE/TON	364.23	685.16	825.13	932.90	1005.98	1427.09	1474.73	1104.91	1183.84	1219.40	1519.87	1443.87	1420.58	1356.59	1452.25
Multiply Conversion Allowance	**LE/Ton**	**364.23**	**685.16**	**825.13**	**932.90**	**1005.98**	**1427.09**	**1474.73**	**1104.91**	**1183.84**	**1219.40**	**1519.87**	**1443.87**	**1420.58**	**1356.59**	**1452.25**

TABLE A5-10: ESTIMATION OF EXPORT PARITY PRICE FOR RICE AT FARM LEVEL

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (Thiland-Bangkok)	$/TON	195.67	214.42	277.25	299.75	270.67	293.67	267.67	237.25	269.46	320.80	338.06	302.47	305.42	248.97	202.40
Add																
Quality factor (2%)	$/TON	3.91	4.29	5.55	6.00	5.41	5.87	5.35	4.75	5.39	6.42	6.76	6.05	6.11	4.98	4.05
Deduct:																
Freight & Insurance	$/TON	12.00	7.60	7.75	7.82	8.96	9.00	5.35	6.10	7.00	8.72	13.50	14.10	15.25	15.30	16.10
World Price at Alexandria Port (CIF)	$/TON	187.58	211.11	275.05	297.93	267.12	290.54	267.67	235.90	267.85	318.50	331.32	294.42	296.28	238.65	190.35
Multiply:																
Shadow Exchange Rate	LE/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
World Price of milled rice at Alexandria Port	LE/TON	253.24	320.88	610.60	750.77	723.90	1053.81	1010.17	908.74	1043.25	1233.92	1287.51	1142.88	1148.55	1002.28	824.23
Deduct:																
Transportation from mill to port	LE/TON	7.40	7.50	9.00	10.67	11.20	11.90	12.35	13.00	13.56	14.25	15.20	15.90	16.20	16.78	17.00
World of milled rice Price at Mill	LE/TON	245.84	313.38	601.60	740.10	712.70	1041.91	997.82	895.74	1029.69	1219.67	1272.31	1126.98	1132.35	985.50	807.23
Domestic Price of Bran	LE/TON	10.50	13.75	16.47	18.98	23.89	28.90	29.10	29.78	30.00	30.15	30.45	31.00	31.89	32.00	32.86
Milled Rice Yeild/Ton Paddy Rice	Yeild/Ton	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Bran Yeild/Ton Paddy Rice	Yeild/Ton	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33
Joint product, Paddy rice	LE/TON	169.12	215.70	410.85	505.02	488.15	711.67	682.02	613.44	703.79	831.88	867.47	769.69	773.60	674.66	554.79
Deduct:																
Milling Margin + Trans. From Farm to Mill	LE/TON	15.70	18.50	17.80	19.10	33.00	33.05	33.60	34.60	36.00	37.10	39.15	40.12	41.11	42.21	43.00
World Price, Paddy rice at Farm Gate	LE/TON	153.42	197.20	393.05	485.92	455.15	678.62	648.42	578.84	667.79	794.78	828.32	729.57	732.49	632.45	511.79

TABLE A5-11: ESTIMATION OF EXPORT PARITY PRICE FOR TOMATOES AT FARM LEVEL

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (CAPMS) AT ALEX. Inc All Fees	$/TON	315.85	209.75	193.25	282.50	231.20	267.60	270.32	247.96	231.92	192.03	144.91	104.99	118.36	185.32	215.43
Deduct: **Freight & Insurance**	$/TON															
World Price at Alexandria Port	$/TON	315.85	209.75	193.25	282.50	231.20	267.60	270.32	247.96	231.92	192.03	144.91	104.99	118.36	185.32	215.43
Multiply: **Shadow Exchange Rate**	LE/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
World Price at Alexandria Port	LE/TON	426.40	318.82	429.02	711.90	626.55	970.60	1020.16	955.23	903.32	743.97	563.12	407.56	458.83	778.31	932.83
Deduct: **Transportation & Marketing Cost**	LE/TON	37.40	41.50	45.00	47.67	51.20	52.90	56.35	58.00	59.56	62.25	67.20	70.90	72.20	74.78	75.00
World Price at Farm gate	**LE/TON**	**389.00**	**277.32**	**384.02**	**664.23**	**575.35**	**917.70**	**963.81**	**897.23**	**843.76**	**681.72**	**495.92**	**336.66**	**386.63**	**703.53**	**857.83**

TABLE A5-12: ESTIMATION OF EXPORT PARITY PRICE FOR POTATOES AT FARM LEVEL

Estimation Steps	Unit	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
World Price (CAPMS) AT ALEX .Inc All Fees	$/TON	203.42	196.87	189.55	172.88	165.42	219.52	204.48	183.44	200.99	243.89	194.32	176.99	188.96	180.12	169.93
Deduct: **Freight & Insurance**	$/TON															
World Price at Alexandria Port	$/TON	203.42	196.87	189.55	172.88	165.42	219.52	204.48	183.44	200.99	243.89	194.32	176.99	188.96	180.12	169.93
Multiply: **Shadow Exchange Rate**	LE/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
World Price at Alexandria Port	LE/TON	274.62	299.24	420.80	435.66	448.29	796.19	771.67	706.68	782.85	944.86	755.14	687.03	732.52	756.48	735.82
Deduct: Transportation & Marketing Cost	LE/TON	28.30	32.32	35.25	38.03	41.85	43.85	47.00	48.14	50.52	52.70	58.07	61.04	63.07	64.90	65.47
World Price at Farm gate	**LE/TON**	**246.32**	**266.92**	**385.55**	**397.63**	**406.44**	**752.34**	**724.67**	**658.54**	**732.33**	**892.16**	**697.07**	**625.99**	**669.45**	**691.58**	**670.35**

TABLE A5-13: ESTIMATION OF TRACTOR MARKET VALUE IN THE PERIOD 1986-2000.

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000		Average value imported tractor in use / LE
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	28
Number	1849.00	3498.00	6000.00	2850.00	5282.00	13009.00	6400.00	3531.00	7917.00	8456.00	11000.00	5267.00	7757.00	2631.00	3518.00	2693.00	2373.00	2000.00	1574.00	2282.00	2285.00	935.00	3975.00	3000.00	3001.00		
1976	6048.42																									1976	
1977	5443.57	7825.34																								1977	
1978	4354.86	7042.81	6128.03																							1978	
1979	3048.40	5634.24	5515.23	11004.46																						1979	
1980	1829.04	3943.97	4412.18	9904.01	9497.22																					1980	
1981	914.52	2366.38	3088.53	7923.21	8547.50	7728.33																				1981	
1982	365.81	1183.19	1853.12	5546.25	6838.00	6955.50	8064.88																			1982	
1983	109.74	473.28	926.56	3327.75	4786.60	5564.40	7258.39	11163.51																		1983	
1984	21.95	141.98	370.62	1663.87	2871.96	3895.08	5806.72	10047.16	7694.91																	1984	
1985	2.19	28.40	111.19	665.55	1435.98	2337.05	4064.70	8037.73	6925.42	8047.61																1985	
1986	0.00	2.84	22.24	199.66	574.39	1168.52	2438.82	5626.41	5540.34	7242.85	14966.16															1986	9200.83
1987		0.00	2.22	39.93	172.32	467.41	1219.41	3375.85	3878.23	5794.28	13469.54	21623.94														1987	10854.37
1988			0.00	3.99	34.46	140.22	487.76	1687.92	2326.94	4056.00	10775.64	19461.55	37681.27													1988	16674.05
1989				0.00	3.45	28.04	146.33	675.17	1163.47	2433.60	7542.94	15569.24	33913.14	48755.04												1989	20033.54
1990					0.00	2.80	29.27	282.55	465.39	1216.80	4525.77	10898.47	27130.51	43879.54	37769.91											1990	20861.26
1991						0.00	2.93	40.51	139.62	486.72	2262.88	6539.08	18991.36	35103.63	33992.92	33588.39										1991	21171.56
1992							0.00	4.05	27.92	146.02	905.15	3269.54	11394.82	24572.54	27194.34	30229.55	54469.72									1992	22863.70
1993								0.00	2.79	29.20	271.55	1307.82	5697.41	14743.52	19036.03	24183.64	49022.75	53962.25								1993	24406.71
1994									0.00	2.92	54.31	392.34	2278.96	7371.76	11421.62	16928.55	39218.20	48566.03	62185.23							1994	27103.61
1995										0.00	5.43	78.47	683.69	2948.70	5710.81	10157.13	27452.74	38852.82	55966.71	58147.56						1995	32112.15
1996											0.00	7.85	136.74	884.61	2284.32	5078.56	16471.64	27196.97	44773.37	52332.80	59619.09					1996	38004.95
1997												0.00	13.67	176.92	685.30	2031.43	8235.82	16318.18	31341.36	41866.24	53657.18	64870.36				1997	39737.67
1998													0.00	17.69	137.06	609.43	3294.33	8159.09	18804.81	29306.37	42925.74	58383.32	64863.52			1998	49569.35
1999														0.00	13.71	121.89	988.30	3263.64	9402.41	17583.82	30048.02	46706.66	58377.17	61899.61		1999	52887.14
2000															0.00	12.19	197.66	979.09	3760.96	8791.91	18028.81	32694.66	46701.73	55709.65	62650.44	2000	54859.76
																0.00	19.77	195.82	1128.29	3516.76	9014.41	19616.80	32691.21	44567.72	56385.40		
																	0.00	19.58	225.66	1055.03	3605.76	9808.40	19614.73	31197.40	45108.32		
																		0.00	22.57	211.01	1081.73	3923.36	9807.36	18718.44	31575.82		
																			0.00	21.10	216.35	1177.01	3922.95	9359.22	18945.49		
																				0.00	21.63	235.40	1176.88	3743.69	9472.75		
																					0.00	23.54	235.38	1123.11	3789.10		
																						0.00	23.54	224.62	1136.73		
																							0.00	22.46	227.35		
																								0.00	22.73		
																									0.00		

The second raw indicates the number of imported tractors as a proxy of the tractor stock in use.

The first value in each column represents the value of the tractor at farm gate level (previously estimated in table 19 line number 10).

$$\text{Value of tractor in year (t)} = \frac{P_t * N_t + P_{t-1} * N_{t-1} + \text{--------} + P_{t-10} * N_{t-10}}{N_t * 1 + N_{t-1} * 0.9 + \text{-------} + N_{t-10} * 0} + \left[\frac{P_t * N_t + P_{t-1} * N_{t-1} + \text{--------} + P_{t-10} * N_{t-10}}{N_t * 1 + N_{t-1} * 0.9 + \text{-------} + N_{t-10} * 0} \times 0.20 \right]$$

$$\text{Value of the tractor in 1986} = \frac{14966.16*11000+7242.85*8456+5540.34*7917+5626.41*3531+2438.82*6400+1168.52*13009+574.39*5282+199.66*2850+22.24*6000+2.84*3498+0.00*1849}{11000*1+8456*0.9+7919*0.8+3531*0.7+6400*0.6+13009*0.5+5282*0.4+2850*0.3+6000*0.2*3498*0.1+1849*0} = 7667.36$$

$$= 7667.36 + (0.20*7667.36) = 9200.38$$

TABLE A5-14: SOCIAL PRICE FOR MACHINERY SERVICE (TRACTORS)

Tractors	Year	1986	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
1-Fixed Cost	Unit															
World Price at Port, Alexandria	$	9510.76	12227.41	14613.81	16664.28	11969.59	7928.61	12422.46	12036.04	13726.11	12879.64	13129.26	14320.83	14309.93	12602.17	12371.84
Multiply																
Shadow Exchange Rate	LE/$	1.35	1.52	2.22	2.52	2.71	3.63	3.77	3.85	3.89	3.87	3.89	3.88	3.88	4.20	4.33
World Price at Port, Alexandria	LE	12839.53	18585.67	32442.66	41993.98	32437.58	28780.86	46832.66	46338.74	53394.57	49844.21	51072.81	55564.82	55522.53	52929.10	53570.07
Add																
Port Fees + Handling	LE	641.98	929.28	1622.13	2099.70	1621.88	1439.04	2341.63	2316.94	2669.73	2492.21	2553.64	2778.24	2776.13	2646.46	2678.50
Total Landed Cost	LE	13481.51	19514.95	34064.79	44093.68	34059.46	30219.90	49174.29	48655.68	56064.30	52336.42	53626.45	58343.06	58298.66	55575.56	56248.58
Add																
Transport to Warehouse	LE	65.00	75.00	100.00	120.00	145.00	165.00	180.00	210.00	245.00	275.00	300.00	330.00	350.00	365.00	370.00
Add																
Markup @ 10%	LE	1354.65	1958.99	3416.48	4421.37	3420.45	3038.49	4935.43	4886.57	5630.93	5261.14	5392.64	5867.31	5864.87	5594.06	5661.86
Price at Warehouse	LE	14901.16	21548.94	37581.27	48635.04	37624.91	33423.39	54289.72	53752.25	61940.23	57872.56	59319.09	64540.36	64513.52	61534.61	62280.44
Add																
Transport to Farm	LE	65.00	75.00	100.00	120.00	145.00	165.00	180.00	210.00	245.00	275.00	300.00	330.00	350.00	365.00	370.00
Total Price at Farm	LE	14966.16	21623.94	37681.27	48755.04	37769.91	33588.39	54469.72	53962.25	62185.23	58147.56	59619.09	64870.36	64863.52	61899.61	62650.44
Salvage Value @ 20%	LE	2993.23	4324.79	7536.25	9751.01	7553.98	6717.68	10893.94	10792.45	12437.05	11629.51	11923.82	12974.07	12972.70	12379.92	12530.09
Initial Capital Cost	LE	11972.93	17299.15	30145.02	39004.04	30215.93	26870.71	43575.78	43169.80	49748.19	46518.05	47695.27	51896.29	51890.82	49519.69	50120.35
Use Life	Years	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Rate of Interest	%	0.15	0.16	0.17	0.18	0.19	0.20	0.20	0.18	0.16	0.16	0.15	0.13	0.13	0.13	0.14
Hours of Use/Year	hr	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00	1500.00
Depreciation	LE/hr	0.80	1.15	2.01	2.60	2.01	1.79	2.91	2.88	3.32	3.10	3.18	3.46	3.46	3.30	3.34
Capital Cost	LE/hr	0.75	1.15	2.14	2.93	2.39	2.24	3.63	3.24	3.32	3.10	2.98	2.81	2.81	2.68	2.82
Sub Total Cost 1	LE/hr	**1.55**	**2.31**	**4.14**	**5.53**	**4.41**	**4.03**	**6.54**	**6.12**	**6.63**	**6.20**	**6.16**	**6.27**	**6.27**	**5.98**	**6.16**
2-Variable Cost																
Adjusted Price of tractor stock in use	LE	9200.83	10854.37	16674.05	20033.54	20861.26	21171.56	22863.70	24406.71	27103.61	32112.15	38004.95	39737.67	49569.35	52887.14	54859.76
Maintenance @ 5%	LE/Year	460.04	542.72	833.70	1001.68	1043.06	1058.58	1143.19	1220.34	1355.18	1605.61	1900.25	1986.88	2478.47	2644.36	2742.99
Mobile Oil @ 2%	LE/Year	184.02	217.09	333.48	400.67	417.23	423.43	457.27	488.13	542.07	642.24	760.10	794.75	991.39	1057.74	1097.20
Add																
Maintenance	LE/hr	0.31	0.36	0.56	0.67	0.70	0.71	0.76	0.81	0.90	1.07	1.27	1.32	1.65	1.76	1.83
Add																
Mobile Oil	LE/hr	0.12	0.14	0.22	0.27	0.28	0.28	0.30	0.33	0.36	0.43	0.51	0.53	0.66	0.71	0.73
Add																
Fuel	LE/hr	1.11	1.13	1.19	1.50	1.50	1.70	2.00	2.50	2.75	2.90	3.50	3.50	3.50	3.60	4.00
Add																
Tractor Driver	LE/hr	1.75	1.80	2.00	2.15	2.15	2.25	2.25	2.60	2.80	2.95	3.00	3.10	3.50	3.70	3.90
Sub Total Cost 2	LE/hr	***3.29***	***3.44***	***3.97***	***4.58***	***4.62***	***4.94***	***5.32***	***6.24***	***6.81***	***7.35***	***8.27***	***8.45***	***9.31***	***9.77***	***10.46***
Sub Total 1 + Sub Total 2 **3-Total Cost**	LE/hr	**4.84**	**5.74**	**8.11**	**10.11**	**9.03**	**8.97**	**11.85**	**12.35**	**13.45**	**13.55**	**14.43**	**14.73**	**15.58**	**15.75**	**16.62**

Appendix Chapter 6

TABLE A6-1: NET PRIVATE PROFITABILITY FOR MAJOR CROPS IN EGYPT DURING THE PERIOD 1986-2000.

(Million Egyptian pounds)

	Wheat	Broad beans	Long berseem	Short berseem	Tomatoes	Maize	Rice	Cotton	Potatoes	Sugar cane	Soybean
1986	339.48	78.29	554.40	112.04	226.24	173.79	262.72	153.88	35.42	130.00	12.79
1987	457.83	116.89	991.78	218.55	257.52	337.04	123.86	161.99	34.35	140.70	19.77
1988	467.08	113.08	755.05	167.69	282.42	602.23	210.25	207.88	78.67	180.89	15.77
1989	1155.73	137.05	727.06	169.32	224.97	891.41	539.83	415.74	141.80	258.51	29.65
1990	1696.06	156.44	883.08	183.75	305.93	1012.11	682.66	635.06	39.96	331.47	30.62
1991	1741.45	117.87	1021.50	201.25	413.15	1007.53	789.05	889.95	59.80	259.59	38.04
1992	1467.49	118.41	1097.25	222.46	300.07	892.67	872.35	1156.93	55.99	243.11	10.89
1993	1195.09	46.09	1357.47	207.76	279.16	562.28	745.31	1250.73	32.47	285.38	-3.33
1994	1024.31	54.89	1309.39	227.44	311.83	696.20	1241.70	440.62	119.83	396.34	2.06
1995	1711.42	141.88	1618.07	242.62	527.95	625.18	1489.26	1228.11	56.89	457.18	1.95
1996	2239.45	192.34	1989.47	372.15	674.99	958.86	1711.55	1647.26	58.67	445.27	5.94
1997	2071.52	258.21	2365.39	432.28	593.64	1230.00	1871.32	1436.72	40.63	502.50	5.08
1998	1709.11	123.35	2672.95	542.25	587.56	829.73	1256.75	168.71	2.93	428.83	-2.19
1999	2084.48	-14.79	2896.53	434.48	593.08	1156.39	1703.99	254.13	8.06	318.24	0.31
2000	2224.22	108.54	3253.62	474.93	653.98	1261.16	1771.56	306.91	4.69	427.90	0.12

TABLE A6-1: NET SOCIAL PROFITABILITY FOR MAJOR CROPS IN EGYPT DURING THE PERIOD 1986-2000.

(Million Egyptian pounds)

	Wheat	Broad beans	Long berseem	Short berseem	Tomatoes	Maize	Rice	Cotton	Potatoes	Sugar cane	Soybean	Total
1986	43	2	128	212	291	-81	-156	17	65	-88	-10	**422**
1987	54	71	464	66	88	-138	-165	43	86	-112	-12	**444**
1988	251	35	23	-30	109	167	114	35	87	116	6	**913**
1989	552	80	-292	-104	391	60	361	55	85	264	-10	**1443**
1990	329	83	-258	-170	435	26	351	75	3	216	-15	**1076**
1991	365	60	-363	-217	567	351	602	154	202	-148	-17	**1554**
1992	238	4	-375	-305	658	141	453	-149	141	-153	-15	**639**
1993	19	-75	71	-215	1071	47	76	95	45	-159	-15	**960**
1994	46	-120	-16	-199	1066	64	352	42	111	59	-15	**1390**
1995	119	-33	53	-225	409	-154	609	50	306	-58	-44	**1032**
1996	1238	16	240	-339	340	595	978	-628	93	-131	-8	**2393**
1997	126	61	566	43	-66	27	756	-1	51	-99	-5	**1459**
1998	965	96	1400	216	39	-584	1165	-419	77	-129	-5	**2819**
1999	975	-138	1528	191	817	13	988	-544	74	-521	-3	**3380**
2000	676	24	1840	218	1418	159	-8	-440	75	-344	-4	**3613**

Source: PAM results.

TABLE A6-3: EXPORT AND IMPORTS OF MAJOR AGRICULTURAL OUTPUTS IN EGYPT DURING THE PERIOD 1986-2000.

Year	Export Crops								Import Crops									
	Cotton		Tomatoes		Rice		Potatoes		Wheat		Maize		Broad beans		Sugar		Soybean	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1986	145,637	440,762	17,279	5,458	40,048	16,022	107,740	21,917	6,333,327	906,000	2,028,000	239,000	1,995	1,729	17,000	3,723	45,000	10,835
1987	129,907	388,872	23,398	4,908	100,844	39,657	123,327	24,280	7,076,042	897,000	2,200,000	189,000	21,186	9,700	44,555	10,470	54,884	12,245
1988	79,924	287,039	15,147	2,927	71,353	17,635	166,206	31,505	7,239,380	1,177,000	1,300,000	143,000	Na	Na	49,835	11,857	38,930	7,704
1989	58,407	274,502	14,960	4,227	32,905	8,291	155,510	26,884	6,881,924	1,327,300	1,433,180	210,000	1	4	113,752	39,543	46,295	14,758
1990	39,438	186,092	20,438	4,725	75,718	18,181	135,571	22,426	6,439,468	1,062,885	1,900,000	249,000	502	179	235,773	98,165	24,659	4,006
1991	12,986	60,687	23,417	6,267	150,952	38,710	217,837	47,817	6,187,623	724,912	1,300,000	174,000	Na	Na	269,000	90,000	Na	Na
1992	15,541	52,546	41,532	11,184	187,472	57,313	209,365	42,649	5,683,217	768,193	1,443,817	177,788	Na	Na	58,932	15,312	Na	Na
1993	18,394	43,586	28,470	7,059	144,124	40,051	175,470	32,184	5,038,050	643,672	2,148,000	239,859	54,016	16,421	26,000	6,838	62,990	16,023
1994	113,159	232,900	25,081	5,817	247,175	78,588	131,865	26,516	7,125,006	834,307	2,021,007	262,831	120,983	37,253	381,408	109,352	79,591	21,455
1995	67,415	152,216	9,696	1,862	156,787	56,741	418,744	102,116	5,472,352	937,436	2,425,162	349,271	127,476	40,347	392,494	143,926	54,856	14,100
1996	23,290	91,830	10,726	1,555	327,884	117,723	411,173	79,909	6,086,572	1,246,798	2,471,502	435,404	87,488	33,983	646,186	208,625	124,178	37,899
1997	41,791	110,223	12,353	1,297	202,604	71,363	232,963	41,249	6,990,774	839,015	3,059,000	385,391	28,764	11,140	800,000	263,195	139,476	42,536
1998	66,258	158,173	19,486	2,306	428,925	135,190	228,467	43,224	7,425,257	775,600	3,042,914	388,074	56,000	16,000	375,000	80,500	115,153	31,911
1999	111,535	238,160	5,344	990	306,977	87,592	255,569	46,034	6,062,500	558,467	3,584,900	386,943	226,655	71,055	445,000	63,500	242,676	52,821
2000	63,221	132,272	1,745	454	393,056	112,565	48,464	7,699	4,972,824	722,291	5,161,556	582,523	172,446	53,975	536,000	184,900	349,941	79,258

Quantity in Mt and Values in 1000 U.S $
Source: FAO Database.

Appendix Chapter 9

TABLE A9-1: AREA MODELLING IN LEVELS AND FIRST DIFFERENCES DATA FOR MAJOR CROPS IN EGYPT (*GENERAL AND SPECIFIC MODELS*)

Crop			Regressor											
Wheat	**Levels**	**LAW**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		General	11.2 [0.011]	-1.1 [0.518]	0.9 [0.180]	2.8 [0.145]	0.70 [0.466]	0.60 [0.585]	1.00 [0.303]	0.37 [0.366]	-1.57 [0.052]	1.02 [0.440]	-0.17 [0.574]	0.91
		Specific	12.7 [.000]	0.10 [.896]	0.75 [0.189]	2.36 [0.145]	0.60 [0.492]	0.01 [0.779]	0.69 [0.377]	0.11 [0.583]	-1.75 [0.017]	-	-0.003 [0.989]	0.89
	First Difference	**DLAW**	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	0.26 [0.022]	-2.02 [0.026]	3.01 [0.034]	5.69 [0.050]	0.59 [0.066]	-1.01 [0.040]	0.97 [0.097]	0.77 [0.012]	-4.20 [0.042]	0.09 [0.768]	-.518 [0.031]	0.99
		Specific	0.27 [0.003]	-1.97 [0.004]	3.11 [0.005]	5.95 [0.007]	0.57 [0.021]	-0.98 [0.007]	1.04 [0.014]	0.76 [0.001]	-4.33 [0.007]	-	-0.52 [0.007]	0.99
Short Berseem	**Levels**	**LASB**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		Levels	13.81 [0.001]	0.06 [0.945]	-0.45 [0.161]	0.48 [0.533]	-0.03 [0.951]	0.05 [0.920]	0.22 [0.591]	-0.09 [0.603]	-0.36 [0.233]	0.06 [0.919]	-0.02 [0.908]	0.92
		Specific	13.79 [0.000]	0.04 [0.953]	-0.45 [0.077]	0.44 [0.288]	-	0.04 [0.920]	0.21 [0.506]	-0.09 [0.524]	-0.36 [0.159]	0.07 [0.897]	-0.02 [0.872]	0.92
	First Difference	**DLASB**	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	-0.13 [0.011]	0.58 [0.036]	-1.44 [0.018]	3.62 [0.015]	-0.01 [0.865]	0.32 [0.045]	0.71 [0.023]	-0.33 [0.007]	-2.46 [0.014]	0.44 [0.036]	0.17 [0.032]	0.99
		Specific	-0.13 [0.001]	0.59 [0.006]	-1.43 [0.003]	3.60 [0.002]	-	0.33 [0.008]	0.70 [0.004]	-0.33 [0.000]	-2.46 [0.002]	0.44 [0.008]	0.17 [0.006]	0.99

Continued

Crop			Regressor											R^2
Long berseem	Levels	**LALB**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		General	15.27 [0.000]	0.65 [0.050]	-0.04 [0.568]	0.21 [0.339]	-0.07 [0.571]	0.50 [0.028]	-0.09 [0.443]	-0.04 [0.436]	-0.23 [0.040]	-0.50 [0.045]	0.12 [0.045]	0.96
		Specific	15.04 [0.000]	0.47 [0.000]	-	0.06 [0.250]	-	0.41 [0.000]	-	-	-0.23 [0.002]	-0.40 [0.000]	0.09 [0.000]	0.95
	First Difference	**DLALB**	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	0.01 [0.731]	0.55 [0.146]	-0.22 [0.640]	0.61 [0.582]	-0.07 [0.595]	0.46 [0.092]	-0.21 [0.465]	-0.02 [0.769]	0.05 [0.948]	-0.48 [0.119]	0.09 [0.321]	0.94
		Specific	-0.0007 [0.912]	0.47 [0.003]	-	0.01 [0.943]	-	0.39 [0.001]	-	-	-0.27 [0.029]	-0.36 [0.003]	0.08 [0.018]	0.91

Rice	Levels	**LAR**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		Levels	12.46 [0.000]	-0.86 [0.191]	0.77 [0.019]	-0.66 [0.248]	-0.29 [0.354]	-0.53 [0.185]	0.64 [0.084]	0.06 [0.637]	-0.57 [0.038]	0.76 [0.136]	-0.11 [0.292]	0.99
		Specific	13.05 [0.000]	-0.41 [0.098]	0.69 [0.001]	-0.78 [0.018]	-	-0.23 [0.174]	0.53 [0.032]	-	-0.65 [0.007]	0.35 [0.102]	-	0.98
	First Difference	**DLAR**	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	-0.06 [0.521]	-0.70 [0.384]	1.67 [0.263]	-2.69 [0.394]	-0.25 [0.498]	-0.51 [0.329]	1.19 [0.192]	0.04 [0.825]	-1.88 [0.381]	0.95 [0.189]	-0.03 [0.886]	0.94
		Specific	-0.08 [0.095]	-0.62 [0.036]	2.07 [0.018]	-3.75 [0.039]	-	-0.47 [0.036]	1.46 [0.015]	-	-2.42 [0.031]	0.95 [0.043]	-	0.91

Continued

Crop			Regressor											
Tomatoes	Levels	**LAT**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		General	11.64 [0.003]	0.32 [0.778]	0.06 [0.872]	0.30 [0.775]	-0.46 [0.468]	-0.27 [0.706]	-0.22 [0.700]	0.0006 [0.998]	-0.06 [0.863]	-0.03 [0.967]	-0.04 [0.848]	0.71
		Specific	11.77 [0.000]	0.33 [0.044]	-	0.44 [0.193]	-0.49 [0.100]	-0.25 [0.065]	-0.31 [0.128]	-	-	-	-	0.70
	First Difference	**DLAT**	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	-0.01 [0.952]	0.75 [0.616]	0.15 [0.950]	0.23 [0.968]	-0.53 [0.476]	0.07 [0.942]	-0.33 [0.815]	-0.24 [0.537]	-0.36 [0.926]	-0.23 [0.837]	0.04 [0.930]	0.62
		Specific	0.003 [0.901]	0.21 [0.311]	-	0.33 [0.377]	-0.31 [0.330]	-0.24 [0.205]	-0.31 [0.239]	-	-	-	-	0.45
Maize	Levels	**LAM**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		Levels	14.02 [0.001]	0.04 [0.964]	0.15 [0.637]	-0.49 [0.587]	0.33 [0.531]	0.001 [0.999]	-0.08 [0.874]	-0.09 [0.685]	-0.15 [0.630]	0.04 [0.953]	-0.02 [0.908]	0.73
		Specific	14.02 [0.000]		0.17 [0.081]	-0.57 [0.150]	0.40 [0.162]	-	-0.02 [0.859]	-0.08 [0.261]	-0.15 [0.391]	-	-	0.72
	First Difference	**DLAM**	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	0.12 [0.150]	-0.27 [0.618]	-1.67 [0.165]	3.47 [0.192]	0.28 [0.328]	-0.15 [0.655]	-0.95 [0.163]	0.09 [0.524]	2.51 [0.172]	-0.48 [0.300]	-0.16 [0.335]	0.85
		Specific	0.03 [0.237]	-	-0.32 [0.368]	0.31 [0.687]	0.25 [0.241]	-	-0.30 [0.300]	0.04 [0.604]	0.35 [0.395]	-	-	0.53

Continued

Crop			Regressor											
Cotton	Levels	**LAC**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		General	12.62 [0.004]	-0.67 [0.617]	-0.21 [0.631]	0.25 [0.837]	-0.40 [0.574]	-0.60 [0.477]	0.18 [0.788]	0.20 [0.509]	0.17 [0.682]	0.57 [0.564]	-0.13 [0.589]	0.84
		Specific	12.37 [0.000]	-0.83 [0.374]	-0.14 [0.550]	-	-0.29 [0.446]	-0.68 [0.291]	0.28 [0.450]	0.23 [0.307]	0.16 [0.651]	0.64 [0.426]	-0.15 [0.369]	0.84
	First Difference	DLAC	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	-0.08 [.685]	0.23 [.885]	0.95 [.731]	-2.16 [.733]	-0.46 [.565]	-0.05 [.956]	0.70 [.659]	-0.16 [.692]	-1.73 [.687]	0.40 [.748]	0.10 [.816]	0.56
		Specific	-0.02 [0.758]	0.05 [0.965]	0.02 [0.953]	-	-0.51 [0.429]	-0.12 [0.878]	0.21 [0.677]	-0.13 [0.687]	-0.31 [0.688]	0.15 [0.853]	0.01 [0.982]	0.52

Soybean	Levels	**LAS**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		Levels	12.72 [0.008]	-1.03 [0.550]	-2.12 [0.024]	-0.03 [0.986]	3.54 [0.022]	-0.13 [0.896]	-0.58 [0.500]	0.57 [0.189]	2.30 [0.018]	-0.14 [0.910]	-0.46 [0.185]	0.99
		Specific	13.23 [0.000]		-1.60 [0.001]	-	3.14 [0.001]	-	-	-	2.19 [0.001]	-1.64 [0.005]	-0.55 [0.014]	0.96
	First Difference	DLAS	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	0.24 [0.179]	-2.41 [0.140]	-5.79 [0.079]	7.88 [0.187]	3.51 [0.018]	-0.87 [0.302]	-2.41 [0.134]	1.12 [0.048]	7.87 [0.100]	-0.60 [0.524]	-0.90 [0.085]	0.98
		Specific	-0.01 [0.903]	-	-1.65 [0.024]	-	2.82 [0.018]	-	-	-	1.77 [0.052]	-1.04 [0.192]	-0.45 [0.095]	0.66

Continued

Crop			Regressor											R^2
Potatoes	Levels	**LAC**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		General	12.36 [0.035]	0.51 [0.860]	-1.24 [0.247]	0.16 [0.951]	1.66 [0.319]	0.01 [0.998]	-0.21 [0.884]	0.33 [0.606]	0.31 [0.737]	-0.55 [0.797]	-0.35 [0.497]	0.92
		Specific	11.76 [0.000]	-	-1.32 [0.000]	-	1.47 [0.006]	-	-	0.51 [0.011]	-	-	-0.35 [0.034]	0.90
	First Difference	**DLAC**	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	0.38 [0.241]	-0.13 [0.954]	-6.97 [0.173]	12.76 [0.239]	1.42 [0.267]	-0.18 [0.895]	-3.14 [0.240]	0.67 [0.308]	8.56 [0.241]	-2.36 [0.258]	-0.74 [0.304]	0.90
		Specific	0.02 [0.771]	-	-1.49 [0.012]	-	1.36 [0.021]	-	-	0.63 [0.052]	-	-	-0.23 [0.142]	0.66
Broad bean	Levels	**LABB**	β_0 (Constant)	β_1 (LPW)	β_2 (LPBB)	β_3 (LPLB)	β_4 (LPSB)	β_5 (LPT)	β_6 (LPM)	β_7 (LPC)	β_8 (LPR)	β_9 (LPS)	β_{10} (LPP)	R^2
		General	12.50 [0.019]	1.19 [0.609]	0.11 [0.883]	-1.92 [0.388]	1.07 [0.404]	0.46 [0.742]	0.19 [0.863]	-0.16 [0.751]	-0.85 [0.296]	-1.20 [0.494]	0.14 [0.728]	0.68
		Specific	11.85 [0.000]	0.75 [0.175]	0.16 [0.622]	-1.77 [0.102]	0.99 [0.236]	-	-	-0.8 [0.717]	-0.60 [0.172]	-0.65 [0.318	-	0.63
	First Difference	**DLABB**	γ_0 (Constant)	γ_1 (DLPW)	γ_2 (DLPBB)	γ_3 (DLPLB)	γ_4 (DLPSB)	γ_5 (DLPT)	γ_6 (DLPM)	γ_7 (DLPC)	γ_8 (DLPR)	γ_9 (DLPS)	γ_{10} (DLPP)	R^2
		General	-0.12 [0.715]	1.94 [0.515]	2.12 [0.668]	-6.43 [0.578]	1.15 [0.433]	0.71 [0.691]	1.55 [0.586]	-0.24 [0.737]	-3.81 [0.621]	-1.14 [0.609]	0.42 [0.600]	0.72
		Specific	0.08 [0.396]	0.73 [0.284]	-0.89 [0.365]	0.46 [0.797]	1.12 [0.181]	-	-	0.01 [0.961]	1.06 [0.381]	-1.47 [0.108]	-	0.62

Source: Study results obtained by *MicroFit 4* 'Econometric Program.'

References and Bibliography

References and Bibliography

Abdel-Khalek, G. *Stabilisation and Adjustment in Egypt: Reform or De-Industrialisation*: Edward Elgar Publishing Limited, 2001.

Abdel-Maksoud, H. A. "Linear Programming as a Technique for Maximisation the Value of Agricultural Output: Case of Field and Vegetable Crops." *Menofia Journal of Agricultural Research* 23, no. 4(1998): 1141-1156.

Abo-Saad, M. "The Egyptian Comparative Advantage in Producing and Exportiong Field Crops in Reform Era." Academy of Scientific Research and Technology, Egypt., 1996.

Abo-Saad, H. N. "Investigacion Economica para a Evaluacion del Agua de Riego (Gestion Y Uso) En Egipto." Tesis Doctoral, Universidad Politecnica de Valencia, 1998.

Adelkafi, and Boughanmi. "L'approche de la Matrice d' Analyse des Politiques Appliquee a' L'etude du Secteur Sucrier en Tunisie." *Tropicultura* 16-17, no. 2(1998): 51-58.

Adesina, A. A., et al. (2002) Policy Shifts and Adoption of Alley Farming in West and Central Africa [online]. International Institute of Tropical Agricultural (IITA). Available at: <URL: http:// www.iita.org /info/impact/alley.pdf> [Accessed 15/6/2003]

Adesina, A. A., and O. N. Coulibaly. "Policy and Competitiveness of Agroforestry-based Technologies for Maize Production in Cameroon: An Application of Policy Analysis Matrix." *Agricultural Economics* 19, no. 1-2(1998): 1-13.

Ahmed, A. U., and H. E. Bouis. "Weighing What's Practical: Proxy Means Tests for Targeting Food Subsidies in Egypt." *Food Policy* 27, no. 5-6(2002): 519-540.

Al-Habbab, M. S., and A. Al-Qadi. "Estimation of Relative Advantages of Using New Technologies in Vegetable Production in Jordan." *Journal of Derasat of Agricultural Sciences* 23, no. 3(1996): 277-88.

Alpine, R. W. L., and J. Pickett. "Agriculture, Liberalisation and Economic Growth in Ghana and Cote d' Ivoire, 1960-1990." OECD Development Centre, Paris: OECD Publications, 1993.

Alston, J. M. "An Analysis of Growth of U.S. Farmland Prices 1963-82." *American Journal of Agricultural Economics* 68(1986): 1-9.

Appleyard, D. "Comparative Advantage of Agricultural Production Systems and its Policy Implications in Pakistan." FAO Development Working Paper, No. 68, 1987.

Ayele, G., and F. Heidhues. "Economic Returns of Vertisol Innovation: An Empirical Analysis of Smallholders Mixed Farming in The Highlands of Ethiopia." *Tropenlandwirt* 100, no. 1(1999): 69-81.

Bacha, E., and L. Taylor. "Foreign Exchange Shadow Prices: A Critical Review of Current Theories." *Quarterly Journal of Economics* 52, no. 2(1971): 197-224.

Bahgwati, J. N., and T. N. Srinivasan. "The General Equilibrium Theory of Effective Protection and Resource Allocation." *Journal of International Economics* 3(1973): 259-81.

Balassa, B. "Dis-equilibrium Analysis in Developing Economics: An Overview." *World Development* 10, no. 12(1982): 1027-1038.

Balassa, B. "Incentive Policies and Export Performance in Sub-Saharan Africa." *World Development* 18, no. 3(1990): 347-503.

Balassa, B. (1971) The Structure of Protection in Developing Countries, John Hopkins Press.

Balassa, B. "Tariff Protection in Industrial Countries." *Journal of Political Economy* 73(1965): 573-594.

Balassa, B., and D. M. Schydlowsky. "Effective Tariffs, Domestic Cost of Foreign Exchange, and The Equilibrium Exchange Rate." *Journal of Political Economy* 76(1968): 348-360.

Bozik, M., et al. (2000) The Role of the Agriculture Sector in the Transition to a Market Economy: Slovak Case Study, ed. W.-R. Poganietz, et al., IAMO: Halle.

Bruno, M. "Domestic Resource Costs and Effective Protection: Clarification and Synthesis." *Journal of Political Economy* 80(1972): 16-33.

Bruno, M. "The Optimal Selection of Export-Promoting and Import-Substitution Projects in Planning the External Sector: Techniques, Problems, and Policies", New York, United Nations, 1967.

Byerlee, D., and M. L.Morris. "Calculating Levels of Protection: Is It Always Appropriate to Use World Reference Prices Based on Current Trading Status?" *World Development* 21, no. 5(1993): 805-815.

Centre Authority for Public Mobilisation and Statistics (CAMPS), Computer Information Centre, Egypt.

Corden, M. W. "Protection, Growth and Trade: Essays in International Economics." *Basil Blackwell Ltd, Oxford. U.K.* (1985).

Corden, M. W. "The Structure of a Tariff System and the Effective Protection Rate." *Journal of Political Economy* 74(1966): 221-237.

Corden, M. W. "The Theory of Protection." *Clarendon Press, Oxford* 1966.

Corden, W. M. *Trade Policy and Economic Welfare*: Clarendon, Oxford, 1974.

Cottani, J., D. Cavallo, and M. S. Khan. "Real Exchange Rate Behaviour and Economic Performance in LDCs." *Economic Development and Cultural Change* 39(1990): 61-67.

Cupo, p. ""Policy Analysis Matrix" Approach for the Allocation and Evaluation of Public Investments in Agriculture." *Journal of Rassegna Economica* LVIII, no. 1(1994): 85-114.

Czyzewski, A., et al. (2000) The Role of the Agriculture Sector in the Transition to a Market Economy: Polish Case Study, ed. W.-R. Poganietz, et al., IAMO: Halle.

De Boer, A. J., F. E. Walters, and M. A. Sharafeldin (1996) Impacts of the Policy Reforms on Livestock and Feed Production, Consumption and Trade, ed. A. Iowa State University Press, First Edition, Lehman B. Fletcher, pp. 112-147.

DeMelo, J. "Protection and Resource Allocation in the Walrasian Trade Model." *International Economic Review* 19(1978): 25-44.

DeMelo, J. "Tariffs and Resource Allocation in Partial and General Equilibrium." *Weltwirtschaftliches Archiv* 116(1980): 169-77.

Dobbins, C. L., et al. "The Return to Land Ownership and Land Values: Is There an Economic Relationship." *Purdue University, Agriculture Experiment Station Bulletin, no. 311* (1981).

Edwards, S. "Real and Monetary Determinates of Real Exchange Behaviour: Theory and Evidence From Developing Countries." *Journal of Development Economics* 29(1988): 311-341.

Edwards, S. (1990) Real Exchange Rates in Developing Countries: Concept and Measurement, ed. T. J. Grennes, Westview Press, Boulder Co.

El-Amir, M. R., and G. M. Siam (1996) Output Price Discovery and Transition in Egypt's Liberalised Agricultural Markets, ed. L. B. Fletcher, Iowa State University Press, Ames, Iowa, USA.

EL-Ashry, K. M. "An Economic Study of Egypt's Agricultural Trade Balance." Ph.D, University of Manchester, UK, 1992.

EL-Guendy, M. "Impacts of Agricultural Policy Protection and Competitiveness of Main Field Crops in Egypt." *Journal of Egyptian Agricultural Economics* 9, no. 1(1999).

El-Guendy, M., E. Siddik, and E. Ariza-Nino. "Policy Issues and Options in Egyptian Poultry Feed." Ministry of Agriculture and Land Reclamation (MALR), Agricultural Policy Reform Project, Reform Design and Implementation Unit, Egypt. 1999.

Ellis, F. "Agricultural Policy in Kenya: Applications of the Policy Analysis Matrix." *Journal of Development Studies* 33, no. 1(1996): 142-143.

Fang, C., and J. C. Beghin. "Food Self-Sufficiency, Comparative Advantage and Agricultural Trade: A Policy Analysis Matrix for Chinese Agriculture." Working Paper 99-WP, No. 233, 2000.

Food and Agriculture Organisation (FAO) "Comparative Advantage and Competitiveness of Crops and Crop Rotations and Livestock Products in Egypt: Policy Analysis Matrix Approach." FAO Regional Office, Policy Assistance Branch, Egypt, Cairo, 1999.

Food and Agriculture Organisation (FAO)"Training Module on Agriculture Price policy: Policy Analysis Matrix, The Case of Pakistan." United Nations, Economic and Social Commission for Western Asia, No. E/ESCWA/AGR/1993/6, 1993.

Food and Agriculture Organisation (FAO) "Trade Yearbook." varios issues, FAO, Rome.

Food and Agriculture Organisation (FAO) "Production Yearbook." varios issues, FAO, Rome.

Farrell, C. A. J. "An Evaluation of the Jamaican Agro-21 Export Diversification Program - a Policy Analysis Matrix Application." *Canadian Journal of Agricultural Economics-Revue Canadienne D Economie Rurale* 38, no. 4(1990): 1032-1032.

Finan, T. J. "Macro-Micro Linkages in Northwest Portuguese Agriculture - an Application of the Policy Analysis Matrix (PAM)." *American Anthropologist* 93, no. 1(1991): 137-148.

Fletcher, L. B. *Egypt's Agriculture in a Reform Era*: Iowa State University Press. Ames, Iowa. USA, 1996.

Ghei, N., and S. B. Kamin (1999) The Use of Parallel Market Rate as a Guide to Setting The Official Exchange Rate, ed. L. E. Hinkle, P. J. Montiel, and W. College, Oxford University Press.

Ghounem, S. A. E-M. "Economic Impact of Economic Liberalisation Policy for the Important Crops in the Egyptian Agriculture." Ph.D, University of Menofia, 2000.

Gittinger, J. P. *Economic Analysis of Agricultural Projects*: Baltimore: Johns Hopkins University Press, 1982.

Goletti, F. (1996) Private-Sector Distribution and Market Pricing of Agricultural Inputs: Fertilisers, Pesticides, Seeds and Machinery, ed. L. B. Fletcher, Iowa State University Press, Ames, Iowa, USA, pp. 167-191.

Gonzales, L. A., F. Kasryno, N. D. Perez, and M. W. Rosegrant. "Economic Incentives and Comparative Advantage in Indonesian Food Crop Production." International Food Policy Research Institute, Washington, D.C, 1993.

Granger, C. w. J., and P. Newbold. "Spurious Regressions in Econometrics." *Journal of Econometrics* 2, no. 2(1976): 111-120.

Greenaway, D. "Effective Tariff Protection in the United Kingdom." *Oxford Bulletin Economics and Statistics* 50, no. 3(1988a): 313-324.

Greenaway, D. (1988b) Evaluating The Structure of Protection in Less Developed Countries, ed. D. Greenaway, Macmillan Education, London.

Greenaway, D., and C. Milner. "Effective Protection and Intra-Industry Trade: Some Positive and Normative Issues." *Journal of Economic Studies* 5(1987b): 38-53.

Greenaway, D., and C. Milner. "Estimating the Shifting of Protection Across Sectors: An Application to Mauritius." *Industry and Development* 16(1986).

Greenaway, D., and C. Milner. *Trade and Industrial Policy in Developing Countries: A Manual of Policy Analysis*: The MacMillan Press Ltd, 1993.

Greenaway, D., and C. Milner. "True Protection Concepts and Their Role in Evaluating Trade Policies in LDCs." *Journal of Development Studies* 23, no. 2(1987a): 200-219.

Guendy, M. M. E. "Impacts of Agricultural Policy on Protection and Competitiveness of Main Field Crops in Egypt." *Egyptian Journal of Agricultural Economics* 9, no. 1(1999).

Gumaa, Y. T., et al. "Profitability Analysis of Food Grain in The Sudan's Irrigated Agricultural Sector." *Agricultural Economics* 11, no. 2-3(1994): 325-333.

Gutner, T. "The Political Economy of Food Subsidy Reform: The Case of Egypt." *Food Policy* 27, no. 5-6(2002): 455-476.

Handoussa, H., and H. K. El-Din (1998) A version for Egypt in 2012, ed. N. Shafik. London, MacMillan.

Harrison, K. M. (1996) Agricultural Processing, Marketing and Trade in the Reform Era, ed. L. B. Fletcher, Iowa State University Press, Ames, Iowa, USA.

Hassan, R., D. Greenaway and G.V.Reed. "Nominal and Effective Protection in the Egyptian Agricultural Sector: A Multicommodity Analysis." *Applied Economics* 24(1992): 483-492.

Hassan, R. A.-S. "Economic Efficiency of The Use of Agricultural Resources." Ph.D, University of Nottingham, 1991.

Hauschen, L. D., and W. M. Herr. "A New Look at the Relationship between Farm Real Estate Prices and Expected Returns to Land." *Contributed Paper to the American Agricultural Economics Association meetings* (1980).

Ibrahiem, A.-A. "The policy Analysis Matrix For Crop Rotations in Egypt." United Nations, Economic and Social Commission for Western Asia, No. E/ESCWA/AGR/1993/5, 1993.

Idris, B. "The Use of Policy Analysis Matrix in Agricultural Policy Analysis: A Case Study of Sorghum and Sesame in Sudan." FAO Regional Office for the Near East, Cairo, Egypt, 1993.

Ingram, W. D., and S. R. Pearson. "The Impact of Investment Concessions on the Profitability of Selected Firms in Ghana." *Economic Development Culture Change* 29(1981): 831-839.

International Monetary Fund (IMF) "Direction of Trade." various issues, Washington D.C.

International Monetary Fund (IMF) "Government Finance Statistics." various issues, Washington D.C.

International Monetary Fund (IMF) " International Financial Statistics." various issues, Washington D.C.

Ivanova, N., T. Todorov, and A. Zezza (2000) The Role of the Agriculture Sector in the Transition to a Market Economy: Bulgarian Case Study, ed. W.-R. Poganietz, et al., IAMO: Halle.

Joubert, C., and V. S. HD. "The Effect of Policy on South African Valencia Industry." *Agrekon* 39, no. 1(2000): 82-89.

Karayiannis-Bacon, H. "Tariff Protection and Import Substitution in Post-War Greece." *World Development* 4, no. 6(1976): 529-542.

Khedr, H., R. Ehrich, and L. Fletcher (1996) Nature, Rationale and Accomplishments of The Agricultural Policy Reforms, 1987-1994, ed. L. B. Fletcher, Iowa State University Press. Ames, Iowa. USA, pp. 51-82.

Khedr, H., R. Ehrich, and L. B. Fletcher (1996) Nature, Rationale and Accomplishments of the Agricultural Policy Reforms, 1987-1994, ed. L. B. Fletcher, Iowa State University Press, Ames, Iowa, USA.

Korany, B., and A. E. H. Dessouki. *The Foreign Policies of Arab States: The Challenge of Change*. Second Edition ed: Westview Press, 1991.

Kotb, T. H. S., et al. "Soil Salanisation in the Nile Delta and Related Policy Issues in Egypt." *Journal of Agricultural Water Management* 43(2000): 239-261.

Krabbe, and V. N. "Searching for Comparative Advantage in Commercial Sugar Production in South Africa: A PAM Analysis." *Agrekon* 39, no. 2(2000): 161-173.

Kreuter, U. P., and J. P. Workman. "Government Policy Effects on Cattle and Wildlife Ranching Profits in Zimbabwe." *Journal of Range Management* 47, no. 4(1994): 264-269.

Krueger, A. O. "Evaluating Restrictionist Trade Regimes: Theory and Measurement." *Journal of Political Economy* 80(1972): 48-62.

Krueger, A. O. (1984) Trade Policies in Developing Countries, ed. R. W. Jones and P. B. Kenen, vol. 1, pp. 519-569.

Kubursi, A. A. (2001) Lebanon's Agriculture Potential: A Policy Analysis Matrix approach, McMaster University and Econometric Research limited.

Kydd, J., R. Pearce, and M. Stockbridge. "The Economic Analysis of Commodity Systems: Extending the Policy Analysis Matrix to Account For Environmental Effects and Transactions Costs." *Agricultural Systems* 55, no. 2(1997): 323-345.

Lewis, S., and S. Guisinger. "Measuring Protection in Developing Countries: The Case of Pakistan." *Journal of Political Economy* 76(1968): 1170-1198.

Little, I. M. D., and J. A. Mirrless. *Project Appraisal and Planning for Developing Countries*: Heinemann Educational Books, London, 1974.

Lofchie, M. F. "Agricultural policy in Kenya: Applications of The Policy Analysis Matrix - Pearson,S." *Journal of Developing Areas* 31, no. 1(1996): 97-98.

Lofgren, H. "Economic Policy in Egypt: A Breakdown in Reform Resistance?" *International Journal of Middle East Studies* 25(1993): 407-421.

Lofgren, H., and M. El-Said. "Food Subsidies in Egypt: Reform Options, Distribution and Welfare." *Food Policy* 26, no. 1(2001): 65-83.

Lutz, E., and P. L. Scandizzo. "Price Distortions in Developing Countries: A Bais Against Agriculture." *European Review of Agricultural Economics* 7(1980): 5-27.

Maddala, G. S. *Introduction to Econometrics*. Third Edition ed: John Wiley & Sons Ltd, 2001.

Madnani, G. M. K. *Introduction to Econometrics: Principles and Applications*: Oxford and IBH Publishing Co., 1987.

Mangisoni, J. H. "Economic Efficiency and Investment Potential in the Smallholder Crop Sector in Malawi." *International Journal of Social Economics* 27, no. 7/8/9/10(2000): 968-979.

Masters, W., and A. Winter-Nelson. "Measuring the Comparative Advantage of Agricultural Activities: Domestic Resource Cost and Social Cost Benefit Ratios." *American Journal of Agricultural Economics* 77(1995): 243-250.

Mbiha, E. R. "Staple Food Market Control Policy Alternatives and The Case of Two Regions in Tanzania." Ph.D, London, Wye College, 1993.

McKinnon, R. I. (1996) Issues in Financial Reforms and Sequencing in Economic Transitions, ed. L. B. Fletcher, Iowa State University Press. Ames, Iowa. USA, pp. 9-25.

Melichar, E. "Capital Gains Versus Current Income in the Farming Sector." *American Journal of Agricultural Economics* 61, no. 5(1979): 1085-1097.

Michalek, J. "An Application of the Policy Analysis Matrix for an Evaluation of Agricultural Policies in the Slovak Republic." *Journal of Oxford Agrarian Studies* 23, no. 2(1995): 177-196.

Ministry of Agriculture and Land Reclamation, "Bulletin of Agricultural Economics." Agricultural Research Centre, Institute of Agricultural Economics Research, various issues, Cairo, Egypt.

Mongardini, J. "Estimating Egypt's Equilibrium Real Exchange Rate." International Monetary Fund, Middle Eastern Department, WP/98/5, 1998.

Monke, E. A., and S. R. Pearson. *The Policy Analysis Matrix for Agricultural Development*: Cornell University Press, 1989.

Morris, M. L. "Determining Comparative Advantage Through DRC Analysis: Guidelines Emerging from CIMMYT's Experience." CIMMYT's Economics Paper No. 1. Mexico City, Mexico, 1990.

Morrison, J., and K. Balcombe. "Policy Analysis Matrices: Beyond Simple Sensitivity Analysis." *Journal of International Development* 14(2002): 459-471.

Nassar, S., et al. (1996) Crop Production Responses to The Agricultural Policy Reforms, ed. L. B. Fletcher, Iowa State University Press, Ames, Iowa, USA.

Nelson, G. C., and M. Panggabean. "The Costs of Indonesian Sugar Policy - a Policy Analysis Matrix Approach." *American Journal of Agricultural Economics* 73, no. 3(1991): 703-712.

Organisation for Economic Co-operation and Development (OECD) [CD-ROM]. (1960-97 Geographical Distribution of Financial Flows to Developing Countries). Paris: OECD

Omran, M. A. R. S. "The Impact of the Liberalisation of Agricultural Input and Output Prices on the Cropping Pattern." Ph.D, University of Suez Canal, 1997.

Ott, A. F., and K. Hartley. *Privatisation And Economic Efficiency: A Comparative Analysis of Developed and Developing Countries*: Edward Elgar Publishing Company, 1991.

Principal Bank of Development and Agricultural Credit (PBDAC), Cairo, Egypt.

Pearson, S. "Net Social Profitability, Domestic Resource Costs, and Effective Rate of Protection." *Journal of Development Studies* 12(1975): 230-333.

Pearson, S., Monke, E., Argwings-Kodhek, G., Avillez., F., Mukimbu, M., Pagiola, S., Sellen, D., Winter-Nelson, A., "Agricultural Policy in Kenya, Application of the Policy Analysis Matrix." Cornell University Press, Ithaca, NY, 1995.

Pearson, S., Monke, E., Avillez, F., Bentley, J.W., Finan, T.J., Fox, R., Josling, T., Langworthy, M., Tangerman, S., "Portuguese Agriculture in Transition." Cornell University Press, Ithaca, NY, 1987.

Phipps, T. T. "Land Prices and Farm-Based Returns." *American Journal of Agricultural Economics* 66(1984): 422-429.

Plosser, C. I., and G. W. Schwert. "Money, Income and Sunspot: Measuring Economic Relationships and the Effects of Differencing." *Journal of Monetary Economics* 4(1987): 637-660.

Richards, A. *Egypt's Agriculture Development, 1800-1980: Technical and Social Change*: Westview Press, Boulder, Colorado, 1982.

Salinger, B. L. (2001) The Guide to Developing Agricultural Markets & Agro-Enterprises: Comparative Advantage Analysis, World Bank.

Scandizzo, P. L., and C. Bruce. "Methodologies for Measuring Agricultural Price Intervention Effects." Staff Working Paper, 1980.

Schweinberger, A. G. "Non-traded Intermediate Products and the Measurement of Protection." *Oxford Economics Papers* 27(1975): 215-231.

Sellon, D., 2001. A Simple Tool for Agricultural Policy Analysis [online]. The World Bank-Markets & Agribusiness. Available at: URL: http://wbln0018.worldbank.org/essd/essd.nsf/agroenterprise/pam> [Accessed 28 June 2002].

Shilpi, F. J. "Estimating the Level of Protections of Seasonal Price Fluctuations." *World Development* 24, no.5(1996): 929-937.

Shousha, F. M., and G. R. Pautsch. "Economic Reform and Aggregate Cropping Patterns for Egypt." *Journal of Agricultural Economics* 17(1997): 265-275.

Siggel, E. "Protection, Distortions, and Incentives in Zaire: A Quantitative Analysis." *Journal of Development Economics* 22(1986): 295-319.

Squire, L., and H. VanderTak. *Economic Analysis of Projects*: International Bank for Reconstruction and Development, The John Hopkins University Press, Baltimore and London, 1975.

Staal, S. J., and B. I. Shapiro. "The Effects of Recent Price Liberalisation on Kenyan Periurban Dairy: A Case Study Using the Policy Analysis Matrix Approach." *Food Policy* 19, no. 6(1994): 533-549.

Taskok, I. *Agricultural Price Policy: A Practitioner's Guide To Partial-Equilibrium Analysis*: Cornell University Press, 1990.

Taylor, L., and S. L. Black. "Practical General Equilibrium Estimates of Resource Pulls under Trade Liberalisation." *Journal of International Economics* 4(1974): 37-58.

Thorbecke, E. "The Policy Analysis Matrix for Agricultural-Development - Monke,E, Pearson,S." *American Journal of Agricultural Economics* 72, no. 2(1990): 511-512.

Timmer, C. P. "Agricultural Prices and Stabilisation Policy." Cambridge, MA: Harvard Institute for International Development, Development Discussion Paper No. 290, 1989.

Tyler, W. G. "Effective Incentives For Domestic Market Sales And Exports: A view of Anti-Export Biases and Commercial Policy in Brazil, 1980-81." *Journal of Development Economics* 18(1985): 219-242.

United Nations. " Commodity Trade Statistics." Department of Economic and Social Development, various issues, UN, New York.

United Nations. " Compendium of Social Statistics and Indicators." Economic and Social Commission for Western Asia (ESCWA), various issues, UN, New York.

Wally, Y., O. El-Kholei, M. Abbas and E. O. Heady. "Strategies for Agricultural Development in the Eighties for the Arab Republic of Egypt. International Development Series, DSR-9, Centre of Agricultural and Rural Development, Iowa State University, Ames, 1983.

Wichelns, D. "Economic Analysis of Water Allocation Policies Regarding Nile River Water in Egypt." *Journal of Agricultural Water Management* 52(2002): 155-175.

Winter-Nelson, A. "Rural taxation in Ethiopia, 1981-1989: A Policy Analysis Matrix Assessment for Net Producers and Net Consumers." *Food Policy* 22, no. 5(1997): 419-431.

Wipf, L. "Tariffs, Non-tariffs Distortions, and Effective Protection in U.S. Agriculture." *American Journal of Agricultural Economics* 53(1971): 423-430.

World Bank, "Egypt in the Global Economy: Strategies for Savings, Investments, and Long term Growth", Washington D.C, 1998.

World Bank, "Zimbabwe Agricultural Sector Memorandum", Washington D.C, 1991.

World Bank, "World Development Report", various issues, Washington D.C.

World Bank [CD-ROM]. (2002 World Development Indicators). Washington D.C: International Bank for Reconstruction and Development.

World Trade Organisation (WTO), "Trade Policy Review, Egypt." Geneva, August 1999.

Yao, S. "Rice Production in Thailand Seen through A Policy Analysis Matrix." *Food Policy* 22, no. 6(1997a): 547-560.

Yao, S. J. "Comparative Advantage and Crop Diversification: A Policy Analysis Matrix for Thai Agriculture." *Journal of Agricultural Economics* 48, no. 2(1997b): 211-222.

Yao, S. J. "Efficiency Impacts of Government Policy on Agricultural Production in the Presence of Externalities." *Journal of Environmental Management* 55, no. 1(1999): 57-67.

Yao, S. J. "A Modified Matrix for Policy Analysis on Production Diversification for Thai Agriculture." *Applied Economics Letters* 4, no. 4(1997c): 215-218.

Yeats, A. "A Sensitivity Analysis of the Effective Protection Estimate." *Journal of Development Economics* 3, no. 4(1976).