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INDUSTRIAL DEVELOPMENT IN MALAYSIA

*Dr. Ragayah Mohamed**

Introduction

Malaysia has been one of the most dynamic ecconomies in South-East-Asia over the last two decades (1970-1990). It experienced rapid economic growth, increases in real per capita incomes and underwent major structural shifts in its domestic economy.

Situated in the Malay Archipelago, Malaysia lies in the heart of South-East Asia. The Federation of Malaysia was established in 1963. Before this, Malaya comprised eleven states of Peninsula Malaysia including Singapore. Singapore however ceased to become a member of the Federation in 1965. Malaysia has a land area of 330,108 square kilometres which covers the Malay Peninsula (West Malaysia and the north western coastal area of Borneo Island (East Malaysia). The two areas are separated by 640 kilometres of the South China Sea. West Malaysia shares its northern frontier with Thailand and is separated from Singapore in the south by the Straits of Johore, and covers an area of about 131,598 square kilometres. East Malaysia, covering about 198,510 square kilometres, borders the territory of Indonesian West Borneo. The two parts of the country are in many respects distinctive. West Malaysia, with two-fifths of the land area but 83 per cent of the population accounts for 86 per cent of GDP and enjoys a significantly higher per capita income.

Malaya gained independence in 1957 when her population was 6.3 million. This rose to 10.5 million in 1970, 13.9 million in 1980 to 16.5 million by 1987. In terms of labour force, the country had an estimated total of 2.2 million in 1957 which rose

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to about 6.4 million by 1987, showing an average growth rate of 6.36 per cent per annum.

Malaysia is considered to be the third generation of newly industrialising economies of Asia after Japan and the NICs of the second generation namely, South Korea, Taiwan, Hong Kong and Singapore (Unido, 1984). Its per capita income is one of the highest amongst ASEAN countries (see Table 1) with US$ 2,130 in 1990, which the World Bank classifies as an upper-middle income country. Its growth rate during the 70s and 80s was much above the average of upper middle-income developing countries, with an average of 7.5 per cent in the 70s, 4.9 per cent between 1980-1986 and 6.7 per cent in 1988. Its export/GDP ratio of 54 per cent in 1983 and 67.9 per cent in 1990 (Asian Development Bank, 1991) makes it one of the most open of all developing countries.

Overall, the economic performance of Malaysia since 1960 can generally be described as impressive (Table 2). The Gross Dodestic Product (GDP) after having grown at about 6.4 per cent per annum during the 1960s, achieved an annual growth rate of 7.8 per cent in 1980; it however declined to -1.0 per cent in 1985 before recovering to 4.7 per cent in 1987. Per capita GDP expanded from M$731 in 1960 to M$3,470 in 1980 and M/4,460 in 1990(1),(2).

In 1960s, the economy achieved a strong growth despite sharp fluctuations in the prices of its principal exports, and a decline in the prices of major commodities which has led to a decline in the terms of trade by nearly 20 per cent over the decade. This was due to the favourable performance of its export sector which saw significant expansion in the volume

(1) Per capita GDP are in 1960 constant prices, while those of 1980 and 1990 are in 1978 constant prices, following the coventions of the Malaysian Department of Statistics (MDOS). The MDOS updates base year prices when it conducts a detailed study of the accounts in chosen years during which the weights used are also updated.

(2) Source : Economic Report, Ministry of Finance, Malaysia, various issues.

of exports of rubber, palm oil and timber. Despite the decline in the terms of trade, the export earnings improved from M$5.2 billion in 1970. The strong export performance has led to a positive balance of merchandise account and a surplus in the balance of payment between 1960-1980.

In the 1970s, Gross National Product (GNP) grew at about 7.5 per cent compared to 6.5 per cent in the 1960s. This improved performance was the result of higher levels in investment, the emergence of sizeable output of crude oil and a slowdown in the deterioration in the terms of trade. The share of gross investment in GNP increased from 17 per cent during 1966-70 to about 26 per cent during 1971-75 and 27 per cent during 1976-80 (Jomo, 1990, p. 46).

During the late 1970s and 1980s, the manufacturing sector took over the agricultural sector as an important source for economic growth (Table 3). In 1957, agriculture contributed about 39.3 per cent of the total GDP. By 1975, the share declined to 31.1 per cent. It fell further to 26.6 per cent by 1980 and to 18.7 per cent by 1990. The manufacturing sector, which contributed only 11 per cent of the GDP in 1957, expanded to 15.1 per cent in 1975, 23.9 per cent in 1985 and 24.4 per cent in 1988 (Mid-Term Review, 1989, p. 180) and rose up to 28.7 per cent in 1990. The table also indidicates the increasing dominance of the tertiary sector(3) in the Malaysian economy which accounted for more than 40 per cent of GDP over the period.

The structural changes faced by various economic sectors during the 1970s inevitably affected employment. This was indicated by a shift in the demand for labour away from agriculture to the more productive secondary(4) and tertiary sectors as shown in Table 4. Total employment in the agricultural sector fell from 58.3 per cent in 1957 to 51.6 per cent in 1968 and

(3) Tertiary refers to the utilities sector which comprises electricity, gas, water, etc. It also includes the services sector.

(4) Secondary sector refers to manufacturing, building and construction.

further down to 35.9 per cent in 1985. The manufacturing sector, the most important generator of employment in the 1970s, observed an increasingly high growth rate from 6.4 per cent to 9.1 per cent in 1968 and doubled to 18 per cent by 1985 (Fong, 1986, p. 27-30). By 1990, the manufacturing sector comprised about 19.5 per cent of total employment.

It is therefore evident that the manufacturing sector has played a most crucial role in Malaysia's economic development since the late 50s. It became a target sector in Malaysia's development strategies during the New Economic Policy era as transcribed in the Second (1971-75), Third, (1976-80), Fourth (1981-85), Fifth (1986-90) and Sixth (1991-1995) Malaysia Plans.

Structural Changes in the Manufacturing Sector (1950s-1980s)

The three decades after independence witnessed an acceleration of industrial growth which has made manufacturing industry the most dynamic and fastest growing sector in Malaysia. On average, the rate of growth of real output in manufacturing over the period was in the region of 11 to 12 per cent per annum, about twice the growth rate of real GDP. As a result, the share of manufacturing in GDP rose from barely 11 per cent in 1957 to 23.9 per cent in 1985. This growth was initially based on the processing and packing of primary products, mainly natural rubber, but over the years rapid shifts in the structure of manufacturing industries were evident.

Industrial development in Malysia started during the late 1950s. In the early 50s, Malaysia was a typical dependent colonial economy exporting its rich natural resources and raw materials in exchange for manufactured imports. There was no industrialisation programme as British colonialism was not really interested in local industrial growth, hence during those years, the manufacturing sector remained insingnificant. More than two-thirds of the total active labour force were engaged in agriculture. The agriculture sector was the supplier of reliable and cheap raw materials for industries in Britain. The Malayan industries prior to 1957 were mainly in tin mining, rubber and oil palm plantation, public utilities and communication services

producing goods of a non-traded nature. Though small-scale establishments belonging to individual proprietors and partners were predominant, a relatively small number of primary processing firms accounted for the major portion of the output.

Several reasons account for the lagging industrial development in Malaysia in the 1950s. Firstly, the effective demand generated by foreign trade leaked abroad through profit payments from primary commodities such as rubber and tin to foreign shareholders and remittances of income to Europe, China and India. The entrepot trade which flourished in the free ports of Penang and Singapore also acted as an easy way out from the establishment of a diversified industrial base. In relation to this too was the small size of the domestic markets. Finally, on the part of the Malaysia government there were no policies to encourage industrialisation programmes. However, industry did expand and the period between 1957 and 1980s can be divided into two main phases which roughly corresponds to the distinct, but overlapping stages in the economic transformation of Malaysia, i.e., the phases of «import-substitution» (1957-68) and «export-expansion» (1969 onwards).

1957-1970 : Import Substitution Period

After achieving independence, the Malayan economy of the 60s started off with the import-substitution strategy (ISIS) to promote industrialisation. The first two Five Year Development Plans for Malaya (1956-60 and 1961-65) gave priority to infrastructure development. The interest in industrial development is reflected in the allocation of public investment in this sector (Table 5). As can be seen from the table the government's financial commitment to industrial development was negligible during the First Malaya Plan. However, the expenditure increased very rapidly from the Second Malaya Plan inwards. The biggest increase came with the Second Malaysia Plan (1971-75) when the share of industrial development expenditure reached nearly 18 per cent of the total expenditure. It was during this period that the problems of an imbalanced economic growth of its productive sector was highlighted. There was an indication of overspeicalisation and excessive dependence

of the economy on a single product - rubber - which accounted for over 25% of national income, 30% of employment and about 60% of exports (Second Malaysia Plan, 1971-75). As a result, the entire economy was vulnerable to fluctuations of world rubber markets and the impact of technological development in synthetic rubber.

A number of measures were introduced to achieve rapid growth in the manufacturing sector. These were mainly aimed at attracting foreign investment into the country. The first measure taken for the stimulation of industrial development was tax incentives(5). Under the Pioneer Ordinance (1958), a two-year tax exemption was granted to any new manufacturing establishment approved as «pioneer». In addition, investment tax credit and accelerated depreciation allowances were given. To streamline the industrialisation effort, the government created two independent agencies in 1963; the Federal Industrial Development Authority (FIDA) later renamed the Malaysian Industrial Development Authority (MIDA), and the Tariff Advisory Board (TAB) which was subsequently replaced by the Special Action Committee on Tariffs (SACT).

In order to protect domestic producers from foreign competition, the government introduced taxes and import duties. The import duties which existed in the 1940s and the early 1950s have served exclusively for revenue purposes. The establishment of the Tariff Advisory Board Act was a turning point from tariff policy used for revenue purposes to a tariff for protection. This granting of tariff protection to new industries in 1964, and the income tax reform of 1967, gave further investment increntives to new industries(6).

Despite these measures, however, the government could still be considered to have followed a relatively liberal free trade economic strategy. The effective rate of protection (EPR)

(5) Federation of Malaya Report of Industrial Development Working Party, Government Printer, Kuala Lumpur, 1957.

(6) For the structure of trade and protection policies, see Edwards, 1975; Fong and Lim, 1984; Lee, 1985.

for manufacturing was only 15 per cent in 1962 (Ariff, 1985) which is very low compared to other developing countries such as the neighbouring Phillipines for instance, which revealed a high EPR of 250 per cent during this period (Bautista, 1979).

In response to these policy instruments, the manufacturing sector experienced rapid growth during the 1960s. The dominant industries of the 60s were centred on the manufacture of rubber, food processing and wood based industries (value added and employment profiles of the major manufacturing sub-sectors are given in Tables 6 and 7 respectively). In 1963 these industries accounted for 17.2, 15.4 and 13.6 per cent of the value added respectively.

Industrial growth was also reflected in the changing composition of trade in manufactured goods over the period 1957-70. The proportion of manufactured imports to total imports was 43.2 per cent in 1957 (Table 8). This had increased slightly to 43.7 per cent in 1965. Manufactured exports as a proportion of total exports, on the other hand, increased from 18.1 per cent in 1957 to 27.6 per cent 1965. It is thus evident that during the import-substitution period, although Malaysia was industrialising rapidly through import substitution, its imports of manufactured goods also rose substantially compared to exports of manufactured goods.

Even though Malaysia's early industrial policy has relied on import substitution strategies, substantially on domestic demand expansion, it experienced significant growths in the early stages of its industrialisation process (Hoffman and Tan, 1980). The import substitution strategy made a significant contribution to the development process of the country by helping to diversify the economy.

Post 1970 : Export Oriented Period

While the early part of Malaysia's industrialisation was promoted to reduce the lopsided structure of the economy through diversification, in the late 1970s and early 1980s the government placed greater weight on employment creation and on

restructuring society towards a more equitable participation of all ethnic groups in the commercial, manufacturing and services sector(7). In a country with a small domestic market, import substitution can be a means of growth for only a short period. When the possibilities for further import substitution are exhausted, the manufacturing growth rate cannot exceed that of domestic demand for such commodities, unless it is sustained by export expansion. The government began to recognise this problem towards the end of the 1960s. Thus the Second Malaysia Plan revealed the government's commitment to encourage and actively promote manufacturing exports. The switch to export-oriented industries in 1968 marked the beginning of a new thrust for growth in the manufacturing sector(8).

During this second phase, more liberal industrial legislation was enacted, commencing with the Investment Incentives Act of 1968, which superseded the 1958 Ordinance. Tariff protection was increased for infant industries, and tax concessions were offered to encourage labour intensity, the use of domestic raw materials, location in accordance with government priorities, and increases in efficiency. To encourage exports, export incentives were also offered to new industrial establishments. Under this incentive, expenses incurred in export promotion were allowed double deduction from tax payment. Other inducements offered included industrial estates, free trade zones

(7) This was spelled out in the New Economic Policy which was launched in 1970 after May 13th. 1969 race riots. Its immediate aim was to correct wide imbalances in income, employment and equity ownership between indigenous and ethnic races. To this end, Bumiputras (or native indigenous races) were to increase their ownership of the corporate sector to 30 per cent by 1990, with other Malaysians holding 40 per cent and the stake of foreigners in corporate equity falling to 30 per cent.

(8) Although this marked the beginning of the policy switch from import substitution to export oriented industries, the level of effective protection rate (ERP) is still relatively high in the early 70s. In 1972, the overall manufacturing ERP is estimated to be 70 per cent. This indicates that the export oriented strategies are not accompanied immediately with the removal of import protection. It may also indicate the transitionary period of the policy switch before the full impact could be felt.

(FTZs) (9) and the opening of the Malaysian Export Trade Centere (MEXPO) to introduce products to foreign importers and to encourage foreign investment in Malaysian manufacturing. In 1972, the Federal Industrial Development Authority (FIDA) launched its new promotional campaign establishing investment promotional centres overseas to generate publicity on the announcement of its export-orientated industries in Malaysia as a further effort to attract foreign investors.

Two main types of export-oriented industries developed. The first type is the processing of raw materials such as rubber, palm oil, and timber for exports. A second type of export-oriented industries are those which are highly labour intensive.

By the mid 70s, manufacturing industried became the leading growth sector in the Malaysian economy. Over the period 1970-1975, the average annual growth rate of the manufacturing sector was 10.9 per cent, surpassing that of agriculture which was 5.9 per cent per annum (Third Malaysia Plan, 1976-80). However, in terms of its relative contribution to total growth, agricultural production, mainly from the palm oil sector, continued to predominate with over 25 per cent in real GDP while manufacturing accounted for 19.3 per cent of total growth. The share of manufacturing in GDP increases from 13.2% in 1968 to 15.1 per cent in 1975 and 19.1 per cent in 1980 while the share of the agricultural sector, declined from 35 per cent in 1968 to 31.1 per cent in 1975 and down to 26.6 per cent in 1980.

Industrial development during the decade has led to a rapid increase in employment in the manufacturing sector. The share of employment in manufacturing sector increased from 9.1 per cent in 1968 to 15.8 percent in 1980 while the share of employment in the agriculture sector decreased from 51.6 per cent to 40.6 per cent over the same period.

(9) The importance of export processing zones (Free Trade Zones - FTZ) in Malaysia is unique among the developing countries establishing these zones. The role of FTZs in Malaysia is significant both in absolute terms or as a proportion of overall manufacturing activity (Warr, 1987, p. 30).

According to the Fourth Malaysia Plan (1981-1985). the major industries contributing to the high growth of value added in the manufacturing sector during the 70s were rubber processing and products, food manufacturing, chemical products and wood based products. One of the more obvious results of the export-oriented industrial strategy was the emergence of electrical machinery, mainly in the form of electronics and electrical components, as a significant contributor of value added and employment opportunities. By 1985, it had become the second largest industry after food products in terms of both output and value added. Other leading industries were food manufacturing, textiles petroleum products, non-etal mineral products, and transport equipment industries.

Interestingly, the food processing industry whose contribution to value added had increased from 16.1 per cent in 1968 to 20.8 per cent in 1978, had its contribution to industrial employment reduced from 14.9 per cent in 1968 to 8.8 per cent in 1978. This is due to the steady upgrading in the food-processing technology, which by 1978 had resulted in a much more capital-intensive food-processing sector than the early 70s (Fong, 1986, p. 38-39).

Another fast-growing export-oriented labour intensive industry which shows promising growth in terms of value added and employment is textile manufacturing. From 3.1 per cent share of value added in 1968, it grew to 8% in 1978 alongside increasing employment growth from 6.6% to 14.7% in the respective years.

While the export-oriented industries of food processing, electrical machinery and textiles showed rapid growth, the domestic oriented industries such as beverages, tobacco products, nonmetallic products and printing industries declined in their share of value added. The decline in relative importance of domestic-oriented industries became very clear by 1978. Chemical products declined from their 1968 share of 9.1 per cent of industrial value added to 5.7 per cent in 1978. Similarly, beverages and tobacco products declined from the 1968 share of 10.6 per cent of value added to 5.3 per cent in 1978, and the contribution

of non-metal products from 7.1 per cent in 1968 to 3.9 per cent in 1978.

The rapid increase in manufactured exports and the significant changes in their composition were reflective of the significant changes in the structure of the manufacturing sector in the 1970s. Exports of manufactured goods accounted for 26.1 per cent of the total gross exports in 1970, 27.8 per cent in 1980 and 59.3 per cent in 1990 (see Table 8). During this period the sub-sectors of electronics and electrical products, in particular, and textiles and garments grew significantly. After 1975, electronic products form the largest export item with textile coming in second place (Table 9)(10).

By this time foreign interests owned 55 per cent of the share capital in limited companies revealing the growing importance of foreign direct investment in the economic development of Malaysia (Lim, 1983, p. 207). The substantial outflow of funds in the form of profit repatriation and royalties payments of the parent foreign companies coupled with limited transfer of technology from the multinational electronic corporations expressed the need for Malaysia to reexamine its industrialisation strategies. If in the past, the bulk of exports were in the form of raw primary products, the policy makers realised a need to engage in producing finished and semi-finished products by utilising its rich primary resources of rubber, palm oil, timber, tin and petroleum.

Malaysia in the 1980s came to an important crossroad where in order to push forward for further development and progress, she had to modify her priorities and adopt new strategies. While resource-based(11) industries and exportoriented industries were

(10) Note that Table 9 shows figures for Peninsula Malaysia (West Malaysia) and does not include East Malaysia. These industries are mainly centred in Peninsual Malaysia. East Malaysia mainly exports timber and wood-based products.

1) Such as rubber products, palm oil products, wood-based products, chemicals and petrochemicals, non-ferrous metal products and non-metallic mineral products industries (IMP-Executive Highlights 1986-95).

still being encouroger, Malaysia began to emphasise the need to widen and strengthen the foundation and structure of her manufacturing sector. Employment creation was seen to be no longer as crucial as before. The country instead saw a need to train workers in engineering and other related skills. There was a new need to import and absorb more sophisticated technologies with the aim of developing her own technologies in the near future. Instead of assembling, semi-processing and producing simple consumer goods, Malaysia decided to produce industrial raw materials and intermediate inputs for her industries and also machinery and capital goods. All these structural changes in the manufacturing sector required that Malaysia venture into heavy industries(12) in the 1980s.

Hence with the Fourth Malaysia Plan (1981-1985) and the Fifth Malaysia Plan (1986-1990) the thrust of the exportoriented industrialisation is geared towards heavy industries. The new emphasis towards heavy industries is to provide the link between industrialisation and non-reliance on foreign countries for the supply of machinery and intermediate inputs. It is intended that heavy industries such as chemical complexes and integrated steel mills could provide strong linkage effects to less developed regions, which would lead to the development of other ancillary industries.

Consequently, the period between 1980-1987 saw an increase in the value added of industries such as chemical products (from 201 million Ringgit in 1980 to 966 million Ringgit in 1987), petroleum refineries (116 million to 172 million Ringgit), steel and iron (80 million to 184 million Ringgit) and transport equipment (156 million to 250 million Ringgit) (UNIDO Global

(12) Heavy industries are those associated with high capital intensity, long gestation periods and substantial economies of scale. In Malaysia, heavy industrialisation refers to the setting up of iron and steel plants, cement, petrochemicals, shipbuilding and repair and the manufacturing of motor vehicles (Jomo, 1990; Ariff and Semudram, 1987).

Report, 1989/90) (13).

The shift towards heavy and capital intensive industries in the 80s and 90s is essential for the development and advancement of Malaysia's industries in view of the high and escalating labour costs(14). With the low wage rate countries of Thailand and Indonesia as her immediate neighbours vigorously attracting labour intensive investments from abroad, there is an important need to widen and strengthen the industrial base, by diversifying its labour intensive industries to higher level technologies in resource based industries(15).

Hence, the development of heavy indsutries to reduce dependence on foreign countries for intermediate inputs, together with regional dispersal of industry, promotion of high-technology industries, at one end, and small-scale industry, on the other all became avowed development objectives of the 80s and 90s.

Foreign investment was important, especially in pioneer industries, with Japan, United Kingdom, United States, Australia, Singapore and Hong Kong as the chief sources of capital. Direct foreign investment represents the most important form of foreign investment in the country (Ariff and Semudram, 1987). Recent statistics reveal that approvals for foreign investment increased by more than 50 per cent from the 1988 figure of an average 12 per cent contribution to total private investment growth (Lee, 1989, p. 10-11).

(13) Although their value added have shown marked increases, their shares in total manufacturing appear to have declined slightly due to an increase in the total manufacturing value added. The increase in total manufacturing value added is also accounted by large increases in the value added of industries such as food products and electrical machinery.

(14) Malaysia's labour cost is comparatively higher than many of its Asean neighours with the exception of Singapore. It is anticipated that Malaysia would soon loose its competitiveness in labour intensive industries (Fong, 1986; World Bank, 1989, p. 10).

(15) It was with this effect in mind that the Heavy Industries Corporation of Malaysia Berhad (HICOM) was established in November of 1980 aiming at implementing and managing projects which require large investment outlays and having long gestation periods.

The evidence from the statistics and trends of the manufacturing sector in the 60s, 70s and 80s, shows it to be a leading growth sector of the economy and it will continue to play a crucial role in the development strategies for Malaysia beyond 1990. The importance of the manufacturing sector in contributing to economic growth has made it a focus of the nation's planning and development strategies. Hence it is not surprising that the Government played a substantial part by directly participating in the expansion of those industries considered important to the economy.

With the aim of promoting industrial development, combined with the commitment to the New Economic Policy, the Government undertook the responsibility of participating in the establishment and operation of a wide range of productive enterprises. This was done through the establishment of publicly owned enterprises as well as joint-ventures with the private sector in agriculture, public utilities and infrastructure, commerce and finance and more distinctively in the industries of the manufacturing sector.

The NFPEs were established in almost every area of the manufacturing sector especially in food, chemical, iron and steel, petroleum, cement, transport equipment and wood-based industries amongst others(16). The highest contribution of value added by publicly owned enterprises is in the manufacture of industrial gases (85.0% of total value added in 1985). Government enterprises also dominate the manufacturing sub-sectors of petroleum (63.1%), tyre and tube (62.8%), sugar factory (56.10%), hydraulic cement (45.0%), food products (44.6%), vegetable and animal oils (33.3%), palm oil (32.9%) and palm kernel oil (30.9%) (17).

In the 1990s, the private sector is expected to assume a more rigorous role in generating investment and sustaining growth

(16) Information gathered from the Central Information Coordination Unit (CICU), Permodalan Nasional Berhad.

(17) Data collected from the Malaysian Statistics Department, Kuala Lumpur.

in the Malaysian economy. The Privatisation Master Plan (1991) indicates greater transfer of ownership from public sector to private sector firms during the nineties decade. Twenty-two public enterprises have already been identified for privatisation in 1990, eight of which are in the manufacturing sector(18). By early 1992, a total of 54 public enterprises have been privatised(19).

Conclusions

The Malaysian economy has demonstrated considerable growth in the last two decades. The attempt towards diversification from heavy reliance on agriculture sector towards the manufacturing sector took place at very impressive rates over the period 1960s to the 80s. The share of the primary sector in the gross domestic product went down from about 28 per cent in the early 70s to about 22 per cent in the late 80s, while that of the secondary sector went up from about 15 per cent to 23 per cent.

Much of the overall economic growth originated from the manufacturing sector. In the late sixties, the structure of the manufacturing sector changed from import-substitution to export-oriented industries, while the period of the early eighties show a tendency towards heavy industries.

Industrial development in the 1980s was more restrained by effective demand (external and internal) than in the 1960s and 1970s, when supply was the main constraint. On the demand side, the achievement of industrial growth has been made difficult by external conditions over which Malaysia can exert little control. Constraints imposed by internal demand include amongst others, economic factors such as income inequality, low productivity in agricultural sector and insufficient private investment.

(18) Economic Planning Unit (EPU) (Privatisation Section), Prime Minister's Department, 1991.

(19) EPU (1992), unpublished data.

Public sector involvement in key manufacturing sectors such as food processing, wood and wood products, chemical industries, rubber products, non-metallic mineral products, iron and steel and transport equipment provided the impetus for their further development.

After 1985 although the new industrialisation strategy (outlined in the Industrial Master Plan (1986-1995) continued to place emphasis on the national objectives of the New Economic Policy (i.e. to restructure society through equitable distribution of income and wealth), the thrust of industrial development is focused on the private sector. Future industrial development and economic expansion in the nineties are to rely on greater participation by the private sector. Manufacturing sector is expected to remain as an important growth sector in the Malaysian economy.

Table 1

Selected indicators for South-East-Asian Countries for 1990

Country	Pop. (mil.)	Land Area ('000) Km	Growth Rate of GDP % per annum	Exports/ GDP (%)	Growth Rate of MVA (%)	Per Capita GNP(US$) @
Indonesia	178.3	1919	7.0	22.9	8.4	430
Malaysia	17.4	330	9.4	67.9	12.8	2130
Phillipines	60.3	300	2.5	12.6	1.9	700
Singapore	2.7	0.6	8.3	144.4	7.1	10450
Thailand	55.5	514	10.0	28.6	15.8	1160

Source: Asian Development Bank, Asian Development Outlook 1991 pp. 278-295

Table 2.

Malaysia: Important Economic Statistics, 1960-1990

	1960	1965	1970	1975	1980	1985	1990
GNP at constant @ prices (M$ billion)	6.6	8.6	12.2	16.9	42.9	52.7	75.8
Growth of GNP (%)	6.1	6.0	6.0	2.2	8.6	-1.4	14.8
Per Capita GNP (M$)	821	917	1169	1419	3675	4573	6176
GDP at constant prices (M$ billion)	6.9	9.2	10.7	17.4	44.5	57.2	79.2
Growth of GDP (%)	6.4	6.9	6.3	0.8	7.8	-1.0	9.8
Per capita GDP (M$)	731	976	1029	2005	3470	3643	4460
Unemployment rate (% of labour force)	6.0	5.0	7.4	7.0	5.7	7.6	6.0
External public debt as % of GNP	5.4	5.9	6.1	14.3	11.3	32.2	48.2

@ Figures for 1960 and 1965 are in 1960 constant prices, 1970 and 1975 in 1970 constant prices and 1980,1985,1987 and 1990 are in 1978 constant prices.

Sources :

Bank Negara Malaysia, Annual Report, Bank Negara Malaysia, various years.
First Malaysia Plan, 1966-70, Government Printer, Kuala Lumpur.
Second Malaysia Plan, 1971-75, Government Printer, Kuala Lumpur.
Economic Report 1991/1992, Ministry of Finance, Malaysia.

Table 3.

Percentage Composition of GDP by Economic Sectors 1957 - 1990

Sector	1957	1965	1968	1975	1980	1985	1990
Agriculture	39.3	34.4	35.0	31.1	26.6	17.8	18.7
Manufacturing	11.1	11	13.2	15.1	19.1	23.9	28.7
Mining	6.4	5.2	4.9	3.0	3.0	4.3	9.8
Construction	-	4.3	3.9	4.5	4.7	4.8	3.6
Services	43.2	45.1	43.0	46.1	46.6	49.2	42.4

Sources:

Malaysia, Monthly Statistical Bulletin, Department of Statistics, Kuala Lumpur, various issues.
Economic Report 1991/1992, Ministry of Finance, Malaysia.

Table 4

Percentage Composition of Employment by Economic Sectors 1957 - 1990

Sector	1957	1965	1968	1975	1980	1985	1990
Agriculture	58.3	52.1	51.6	49.3	40.6	35.9	27.8
Manufacturing	6.4	8.4	9.1	10.1	15.8	18.0	19.5
Mining	2.8	2.5	3.0	2.2	1.7	1.5	0.6
Construction	3.2	3.5	3.3	2.9	5.2	5.5	6.9
Services	29.1	33.5	33.0	35.5	36.7	39.1	45.2

Sources:

Malaysia, Monthly Statistical Bulletin, Department of Statistics, Kuala Lumpur
Economic Report 1991/92, Ministry of Finance, Malaysia

Table 5:

Percentage of Public Expenditure in Various Sectors for 1959 - 1975

Sectors	1st. Malaya Plan 1956-60	2nd.Malaya Plan 1961-65	1st.M'sia Plan 1966-70	2nd. M'sia Plan 1971-75
Agriculture and rural development	23.61	17.53	30.74	27.77
Mining		0.03	0.01	0.01
Industrial development	1.25	2.52	4.62	17.55
Transport	23.90	25.10	12.00	15.69
Communications	5.35	4.83	5.38	5.40
Utilities	24.75	22.49	21.82	12.57
Social services	14.40	22.22	21.75	16.55
Government administration	6.74	5.27	3.68	4.46

Sources: First Malaysia Plan, 1966-70, 28-9, 69-70
Second Malaysia Plan, 1971-75, 68-71
Mid-Term Review of the Second Malaysia Plan, 1971-75, 98-101

able 6:

ercentage Composition of Value Added in Manufacturing Industries 1963 - 1990

Sector	1963	1968	1974	1978	1985	1990
Food products	15.4	16.1	17.3	20.8	16.2	9.5
Beverages and Tobacco	9.8	10.6	6.3	5.3	3.6	3.6
Textiles	1.9	3.1	5.3	8.0	5.1	6.4
Timber based products	13.6	12	10.9	10.4	8.1	7.2
Paper,leather & printing	7.9	6.8	6.2	4.8	5.4	4.7
Chemical & chemical products		9.1	6.8	5.7	5.0	10.8
Petroleum products	10.0	4.7	1.8	3.3	4.0	2.6
Rubber products	17.2	14.5	12.7	9.9	9.9	5.8
Other non metal mineral prod.	6.5	7.1	4.4	3.9	2.5	8.9
Electrical machinery	1.1	2.4	9.4	10.9	12.9	21.4
Transport equipment	1.4	2.1	3.2	3.0	2.2	5.4
Other manufactures	15.2	11.4	15.7	14.0	25.1	13.7

urces: Census of Manufacturing Industries, 1963 and 1968, Department of Statistics, Kuala Lumpur.
Survey of Manufacturing Industries, 1974 - 1990, Department of Statistics, Kuala Lumpur.
Fourth and Fifth Malaysia Plan, Government Printers, Kuala Lumpur

ble 7:

rcentage Composition of Employment in Manufacturing Industries 1963 - 1990

Sector	1963	1968	1974	1978	1985	1990
od products	16	14.9	10.7	8.8	12.9	8.9
verages and Tobacco	7.4	5.1	4.1	2.8	2.1	1.1
xtiles	2.7	6.6	13.3	14.7	5.8	12.2
mber based products	17.2	18.0	17.0	15.0	13.4	12.5
per,leather & printing	9.3	8.8	7.2	5.9	8.4	4.5
emical & chemical products		4.5			3.4	2.6
troleum products	4.8	0.3	4.0	3.4	0.5	0.3
bber products	19.7	15.6	10.3	8.6	5.9	7
ner non metal mineral prod.	5.9	5.7	5.1	4.7	4.7	8.7
ectrical machinery	0.8	1.7	10.6	17	17.2	25.8
nsport equipment	1.9	2.9	1.4	3.6	4.1	3
ner manufactures	14.3	15.9	16.3	15.5	21.6	13.4

Sources:

Census of Manufacturing Industries, 1963 and 1968, Department of Statistics, Kuala Lumpur
Survey of Manufacturing Industries, 1974 and 1978, Department of Statistics, Kuala Lumpur
Fourth and Fifth Malaysia Plan, Government Printers, Kuala Lumpur

Table 8

Malaysia: Exports and Imports of Manufactured Goods, 1957-1990

Year	Manufactured Exports ($ mil)	% of total Exports	Manufactured Imports ($ mil)	% of total Imports
1957	395.8	18.1	784.4	43.2
1960	608.0	20.8	962.7	44.8
1965	1045.8	27.6	1466.7	43.7
1970	1347.4	26.1	2484.2	57.2
1975	2805.0	30.4	5340.0	62.8
1980	7840.0	27.8	15951.0	68.0
1985	11973.0	31.5	21995.0	72.3
1986	14911.0	41.7	18729.0	67.1
1987	20267.0	44.9	21409.0	67.0
1988	27085.0	49.0	28642.0	66.2
1989	36350.0	54.7	38035.0	65.9
1990	47143.0	59.3	52387.0	66.2

Notes: Figures for 1957-1965 refer to Peninsula Malaysia only.
Figures for 1970-1985 refer to Malaysia.

Sources: Federation of Malaya, Monthly Statistical Bulletin of the Federation of Malaya, Dept. of Statistics, Kuala Lumpur, 1960.
Malaya, Monthly Statistical Bulletin of the States of Malaya, Dept. of Statistics, Kuala Lumpur, 1964
Malaysia, Annual Bulletin of Statistics, Dept. of Statistics, Kuala Lumpur, 1965,1970,1971
Malaysia, Economic Report, Ministry of Finance, Kuala Lumpur, various issues.

Table 9

Peninsula Malaysia: Exports of Major Manufactured Goods, 1970-1990

Industry	1970		1975		1980		1982		1986		1990	
	M$mil	%	M$mil	%	M$mil	%	M$mil	%	M$mil	%	M$mil	%
Food, Beverage and tobacco	84	16.2	232	12.9	493	8.0	533	7.2	753	4.5	2061	4.4
Textiles and Footwear	44	8.5	214	11.9	802	13.0	819	11.0	1644	11.0	3983	8.5
Wood products	20	3.8	197	11.0	432	7.0	413	5.5	534	3.6	1535	3.3
Manufacturing Transport equipment	41	7.8	464	25.9	308	5.0	429	5.8	1034	6.9	2234	4.7
Electronics, Electrical Components	31	6.0	411	23.0	2691	48.0	3573	47.9	7976	53.5	26496	56.2
Others	300	57.7	268	15.0	1172	19.0	1681	22.6	2970	19.9	10834	22.9

Sources: Malaysia, Economic Report, Ministry of Finance, Kuala Lumpur, various issues.
Malaysia, Annual Statistics of External Trade, Vol. 1, Department of Statistics, Kuala Lumpur, various years.

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EGYPT'S EXPERIENCE FROM CGE MODELING

A CRITICAL REVIEW

*HANS LOFGREN**

1. INTRODUCTION

Since the 1970s, a relatively large number of Computable General Equilibrium (CGE) models have been built for the Egyptian economy. However, like model-based analyses in most Arab countries, the contribution of these models to policy making has been very limited. As noted by Issawy [1993 : 411], this is caused by a number of interrelated factors, including the non-continuous nature of modeling which prevents the accumulation of knowledge ... i.e. new modelers have only to a limited extent been able to stand on the shoulders of their predecessors. The purpose of this paper is, through a critical review of major CGE models for Egypt, to mitigate this problem. These models, moreover, are scattered over a variety of sources and many are not easily located. Section 2 provides a brief background on CGE modeling in Egypt. In Section 3, specific aspects of the model structures are contrasted and evaluated. Simulations of policies and exogenous shocks are discussed in Section 4. A concluding evaluation with guidelines for future research follow in Section 5.

2. BACKGROUND AND OVERVIEW

CGE models may be defined as a economy-wide models the solutions to which depict a simultaneous general equilibrium in all markets of the economy(1). Most rarely all of the data required may be derived from a Social Accounting Matrix (SAM).

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(1) For further guidance regarding CGE modeling, see Bergman (1990), Dervis et al (1982), Robinson (1989), and Taylor (1990).

The first CGE model was developed by Johansen (1960). The first applications to LDCs came in the early 1970s. Since then, these models have become standard tools for policy analysis in LDCs.

The studies of Egypt that will be reviewed in this report are listed in chronological order in Table 1. In the table, the models are classified by their time frame (static or dynamic), underlying theoretical paradigm (neoclassical or structuralist), and policy focus. A static model is typically solved for only one time period whereas, the dynamic models under review are solved for several periods with recursive links between the solutions for one period and the solutions for preceding periods. I.e. in addition to exogenous parameter updating, some of the updated parameter values depend on the simulated values for earlier periods. In its stylized form, a neoclassical model assumes profit-maximizing firms, utility-maximizing consumers, continuous production and utility functions, and price-clearing competitive markets for all goods and factors(2). A model may be termed structuralist if it significantly deviates from these assumptions. Structuralist features commonly included are fixed input coefficients, not only for intermediate inputs but also for primary factors, markup pricing, the clearing of markets via mechanisms other than price adjustment, and constraints on nominal macro aggregates [Robinson 1989:913-915]. Most applied models of LDCs deviate from the pure neoclassical case. Thus, the classification in Table 1 should be understood in relative terms. Next, we will briefly outline the institutional context and the areas on which each of these models was focused. while the information provided in Table 1 will be analyzed, it will, throughout this paper not be restated.

The first CGE of Egypt, an aggregate model focused on food subsidies, was developed by Lance Taylor in 1976 as part of a World Bank assignment. It was published in 1979. While Taylor is not the author of any of the other studies, models he developed for Pakistan and India provide the basic framework

(2) The term «good» is used broadly to cover both goods and services.

Table 1. Summary of model features

MODEL FEATURE	TAYLOR (1979)	ECKAUS, McCARTHY, & MOHIE-ELDIN (1979)	CHOUCRI & LAHIRI (1983a)	KHORSHID (1984)	DETHIER (1985)	AHMED, BHATTACHARYA, GRAIS & PLESKOVIC (1985)	KHEIR-EL-DIN & EL-LAITHY (1990)
A. OVERVIEW							
Static-Dynamic	Static	Static	Static	Static	Dynamic	Dynamic	Static
Theoretical basis	Structuralist	Neoclassical	Structuralist	Structuralist	Neoclassical	Neoclassical	Neoclassical
Disaggregation							
prod'on sectors	3	12	10	5	8	9	12
primary factors	2 (labor, capital)	3 (labor, capital, land)	2 (labor, capital)	1	8 (capital, 7 for labor	3 (labor, capital, land)	3 (labor, capital, land)
households	2 (urban, rural)	6 (3 urban, 3 rural)	1	1	9 (urban & rural)	2 (urban, rural)	2 (urban, rural)
Policy focus	Food subsidies	Taxes, subsidies & income distribution	Domestic oil pricing	Aggregate demand, tax & subsidy policies	Food policy & income distribution	Public sector reform	Aggregate demand, tax & subsidy policies
SAM (year; size)	18 x 19; 1975	40 x 40; 1976	22 x 20; 1977	33 x 33; 1980/81	1979; 47 x 47 ?	1979; 362 x 362	1983/84; 121 x 121
B. PRODUCTION FUNCTIONS, INPUTS & PRODUCER TAXES/SUBSIDIES							
Factors	Fixed coeff. for labor; variable cost markup to capital	Cobb-Douglas for capital, labor & land	Fixed coeff. for labor; variable cost markup to capital	Fixed coeff. for aggregate factor	Two-level CES with capital & composite labor at level 1 & 7 labor types at level 2	Labor, capital & land in CES	Fixed coeff's for labor & capital
Intermediate inputs	Fixed coeff's for domestic goods & non-competitive imports	Fixed coeff's for domestic goods & non-competitive imports	Fixed coeff's for domestic goods & non-comp. imports; flexible energy coeff's for energy-intensive sectors	Fixed coeff's for composite goods	Fixed coeff's for composite goods	Composite domestic goods & composite imports in CES; Leontief aggregation for both types of composite goods	Fixed coeff's for composite goods
Producer taxes/ subsidies	Producer-specific subsidies on intermediate inputs	Producer-specific taxes & subsidies on intermediate inputs	Producer subsidies on sectoral output values	Subsidies/taxes uniform for all users	Subsidies/taxes uniform for all users	Subsidies/taxes uniform for all users	Subsidies/taxes uniform for all users

cont. table 1

MODEL FEATURE	TAYLOR (1979)	ECKAUS, McCARTHY, & MONIE-ELDIN (1979)	CHOUCRI & LAHIRI (1983a)	KHORSHID (1984)	DETHIER (1985)	AHMED, BHATTACHARYA, GRAIS & PLESKOVIC (1985)	KHEIR-EL-DIN & EL-LAITHY (1990)
C. FOREIGN TRADE							
Internat'al Prices	exog	exog	exog	exog (imports) endog (exports)	exog (imports) endog (exports)	exog (imports) endog (exports)	exog (imports) endog (exports)
Import Quantities	endog/exog	endog/exog	endog/exog	endog	endog	endog	endog
Import Substitut'y	zero/infinite	zero/infinite	zero/infinite	imperfect	imperfect	imperfect	zero
Export Quantities	exog	exog	exog	endog (constant elasticity demand functions)	endog (constant elasticity demand functions)	endog (constant elasticity demand functions)	endog (constant elasticity demand functions)
Export Substitut'y	perfect	perfect	perfect	perfect	perfect?	perfect	perfect
D. REAL SYSTEM CONSTRAINTS: EQUILIBRATING VARIABLES							
Goods Markets	supply (1a): all	price-quantity (1b): all	price (1c): constr'on imports (1d): agricult'e supply (1e): all other	exports (1e): oil supply (1a): all other	imports (1d): agricult'e price-quantity (1b): all other	price-quantity (1b): all private exports (1e): oil-public supply (2a): electr'y & services, both public domestic demand (2b/c): other public	price-quantity (1b): all
Labor Markets	supply (1a)	price (1c)	supply (1f)	supply (1c): agg. factor	supply (1a), see (1) price (1c): see (1)	supply (1a): rural price (1c): urban	price (1c)
Capital Markets	supply (mark-up)	price (1c)	supply (mark-up)	supply (1c): agg. factor	price (1c)	price (1c)	price (1c)
E. NOMINAL SYSTEM CONSTRAINTS: EQUILIBRATING VARIABLES							
Government balance	government savings	government savings	government savings	government savings	government spending	government savings	government spending
Balance of Payments	foreign savings	foreign savings	foreign savings	foreign savings	foreign savings	borrowing/import rationing/exchange rate	exchange rate
Savings-Investment	output	aggregate price level	output	output	government savings	public: output & prices private: investment	foreign savings

Notes: 1. Dethier's model has seven labor types with two alternative closures: supply adjustment with a fixed nominal wage (e.g. for skilled industrial workers), and a flexible wage (e.g. for construction workers); 2. The references (1a), (1b), ..., (2c) in Part D of the table refer to Panels 1 and 2.

for the models presented by Eckaus, McCarthy, and Mohie-Eldin (1979), and Choucri and Lahiri (1983a; 1983b)(3). The first large-scale activity, started in 1977, was carried out within the framework of a Cairo University - M.I.T. research project. It produced the first disaggregated Egyptian SAM, for 1976 (Eckaus *et al.* 1981), and subsequently provided most of the data for the CGE model of Eckaus *et al.* (1979), named GEM (General Equilibrium Model). In this review, we refer to one of its versions, GEM-3(4). GEM is relatively disaggregated, especially for income distribution and government activities, including taxes and subsidies. The importance of this project is indicated by the large number of studies that are based on its model and/or its 1976 SAM(5). The research of Choucri and Lahiri (1983a; 1983b), was also carried out within a Cairo University - M.I.T. project. Their model was geared toward analyzing energy-economy interactions but also applied to exploring the impact of changes in worker remittances.

Between 1981 and 1983, a substantial effort was made in the data area. A disaggregated SAM for 1979 was built by the project «Economywide Modeling and SAM Updating», with the participation of Cairo University, various Egyptian government ministries, and the World Bank. As a follow-up, Egypt's Central Agency for Public Mobilization and Statistics (CAPMAS), embarked on the project «Social Accounting Matrices and Economic Modelling in Egypt», one result of which was a SAM for 1980/81. The model developed by Khorshid, called MISR1, was a key component of this CAPMAS project(6). This was the first CGE

(3) See McCarthy and Taylor (1980), and Taylor (1983).

(4) The difference between GEM-3 and the other versions lies in the closure rules for the factor markets (Eckaus et al. 1979 : 1).

(5) See Boutrus-Ghali and Taylor (1980), Dethier and Esfahani (1981), Eckaus and Mohie-Eldin (1980; 1984), a background paper to an ILO study by Osman M. Osman (see Hansen and Radwan 1982 : 292), and Nugent (1988). The latter two studies were unfortunately not available for this review.

(6) Three papers relevant to MISRI are found in CAPMAS (1984) : Khorshid (1984) (model structure); Kheir-El-Din, Khorshid and El-Safty (1984) (model validation); and Khorshid and Kheir-El-Din (1984) (Policy experiments).

activity carried out almost exclusively by Egyptians, suggesting that the technology transfer involved had achieved a reasonable degree of success. While their model was solved for several years, it is nevertheless considered static since there are no recursive links between model solutions for different years.

Dethier (1985) and Ahmed, Bhattacharya, Grais, and Pleskovic (1985) developed the first dynamic CGE models for Egypt. In the data area, both studies have the above-mentioned 1979 SAM as their strating point. Their model structures belong to the brand of CGE models presented in Dervis, de Melo, and Robinson (1982). Dethier's model is part of a Ph.D. dissertation at the University of California at Berkeley. The comparative advantage of his model lies in its disaggregated treatment of households and labor categories, permitting analysis of distributional issues. The between-period module includes a recursive link for the capital stock. Ahmed *et al.* built their model, MISR2, as an assignment for the World Bank. At the time when it was developed, this study embodied state of the art modeling. Its distinguishing characteristics include a high degree of disaggregation in the foreign exchange area and along the private-public dimension for production and savings-investment. The last model surveyed in this paper, MISR3, was developed by Kheir-el-Din and El-Laithy (1990), both of whom are on the Faculty of Economics and Political Science at Cairo University. The model is based on a 1983/84 SAM developed by a joint team from Cairo University and CAPMAS (CAPMAS 1988). In general, it is quite disaggregated. Like the model by Khorshid (1984), it was solved for several years. In the absence of any recursive links, it is, nevertheless, considered a static model. It should also be noted that more recently CAPMAS published a SAM for 1986/87 (CAPMAS 1991) and that an ongoing CAPMAS project is involved in constructing a SAM for 1989/90.

Three high-quality models, not included in this review, should also be mentioned(7). The first is the Domestic Resource

(7) In addition, Arne Drud and Wafik Grais have developed a disaggregated CGE model focused on the public-private sector dichotomy. The model has, however ,not been published in any manner. A more recent model, Khorshid (1992), was available too late to be included in this review.

Mobilization (DRM) model, developed by Dervis and others at the World Bank (World Bank 1980; 1983). It is an economy-wide dynamic growth model for consistent projections designed to analyze alternative mechanisms for resource mobilization. Prices are exogenous. Given that this structure strongly deviates from that of a standard CGE model, it was not included. The other two models are by Pleskovic (1982; 1989) and Umari (1990). The primary purpose of Pleskovic's work was to extend the Harberger fiscal incidence model to include inter-industry transactions and preexisting taxes. Umari (1990) presents a in inter-sectoral terms of trade on industrial capital accumula-in inter-sectoral terms of trade on industrial capital accumpla-tion. These last two models were left out due to their highly stylized nature and the fact that the formulations they use also appear in one or more of the models in Table 1.

3. A TOPICAL REVIEW OF SELECTED MODEL ASPECTS

In this section, we will present and comment on the structures of reviewed models ... production, household incomes and consumption, the treatment of foreign trade, and system constraints.

3.1. Production

From Section A of Table 1 it is apparent that the levels of disaggregation for primary factors and sectors/goods (including intermediate inputs) vary greatly across the reviewed studies.

Section B of Table 1 summarizes the treatments of production relations, linking factors, intermediate inputs, and outputs. In general, fixed coefficients are used for intermediate inputs and, in structuralist models, also for labor in combination with a markup, on variable cost paid to capital(8). For a neoclassical model, primary factors enter continuous production functions

(8) In the case where capital receives a markup on variable costs, it is, strictly speaking, not specified whether the capital input coefficient is fixed or variable ... this is irrelevant given that capital is paid a markup, not a unit price, and the accompanying assumption of sufficient surplus capacity to meet any demand for capital.

with factor demand functions derived from the assumption of profit maximization. Invariably, the latter category of models assume that firms are price-takers.

As variations on this general picture, Choucri and Lahiri introduce price-responsive energy coefficients derived from a CES unit cost function for «aggregate» energy (Choucri and Lahiri 1983b:25-27). The models by Dethier and Ahmed *et al.* both rely on two-level specifications, with the inputs at the lower level «producing» a composite (or aggregate) input entering the function at the higher level(9). Such specifications provide a means of allowing for different substitution possibilities between different subsets of the inputs. In addition, Dethier's model is characterized by a complex pattern of labor disaggregation by sector and skill (1985:204).

3.2. Household Incomes and Consumption

Section A in Table 1 shows that, in all models except those by Choucri and Lahiri (1983a), and Khorshid (1984), households are disaggregated. The most detailed treatments are found in Eckaus *et al.* (1979) and Dethier (1985). Both rely on disaggregations that, at least in part, are based on percentile income groups rather than the socio-economic characteristics of the households(10).

The sources and uses of household incomes obey the following standard pattern: incomes are derived from factor employment and transfers, and allocated in fixed shares to direct taxes, savings and consumption. The allocation of consumption over different goods is determined by the linear expenditure system (LES). The only exception is the model of Ahmed *et al.* which uses a logistic function generalization of the LES (1985:159).

(9) Similarly, Boutrus-Ghali and Taylor extended the GEM model of Eckaus et al. by introducing a two-level CES formulation, with disaggregated labor at the lower level and aggregate labor, capital, and land at the higher level (1980 : 7-8).

(10) For a discussion, see Dethier (1985 : 139-170).

3.3. Foreign Trade

In Section C of Table 1, the treatments of Egypt's foreign trade are summarized. With regard to imports and exports, the models may be divided into two groups: the first-generation models by Taylor, Eckaus *et al.*, and Choucri and Lahiri; and the second-generation models by Khorshid, Dethier, Ahmed *et al.*, and Kheir-el-Din and El-Laithy. The earlier studies divide imports into two groups, competitive and non-competitive (perfect substitutes and perfect complements to domestic goods, respectively). Competitive imports are exogenous whereas noncompetitive imports are endogenous, depending on household incomes (for consumption goods) and production levels (for intermediate goods) (11). For exports, the earlier models assume that both prices and quantities are exogenous.

The more recent models rely on weaker assumptions. They assume that imports and domestic output used at home are imperfect substitutes by means of a CES (Armington) function in which composite goods are «produced» by domestic and imported goods entering it as «inputs». The mixture between goods from these two sources is a function of the import/domestic price ratio. For exports, the more recent applications assume that export demand is a function of the endogenous export supply price via a constant elasticity function(12).

However, all models treat import prices as exogenous. The justification for this asymmetric treatment of import and exports prices is Egypt's smaller share in the world market for

(11) For agriculture, Choucri and Lahiri deviate from this general picture by assuming that imports are endogenous and perfect substitutes for domestic goods (1983a : 13-15). In the earier models ... by Taylor, Eckaus et al., and Choucri and Lahiri ... non-competitive investment imports are exogenous.

(12) For this case, a distinction is made between the «world price», an aggregate international price level and the price at which exports are sold ... Egypt's export supply price. The export supply price (which may deviate from the world price) is computed as the domestic price level adjusted for any export taxes/subsidies and transformed into foreign currency via the exchange rate (Dervis et al. 1982 : 225-226).

most of its imports. Another assumption common to all models is perfect substitutability between the domestically produced goods that are exported and those used domestically. This assumption was made in spite of the option of incorporating imperfect substitutability via a Constant Elasticity of Transformation (CET) function or a logistic function(13).

3.4 *Real System Constraints*

System contraints, or «closure rules», are those constraints that have to be satisfied by the economic system, but which are not considered in the decisions of any micro agent. They may be classified as real and nominal (Robinson 1989:907-908). The real constraints, applying to markets for goods and factors, are summarized in Section D of Table 1. The numbers in brackets refer to the corresponding demand-supply diagrams in Figure 1.

Panels (a) - (e) presents the five most common equilibrating mechanisms. (All curves are arbitrarily drawn as straight lines). Panel (a) shows an infinitely elastic supply at a fixed price, while Panels (b) and (c) assume an equilibrating price, accompanied by supply and demand adjustments for (b) but with a fixed supply for (c). Panels (d) and (e) assume, respectively, that imports and exports clear the market; in either case, their quantities have to be endogenous and they have to be perfect substitutes to domestic outputs sold at home. In both panels, domestic price and supply are fixed. With regard to the factors, most studies assume that capital, once installed, is sector-specific whereas labor tends to enjoy a larger degree of mobility(14).

For goods markets, the treatment in the MISR2 model of Ahmed *et al.* is quite complex. By means of a composite-good approach, they permit price differentials between public and

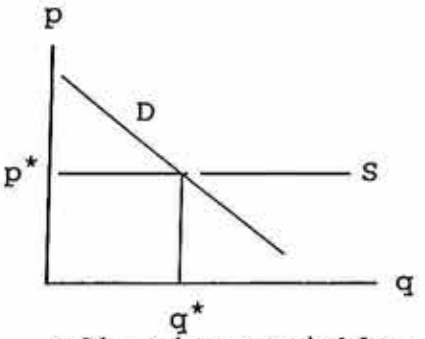
13) The approach relying on a logistic function is covered in Dervis et al. (1982-230); the CET approach is explained in a CGE context in Condon et al. (1985 : 80-81).

(14) For capital, Kheir-el-Din and El-Laithy deviate by assuming that the existing stock is sectorally mobile (1990 : 18, 36).

Figure 1.

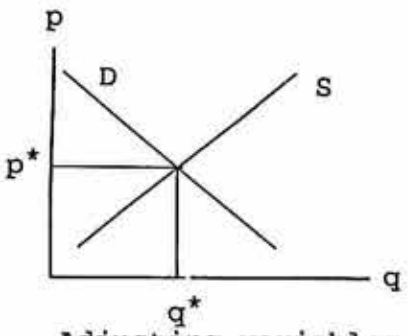
Alternative Closures for Goods and Factor Markets

Panel a



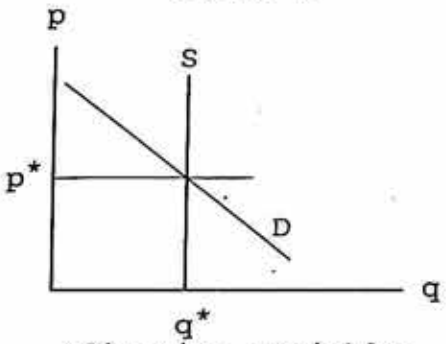
Adjusting variable:
Supply

Panel b



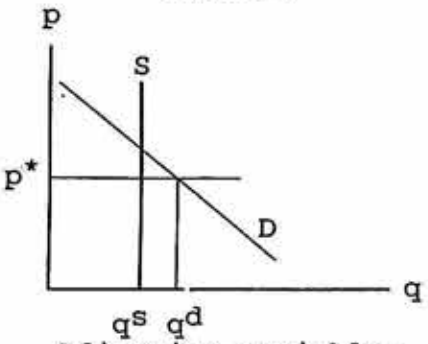
Adjusting variables:
Price-Quantity

Panel c



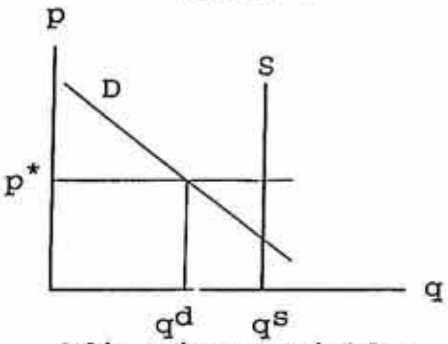
Adjusting variable:
Price

Panel d



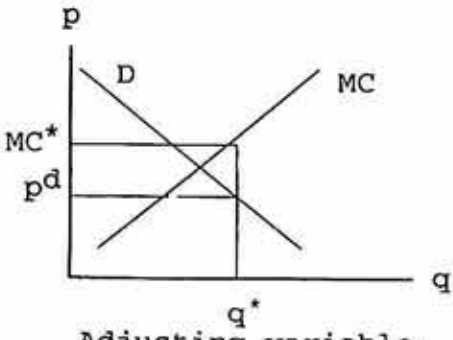
Adjusting variable:
Imports (= $q^d - q^s$)

Panel e



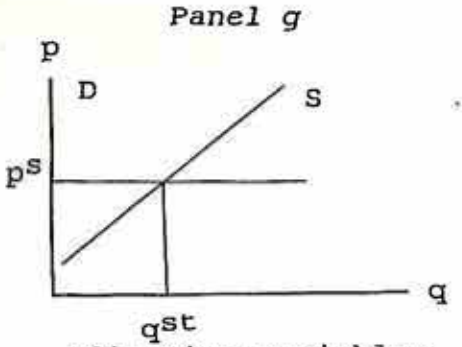
Adjusting variable:
Exports (= $q^s - q^d$)

Panel f

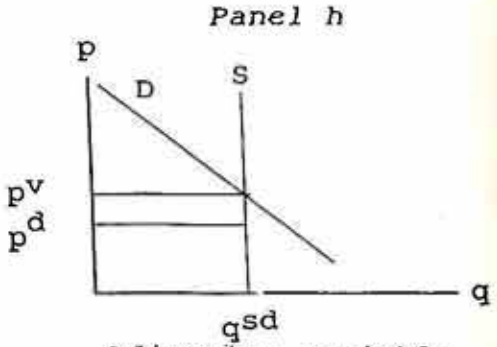


Adjusting variable:
Supply

cont. Figure 1.



Adjusting variable globally: Demand



Adjusting variable for the demand side: Domestic Demand

private sector goods. For private sector goods, it is assumed that flexible prices clear the markets, as in Panel (b). All public sector prices are, on the contrary, fixed (by government policy). The adjusting variables in the markets for public sector goods are export demand (for oil, Panel (e)), domestic supply (for electricity and services, Panel (f)), or domestic demand (for remaining markets, Panels (g) and (h)). For the case of supply adjustment, it is assumed that the public sector supplies any quantity demanded at the fixed price, p^d Given the assumed marginal cost (MC) schedule, this price falls short of the MC at q^* (MC^*), thus, forcing the producer to deviate from profit maximizing behavior (Ahmed *et al.* 1985:15-17). For the case of domestic demand adjustment, the domestic public sector determines its total quantity supplied, q^{st} as a function of the fixed supply price, p^s (Panel (g)). Exports, if any, are determined endogenously as a function of the supply price in foreign currency, in its turn determined by supply price in domestic currency, subsidies/taxes, and the exchange rate (cf. Panel (a)). The quantity supplied to the domestic market, q^{sd} is the residual (domestic supply *less* exports; see Panel (h)). The demand price is fixed at p^d Equilibrium is achieved via rationing with the goods received by the domestic demanders with the highest reservation prices p^v or higher) (Ahmed *et al.* 1985:15) (15).

(15) The rent, received by the demanders, is represented by the area This approach to consumer rationing is due to Neary and Roberts (1980). The model of Ahmed et al. constitutes the first CGE application (Dewatripont et al. 1990 : 220, 238).

This is a wide range of alternative closures indicative of the richness of the CGE methodology. The choice between these alternatives should, *inter alia,* depend on the structure of the economy, its base-year state, the degree of model disaggregation(16), and the time frame. However, when the reviewed models are contrasted, the differences between their closures are quite striking not easily explained with reference to these considerations. For example, while Taylor (1979) assumes general excess capacity (no constraints for factor supplies effectively fixing the aggregate output level. Similarly, Khorshid (1984) and Choucri-Lahiri (1983a) make different assumptions for oil, agriculture, and construction(17). This suggests that satisfactory information has not been available to the model builders.

3.5 Nominal System Constraints

In a typical CGE model, the nominal system constraints are the government balance, the balance of payments, and the savings investment balance. The selected equilibrating machanisms should aim at reflecting the actual workings of the modeled economy. The different treatments of these constraints in the reviewed models are summarized in Section E of Table 1. The modeling of the two first balances is relatively uniform. In the standard case, government savings is the residual that clears the government balance while foreign savings clears the balance of payments. For the government balance, the only exceptions are Dethier (1985:220, 227) and Kheir-el-Din and El-Laithy (1990:20), both of whom assume that government spending is adjusted. For the balance of payments, Ahmed *et al.* (1985)

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(16) Dethier's treatment of labor exemplifies how a high degree of model disaggregation permits a finetuning of closure rules. Moreover, on the basis of empirical data, he imposes sectoral wage differentials for each labor type (Dethier 1985 : 191-192, 203-204, 224).

(17) Those involved in the MISRI project were aware that their closure assumptions were too simplistic, especially for the construction sector (Kheir-El-Din et al. 1984 : 143). Choucri and Lahiri's assumption of unatilized oil capacity is contrary to the assumptions of Khorshid (1984 : 127) and Ahmed et al. (1985 : 10).

and Kheir-el-Din and El-Laithy (1990) deviate from the general picture. The latter assume that an endogenous exchange rate clears the balance of payments (Kheir-el-Din and El-Laithy 1990:371), while Ahmed *et al.*, reflecting the policy regime of 1983, have a highly detailed treatment in this area, including three foreign exchange pools ... the Central Bank pool, and the Commercial Bank pool, and the free market ... each of which is associated with an exchange rate and a specific clearing mechanism (1985:11, 32-35).

Balance between savings and investment is the condition for overall macroeconmic equilibrium. With one exception, all models assume that investment is fixed (in real or nominal terms). The three models earlier defined as structuralist ... Taylor (1979), Choucri and Lahiri (1983a), and Khorshid (1984) ... have a uniform treatment : in the absence of supply constraints, output and income are adjusted until savings meets the level of incestments. In addition, income redistribution is a potential parallel means of achieving overall savings-investment equality given that savings behavior differs across income recipients. Each of the remaining models presents its specific mechanism for achieving savings-investment balance ... changes in the overall price level (Eckaus *et al.* 1979:29), foreign savings (Kheir-el-Din and El-Laithy 1990:22), and government savings (Dethier 1985:219).

Compared to the other models, Ahmed *et al.* have a more disaggregated treatment with separate savings-investment balances for the public and private sectors. Total savings generated by the private sector of the economy is made available for both private and public sector investment, according to exogenous shares. Private sector investment is determined by the level of private savings made available through this mechanism ... this is the only example of savings-driven investment in the reviewed models. Public sector investment spending is, on the other hand, exogenous. Variations in prices and output adjust the size of the savings pool available for public sector investment (Ahmed *et al.* 1985:32-35).

Thus, there are also considerable variations across the models for the nominal system constraints, apparently in part reflect-

ing uncertainty about the functioning or state of the economy. As for the real constraints, a more disaggregated treatment can make these choices less difficult, as exemplified by Ahmed *et al.* (1985). In addition, in the presence of uncertainty it may be fruitful to test the sensitivity of any simulation results to alternative rules for system constraints, both real and nominal(18).

4. SIMULATION OF POLICY CHANGES AND EXOGENOUS SHOCKS

The ultimate motive behind the development of CGE models, in Egypt and elsewhere, has been a desire to better understand the economic effects of alternative policies. Experiments with CGE models are counterfactual : the question «what if?» is addressed through comparisons between a base case and simulations involving changes in policies and/or various exogenous phenomena. Table 2 presents the types of policy changes and exogenous shocks that have been simulated with each model(19). Some of the issues were analyzed separately, some in combined expeéiments. All models except Khorshid (1984), Dethier (1985), and Ahmed *et al.* (1985) were used for simple comparative static experiments. In spite of that it is static, Khorshid's model was used in a «dynamic mode» ... it was solved for a series of years with changes in exogenous parameters between the different solutions.

A CGE model may help in assessing the approximate magnitudes of the impacts on a large number of indicators. An important characteristic enhancing their relevance is that the indicators are from both the macro and micro levels. The most important indicators have typically included GDP, sectoral production levels, wages, household incomes and consumption, as well as Egypt's macro (im) balances ... the savings-investment balance, the government deficit, and the current account

(18) Dethier and Esfahani (1981) follow this route in a set of experiments with the GEM of Eckaus and coauthors.

(19) The results of the simulations are not discussed in this section since this cannot be done adequately without a relatively detailed consideration of the structure of each model. No policy experiments are reported in Kheir-el-Din and El-Laithy (1990).

Table 2. Simulations of Policy Changes and Exogenous Shocks

SIMULATION AREA	MODEL REFERENCE: TAYLOR [1979]	ECKAUS, McCARTHY, & MOHIE-ELDIN [1979]	CHOUCRI & LAHIRI [1983a]	KHORSHID [1984]	DETHIER [1985]	AHMED, BHATTACHARYA, GRAIS & PLESKOVIC [1985]
Aggregate Demand	economywide investment	econ-wide invest. (DE)	econ-wide inv (CLa, CLb) gov't spending (CLa)	economywide investment	agricultural investment economywide investment	public investment
Taxes		direct taxes (DE, HR) land tax (HR)		indirect taxes		
Subsidies	food	food (EM, DE) agricultural inputs (DE) producer & consumer (HR)			food	
Domestic pricing		agriculture (DE)	petroleum (CLa)		agriculture	public sector
Wages & employment	nominal wage change	nominal wage change (HR)		nominal wage change	nominal wage change	public sector wage & employment liberalization; public sector borrowing from private sector
Exchange rate					liberalization	liberalization; devaluation
Others		remittances (HR)	remittances (CLb)	remittances		foreign borrowing
		terms of trade (HR)		export demand		
		reduced armed forces combined with changes in labor force & taxes (HR)		oil prod'on (capacity)		

Explanation: For models other than Eckaus et al. [1979], Choucri and Lahiri [1983a], and Khorshid [1984], the simulations are without exception reported in the model reference. The source for Khorshid is Khorshid and Kheir-el-Din [1984]. The following abbreviations were used for Eckaus et al., and Choucri and Lahiri: CLa = Choucri and Lahiri [1983a]; CLb = Choucri and Lahiri [1983b]; DE = Dethier and Esfahani [1981]; EM = Eckaus and Mohie-Eldin [1984]; HR = Hansen and Radwan [1982].

deficit. Depending on the model structure, additional aspects have also been considered, such as income distribution in the models by Eckaus *et al.* (1979) and Dethier (1985).

The information in Table 2 suggests that the issues addressed closely coincide with the key concerns faced by Egypt's policy-makers since the mid-1970s. This choice of simulation topics is also compatible with the comparative advantage of CGE models ... they are particularly good at analysing price, tax, and subsidy policies as well as exogenous shocks(20). The only areas of relative neglect may be the foreign exchange system and trade policy. Apart from Ahmed *et al.* very little attention was paid to these issues in spite of both their policy relevance and the relative strength of CGE models in this area.

The fact that the experiments have targeted important policy areas does not automatically mean that they have been used by (or useful to) policymakers. On the contrary it seems that, while they indeed have provided some direct input to decision-making, their value has, so far, primarily been academic (Issawy 1993:52) (21). This may part be due to a lack of institutionalized channels for interaction between economic analysts and policymakers. However, it may also reflect that the analyses at best only provide very rough guidance to policy making due to various shortcomings, an issue to which we will return in the concluding section.

5. *CONCLUSIONS*

This review shows that CGE models of Egypt have included a wide variety of formulations, providing a foundation upon which future model builders can draw. They have been used to address some of the most crucial policy issues of the last decades. While a SAM was an unknown concept until the mid-1970s (at

(20) The emphasis on these issues in an LDC context is evident from the survey of DecaluWé and Martens (1988 : 551).

(21) The simulations with the model of Eckaus et al., reported in Hansen and Radwan (1982), may have reached the largest audience among the reviewed studies ... their book constitutes the report of a large ILO mission to Egypt concerned with issues of employment and equity.

least in its socio-economic form), SAM building has now become an institutionalized process.

While much has been achieved, the value of these studies has so far primarily been academic. Progress in a number of areas could significantly enhance the future contributions of CGE modeling. First, there is an urgent need for more current and more extensive data. As an indicator, the two most recent SAMs, for 1983/84 and 1986/87, appeared in October 1988 and May 1990, respectively ... i.e. with a lag of three to four years. Moreover, the disaggregation of these SAMs is insufficient in many areas, including labor, households, and production (in particular, the absence of disaggregation along private-public sector lines in the 1986/87 SAM is disturbing), making it very difficult to analyze key issues like poverty, income distribution, and privatization. These difficulties are augmented by limited access to existing complementary data as well as by time- consuming approval procedures for sepecialized surveys. From a different angle, there is a need for increased emphasis on econometric parameter estimation in the areas of production, consumption, and foreign trade. For the reviewed models very few references are made to econometric studies ... it seems that the selected parameter values are typically «guesstimates» (22).

Second, the more advanced of the reviewed models represent the state of the art as of the mid 1980s. Since then, advances have been made, including the incorporation of imperfect competition, economies of scale, and financial aspects (23). The ability of CGE models to reflect Egypt's economic structure may be enhanced if these advances are drawn upon. However,

(22) Among the exceptions are Choucri and Lahiri for substitutability between energy inputs (1983a : 27), Dethier for consumer demand (1985 : 122), and Kheir-El-Din and El-Laithy for general input substitutability (1990 : 12, 35). However, robust econometric parameter estimates may not be found easily. As noted by Shoven and Whalley, econometric analyses tend to yield conflicting and frequently changing values for key elasticities (1984 : 1031).

(23) Harris (1984) is a pioneering study including both imperfect competition and economies of scale. For a real-financial model, see Bourguignon et al. (1992).

to a significant extent, the ability to do so critically depends on an improved data base and work in the econometric area.

Third, most of the reviewed models suffer from shortcomings in accuracy and style, ranging from missing or unclear variable and parameter definitions to inconsistent equations, unspecified equation domains, and the absence of a complete mathematical statement(24). Many of these shortcomings could be minimized if the model documentation, as a rule, included a complete mathematical statement, definitions of all model elements, the parameter values for the base run, the changes introduced in the simulations, the results of the policy experiments, as well as a printout of key computer input files(25). Moreover, increased emphasis on peer review and the formal refereeing of the publication process should raise the quality of future studies.

Fourth, the intermittent nature of previous activities and the small number of researchers involved suggest that an effort should be made to broaden the base of researchers working on a continuous basis in this area, perhaps most importantly by training graduate students and by developing institutions engaged in CGE modeling and supporting data activities. With regard to institutional development, it is important to learn from the successes of others; in the CGE area, the Australian experience may be the most impressive(26).

Given the shortcomings referred to in this concluding section, it is not surprising if the input to policymaking of these studies has been limited. Some of these shortcomings are, however, due to a lack of support from government institutions,

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(24) See Löfgren (1992 : 36-38) for more details.

(25) Some of these points are from Kendrick (1984). It is easier to produce an accurate mathematical statement if the format in which the model is stated for computer solution closely corresponds to the mathematical statement. This is the case for the GAMS software which, in addition, makes it possible to include all data transformations in the input file. See Brooke et al. (1988) for further details about GAMS.

(26) For Australia's experience, see Powell and Lawson (1990), and Vincent (1990).

including limited funding and data problems. With increased data access, the incorporation of methodological advances, improved quality control, and a larger base of active researchers, CGE modeling should be able to make an effective contribution to the understanding of some of the critical issues currently facing Egypt.

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ABSTRACT

This paper reviews Egypt's experience of SAM-based CGE modeling, dating back to the mid-1970s. Its purpose is to extract lessons for the future application of such models to Egypt and other LDCs. The paper provides a detailed review of seven models, covering their data bases, key aspects of their structures (with regard to production, consumption, foreign trade, micro and macro closures), as well as policy simulations. It is concluded with critical observations and suggestions for future research.

TRADE LIBERALIZATION AND EGYPT'S INDUSTRY
A CGE ANALYSIS

*MOATAZ EL-SAID**

I. Introduction

As early as the 1930s Egypt's choice of foreigh trade policies followed a path aiming at import substitution industrialization (ISI). During the 1970s Egypt shifted toward a more liberal economy as signalled by the introduction of Sadat's October Working Paper (OWP) (1974). During the 1980s, as a result of deteriorating economic balances, low rates of growth, and unbearable debt levels, a dialogue between the Government of Egypt (GOE), the World Bank (WB), and the International Monetary Fund (IMF) was initiated, leading to the formulation of a comprehensive economic reform program. One of the major components of this reform program is the adoption of an outward-looking trade strategy. The aim of this paper is to perform a quantitative examination of the impact of trade policy changes on the Egyptian Industrial Sector (EIS), a sector that grew under protectionist policies since the 1930s. A set of policy experiments, employing a Computable General Equilibrium (CGE) model, simulate changes in trade policy. In light of the results, questions at the macro and micro level are addressed and the policy trade-offs are highlighted.

The paper is organized as follows : Section II presents the model and its primary data source. In Section III, the model simulations are reported and Section IV provides a summary and highlights the policy trade-offs according to the results obtained from the model simulations.

II. Model and Database

In order to meet the objective stated above an economy-wide Computable General Equilibrium (CGE) model will be used to

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simulate the workings of a market economy with autonomous decision makrrs. The 1986-87 Social Accounting Matrix (SAM) is used to provide the main source of data for the CGE model(1).

A. Definition and Theory

Typically CGE models are defined as a class of multisectoral models for which prices as well as quantities are allowed to vary endogenously to determine a set of market-clearing prices (Bergman 1990:4). The main aim of CGE analysis is to convert the Walrasian general equilibrium theory into an empirically oriented tool for economic analysis. As such, CGE analysis is an operational counterpart of general equilibrium theory, emphasizing quantitative results based on empirical data (Bergman 1990:3).

B. Model Database

A SAM is often used as a database for CGE models. It is a system for organizing economic data for a country covering a speciffic period of time and is normally in the form of a square matrix - equal number of rows and columns(2). Table 1 displays the SAM as it is set for the model and provides a schematic description of the different accounts. The SAM is made up of 28 accounts describing the circular flow of the economy :

Accounts for three factors of production :

— Labor

— Capital

— Land

(1) The 1986-87 SAM is the most recent year for which an official SAM has been produced (CAPMAS 1991).

(2) For more information about Social Accounting Matrices check Pyatt 1985, and for information about Social Accounting Matrices in Egypt see CAPMAS 1984 and 1991.

Current accounts for six institutions :

— Urban and Rural Households
— Private and Public Companies
— The Government of Egypt (GOE)
— The Rest of the World (ROW).

The Capital account :

— One account common to all institutions that serves as an intermediary by allocating its revenue (savings of the institutions) for investment.

Activity and Commodity accounts for eight production sectors :

— Agriculture
— Oil
— Food.
— Spinning and Weaving
— Other Industry
— Electricity
— Construction
— Services.

Tax accounts :

— Tariff account
— Domestic Tax account

C. Model Structure (Egypt 1)

Egypt1, a static one-period CGE model, incorporates many of the features of CGE models applied to developing countries as pioneered by Dervis, de Melo, and Robinson (1982). Egypt 1 starting point was the stylized CGE model developed by Lofgren (1993). In this section, the different blocks of Egypt 1 are presented, and the differences between Egypt 1 and the Lofgren (1993) model are discussed. The section also covers the closure rules of Egypt 1.

The SAM presented above provides a description of the circular flow of income in the Eghptian economy from the activi-

Table 1:

1980/87 SAM

		1 LABOR	2 CAPITAL	3 LAND	4 URB HH	5 RUR HH	6 PRIV. CO.	7 PUB. CO	8 GOVT	9 ROW	10 CAP ACC	11 AGR A	12 OIL A
	1 LABOR								4 976	3 051		3.033	0.1
	2 CAPITAL								C	J		7.875	1.3
	3 LAND		A					C				0 612	
	4 URBAN HH	13.082	6.820	0.073			0.703	1.202	0 861	0 350			
	5 RURAL HH	4 840	9.042	0 539			0 028	0 271	0 515				
	6 PRIVATE CO.		1.568		0.838	0 436		0 663	0 187	1 470			
	7 PUBLIC CO.		7.266		0.393	0 093	1.095		1 702	0 226			
	8 GOVT		0 004		3.193	0.935	0 094	2.870		0 604			
	9 ROW	0 054					1.791	1.235	0 301				
	10 CAPITAL ACC		B		2.814	0.683	1.382	2 922	1 170	1.535	<-- K		
A	11 AGR A							D	-0 082	0 382			
C	12 OIL A									1 901			
T	13 FOOD A								-0 006	0 058			
I	14 SWTV A							H -->		0 382	<-- L		
V	15 OND A									0 260			
I	16 ELE A									0 016			
T	17 CON A									0 070			
Y	18 SER A				C					2 617			
C	19 AGR C				4.923	5 142			0 485		1.514	4.309	
O	20 OIL C				0 779	0 064			0.327		0 059	0.037	0.2
M	21 FOOD C				2 442	2 349			0 516		0 315	0.460	
M	22 SWTV C				0 763	0 789			0 390		0 537	0.101	
O	23 OND C				2 495	1.535		I -->	0 782	M -->	3 374	0 488	0.1
D	24 ELE C				0 299	0 093			0 680			0.010	0.0
I	25 CON C				0 028	C 015			0 098		3 668	0.027	0.0
TY	26 SER C				3.698	2.952			0 436		0 878	0 848	1.0
	27 TARIFFS												
	28 O-TAX				0 474	0 190	0 083	1 737				0 036	0
	29 TOTAL	17 927	24 700	0 613	22 093	15 324	6.181	10.781	12.739	12 673	10.405	12.784	3

URBAN HH = URBAN HOUSHOLD
RURAL HH = RURAL HOUSHOLD
PRIVATE CO = PRIVATE COMPANIES
PUBLIC CO = PUBLIC COMPANIES
GOV T = GOVERNMENT
ROW = REST OF THE WORLD
CAPITAL ACC = CAPITAL ACCOUNT
AGR A/C = AGRICULTURE ACTIVITY/COMMODITY
OIL A/C = OIL ACTIVITY/COMMODITY
FOOD A/C = FOOD PROCESSING ACTIVITY/COMMODITY
SWTV A/C = SPINNING AND WEAVING ACTIVITY/COMMODITY
OND A/C = OTHER INDUSTRY ACTIVITY/COMMODITY
ELE A/C = ELECTRICITY ACTIVITY/COMMODITY
CON A/C = CONSTRUCTION ACTIVITY/COMMODITY
SER A/C = SERVICES ACTIVITY/COMMODITY
O TAX = OTHER TAX

A = Absorption Matrix
B = Factor transfers to
C = Inter-institutional
D = Institutional savings
I = Household savings
J = Direct taxes
G = Value added
H = Export subsidy
L = Government
J = Worker's Remittances

ITY				COMMODITY										
15 IND-A	16 ELE-A	17 CON-A	18 SER-A	19 AGR-C	20 OIL-C	21 FOOD-C	22 ENEV-C	23 IND-C	24 ELE-C	25 CON-C	26 SER-C	27 TARIFF	28 O-TAX	29 TOTAL
1.598	0.238	0 726	3.000											17.587
2.789	0.375	1.291	9.079											24.700
														0.612
														23.052
														16.236
														6.161
												S	T	10.781
							P					1.927	3.112	12.739
				1.565	0.318	1.352	0.095	4.894	0.016	0.020	1.224			12.072
														10.409
				17.464										17.764
					1.928									3.827
						6.400								6.462
							3.074							3.455
			Q ->					11.215						11.476
									0.992					1.008
										4.163				4.183
											13.060			16.631
0.102			0.135											18.499
0.146	0.090	0.020	0.437											2.257
0.061			0 316											7 831
0.025		0 0001	0.031											3 237
5.100	0.237	1.923	0.838											17.368
0.216	0.029	0.003	0.127											1 008
0.171	0.001	0.007	0 084											4.103
1.003	0.073	0.744	2.351			R								14.284
				0 465	0 016	0 119	0 004	1 759						1.927
0.794	-0 035	-0 031	-0 721											3.112
13.479	1.000	4 183	15 873	19.494	2.257	7.871	3.237	17.368	1.008	4 183	14.284	1.927	3 112	

Page 4

ties to the factors of production, to the institutions, to commodities, and back to the activities. It is a snapshot of the economy. The role of Egypt1 is to specify the market, behavioral, and system-relationships embodied in each account of the SAM. Following the flow of income in the SAM, the equations of Egypt 1, stated in Table 2, have been divided into four main sections. The first block includes the equations defining the price system in the economy. Secondly, the equations specifying the supply and demand side of Egypt 1 are provided in the output and demand block. This is followed by the income block which specifies the equations describing the allocation of factor income to institutions and households. Finally, the system constraint block includes the equations describing the market clearing conditions for factor and product markets and the macro closure rules of the model.

Price Block.

Considered as a strong aspect of models related to trade theory, in the price block there are nine prices for each sector, out of which seven are determined endogenously. The block specifies five equations defining domestic import and export prices (equations 1 and 2), composite and average output prices (equations 3 and 4), and value added prices. In equation 1, the «small country» assumption is maintained as the world price of imports is exogenous, whereas in equation 2 the world price of exports is endogenous assuming a downward sloping world demand curve. Equations 3 and 4 describe the prices for the composite and average output prices. Also the price block defines a sectoral price of value-added or net price as the unit output price less indirect taxes and cost of intermediate inputs per unit. The value-added price is the return to the factors of production per unit of output.

Output and Demand Block.

The output and demand block specifies seven equations describing the supply side of the economy. Equations 6 and 7 (Table 2) outlines the production technology and factor demand. The primary factors of production are inputs in a neoclassical -

Cobb-Douglas (D-C) - production function. Assuming profit maximizing behavior by tne producers, the first order conditions for profit maximization subject to the production technology (as specified by the C-D production function) is what determines factor demand in the model. The remaining equations (8-12) describe Egypt1 treatment of sectoral imports and exports. They determine the supply of imports and exports, as well as export demand. (Robinson 1989 : 920).

Table 2 Cont

Table 2 Mathematical Statement of Egypt1

PARAMETERS

Price Block

PARAMETERS

e^R = exchange rate (LE per Dollar)

t^M_s = import tariff rate

t^E_s = export subsidy rate

t^I_s = indirect tax rate

$io_{s\ s}$ = input output coefficient

p^{WM}_s = world price of imports

α = total international trade value

Ω^E_s = share of sector s exports in total international trade value

Ω^M_s = share of sector s imports in total international trade value

z = index for the price of tradables

p^{WER} = base year world price of exports

τ_s = rate of sales tax

Output and Demand Block

PARAMETERS

$s^{FS}_{f\ s}$ = share of factor f in value added of sector s

a^D_s = production function shift parameter

$\bar{p}^{WE}_{s}$ = base year world price (in dollar)

η_{s} = export demand elasticity

$\bar{E}_{s}$ = base year export quantity

ρ^{t}_{s} = CET function exponent

α_{s} = CET function share parameter

a^{T}_{s} = CET function shift parameter

ρ^{c}_{s} = Armington function exponent

δ_{s} = Armington function share parameter

Table 2 Cont

a^{C}_{s} = Armington function shift parameter

e^{H}_{s} = employment of labor by sector

s^{W}_{s} = sectoral wage (million L.E.)

a^{W} = average annual economy-wide wage (million L.E.)

$\Omega^{W}_{fm\ s}$ = wage proportionality factor by sector

$\bar{W}_{fm}$ = base year wage

Ω^{CPI}_{s} = weights in the consumer price index

Income Block

PARAMETERS

$\bar{L}^{G}$ = government labor demand

r^{em} = labor remittances from abroad

$s^{IF}_{i\ f}$ = share of the income of factor f transfered to i

$s^{II}_{i\ i'}$ = share of the income of institution i' transferred to i

tr^{IROW}_{i} = transfers from the ROW to institution i

tr^{GOV}_{i} = transfers from the government to institution i

s^{R}_{i} = savings rate of institution i

$y^{DS}_{h\ s}$ = share of disposable income for household h spent on good s

t^{D}_{i} = income share for institution i as direct tax

s_h^{IG} = share of income of household h transferred to the government

Ω_s^{RPI} = weights in the retail price index

System Constraint

PARAMETERS

$\bar{S}_{f\,s}$ = Supply of sector specific factors

$\bar{I}_s^D$ = Investment demand for good s (by sector of origin)

$\bar{G}_s^D$ = government demand for good s

s_i^{IROW} = Share of the income of institution i transferred to the ROW

tr^{GROW} = transfers to the government from the ROW ($)

tr^{ROWG} = transfers to the ROW from the government($)

$\bar{P}$ = Price index

Ω_s = Weight of good s in the price index

Table 2 Cont

VARIABLES

Price Block

VARIABLES

P_s^M = domestic price of imports (L.E.)

P_s^E = domestic price of exports (L.E.)

P^{WE} = world price of exports ($)

P_s = composite good price

P_s^D = price of domestic output sold domestically

X_s^{XD} = domestic sales of domestic output

M_s = imports

X_s = composite goods supply

P_s^X = average output price

E_s = exports

X_s^D = supply of domestically produced goods (for exports and domestic

P_s^{VA} = value added price

Output and Demand Block

VARIABLES

$P^{FS}_{f\,sg}$ = price of a factor (wage)

$C^{F}_{f\,s}$ = demand for factor f from sector s

III. Income Block

VARIABLES

V^{D}_{s} = intermediate demand for good s

Y^{F}_{f} = income to factor f

$T^{IF}_{i\,f}$ = transfer of income from factor f to institution i

$T^{II}_{i\,i'}$ = transfer of income from institution i to institution i'

Y^{I}_{i} = income of institution i

S^{I}_{i} = savings of institution i

Y^{D}_{h} = disposable income of household h

$C^{D}_{h\,s}$ = consumption demand by household h for good s

RPI = retail price index

Table 2 Cont

IV. System Constraint

VARIABLES

WALRAS = savings-investment difference (zero at equilibrium)
MINIMAND = objective function variable
D^{ADJ} = adjustment factor for investment demand
Y^G = government revenue
E^G = government expenditures
F^S = foreign savings
CPI = consumer price index

EQUATIONS

Price Block

(1) $P_s^M = p_s^{WM} e^R (1+t_s^M)$ $\quad s \in S$

(2) $P_s^E = p_s^{WE} e^R (1+t_s^E)$ $\quad s \in S$

(3) $P_s = \left[P_s^D \left(\frac{X_s^{XD}}{X_s} \right) + p_s^M \left(\frac{M_s}{X_s} \right) \right] (1+\tau)$ $\quad s \in S$

(4) $P_s^X = P_s^D \left(\frac{X_s^{XD}}{X_s^X} \right) + P_s^E \left(\frac{E_s}{X_s^X} \right)$ $\quad s \in S$

(5) $P_s^{VA} = P_s^X (1-t_s^I) - \sum_{s' \in S} io_{s',s} P_{s'}$ $\quad s' \in S$

Output and Demand Block

(6) $X_s^D = a_s^D \prod_{f \in F \mid (f,s) \in MFS} C_{f,s}^{F\,S_{f,s}^{FS}}$ $\quad s \in S$, $f \in F$

(7) $C_{f,s}^F = \frac{P_s^{VA} X_s^D S_{f,s}^{FS}}{P_{f,s}^{FS}}$ $\quad s \in S$, $f \in F$

Table 2 Cont

$$(8)\quad E_s = \bar{E}_s \left[\frac{\bar{p}^{WE}_s}{p^{WE}_s} \right]^{\eta_s} \qquad s \in S$$

$$(9)\quad X^D_s = a^T_s \left(\alpha_s E_s^{\rho^t_s} + (1-\alpha_s) X^{XD}_s{}^{\rho^t_s} \right)^{\frac{1}{\rho^t_s}} \qquad s \in S$$

$$(10)\quad E_s = X^{XD}_s \left[\frac{p^E_s}{p^D_s} \right] \left[\frac{1-\alpha_s}{\alpha_s} \right]^{\frac{1}{\rho^t_s - 1}} \qquad s \in S$$

$$(11)\quad X_s = a^C_s \left(\delta_s M_s^{-\rho^C_s} + (1-\delta_s) X^{XD}_s{}^{-\rho^C_s} \right)^{-\frac{1}{\rho^C_s}} \qquad s \in S$$

$$(12)\quad M_s = X^{XD}_s \left[\frac{p^D_s}{p^M_s} \right]^{\frac{1}{1+\rho^C_s}} \left[\frac{\delta_s}{1-\delta_s} \right]^{\frac{1}{1+\rho^C_s}} \qquad s \in S$$

Income Block

$$(13)\quad V^D_s = \sum_{s' \in S} io_{s\,s'}\, X^D_{s'} \qquad s' \in S$$

$$(14)\quad Y^F_f = \sum_{s \in S \,|\, (f,s) \in MFS} C^F_{f\,s}\, P^{FS}_{f\,s} \qquad f \in FS,\ s \in S$$

$$(15)\quad Y^F_f = \sum_{s \in S} C^F_{f\,s}\, P^{FS}_{f\,s} + \bar{L}^G\, P^{FS}_{f\,gov} + e^R\, rem \qquad f \in FM,\ s \in SG$$

Table 2 Cont

(16) $T^{IF}_{i\,f} = s^{IF}_{i\,f} \quad Y^{F}_{f}$ — $f \in FM$, $i \in I$, $(i,f) \in MIF$

(17) $T^{II}_{i\,i'} = s^{II}_{i\,i'} \quad Y^{I}_{i'}$ — $i \in ID$, $i' \in ID'$, $(i,i') \in MIIP$

(18) $RPI = \sum_{s \in S} \Omega^{RPI}_{s} \; P_{s}$ — $s \in S$

(19) $Y^{I}_{i} = \sum_{f \in F \,|\, (i,f) \in MIF} T^{IF}_{i\,f} + \sum_{i' \in I \,|\, (i,i') \in MIIP} T^{II}_{i\,i'} + tr^{GOV}_{i} \; RPI + e^{R} \; tr^{IROW}_{i}$ — $i \in ID$, $i' \in ID'$, $f \in F$, $(i,i') \in MI$, $(i,f) \in MI$

(20) $Y^{D}_{h} = Y^{I}_{h} - \left(\sum_{i \in I \,|\, (i,h) \in MIH} s^{II}_{i\,h} + s^{IG}_{h} + t^{D}_{h} + s^{R}_{h} \right) Y^{I}_{h}$ — $i \in ID$, $h \in H$

(21) $C^{D}_{h\,s} = \dfrac{y^{DS}_{h\,s} \; Y^{D}_{h}}{P_{s}}$ — $s \in S$, $h \in H$

System Constraint

(22) $C^{F}_{f\,s} = \bar{S}_{f\,s}$ — $f \in FS$, $s \in S$

(23) $CPI = \sum_{s \in S} \Omega^{CPI}_{s} \; P_{s}$ — $s \in S$

(24) $P^{FS}_{f\,s} = \Omega^{W}_{f\,s} \; \bar{W}_{f} \; CPI$ — $f \in FM$, $s \in SG$

(25) $X_{s} = V^{D}_{s} + \sum_{h \in H} C^{D}_{h\,s} + \bar{G}^{D}_{s} + D^{ADJ} \; \bar{I}^{D}_{s}$ — $s \in S$, $h \in H$

Table 2 Cont

(26) $$Y^{GOV} = T^{IF}_{gov\ f} + \sum_{i \in I} s^{IG}_i\ Y^I_i + \sum_{i \in I} t^D_i\ Y^I$$

$$+ e^R\ tr^{GROW} + \sum_{s \in S} t^I_s\ P^D_s\ X^D_s + \sum_{s \in S} t^M_s\ P^{WM}_s\ e^R\ M_s$$

$$+ \tau_s \left[\sum_{s \in S} P^D_s\ X^D_s + \sum_{s \in S} P^M_s\ M_s \right]$$

f ∈ {CAP}
s ∈ S
i ∈ ID

(27) $$E^{GOV} = \bar{L}^G\ P^{FS}_{lab\ govt} + \sum_{i \in I} tr^{GOV}_i RPI + \sum_{s \in S} \bar{G}^D_s\ P_s$$

$$+ tr^{ROWG}\ e^R + \sum_{s \in S} t^E_s\ P^{WE}_s\ e^R\ E_s$$

i ∈ ID
s ∈ S

(28) $$\sum_{i \in I} s^R_i\ Y^I_i + (Y^{GOV} - E^{GOV}) + e^R\ F^S = \sum_{s \in S} D^{ADJ}\ \bar{I}^D_s\ P_s$$

i ∈ ID
s ∈ S

(29) $$rem + \sum_{i \in I} tr^{IROW}_i + tr^{GROW} + \sum_{s \in S} P^{WE}_s\ E_s + F^S$$

$$= \frac{\sum_{i \in I} s^{IROW}_i\ Y^I_i + T^{IF}_{ROW\ f}}{e^R} + \sum_{s \in S} p^{WM}_s\ M_s + tr^{ROWG}$$

i ∈ I
s ∈ S
f ∈ {I

(30) $$\sum_{s \in S} \Omega_s\ P^D_s = \bar{P}$$

s ∈

Income Block

The equations of this block trace the flow of income from value-added to institutions, including households. These equations determine factor income (Equations 14 and 15), transfers between factors and institutions, and transfers among institutions (equations 16 and 17). Equation 18 sums the inter-institutional transfers to arrive at each institution total income. Equations 14-18 do not follow a complex behavioral representation, but rather outline the structure of the Egyptian economy as it pertains to the SAM accounts through simple share relationships. Furthermore, the income block includes an equation (19) that defines household disposable income after deducting fixed shares from total household income as transfers to other institutions, direct taxes, and savings. Households are assumed to maximize a C-D utility function subject to their budget constraints that produce the corresponding demand functions for different goods with fixed spending shares (equation 20) (Lofgren 1993:34).

System Constraint Block

This block constitutes the equilibrium conditions, or system constraints, that Egypt1 must satisfy, but are not considered by the economic agents when making their own decisions. In other words, the system constraints are the conditions that govern the equilibrium outcome - the set of equilibrium prices and output levels that clears all markets (Robinson 1989:907). The system constraint block accounts for both real system constraints through equations (21-23) that assure equilibrium in the factor and product markets, and nominal system constraint. These later are indicated in equations for the government balance (24-25), the Saving-Investment equality (26), current account balance (27). A price normalization equation are also specified in this block.

Model Extensions

As was mentioned earlier, the starting point for Egypt1 was the model presented by Lofgren. (1993). Egypt1 can be

viewed as an extension of the Lofgren model, tailored to address the objectives of the current research presented here. To this end, Egypt1 introduces the following extensions :

With respect to the SAM, Egypt1 includes eight productive sectors as opposed to six in the Lofgren (1993) model. This is a result of disaggregating the EIS into three productive sectors that include Food Processing, Spinning and Weaving, and Other Industry. In addition, the exchange rate in the earlier specification is determined endogenously. Egypt1 incorporates a flexible treatment to accomodate the exchange rate as either a parameter a parameter or as an endogenous variable. The advantage of this treatment is related to the policy experiments implemented in a later section (III. A). It is possible to conduct policy experiments assuming different values for the exchange rate, as it can be set exogenously. Furthermore, some of the policy experiments performed below assume a fixed real exchange rate. In order to maintain a fixed exchange rate the choice of weights in the aggregator for the numeraire price index differs from that of Lofgren's model (1993) (3).

Egypt1 introduces unemployment in the labor market as a feature of the Egyptian economy. (It should be noted that the Lofgren (1993) model may be classified as neoclassical since it assumes full employment of the factors of production). More specifically, Egypt1 assumes a fixed real wage with an infinitely elastic supply curve for labor. Thus, any quantity of labor demanded at the fixed real wage is met by the supply of unemployed labor to clear the labor market(4). Finally, Egypt1 accounts for another aspect of the Egyptian economy, a sales tax, not present in 1986/87. Again, the advantage of this treatment appears later in the section where the policy experiments are performed. As a tariff reduction entails a loss of government revenue, it is possible to analyze the effects of a higher sales tax compensating the government for the reduction in its revenue.

(3) For a discussion concerning the technical aspects related to the treatment of the real exchange rate check Appendix E in El-Said (1994).

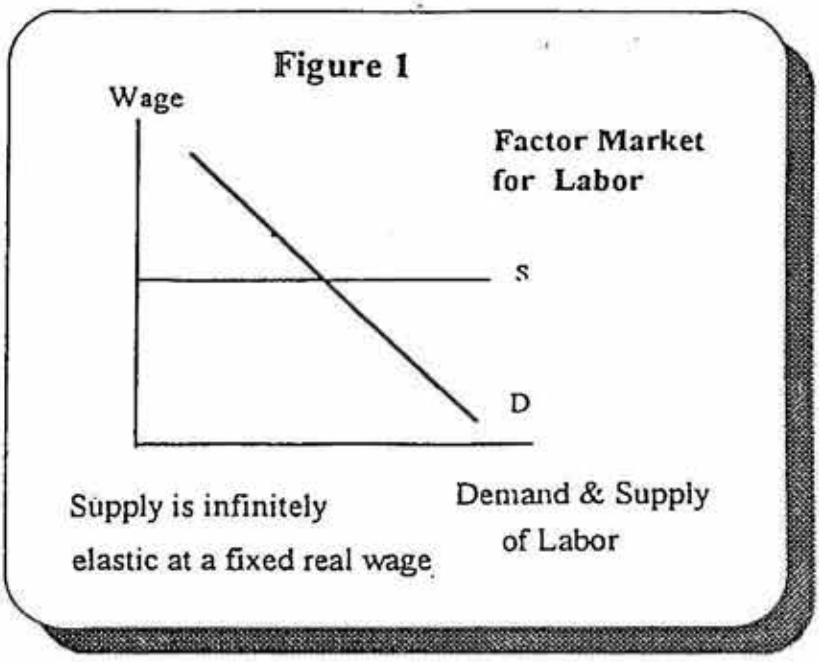
(4) In El-Said (1994), Appendix F presents the treatment of unemployment as it relates to Egypt1.

D. Market Clearing and Macro Closure Rules

Market clearing and macro closure rules, often referred to as system constraints, are a very important feature of CGE models. It is important for a CGE modeler to carefully specify the system constraints as they directly govern the model solution — the equilibrium outcome. In Egypt1, the system constraint block includes market clearing conditions for the real system constraints — the factor and the product markets — as well as the nominal system constraints — the government balance, the current account, the savings-invstment balance, and a price normalization equation.

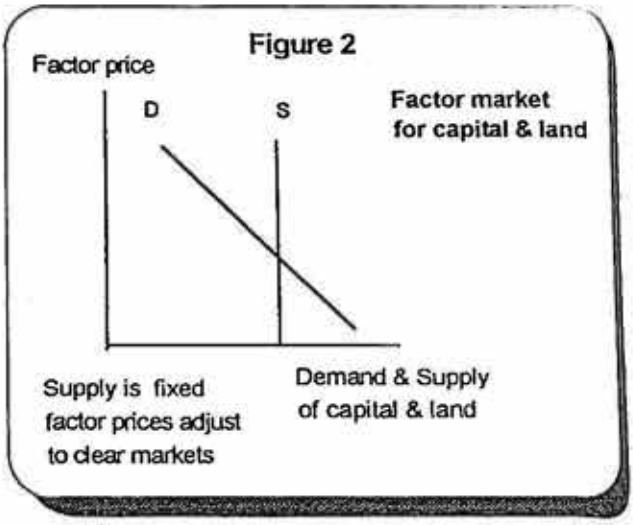
Real System Constraints

The Factor Market. To maintain equilibrium in the factor markets, i.e. the markets for Labor, Capital and Land, quantities



demanded and supplied must be equal. Egypt1 specifies two sets of equations to generate equilibrium in the factor markets.

The first applies to the labor market whereas the second applies to capital and land. Figure 1 depicts the equilibrating mechanism underlying the labor market system constraint. Egypt 1 assumes that labor supply is infinitely elastic at a fixed real wage, while the nominal wage adjusts according to a consumer price index(5). The demand for labor is derived from the first-order profit maximization conditions of the C-D production function while the infinitely elastic supply of labor adjusts to clear the market. Underlying this treatment is the assumption that producers are always on their demand curve for labor and that all unemployment is borne by the suppliers of labor (Robinson 1989:923). Thus the market for labor is in equilibrium since any quantity of labor demanded is met by supply at the indexed wage.



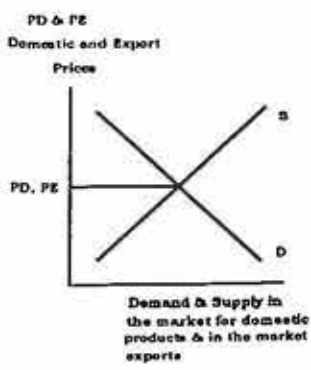
For capital and land, Figure 2 displays the equilibrium mechanism. In Egypt1 factor demand for the two factors of production, derived in a similar way as labor demand, is equal to supply, which is fixed. The price of each factor is the equilibrating variable. In other words, once installed the sector specific factors are in fixed supply and fully utilized.

(5) For a detailed discussion on the treatment of the labor market refer to Appendix F In. El-Said (1994).

The Product Market. The product market equilibrium conditions assume that for each sector, supply of composite goods equal demand. Supply for each sector is determined according to the CES aggregation function in the output and demand block. Demand is composed of intermediate demand, household and government consumption, and investment demand.

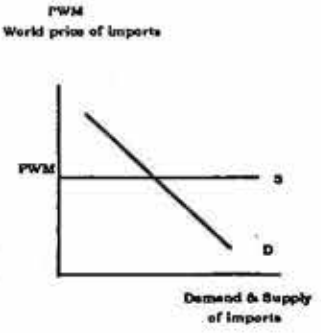
It is easier to view the product market as consisting of three markets : 1) a market for domestic products, 2) a market for exports, and 3) a market for imports. As shown in Figure 3, a flexible price adjusts to generate equilibrium in the first two markets. For imports, it is assumed that import supply is infinitely elastic at a fixed world price. Thus import supply provides an equilibrating mechanism in the market for imports.

Figure 3



Treatment of the market for domestic products and the market for exports

A



Treatment of the market for imports

B

Nominal System Constraints

Table 3 summarizes the equilibrating variables for the nominal system constraints in Eghpt1.

Table 3 : Equilibrating Variables for the Nominal System Constraints under Fixed and Flexible Exchange Rate

Table 3: Equilibrating Variables for the Nominal System Constraints under Fixed and Flexible Exchange Rate

Nominal System Constraints	Equilibrating Variables	
	Fixed Exchange Rate	Variable Exchange Rate
Government Balance	Residual Government Savings	Residual Government Savings
Current Account	Foreign Savings	Exchange Rate (Foreign Savings Fixed)
Saving-Investment Balance	Real Investment Demand	Real Investment Demand

The Government Balance. There are two equations, one defining government revenue and another defining government expenditures (equations 26 and 27 in table). According to the SAM, government revenue consist of factor and institutional transfers, transfers from the rest of the world, revenue from indirect and direct taxes, and income from tariffs. Expenditures are made up of wages, consumption demand, export subsidies, and transfers to other institutions and the rest of the world. Government savings are not included in the expenditure equation as they are a residual obtained from the difference between revenue and expenditures to satisfy the government's current account balance constraint. Contrary to other institutions, this treatment implies that the government does not work under any budget constraint.

The Current Account Balance. The current account defines all trade with the rest of the world. On one side, are inflows of foreign exchange accruing from worker's remittances, transfers from the rest of the world to institutions, exports, and foreign savings. On the other side, are outflows of foreign exchange in the form of transfers from institutions to the rest of the world and imports. Under one scenario the exchange rate is fixed and foreign savings adjusts to maintain the current account in balance(6). Under the second policy scenario, foreign

(6) The purpose of this treatment is to allow for policy simulations assuming different values for the exchange rate as it can be set exogenously. Also this treatment is possible because a CGE model determine a stable relationship between foreign savings and the exchange rate. Given the value of any two of the following variables : including the nominal exchange rate, the composite price level, and foreign savings, the CGE model will determine the equilibrium values of the third (Robinson 1989:921).

savings is fixed and the exchange rate is flexible to maintain a balance in the current account.

The Saving-Investment Balance. When savings equals investment, the model is said to be in macroeconomic equilibrium. In the model, savings is the sum of savings by domestic non-government institutions (fixed proportions of their respective incomes,) the government (determined as a residual), and the ROW (foreign savings, fixed in foreign currency for most model versions). There is no independent investment function; in the model, investment is assumed to be savings-driven — nominal investment fully exhausts the nominal value of savings. In Egypt1 the saving-investment balance identity is expressed as : where :

$$\sum_{i \in I} S_i^I \; Y_i^I + (Y^{GOV} - E^{GOV}) + E^R \; F^S = \sum_{s \in S} D^{ADJ} \; \overline{I}_s^D \; P_s \qquad (1)$$

where
- S_i^I = Marginal non-government propensity to save
- Y_i^I = Non-government income
- Y^{GOV} = Government income
- E^{GOV} = government expenditures
- E^R = Exchange rate
- F^S = Foreign savings (in foreign currency)
- D^{ADJ} = Adjustment variable
- $\overline{I}_s^D$ = Base period real investment demand
- P_s = Price of investment goods

The problem is to figure which variable appearing in (1) adjusts so as to maintain the saving-investment identity balanced. Under one scenario foreign savings (F^S) clears the current account, while investment $\overline{I}_s^D$ is fixed by sector of origin. Hence, we are left with government savings, non-government savings, the exchange rate, the adjustment variable, and the price to maintain equality between the left hand side and the right hand side of the identity. Government savings is a residual and clears the government balance while non-government savings are determined as fixed shares out of non-government incomes. The exchange rate is fixed under the same scenario. The above specification will not insure equality between savings and investment, so a new investment adjustment variable (D^{ADJ}) has been introduced into the model and initialized with the value equal

to one. The role of this adjustment variable is to change endogenously and thereby equalizes investment with savings. Accordingly, investment is said to be savings-driven(7).

Price Normalization

When the real nominal system constraints are satisfied the value of excess demand is equal to zero and Walras' law will hold. Thus, with the number of equations equal to the number of variables, one equation will be dependent on the others. However, since the behavioral assumption is that all supply and demands are homogeneous of degree zero in all prices, it is possible to add an equation defining a numeraire price index without affecting the equilibrium value of any real variable (Robinson 1989:911).

Egypt1 defines a price normalization equation making the number of variables equal to the number of independent equations. The chosen price index indicates the price level for non-tradables. Its weights are the base period sectoral shares in total sales of non-tradables. The reason for this choice is that it facilitates measuring the real exchange rate for the different model expermients(8).

III. Model Simulations and Results

It was mentioned that Egypt is undergoing a comprehensive reform program and that one of the major components of this program is the adoption of an outward-looking trade strategy. Two elements are essential for adopting an outward-oriented

(7) Maintaining the assumption of investment being savings-driven entails an important advantage. It is possible to conduct policy experiments under two different environments : a fixed exchange rate with flexible foreign savings (clearing the current account), and a varible exchange rate (clearing the current account) with fixed foreign savings. Hence, alternative specifications allow a comparison between the results of a policy experiment under a fixed exchange regime and a floating exchange regime.

(8) In El-Said (1994) Appendix E presents the technical aspects related to the treatment of the real exchange rate and the numeraire price index.

economic policy. The first element is import liberalization and the second is maintaining a competitive exchange rate (Williamson 1990:14). Given these policy elements, concern has been expressed about the likely impact of trade liberalization on the EIS erected under protectionist regimes. How would the removal of trade protection affect the EIS? How would the choice of a foreign exchange regime affect the EIS? Would the EIS maintain its share in the domestic market? What may happen to EIS exports?

A. Simulations

In an attempt to answer these questions, two sets of policy simulations are performed. The first set assumes a fixed real exchange rate along with tariff rates set at ten percent, first for each industrial sector individually and then for all industrial sectors simultaneously. Accordingly, five experiments are undertaken here :

1.—Reducing the tariff rate on Spinning and Weaving from 68% to 10%

2.—Reducing the tariff rate on Other Industry from 26% to 10%

3.—Setting the tariff rates on Food Processing, Spinning and Weaving, and Other Industry to 10%, simultaneously; and

4.—Modifying experiment three by introducing a 10% devaluation of the real exchange rate.

5.—Modifying experiment three by introducing a 10% increase in the sales tax.

The second set repeats experiments 1-3 and experiment 5 referred to under the first set but under the assumption of a flexible exchange rate.

The ratinale behind the choice of these policy experiments is related to the trade liberalization attempts by the GOE. On the import side, the range of import tariffs - between a minimum

and a maximum - was narrowed from 1-240% to 10-80% (Lofgren (1993b : 25). By the end of 1993 the maximum fell to 70% and is expected to reach 60% in 1994 and 50% in 1995, with the minimum remaining at 10%(9) (Economist Intelligence unit (EIU) 1993/94:47). Thus, selected tariff rates are set at ten percent in each expermient so as to see the likely impact of the maximum possible decrease. With regard to the foreign exchange regime, foreign exchange rate policies have changed. The multiple exchange rate system, effective until February 1991, was abolished and a single exchange rate prevailed from that date (EIU 1993/94:11). At the same time, the GOE depreciated the Egyptian pound by about 10% against the U.S. dollar (Lofgren 1993b: 24). Hence, a 10% devaluation was conducted in the fourth policy experiment of the first set and the first set was repeated with a flexible exchange rate (denoted by the second set of experiments).

The 10% increase in the sales tax in the fifth experiment is consistent with the GOE's recent policy measures. A sales tax was introduced in 1991. In addition, the 10% increase in the sales tax. generates revenue which compensates the government for lossesfrom a tariff reduction. Note the distinction between a sales tax and a tariff. A sales tax is here applied with the same rate to imported and domestically produced goods, whereas a tariff is applied only to imports. Hence, for a tariff to raise the same revenue as a sales tax requires the tariff rate to be much higher (given that the tax base is narrower) (Gersovitz, et al 1993:6-7).

B. Results

Tables 4 through 9 present the results of each policy experiment (referred to as a simulation) as percentage changes from the base solution values (1986/87 data). Table 4 presents the outcome of the policy simulations at the sectoral level while Table 5 presents them at the macro level, both under the assumption of a fixed real exchange rate. Table 6 and 7 follow the same structure as Tables 4 and 5 but under the assumption

(9) With the exception of basic foodstuff imports whose minimum is less than 10%.

of a flexible exchange rate. Table 8 compares the macro variables of Tables 5 and 7, while Table 9 focuses on the results of the policy experiments as they pertain to the EIS.

The economic interpretation of the results for the simulations under a fixed exchange rate will be discussed first. Under each assumption (fixed vs. flexible exchange rate) an analysis of the results of each simulation at the sectoral level will be considered first, to be followed by the analysis at the macro level. A discussion of the results concerning the EIS will end this section.

Fixed Exchange Rate

Once an exogenous shock is introduced, the modeled economy is out of general equilibrium, and the role of Egypt1 is to find a new set of prices and quantities that restores general equilibrium. Interpretation of the policy experiments will be based on the changes in selected endogenous values compared to the base solution.

Simulation 1. Tables 4 and 5 (Simulation 1) present the results of reducing the tariff rate on the Spinning and Weaving sector. To comprehend the effect which a traiff reduction propagates in the modeled economy, consider the changes at the sectoral level in terms of the following chain of events :

Primary-Specific

Tariff rate reduced

- — lower domestic prices of import prices
- — rise in the relative price ratio between domestic and imported products (Pd/PM)
- — domestic demand shifts toward imports and away from domestic output
- — excess supply for domestic output sold domestically
- — lower prices of domestic output sold domestically (Pd)
- — two effects

(1) raised price ratio between exported and domestic products sold domestically (PE/Pd) a larger share of domestic output is exported

(2) the value added price is reduced lower labor demand a reduction in output

With respect to other sectors of the economy, a lower composite price for the sector facing a tariff cut will be enjoyed by the remaining sectors (both domestic prices of non-traded domestic output and import prices fell). This secondary effect implies that the cost of intermediate inputs purchased by the remaining sectors is now less. How much another sector enjoys this secondary effect depends on the share of intermediate inputs purchased from the sector witnessing a fall in composite prices to the total intermediate input purchases. In other words, the larger the volume of trade between the sector experiencing a tariff reduction and other sectors of the economy, the larger the gains that are extended to those esctors in terms of lower input costs. The following chain of events outlines the secondary effect of the initial change on other sectors :

Secondary Effects

Composite prices decrease

— lower cost of intermediates for other sectors

— a higher value added price for other sectors

— increased employment in other sectors

— increases the sector output for other sectors

With regard to the overall effect of this simulation on the economy, the trade deficit and government savings are variables that are directly affected (tariffs were reduced). The changes in the trade deficit are linked to changes in foreign savings, clearing the current account, while changes in government savings are linked to real investment demand, with the latter being adjusted to maintain savings-investment equality.

Table 4 : Sector-Specific results (percentage change from base value)

Fixed Real Exchange Rate

Productive Sectors	Output	Value added Price	Value added	Employment*	Average Output Price	Domestic Price (Pd)	Export Price (PE)	Relative Price (PE/Pd)	Exports	Composite Price (P)	Import Price (PM)	Relative Price (Pd/PM)	Imports
Simulation 1													
Industrial Sectors													
Food Processing	0.0	0.0	0.0	0.1	0.1	0.0	-0.1	0.2	0.4	0.1	0.3	-0.3	-0.3
Spinning & Weaving	0.0	-0.1	0.0	0.0	-0.4	-0.1	-0.1	0.7	0.5	-2.4	-34.1	50.9	31.1
Other Industry	0.1	0.0	0.0	0.1	0.1	0.1	-0.1	0.2	0.4	0.2	0.3	-0.2	-0.3
Other Sectors													
Agriculture	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	0.2	0.3	0.0	0.3	-0.3	0.0
Oil	0.1	0.4	0.0	0.5	0.3	0.2	0.0	0.1	-0.3	0.2	0.3	-0.1	0.0
Services	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.3	0.1	0.0	0.3	-0.3	-0.1
Simulation 2													
Industrial Sectors													
Food Processing	0.6	1.7	0.5	1.7	1.3	1.3	-0.9	2.5	5.8	1.9	4.7	-3.3	-3.5
Spinning & Weaving	0.8	1.3	0.7	1.6	0.7	0.3	-0.6	3.8	3.9	0.5	4.7	-4.2	-2.3
Other Industry	-1.4	-1.9	-1.1	-3.8	-2.8	-3.0	-1.7	6.0	10.8	-4.8	-8.2	5.7	5.4
Other Sectors												-3.4	
Agriculture	0.2	1.2	0.3	0.9	1.1	1.1	-1.0	2.5	4.2	1.4	4.7	-1.0	-1.2
Oil	0.6	6.5	0.1	6.5	4.1	3.6	-0.1	0.9	-3.2	3.7	4.7	-1.0	0.0
Services	15.7	1.8	0.5	1.7	0.4	0.8	-0.4	3.4	1.7	1.1	4.7	-3.7	-1.0
Simulation 3													
Industrial Sectors													
Food Processing	0.7	1.8	0.5	2.0	1.4	1.4	-0.9	2.5	6.0	2.2	6.1	-4.4	-4.9
Spinning & Weaving	0.8	1.2	0.6	1.5	0.3	-0.2	-0.6	4.5	4.3	-1.9	-31.1	44.8	28.1
Other Industry	-1.4	-1.9	-1.1	-3.7	-2.8	-1.4	-1.7	6.2	11.1	-4.7	-8.0	5.5	5.2
Other Sectors													
Agriculture	0.2	1.2	0.4	0.9	1.1	1.1	-1.0	2.7	4.4	1.5	4.9	-3.7	-1.3
Oil	0.6	6.8	0.1	6.9	4.3	3.8	-0.1	1.0	-3.4	3.9	4.9	-1.1	0.0
Services	15.7	1.9	0.5	1.8	1.4	0.8	-0.4	3.6	1.8	1.2	4.9	-3.9	-1.1
Simulation 4													
Industrial Sectors													
Food Processing	0.3	2.7	0.2	0.8	2.9	2.8	-2.9	9.2	20.2	5.2	16.7	-11.9	-14.5
Spinning & Weaving	-0.4	1.9	-0.3	-0.6	1.1	-0.6	-1.5	14.8	11.1	-1.9	-24.2	31.1	17.6
Other Industry	-2.8	-2.7	-2.1	-7.4	-1.0	-1.4	-3.4	12.7	24.3	-0.4	1.2	-2.6	-6.5
Other Sectors													
Agriculture	-0.7	0.2	-1.0	-2.6	0.9	0.7	-3.5	10.6	18.0	2.2	15.4	-12.8	-6.2
Oil	1.8	20.7	0.4	20.2	13.0	10.8	-0.3	3.7	-12.5	11.5	15.4	-4.0	0.0
Services	15.7	2.8	0.2	0.8	2.7	0.3	-1.1	13.6	5.2	1.6	15.4	-13.1	-5.2

Table Notes

Simulation 1 = Tariff rate on Spinning and weaving reduced from 68% to 10%

Simulation 2 = Tariff rate on Other Industry reduced from 26% to 10%

Table 4 : Cont. Sector-Specific results (percentage change from base value) Fixed Real Exchange Rate

Productive Sectors	Simulation 5												
	Output	Value added Price	Value added	Employment*	Average Output Price	Domestic Price (Pd)	Export Price (PE)	Relative Price (PE/Pd)	Exports	Composite Price (P)	Import Price (PM)	Relative Price (Pd/PM)	Imports
Industrial Sectors													
Food Processing	-6.1	-9.6	-4.5	-16.8	0.9	0.9	-0.2	3.9	2.0	12.0	6.1	-4.9	-11.9
Spinning & Weaving	0.2	2.2	0.2	0.5	0.7	0.3	-0.5	4.4	4.5	-1.4	-31.1	45.5	27.9
Other Industry	-1.8	-1.1	-1.3	-4.7	-2.2	-2.4	-1.5	5.6	10.6	-4.4	-8.0	6.1	5.5
Other Sectors													
Agriculture	-0.7	0.0	-1.0	-2.6	0.5	0.4	-1.0	3.3	4.9	0.9	4.9	-4.3	-2.5
Oil	0.5	6.6	0.1	5.0	4.2	3.6	-0.1	1.0	-3.7	3.8	4.9	-5.2	0.0
Services	15.7	1.6	-0.2	-0.6	1.4	0.8	-0.3	3.7	1.7	1.1	4.9	-4.0	-1.7

Table Notes

Simulation 1 = Tariff rate on Spinning and weaving reduced from 68% to 10%

Simulation 2 = Tariff rate on Other Industry reduced from 28% to 10%

Simulation 3 = Tariff rates on Food Processing, Spinning and Weaving, and Other Industry all set at 10 %

Simulation 4 = Same as simulation 3 plus a 10% devaluation of the Exchange rate

Simulation 5 = Same as simulation 3 plus a 10% sales tax imposed on the industrial sector

Table 5 : Macroeconomic Variables (percentage change from base value)

Fixed Real Exchange Rate

Indicator	Base	Simulation 1	2	3	4	5
	(L.E. Billion)					
Real Macro Data:						
Real GDP	40.2	0.0	0.1	0.1	-0.8	-0.6
Real Private Consumption	28.4	0.1	0.9	1.0	-0.5	-1.1
Real Investment Demand	10.4	-0.2	-1.3	-1.5	-14.4	0.0
Trade Deficit	5.9	0.3	1.7	1.8	-20.5	0.2
Total Employment*	14.9	0.1	0.4	0.4	-3.0	-1.8
Nominal Macro Data:						
Investment	10.4	-0.3	-3.5	-3.7	-16.8	-1.2
Government Savings	1.2	-2.6	-45.3	-47.1	-53.1	-9.9
Non-Government Savings	7.7	0.1	1.5	1.6	2.3	0.9
Foreign Savings	1.5	-0.1	3.4	2.7	-85.2	-4.8
Exchange Rate	1	0.3	4.7	4.9	15.4	4.9
Government Revenue	12.7	-0.3	-4.0	-4.3	-3.1	0.5
Government Expenditures	11.6	-0.1	0.1	0.1	2.0	1.5
Other						
Value of Exports $	5.6	0.2	1.9	2.0	5.6	1.7
Value of Imports $	9.5	0.1	1.8	1.8	-7.5	0.6
Real Exchange rate	1	0.0	0.0	0.0	10.0	0.0
Imports / Domestic Sales	19.6 %	0.2	2.2	2.3	-5.2	2.5
Exports / Domestic Sales	9.5 %	0.2	2.5	2.7	9.2	3.5

Table Notes

Simulation 1 = Tariff rate on Spinning and weaving reduced from 68% to 10%

Simulation 2 = Tariff rate on Other Industry reduced from 26% to 10%

Simulation 3 = Tariff rates on Food Processing, Spinning and Weaving, and Other Industry all set at 10 %

Simulation 4 = Same as simulation 3 plus a 10% devaluation of the Exchange rate

Simulation 5 = Same as simulation 3 plus a 10% Sales Tax imposed on the industrial sector

* Employment is in thousand (1000) workers

The sectoral results obtained from Table 4 (Simulation 1) are consistent with the chain of events described above. Note that the sector facing the tariff cut (Spinning and Weaving) is the one most strongly affected. For the other sectors of the economy, the effect of a tariff reduction on Spinning and Weaving is not significant because of the small weight of this sector in the economy as indicated by its GDP share in Table 4. However, the direction of change for the remaining sectors of the economy is consistent with the chain of events outlined above.

Table 5, which presents the results of Simulation 1 on aggregate variables, shows that government savings were reduced (-2.6%) since the tariff reduction led to a fall in government revenue. The trade deficit reported a net increase (0.3%). The combined changes in government savings, non-government savings, and foreign savings led to a relatively insignificant fall in real investment (0.3%) (10). Real GDP reported no change while employment reported a minimal positive change.

Simulation 2. Concerning the results obtained from simulation 2, Table 4 shows that the results are again consistent with the chain of events described above (for sector-specific changes as well as other sectors). However, with regard to the secondary effects of the experiment on other productive sectors, Table 4 indicates significant changes (much stronger than for Simulation 1). This is explained by the larger size of the Other Industry sector (as indicated by its GDP share), specifically, the decline in Other Industry sector composite price (the price of intermediate inputs from Other Industry), lower production costs for the remaining sectors, as reflected by the positive effect on value added, output and employment.

Again, the overall effect of the experiment on the economy's aggregate variables is presented in Table 5. The results indicate

(10) Note that foreign savings reported a decrease of -0.1%, a fall that might seem contradictory with the rise in the trade deficit. This is explained by the fact that we are fixing the real exchange rate as opposed to the nominal rate. This implies that the nominal exchange rate changes will influence the final value obtained for foreign savings.

a similar effect as that of Simulation 1 with two differences. First, the magnitude of change for most of the variables increased. Second, foreign savings reported an increase (3.4%).

Simulation 3. Simulation 3 combines Simulation 1 and 2 plus a relatively insignificant change in the tariff rate of the Food Processing sector which was initially equal to 8%. Again Tables 4 and 5 summarize the outcome of this experiment. The results obtained do not show a marked difference from the results obtained in the previous two simulations. As the traiff reduction on Spinning and Weaving is combined with the tariff reduction on Other Industry, the direction of change relative to Simulation 2 is the same, but the magnitude of change is slightly increased or decreased depending on the initial sign of change. For example, government savings were reduced by 42.4% in Simulation 2, whereas in this Simulation it declined by 44.5%.

However, note that according to the sector-specific chain of events outlined above, output for the Spinning and Weaving sector should decline as prices of domestic output sold domestically fall (from Table 4, Simulation 3). The reported increase for the Spinning and Weaving output is attributed to the decrease in Other Industry composite prices (4.7%). Thus, there are two counter forces exerting a pressure on the Spinning and Weaving value added price, these being the decrease in the sector prices of domestic output sold domestically and the decrease in Other Industry composite prices. The net effect is 0.8% increase in the Spinning and Weaving output.

Simulation 4. This experiment is the same as the previous one with the exception that the real exchange rate was devalued by 10%. On the one hand, the combined effect of tariff reduction and an exchange rate devaluation, compared to Simulation 3, led to a decline in Food Processing, Spinning and Weaving, and Other Industry sectors imports. On the other hand, the real exchange rate devaluation had a significant positive effect on exports of all the sectors with the exception of the Oil sector (Table 4 Simulation 4).

As for the overall effect of the experiment (Table 5, Simulation 4), the devaluation outweighed the negative impact a reduction of import tariffs would have on the trade deficit (20% decrease). As for foreign savings, a remarkable decline was noted which is a result of the exchange rate devaluation. With regard to real investment demand, the combined reduction in government savings and foreign savings led to a further decline in real investment demand as compared to Simulation 3 (-14.4% compared to -1.5%). Finally, the ratio of imports to domestic sales decreased — an outcome unique to all of the simulations — while that of exports to domestic sales reported a higher increase than for Simulation 3. The outcome of this experiment reflects the sensitivity of the macro variables to changes in the foreign exchange rate and the pro-export and anti-import bias inherent in the foreign exchange devaluation.

Simulation 5. Again this experiment is the same as the experiment performed under simulation 3, but with a 10% sales tax imposed on the three sectors representing the EIS. As mentioned earlier the reason for the increase in the sales tax is to compensate the government for the revenue lost from the tariff reduction.

Comparing the results of this Simulation with those of Simulation 3, introducing a sales tax tends to have a contractional effect on economic activity. At the sectoral level, output, value added, and employment of the EIS have been constrained. At the macro level, both real GDP and real private consumption were reduced. However, the decline in government savings reduced significantly as sales tax revenues made up most of what was lost from the tariff reduction. In addition, the combined changes in government savings, non-government savings, and foreign savings left real investment demand unchanged (mainly due to higher government savings).

Fexible Exchange Rate

The following set of policy experiments are conducted under the assumption of a flexible exchange rate and hence fixed foreign savings. That is, the exchange rate takes on the role of

foreign davings in maintaining the current account in balance. In addition, this set of experiments will include four simulations in contrast with the five simulations conducted under the assumption of a fixed exchange rate. (There is no need to perform a policy experiment considering a devaluation as the exchange rate already is flexible).

Again, to trace the results of the experiments, we basically follow the same reasoning as outlined in the chain of events discussed earlier. However, note the difference regarding the current account constraint : foreign savings are fixed and the exchange rate adjusts fully to clear the current account (as opposed to variable foreign savings) (11). For the sake of brevity and given the great similarities, the analysis of the results obtained under this set of policy experiments will be considered in a less detailed manner.

Tables 6 and 7 report the results for this set of experiments. At the sectoral level, the results follow a logic similar to that of the earlier experiments. Regarding the overall effect of these experiments on the economy note the following :

— Under a flexible real exchange rate, the negative impact on real investment demand is moderated; it even reported a positive change (+1.3%) under Simulation 4 (Table 7). This moderate change in real investment demand under a flexible exchange rate is a result of having foreign savings fixed (in foreign currency).

— Government savings are negatively affected under the two different assumptions concerning the exchange rate. A similar negative effect is reported in Table 5 and 7.

— Table 7 shows that the real exchange rate appreciated under Simulations 2-4 (although the change is relatively small).

(11) Foreign savings is fixed in foreign currency; however in domestic currency it will be influenced by changes in the nominal exchange rate.

The EIS

Two sets of policy experiments were performed and their sector specific and overall effects on the economy were analyzed. In this section, results of the two sets of experiments are reproduced to highlight the effects of each policy experiment on the EIS.

Table 9 aggregates the results of the three industrial sectors for selected variables. The results show that the tariff cuts lead to a reduction in sector value added, under both exchange rate assumptions. The EIS sales shares in the domestic market are negatively affected as the tariff reduction significantly lowers import prices. The EIS ability to compete at the level of the domestic market deteriorates as reflected by the changes in the ratio of imports to output. At the international market level, EIS exports increase. Only when the exchange rate was devalued by 10% (Simulation 4, fixed real exchange rate) was there an improvement for the EIS at the domestic and the international market level.

IV. Summary and Conclusion

In light of the comprehensive economic reform program adopted by the GOE and the shift toward an outward-looking trade strategy, this study has been motivated by the concern about the likely impact of the shift in trade strategy on the EIS. Hence, the purpose has been to perform a quantitative examination of the impact of trade policy changes on the EIS. A CGE model was used to simulate changes in trade policy through a series of policy experiments under two different assumptions concerning the xechange rate.

With regard to the findings of the simulations, our attention has been drawn to a number of interesting points. The findings may provide some guidance to the decision maker as it highlights the tradeoffs attending different policy alternatives. The following points are noted :

— The removal of tariff protection has a negative impact on government savings both under fixed and flexible exchange rates. This is a direct outcome of tariff reduction.

Table 6 : Sector-Specific results (percentage change from base value)

Productive Sectors	Output	Value added Price	Value added	Employment*	Average Output Price	Domestic Price (Pd)	Export Price (PE)	Relative Price (PE/Pd)	Exports	Composite Price (P)	Import Price (PM)	∗ Relative Price (Pd/PM)	Imports
Flexible Exchange Rate													
Simulation 1													
Industrial Sectors													
Food Processing	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	0.2	0.4	0.1	0.3	-0.2	-0.3
Spinning & Weaving	0.0	-0.9	0.0	0.0	-0.4	-0.5	-0.1	0.7	0.5	-2.3	-34.1	51.0	31.1
Other Industry	0.1	0.0	0.0	0.2	0.1	0.1	-0.1	0.1	0.3	0.1	0.3	-0.2	-0.2
Other Sectors													
Agriculture	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	0.2	0.3	0.0	0.3	-0.3	-0.1
Oil	0.0	0.4	0.0	0.5	0.2	0.2	0.0	0.1	-0.2	0.2	0.3	-0.1	0.0
Services	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.2	0.1	0.0	0.3	-0.3	-0.1
Simulation 2													
Industrial Sectors													
Food Processing	0.6	1.7	0.5	1.7	1.3	1.2	-0.9	2.4	5.4	1.8	4.5	-3.2	-3.4
Spinning & Weaving	0.8	1.3	0.7	1.8	0.7	0.3	-0.6	3.8	3.4	0.5	4.5	-4.0	-2.2
Other Industry	-1.4	-1.9	-1.1	-3.7	-2.8	-3.0	-1.8	6.0	10.4	-4.9	-8.3	5.8	5.5
Other Sectors													
Agriculture	0.2	1.2	0.4	0.9	1.1	1.1	-0.9	2.5	3.9	1.4	4.5	-3.3	-1.2
Oil	0.6	6.3	0.1	6.4	4.0	3.5	-0.1	0.8	-3.2	3.8	4.5	-1.0	0.0
Services	0.4	1.8	0.5	1.7	1.4	0.8	-0.4	3.3	1.5	1.1	4.5	-3.5	-1.0
Simulation 3													
Industrial Sectors													
Food Processing	0.7	1.8	0.5	2.0	1.4	1.4	-0.9	2.4	5.4	2.2	5.8	-4.2	-4.6
Spinning & Weaving	0.8	1.2	0.7	1.5	0.3	-0.2	-0.8	4.2	3.8	-1.9	-31.2	45.1	58.4
Other Industry	-1.3	-1.9	-1.0	-3.6	-2.8	-2.9	-1.7	6.0	10.6	-4.8	-8.2	5.7	5.4
Other Sectors													
Agriculture	0.3	1.2	0.4	1.0	1.1	1.1	-1.0	2.5	4.0	1.4	4.7	-3.4	-1.2
Oil	0.6	6.5	0.1	6.6	4.1	3.6	-0.1	1.0	-3.4	3.8	4.7	-1.0	0.0
Services	0.4	1.8	0.5	1.8	1.4	0.8	-0.4	3.4	1.6	1.2	4.7	-3.7	-1.0
Simulation 4													
Industrial Sectors													
Food Processing	-8.1	-9.7	-4.4	-16.7	0.7	0.7	0.0	3.1	-0.1	11.6	5.0	-4.1	-10.9
Spinning & Weaving	0.4	2.2	0.3	0.7	0.7	0.3	-0.4	3.1	2.6	-1.5	-31.8	47.0	29.1
Other Industry	-1.6	-1.0	-1.3	-4.4	-2.4	-2.5	-1.3	5.1	8.4	-4.9	-8.9	7.0	6.9
Other Sectors													
Agriculture	-0.6	0.2	-0.9	-2.2	0.5	0.5	-0.8	2.6	3.2	0.8	3.8	-3.2	-2.0
Oil	0.4	5.2	0.1	3.7	3.3	2.9	-0.1	0.9	-3.3	3.0	3.8	-0.9	0.0
Services	-0.1	1.5	-0.1	-0.5	1.3	0.8	-0.2	2.8	0.8	1.1	3.8	-2.9	-1.2

Table Notes

Simulation 1 = Tariff rate on Spinning and weaving reduced from 68% to 10%

Simulation 2 = Tariff rate on Other Industry reduced from 28% to 10%

Table 7: Macroeconomic Variables

(Percentage Change from Base Value)

Flex. Exchange rate

Indicator	Simulation				
	Base	1	2	3	4
	(L.E. Billion)				
Real Macro Data:					
Real GDP	40.2	0.0	0.1	0.1	-0.5
Real Private Consumption	28.4	0.1	0.9	1.0	-0.9
Real Investment Demand	10.4	-0.1	-1.2	-1.2	1.3
Trade Deficit	5.9	0.4	2.0	2.3	2.6
Total Employment*	14.9	0.1	0.5	0.5	-1.4
Nominal Macro Data:					
Investment	10.4	-0.2	-3.3	-3.4	0.1
Government Savings	1.2	-2.6	-45.2	-47.0	-9.1
Non-Government Savings	7.7	0.1	1.5	1.6	0.8
Foreign Savings**	1.5	0.3	4.5	4.7	3.8
Exchange Rate	1	0.3	4.5	4.7	3.8
Government Revenue	12.7	-0.3	-4.0	-4.3	0.3
Government Expenditures	11.6	-0.1	0.1	0.0	1.3
Other					
Value of Exports $	5.6	0.1	1.8	1.9	1.3
Value of Imports $	9.5	0.1	1.9	2.0	1.6
Real Exchange Rate	1	0.0	-0.1	-0.2	-1.0
Imports / Domestic Sales	19.6 %	0.2	2.3	2.5	3.4
Exports / Domestic Sales	9.5 %	0.1	2.4	2.5	2.8

Table Notes

Simulation 1 = Tariff rate on Spinning and weaving reduced from 68% to 10%

Simulation 2 = Tariff rate on Other Industry reduced from 26% to 10%

Simulation 3 = Tariff rates on Food Processing, Spinning and Weaving, and Other Industry all set at 10%

Simulation 4 = Same as simulation 3 plus a 10% Sales Tax imposed on the industrial sector

* = Employment is in thousand (1000) workers

** = Foreign Savings is fixed in foreign currency but varies in local currency as a result of the exchange rate changes

Table 5: Comparison between Macroeconomic Variables (Flexible Vs. Fixed Exchange rate)

(Percentage change from base value)

Indicator		Simulation							
	Base	Flex. 1	Fixed 1	Flex. 2	Fixed 2	Flex. 3	Fixed 3	Flex. 4	Fixed 5*
	(L.E. Billion)								
Real Macro Data:									
Real GDP	40.2	0.0	0.0	0.1	0.1	0.1	0.1	-0.5	-0.6
Real Private Consumption	28.4	0.1	0.1	0.9	0.9	1.0	1.0	-0.9	-1.1
Real Investment Demand	10.4	-0.1	-0.2	-1.2	-1.3	-1.2	-1.5	1.3	0.0
Net Exports	5.9	0.4	0.3	2.0	1.7	2.3	1.8	2.6	0.2
Total Employment*	14.9	0.1	0.1	0.5	0.4	0.5	0.4	-1.4	-1.8
Nominal Macro Data:									
Investment	10.4	-0.2	-0.3	-3.3	-3.5	-3.4	-3.7	0.1	-1.2
Government Savings	1.2	-2.6	-2.6	-45.2	-45.3	-47.0	-47.1	-9.1	-9.9
Non-Government Savings	7.7	0.1	0.1	1.5	1.5	1.8	1.6	0.8	0.9
Foreign Savings	1.5	0.3	-0.1	4.5	3.4	4.7	2.7	3.8	-4.8
Exchange Rate	1	0.3	0.3	4.5	4.7	4.7	4.9	3.8	4.9
Government Revenue	12.7	-0.3	-0.3	-4.0	-4.0	-4.3	-4.3	0.3	0.5
Government Expenditures	11.6	-0.1	-0.1	0.1	0.1	0.0	0.1	1.3	1.5
Other									
Value of Exports $	5.6	0.1	0.2	1.8	1.9	1.9	2.0	1.3	1.7
Value of Imports $	9.5	0.1	0.1	1.9	1.8	2.0	1.8	1.6	0.6
Exchange rate	1	0.0	0.0	-0.1	0.0	-0.2	0.0	-1.0	0.0
Imports / Domestic Sales	19.6 %	0.2	0.2	2.3	2.2	2.5	2.3	3.4	2.5
Exports / Domestic Sales	9.5 %	0.1	0.2	2.4	2.5	2.5	2.7	2.8	3.5

Table Notes

Simulation 1 = Tariff rate on Spinning and weaving reduced from 68% to 10%

Simulation 2 = Tariff rate on Other Industry reduced from 26% to 10%

Simulation 3 = Tariff rates on Food Processing, Spinning and Weaving, and

Simulation 4/5 = Same as simulation 3 plus a 1% Sales Tax imposed on the industrial sector

* = The simulation is the same as simulation 4 under a fixed exchange rate

** = Base value is a percentage

Table 9 : Results of the Policy Experiments on selected variables for the EIS (L.E. Million)

Fixed Exchange rate

	Value added	Exports	Ratio of Exports to output^	Imports	Ratio of Imports to output^^	Ratio of Exports to GDP	Ratio of Imports to GDP
Base Value	6253.0	694.0	3.2	7783.0	27.3	1.7	19.3
				Simulation 1			
ercentage Change	0.0	0.5	0.4	0.4	0.3	0.4	0.3
				Simulation 2			
ercentage Change	-0.5	6.3	6.8	3.5	3.0	5.1	2.3
				Simulation 3			
Percentage Change	-0.4	6.7	7.1	3.7	3.2	5.4	2.5
				Simulation 4			
Percentage Change	-1.3	15.4	17.1	-7.5	-4.1	15.1	-7.7
				Simulation 5			
Percentage Change	-1.7	5.4	8.4	2.7	4.2	5.2	2.5

Flexible Exchange rate

	Value added	Exports	Ratio of Exports to output^	Imports	Ratio of Imports to output^^	Ratio of Exports to GDP	Ratio of Imports to GDP
IS							
Base Value	6253.0	694.0	3.2	7783.0	27.3	1.7	19.3
				Simulation 1			
Percentage Change	0.0	0.4	0.4	0.4	0.3	0.4	0.4
				Simulation 2			
Percentage Change	-0.4	6.2	6.6	3.7	3.1	4.9	2.5
				Simulation 3			
Percentage Change	-0.4	6.5	6.9	4.0	3.3	5.19	2.75
				Simulation 4'			
Percentage Change	-1.6	4.6	7.4	3.9	5.0	4.2	3.6

able Notes

imulation 1 = Tariff rate on Spinning and weaving reduced from 68% to 10%

imulation 2 = Tariff rate on Other Industry reduced from 26% to 10%

imulation 3 = Tariff rates on Food Processing, Spinning and Weaving, and Other Industry equated to 10 %

imulation 4 = Same as simulation 3 plus a 10% devaluation of the Exchange rate

imulation 5/4' = Same as simulation 3 plus a 10% increase in the sales tax

= The EIS exports are divided by the EIS total domestic output

^ = The EIS imports are divided by the EIS supply available for sale at the domestic markets (non-traded domestic output + imports)

— The trade deficit increases in all of the policy experiments, but under the assumption of a fixed real exchange rate the increase is always less than that under the flexible exchange rate assumption.

— Since government savings are reduced, it is expected that real investment demand is reduced since it is savings driven. However, under two simulations, real investment demand does not change or increases by 1.3%; this was due to increased foreign savings and the complementary policy of introducing a sales tax to reduce the loss in government savings.

— When the exchange rate is devalued by 10% in combination with import tariff cuts, the trade deficit fall and the ratio of exports to domestic supply increases, while the ratio of imports to domestic sales is reduced. However there are tradeoffs associated with these gains. When the exchange rate is devalued real investment demand, real GDP, and employment are markedly reduced.

Concerning the EIS, the following points may be stressed :

— Under most of the policy experiments, EIS value added is negativiely affected. Removal of tariff protection means a loss of EIS sales shares in the domestic market that is not matched by an equivalent gain in the international markets.

— When the exchange rate is devalued, the EIS experiences a unique situation compared to the other policy experiments. The ratio of imports to output shows decline, implying a gain in the domestic markets. At the same time, the ratio of exports to output increases which reflects the increase in EIS exports. However, the same tradeoffs mentioned earlier apply — investment, GDP and employment suffer.

From the results some policy implications emerge. It can be concluded that management of the foreign exchange regime is of marked importance in the short run. A decision maker should be aware of the tradeoffs related to alternative exchange rate policies in the context of a tariff cut. If the aim is to reduce

the trade deficit and promote EIS competitiveness, it is advisable to devalue the exchange rate in real terms. If the aim is to encourage investment and reduce unemployment, then a flexible exchange rate strategy with little change in real terms provides a better alternative. In addition, if foreign savings inflows are a constraint, then Egypt should devalue the real exchange rate, as less foreign savings would be required to clear the current account when tariffs are reduced.

Introducing a sales tax reduces the deficit in the GOE budget when import liberalization measures are attempted. However, the introduction of a sales tax entails a reduction in real GDP, and more unemployment. If a sales tax is introduced, then the choice between a flexible and a fixed real exchange rate depends on the same considerations as above : a flexible exchange rate favors investment and employment whereas a real devaluation reduces the trade deficit and promotes EIS competitiveness.

Finally, introducing a more neutral trade regime (less bias against imports) without devaluation would have negative short-run impact on industrial output and incomes for all alternative exchange rate policies considered in the experiments. Over a longer time period, a change in strategy may have other stronger effects due to changes in investment patterns, efficiency and technology advancement.

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Appendix 1: Extraneous Data used for the model

Table A1.1: Elasticity Values for the model

Elasticity	*Value*
Export demand	
Agriculture	4
Oil	20
Food Processing	6
Spinning and Weaving	6
Other Industry	6
Electricity	0
Construction	0
Services	4
Domestic good - import substitution	
Agriculture	0.4
Oil	3
Food Processing	1.25
Spinning and Weaving	0.66
Other Industry	1.25
Electricity	0.6
Construction	0.6
Services	0.33
Domestic good - export transformation	
Agriculture	1.5
Oil	2
Food Processing	2
Spinning and Weaving	0.8
Other Industry	2
Electricity	0.5
Construction	0.8
Services	0.4

Source: Lofgren (1995)

Table A1.2: Sectoral Employment 1000 Workers

Sector	*Employment*
Agriculture	4330
Oil	30
Food Processing	300
Spinning and Weaving	500
Other Industry	1100
Electricity	81
Construction	690
Services	3129
Government	2185

Source: CAPMAS. Annual Statistical Yearbook. Cairo:June 1993

list of Abbreviations

List of Abbreviations

C-D	: Cobb-Douglas function
CET	: Constant Elasticity of transformation
CES	: Constant Elasticity of substitution
CGE	: Computable General Equilibrium
Egypt1	: The CGE model of this thesis
EIS	: Egyptian Industrial Sector
GOE	: Government of Egypt
IMF	: International Monetary Fund
ISI	: Import Substitution Industrialization
OWP	: October Working Paper
ROW	: Rest of the World
SAM	: Social Accounting Matrix

رقم الايداع بدار الكتب
١٩٩٢ / ٥٣٤
مطابع الأهرام – كورنيش النيل

مطابع الأهرام بكورنيش النيل