Economics Division Working Papers

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92/6

Research School of Pacific Studies ANU

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n.a.	**Not applicable**
..	**Not available**
-	**Zero**
.	**Insignificant**

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Islands/Australia Program

National Centre for Development Studies

This paper originates in the Islands/Australia Program at the National Centre for Development Studies. The size, geographic isolation and histories of the Pacific island states create special development problems. Australia plays an important role in the region, both as an aid donor and trading partner. The National Centre for Development Studies has given priority to research on the islands since 1975. The Islands/Australia Program provides policy insights, primarily for Australia in its relations with its Pacific neighbours, but also for the island governments and international agencies. This stream of the Economics Division Working Papers widens the former Islands/Australia Working Paper series. Research on the area is being undertaken by other scholars in the Division. The National Centre for Development Studies continues to disseminate analysis of the island economies through its *Pacific Policy Papers*, *Pacific Research Monographs* and the *Pacific Economic Bulletin*.

abstract

Under the Lomé Convention Mauritius has free access for its exports of clothing to the EC market. In practice it also has open market access to the United States for most of its clothing exports under the General System of Preferences. By restricting the clothing exports of large exporters such as Hong Kong, the Republic of Korea, Taiwan and China, the Multifibre Arrangement creates opportunities for Mauritius, which is not a member. Mauritius receives higher prices for its clothing exports to the EC (60 per cent of Mauritian clothing exports) and the United States (35 per cent of Mauritian clothing exports) than it would obtain in the absence of the Multifibre Arrangement. Losses could occur to the Mauritian economy if the Multifibre Arrangement ends. Clothing prices would be likely to drop by the amount prices have been raised by the Arrangement.

While the main impact of the reduction in export prices of clothing would fall on the industry itself, there would be important consequences for other sections of the economy. The simulation results indicate that lower export prices for clothing results in smaller clothing production. However, other exporting and import competing industries expand due to improvement in their competitiveness. Non-traded goods industries would contract marginally. In the short run, the spillover effect on the macro aggregates (GDP, exports, imports, investment etc.) would be negative, but there can be little doubt that in the medium to long term increased competitiveness would stimulate further growth.

Mauritian clothing exports without the MFA

In the 1960s and 1970s Mauritius was faced with problems typical of developing countries; slow economic growth, high unemployment and balance of payments deficits. By the late 1980s it had succeeded in overcoming these problems and had achieved a high level of economic growth, joining the World Bank list of middle income countries. It was transformed from a mono-culture, sugar economy to a semi-industral nation. In stark contrast to neighbouring African nations, which had meagre economic growth, the Mauritian economy became one of the most rapidly growing developing countries. The growth of the economy was closely related to the growth of clothing exports. Mauritius has been transformed from a mono-culture economy in the early 1970s to a semi-industrialized country in two decades. The driving force behind this transformation is the clothing industry. The clothing industry has evolved from a negligible base in the early 1970s to the most dominant industry in terms of its contribution to GDP, employment and export earnings in the late 1980s.

The success of the clothing industry in Mauritius has largely depended on the domestic policies implemented to promote production for export. The policies have played a prominent role in enhancing both domestic and foreign investment in the clothing industry. Above all, the policies allowed resources to move to where they are most efficiently employed.

Further, external marketing arrangements have been made for clothing exports. Among these arrangements, the free access of Mauritian clothing exports to the EC is prominent. As imports from non-preference countries are charged import duties, free access of Mauritian exports to the EC market can be considered as an increase in the export price of Mauritian clothing.

While the clothing industry has benefited significantly from the trading arrangements and protectionist policies of the EC, new application of trade restrictions presently imposed on other countries could potentially constrain future growth. However, there is still a potential for expanding wearing apparel exports to the EC in categories that are not yet restricted by quota, such as ties,

socks and scarves. For items already under a quota, since quotas are set in volume rather than value terms, there is a possibility for marketing into higher value products, as Hong Kong did to the United States.

The Multifibre Arrangement

Exports of textiles and clothing from over 30 developing countries are regulated under the Multifibre Arrangement. The Arrangement mandates bilateral agreements between importing industrial countries and exporting developing countries to limit trade in textiles and clothing.

The Multifibre Arrangement originated from the Short-Term Agreements (1960-61) and Long-Term Agreements (1962-74) on international trade in cotton textiles and clothing. Other fibres have been included over time.

The Multifibre Arrangement has been operating since 1974. Although the Multifibre Arrangement violates the basic principle of non-discrimination among trading partners of the General Agreement on Trade and Tariffs, GATT supervises the implementation of the Multifibre Arrangement.

Under the Arrangement, developing member countries agree to limit their exports to member industrial countries through voluntary export restrictions. The importing country imposes an upper limit on foreign supply and the exporting country administers the restriction on export supply. In doing so, exporting countries obtain the rents arising from quantitative restrictions.

Voluntary export restraints create scarcity of the restricted item in the importing industrial countries. This pushes up the price of the restricted item, allowing the exporting country to charge a higher price. The exporting country collects rents (the difference between export earnings at the restricted price and at the unrestricted equilibrium price). In contrast to a tariff which benefits consuming countries' producers or a quota which benefits consuming countries' importers, the system transfers income from consumers and producers in industrial countries to exporters in developing countries, offsetting their losses due to the restrictions on volume. This is the reason why exporting countries usually prefer voluntary export restraints to other import barriers such as tariffs or quotas whose rents accrue totally to the importing countries.

Wolf (1990) noted that quota rents may not be very important for the economies of the exporting countries but still could be important for the entrepreneurs, bureaucrats, and politicians directly engaged in the industry. It is thought that much of the profits of the Hong Kong clothing industry from exports

to the United States in the early 1980s may have come from quota rents. Bureaucrats also extract rent in the allocation of export quotas to firms (Wolf 1990).

In non-Multifibre Arrangement markets, prices are lower as producers are willing to sell their excess supply (production less exports to the Multifibre Arrangement markets) at lower prices than those that would prevail without quota rents. This means that producers are cross-subsidizing production to non-Multifibre Arrangement markets from Multifibre Arrangement markets.

Producers in the protected industries in the industrial countries certainly benefit. The scarcity created by the voluntary export restraint allows domestic producers of similar products to mark-up prices and raises production in industrial countries. But consumers lose in industrial countries because prices are higher than they otherwise would be. Hamilton (1984) estimated that trade barriers (tariffs and voluntary export restraints) against clothing imports from Hong Kong raised the price of the imports by 25 per cent in Italy and 49 per cent in Sweden. The variety of clothing products available is also diminished.

Developing countries that are newcomers to the export market receive a short-run benefit from the Multifibre Arrangement. They are able to enter markets freely while established exporters are limited. The latecomers only face restraints when quotas are established and exports hit quota ceilings. As export quotas are allocated among suppliers on the basis of past performance, latecomers are given low levels of quotas. Latecomers lose in the long run, because the arrangement slows down their export growth.

The Multifibre Arrangement has not achieved its main objective of progressively liberalizing the world clothing trade. It is widely recognized, (for instance Cline (1987) and Raffaelli (1990), that dismantling the Multifibre Arrangement would result in large efficiency gains. If the Multifibre Arrangement is abolished, countries at relatively low levels of development that are low wage exporters with cheaper fabrics and styles may increase their market share. Producers that have acquired a foothold in the clothing trade through the Arrangement, rather than efficiency, would be forced to leave the market for more efficient producers. Other producers would be able to move up market.

The political economy of protectionism, however, has worked in favour of maintaining the Multifibre Arrangement (Hamilton 1984), in both major exporting developing and importing industrial countries. Inefficient producers in developing countries want to retain the Agreement to maintain their rents. Consumers in industrial countries, the main losers from restrictions, are poorly

organized and have weaker bargaining power than the groups who would like to maintain the status quo (Hughes 1986).

The Multifibre Arrangement was to expire by 31 July 1991. It was renewed to the end of 1992 in the expectation that the Uruguay Round which dealt with the trade in clothing and textiles would be completed by this time. It is now agreed within the Uruguay Round that the Multifibre Arrangement will be to phased out over 10 years from 1993 by the gradual removal of quotas towards the end of this period (Page 1991).

Global aspects of trade in clothing

Clothing has been one of the early manufacturing industries to develop in both industrial and developing countries (Blokker 1989). It is one of the least skill and capital-intensive industries and its relative importance has declined in industrial countries as industrialization has progressed (Field 1984; Anderson 1990).

Japan was the first of the twentieth century developing countries to begin exporting textiles and clothing in the 1920s. By the 1950s other developing countries had begun to develop clothing exports. Clothing exports, particularly from Asian developing countries, began to penetrate industrial country markets on a broad scale because clothing and textiles were the least competitive component of manufactures in industrial countries. The industrial countries attempted to restrict the rate of expansion of clothing and textiles imports from the 1920s, accelerating their efforts after World War II. A series of restrictive agreements culminated in the Multifibre Arrangement in 1974.

World trade in clothing

Clothing is a small component of world trade in manufactures. In 1989, clothing comprised 4.5 per cent of world manufacturing trade (Table 1). But world trade in clothing has grown rapidly in absolute terms, with the share of clothing exports in total exports of manufactures nearly doubling between 1965 and 1989 (Table 2).

Table 1 Clothing exports as a share of manufactured exports, 1965-89 (per cent)

	1965	1975	1985	1989
Industrial countries	2.3	2.1	2.0	2.0
Developing countries	9.4	16.0	14.8	15.7
Centrally planned European countries	2.3	3.8	4.1	5.8
World	2.7	3.1	3.9	4.5

Sources: International Economic Data Bank, the Australian National University, Canberra, 1991.

World exports of clothing grew faster than world trade in manufactures until the early 1980s. Then their growth fell below the average growth of trade in manufactures. Much of the growth in clothing exports originated from developing countries which quadrupled their share between 1953 and 1988.

Table 2 World trade in clothing: geographical distribution, 1953-88

	1953	1963	1973	1983	1988
Exports (US$ billion)	0.8	2.2	12.6	41.0	89.5
Share of world exports			per cent		
Industrial countries	71	67	51	38	41
Developing countries	10	15	35	48	45
Eastern trading area	19	18	14	14	14
World	100	100	100	100	100
Share of world imports			per cent		
Industrial countries	56	66	78	75	84
Developing countries	26	17	10	17	10
Eastern trading area	18	17	12	8	6
World	100	100	100	100	100

Sources: N. Blokker, *International Regulation of World Trade in Textiles: Lesson for practice a contribution to theory*, London/Boston, 1989; GATT, *International Trade, 1989/90*, Geneva, 1990; and I. Trela, and J. Whalley, 'Unravelling the threads of the MFA', in Carl Hamilton (ed.), *The Uruguay Round Textiles Trade and the Developing Countries: Eliminating the Multifibre Arrangement in the 1990s*, Washington, D.C., 1990.

In the last three decades world clothing exports have shifted from industrial to developing countries. In 1989, the bulk (89 per cent) of clothing exports went to industrial country markets (Table 3). Industrial countries also became increasingly the major markets for clothing exports from other industrial countries. In 1989, 90 per cent of clothing exports of industrial countries went to other industrial countries. In total, industrial countries absorbed almost 90 per cent of world clothing exports as compared to a little over 80 per cent in 1963.

Table 3 **Clothing: direction of trade, 1963 and 1988**

	Industrial countries		Developing countries		Eastern trading area	
	1963	1988	1963	1988	1963	1988
From			US$ billion			
World	1.4	76.0	0.37	8.8	0.37	5.0
Industrial countries	1.2	33.0	0.27	2.8	0.02	0.7
Developing countries	0.2	36.0	0.09	3.8	0.0	0.9
Eastern trading area	0.04	6.8	0.01	2.3	0.35	3.5
			Percentage of total exports			
Industrial countries	81	90	18	8	1	2
Developing countries	69	89	31	9	0	2
Eastern trading area	10	54	3	18	87	28

Source: J. Field, *Trade and textiles: an analysis of the exchanging international division of labour in textile and clothing sector, 1963-78*, Quezon City, Philippines, 1984; and GATT, *International Trade*, 1989/90, Geneva, 1990.

The share of developing countries in the clothing trade grew strongly in the 1960s and early 1970s, albeit from a low initial base (Wolf 1986). The increase in the developing countries share of exports of clothing reflected their increasing exploitation of comparative advantage. Clothing is one of the most labour-intensive manufacturing industries (Cline 1987).

Leading exporters and importers of clothing

The world's leading clothing exporting developing countries (Hong Kong, the Republic of Korea, China and Taiwan) accounted for over 37 per cent of world exports in 1989. World clothing imports in 1989 were also concentrated with five industrial countries taking 80 per cent of world imports (4).

Table 4 Exports and imports of clothing of leading developing country exporters and industrial country importers, 1965-89

	Value US$ billion			Share in world exports/ imports (per cent)			Average annual change (per cent)	Share in country exports/ imports (per cent)
	1965	1975	1989	1965	1975	1989	1980-88	1989
Exporters								
Hong Kong[a]	0.3	2	14	12	12	15	12	19
Korea, Republic of	.	1	9	1	7	10	15	15
China	.	0.3	13	2	2	14	14	12
Taiwan	.	0.9	5	1	6	5	9	7
Turkey	.	0.1	3	.	1	3	44	24
Portugal	.	0.2	3	1	1	3	18	21
Thailand	.	.	2	.	.	3	27	12
India	.	0.2	2	1	1	2	13	12
Greece	.	0.1	2	.	1	2	15	20
Importers	-							
United States	0.5	3	26	20	15	27	16	6
Germany, Rep	0.4	4	15	10	22	15	7	6
Japan	.	0.5	9	0.3	3	9	5	..
France	0.1	0.9	6	3	5	7	11	4
United Kingdom	0.2	1	6	6	7	6	9	3
USSR	0.1	0.7	0.8	3	4	1	6	4
Netherlands	0.2	1	4	8	8	4	4	4

[a] includes re-exports. In 1989 re-exports were valued at US$4.8 billion.
Source: International Economic Data Bank, the Australian National University, Canberra, 1991; and GATT, *International Trade*, 1989/90, Geneva, 1990.

Developing country clothing exports were initially concentrated in a few East Asian countries. A large part of the growth in clothing exports from developing countries originated from Hong Kong, the Republic of Korea and Taiwan. In 1984 these countries supplied 70 per cent of clothing exports from developing countries to industrial countries. In the 1980s China also become an important exporter. In 1988, China and the three other major developing country exporters accounted for 75 per cent of clothing exports from developing to industrial countries. In the 1960s and 1970s the share of exports from developing countries to industrial countries on average increased by 6 per cent every year. However, in the 1980s this growth declined to 3 per cent.

The domination of clothing exports by East Asian countries does not mean that clothing exports are not important to other developing countries. In 1988 clothing exports accounted for more than half of manufactures exports for six developing countries (Table 5). The share of Mauritian clothing exports in total manufactured exports is the highest among developing countries (84 per cent). For all 20 countries listed, clothing exports made up 20 per cent or more of manufactures exports.

Table 5 Exports of clothing for selected developing countries, 1980 and 1988

	Value (US$ million)	Average annual increase 1980-87	Share of manufactured exports (per cent) 1980	1988
Hong Kong	11786[a]	12	28	21
Korea Republic	9100	10	6	7
China	4872	12	56	21
Taiwan	4700	11	13	8
Turkey	2415	50	17	32
Portugal	2218	19	19	27
Thailand	1834	28	16	21
India	1578	15	13	20
Greece	1444	20	17	42
Macao	967	11	72	66
Pakistan	623	29	8	21
Tunisia	550	7	42	42
Morocco	490	23	19	27
Sri Lanka	436	22	64	74
Mauritius	434	29	59	84
Bangladesh	416	120	0	48
Costa Rica	205	40	7	52
Dominican Republic	200	177	0	62
Haiti	163	13	29	38
Uruguay	154	4	30	30
Jamaica	106	47	10	59
Syria	85	19	19	20

[a] includes re-exports from China.
Source: GATT, *International Trade 88/89*, Geneva, 1990.

The role of the clothing industry in Mauritius

The bulk of export from Mauritius was clothing which has increased its share of employment, output and exports until it has become the single most important industry (Table 6). As clothing is labour-intensive it has become the major employer in Mauritius, accounting for 76 per cent of manufacturing employment and 30 per cent of total employment in 1988 (Table 6).

The clothing industry's contribution to exports is equally impressive. In 1988 clothing exports accounted for 78 per cent of manufacturing exports and 46 per cent of total exports.

Table 6 Contribution of clothing to the Mauritian economy, 1976-88

	1976	1983	1988
GDP at factor cost (million rupee)	4165	10613	22643
Manufacturing	669	1678	5593
Export processing enterprises	108	548	3125
Clothing	72	389	2440
Exports (million rupee)	1769	4346	13505
Manufacturing	353	1202	8318
Export processing enterprises	309	1307	8176
Clothing	205	928	6446
Employment ('000)	185	195	270
Manufacturing	28	37	106
Export processing enterprises	17	25	89
Clothing	10	21	80

Source: Mauritius Statistical Office, *Digest of Statistical Yearbook*, Port Louis, various issues and R. Alter, 'Export Processing Zones for Growth and Development: the Mauritian example', IMF Working Paper, International Monetary Fund, Washington, D.C., 1990.

The Lomé Convention

The Lomé Convention establishes a relationship between the EC and the developing African, Caribbean and Pacific countries (ACP) based on the legacies of colonialism. Most of the ACP countries (of which Mauritius is one) were once colonies of either Britain or France. France sought to preserve colonial trading arrangements to maintain its political commitment of fostering social and economic development in its former colonies. The colonies also provided France

with low cost labour, land and natural resources. The implementation of these mutual benefits was initially agreed between the parties involved under the Yaoundé Conventions.

Objectives and historical perspective

The Lomé Convention was built on the Yaoundé Agreements which were signed between the EC and politically independent francophone African countries in 1963 and 1969. The East African Common Market member countries (Kenya, Tanzania and Uganda), the Commonwealth African and Pacific developing countries and the former Dutch colonies of the Caribbean had bilateral trade arrangements with the EC members at that time. By merging these countries with the Yaoundé signatories, Lomé was created in 1975. The Yaoundé Agreement focused on aid and trade, although it had some elements of economic diversification and industrial development. These latter characteristics were to become integrated into the Lomé Conventions later.

Four separate Lomé Conventions have been signed. The Lomé Conventions of 1975, 1979, and 1984 maintained the broad features of the trade and aid regime. The latest Convention, Lomé IV was signed in 1990 and is to run until 1994. By June 1991 the Lomé Convention represented an Agreement between 12 EC countries and 69 ACP countries. One of the stated aims of all four Lomé Conventions has been to promote ACP trade with the EC. The main instrument is the reduction or elimination of tariffs on EC imports from ACP countries.

ACP exports of clothing have increased from a mere US$ 27 million in 1975 to US$ 378 million in 1988. These exports originated mainly from Mauritius, Ivory Coast and Barbados. Mauritius was the principal source of supply. Nevertheless, Mauritian exports comprise a small share of EC imports. Mauritian clothing exports amounted to only 0.2 per cent of total EC imports in 1975 and rose to 1 per cent in 1989 (Table 7).

Table 7 Clothing exports to the EC by major ACP exporters, 1975-89 (US$ million)

	1975	1980	1989
Total ACP	27	108	439
Mauritius	19	80	372
Ivory Coast	2	12	7
Barbados	3	2	3
Other developing countries	2076	5875	15135
Other countries	6090	13493	22608
Total EC import	8193	19476	38182
Mauritius' percentage share of clothing exports to EC of:			
Total ACP	70.0	74.0	85.0
Developing countries	1.0	1.4	2.5
Total EC import	0.2	0.4	1.0

Source: International Economic Data Bank, The Australian National University, Canberra, 1991.

The EC market absorbed as much as 93 per cent of Mauritian clothing exports during the second half of the 1970s. Though the importance of the EC market has steadily declined, it still remains the major market, taking 66 per cent of Mauritian clothing exports in 1985-89. Most of the balance, some 30 per cent of clothing exports, is sold in the US market.

The EC and the United States, the major markets for Mauritian clothing exports, impose Multifibre Arrangement restrictions on developing countries. Any significant supplier (supplying 1 per cent or more of EC total imports) is subject to restriction (Twitchett 1980). As a small supplier Mauritius is subject to restrictions only in the United Kingdom and United States and only for a few categories of clothing. However, the Multifibre Arrangement, by restricting the entry of more competitive large producers, gives Mauritius an advantage in the EC markets where supply restrictions raise prices. Hamilton (1984) estimated that trade barriers against clothing imports from Hong Kong raise prices in France and the United Kingdom, the two major markets of Mauritius, by 38 and 40 per cent, respectively.

Table 8 Share of clothing exports to manfucturing and total exports by destination, 1970-89 (US$ million)

	SITC code	1970-74	1975-79	1980-84	1985-89
Clothing exports to EC	841	11	196	360	1210
Clothing accessories	8414[a]	8	139	263	747
Clothing not knitted accessories	8411[b]	3	35	65	334
Textiles accessories	8412[c]	0	2	9	105
Clothing exports to US	841	2	7	58	524
Clothing accessories	8414[a]	2	5	34	154
Clothing not knitted accessories	8411[b]	.	2	24	370
Textiles accessories	8412[c]	.	.	.	.
Clothing exports as per cent of manufacturing export to:					
World		37	62	72	78
EC		48	71	79	79
US		33	22	63	84
Clothing exports as per cent of total export to:					
World		2	13	24	46
EC		33	15	22	40
US		4	6	38	75

[a] Knitted non-elastic gloves, socks, underwear and outerwear.
[b] Men's and women's underwear and outerwear not knitted.
[c] Includes handkerchiefs, shawls, veils, ties, cravats etc.
Source: International Economic Data Bank, The Australian National University, Canberra, 1991.

Despite Multifibre Arrangement restrictions, clothing imports from developing countries to the EC, expressed as the share of apparent consumption (production plus imports minus exports), have increased. Even the major restricted countries have improved their penetration of the EC market (Table 9). These trends are consistent with the Hughes (1981, 1986) findings that consumption by industrial countries of manufactures imported from developing countries increased in the 1970s and early 1980s.

Table 9 Share of imports in apparent consumption of clothing in the EC (import penetration ratio) by selected country groups, 1980-87

	Penetration ratio		
	I 1980	II 1987	II/I
Major restricted countries			
Hong Kong	0.45	0.51	1.13
Korea, Republic of	0.44	0.60	1.36
Taiwan	0.36	0.44	1.22
ACP	0.21	0.28	1.33
Mauritius	**.04**	**.06**	**1.50**
All developing	6.78	8.51	1.26
Eastern Europe	0.82	0.80	0.97
Developed countries	28.20	32.70	1.16
Intra EC-7	19.90	23.20	1.16
World	35.90	42.20	1.18

Source: International Economic Data Bank, the Australian National University, Canberra, 1991.

The model

The analytical framework of the computable general equilibrium (CGE) model built to analyse the effect of changes in the international trading environment on the Mauritian economy. The analysis draws out the implications of bilateral trade arrangements for Mauritius' major exports of clothing. The model quantifies short-run and long-run effects of policy on sectoral (industrial) and key macroeconomic variables.

Principal features of the model

The model follows inter-industry models of Johansen (1960), Shoven and Whalley (1972), Taylor and Black (1974), Dixon *et al.*, (1982), de Melo and Robinson (1989), and Robinson (1989).

The model is based on the ORANI family of models which follow the Johansen style. The standard short-run ORANI model of the Australian economy (Dixon *et al.* 1982) has been modified to include foreign investment (Dixon *et al.* 1984); long-run closures (Horridge 1985); financial markets (Vincent 1985); forecasting (Dixon and Parmenter 1986); income distribution analysis (Meagher and Agrawal 1986);

the fiscal system (Meagher 1986; Meagher and Parmenter 1985); and exchange rates (Vincent 1986; Martin 1990). A detailed literature survey of ORANI studies is found in Powell and Lawson (1986).

The model is applicable to a wide range of policy problems and it is operationally flexible. Applications of the ORANI model include the study of the effects of protection (Powell 1977; Meltzer 1980; Higgs 1986); of exchange rates (Hagger *et al.* 1983; Horne 1985; Vincent 1986); of international trade (Warr and Lloyd 1983; Dixon and Johnson 1986); and of government taxes and expenditure (Castle and Guest 1980; Agrawal 1986).

These models are general equilibrium comparative static models. All factor and product markets are assumed to be in equilibrium unless disequilibrium behaviour is imposed. They simulate moves from one equilibrium to another as a result of policy changes or external exogenous shocks.

The model constructed for Mauritius is used to generate conditional projections, that is, to address 'what if' types of questions. For example, given a policy change to a given macroeconomic environment, a variable 'z' will change by 'y' per cent from the value it would have had in the absence of the shock. The model focuses on the effects of one or more policy changes while holding constant all other factors affecting economic outcomes. For instance, if a 10 per cent decline in the price of clothing exports occurred at time 0, the model simulates the effect of this change at time t, the Mauritian economy having fully adjusted to the fall in export prices of clothing. This means that a 10 per cent decrease in the export price of clothing would, after period t, cause the rate of output in other manufacturing to be, say, 1 per cent more than it otherwise would have been.

In comparative static models such as this, the time t is not strictly defined. When t refers to a short-run period it generally refers to about two years; the long run is from five to ten years. The short run is defined as the time in which policy change (shock) does not induce changes in capital stocks. But it is long enough for producers and consumers to adjust their decisions in response to the shock. The long run is a long enough period for capital stocks to respond to the shock.

The results of the policy change are conditional on the changes taking place in the given economic environment and on the choice of exogenous variables. For instance, a tariff cut will have different outcomes under full and partial wage indexation. Under full indexation an increase in the consumer price index, induced by an increase in the tariff rate, is fully passed on to the wage bill. However, under partial wage indexation only part of the increase in the consumer price index is passed on to wages. Therefore, everything else remaining constant, a tariff increase under full wage indexation results in higher costs of production

and less competitive industries than under partial wage indexation. The choice of exogenous variables also has important implications for the results obtained from a given shock. For example, if real wages are exogenous and employment is endogenous, economic changes are expected to affect the level of employment while real wage rates remain unchanged. Conversely, if employment is exogenous the level of employment would not be affected.

The model is multi-sectoral and handles production, consumption and trade-related issues for as many commodities as are included in the data set. A disaggregated industry structure also allows solutions by industry. The model captures demand and supply effects. It allows outputs to be used as intermediate inputs, or to meet investment demands, final consumer demands, export demands, or government demands.

The theoretical structure of the model is sufficiently complex to account for important interactions within the economy. The underlying demand and supply curves are non-linear although they are approximated by a system of linear equations in percentage changes of the variables. Thus the model involves the introduction of a linear system through logarithmic differentiation. The linear system is then solved for changes in endogenous variables due to changes in the exogenous variables by matrix manipulation. Hence one of the advantages of using this type of model is that the linearized form enables model solutions from different shocks to be added together or subtracted from one another. The linear systems also have smaller computational requirements than non-linear systems.

The model allows considerable flexibility in the choice of exogenous variables. This flexibility in the closure is found in Johansen-style models because the solution procedure is independent of the closure. In many non-linear models, the solution procedure depends upon the closure and therefore cannot be changed without reconstructing the model. Recent software improvements are diminishing the workload created by this problem.

Model notation

All variables in the model are written in lower case letters, representing percentage changes of the levels. For example x = dX/X*100. A system of subscripts and superscripts is used to define variables by their type, source of origin and use. For instance, $x^{k}_{(is)j}$ denotes use of commodity i from source s by industry j for the purpose k. Commodities range from 1 to g. Sources take the value of 1 for domestic and 2 for imports. Industries range from 1 to h. The value of k ranges from 1 to 5, where 1 is intermediate demand for current production, 2 is investment demand, 3 household demand, 4 is export demand and 5 is other

demand. Similarly, primary factor inputs are represented by xP_{vj} and xP_{1qj}. The former describes demand for a primary input v, where v=1, 2 and 3 (representing demand for labour, fixed capital and land), by industry j. Demand for labour by occupation is represented by xP_{1qj} in industry j and where q takes the value of 1 for skilled and 2 for unskilled labour.

In the data base each industry produces only one commodity and each commodity is produced in only one industry. Therefore h (the number of industries) and g (the number of commodities) are the same and equal to eight.

Theoretical structure of the model

The theoretical structure of the model is derived from assumptions about the behaviour of economic agents (producers and consumers) and about the technological and/or institutional constraints (production and utility functions, market structure, etc.) within which the agents operate. The assumptions generally made in the model follow standard neo-classical assumptions of competitive markets, utility maximization and cost minimization.

Major behavioural assumptions underlying the theoretical structure of the model are as follows.

- Producers are assumed to be efficient (cost minimizing) and competitive (price taking) in choosing their input mixes to produce any given level of output. They are constrained by constant returns to scale production technology. They also face two different production functions in combining intermediate and primary inputs - Leontief and Constant Elasticity of Substitution (CES) production functions.
  - Each intermediate input and an aggregate of primary factors are assumed to be combined in a fixed proportion to output (Leontief production technology), that is, there is no substitution between different material inputs or between material inputs and primary factors. For instance, in making a piece of textile one cannot substitute woollen fibre for man-made fibre or woollen fibre for capital and labour.
  - Producers can substitute between domestic and imported sources of each input; between primary factors of labour, capital and land (where applicable); and between the different skill groups within the labour category. These substitutions are assumed to be described by CES functions. It is assumed that imported inputs may not be perfect substitutes for domestic inputs. This imperfect substitution assumption also applies to primary factors and to different skill groups of labour.

- Households are assumed to maximize their utility from consumption of commodities subject to an aggregate expenditure constraint. With aggregate expenditure held constant, consumers maximize utility by substituting between different categories of goods as well as between domestic and imported sources of each category.

The equations of the model can be classified into six major groups as set out below. The full specification of the equations, the variables, parameters and coefficients of the model are presented as Appendices 1, 2, and 3, respectively.

Industry demands

Industry demands for inputs into production are specified in equations (1)-(4) (Appendix 1). Producers' demand functions for intermediate and primary inputs are derived as functions of output levels and input prices. It is assumed that material inputs are used in fixed proportions, that is, metal cannot be substituted for wood, but domestic metal can be substituted for imported metal. Equation (1) shows that producers choose intermediate inputs from domestic and imported sources, $x^1_{(is)j}$, to minimize the cost of production.

The demand for intermediate inputs is proportional to each industry's output and inversely related to the relative price changes of inputs from domestic and imported sources. For any level of demand for good i, an increase in the price of imports of good i relative to a share weighted average of the imported and domestic prices will lead to a reduction in the demand for imports and an increase in the demand for domestically produced good i. The same holds true for goods for the domestic markets. The extent of the substitution depends on the size of the relative price change and the elasticity of substitution, σ^1_{ij}, between domestic and imported goods. If there is no change in the relative price of good i from domestic and imported sources, then industry j's demand for good i from source s will move with industry j's output.

Equation (2) models demand for primary factors (capital, labour and land) and follows the same logic as equation (1) in that demand is explained by a scale effect (the size of the output) and a substitution effect among labour, capital and land. If the price of labour increases relatively to capital and land, the demand for labour will fall. The extent of the fall depends on the relative price changes and the elasticity of substitution among the primary factors, σP_j.

Equation (3) expresses demand for labour by type of labour (skilled and unskilled) as a function of the industry's demand for labour in general, xP_{1j}, and relative occupational wage rates. Substitution between skilled and unskilled labour is, again, determined by the price differential and elasticity of substitution,

σP_{1j}, between the two types of labour. Other costs of production such as production taxes are modelled in equation (4). They depend only on industry output levels.

Final demands

Final demands are shown in equations (5), (6), (7), (10), (11) and (12). In equation (5) industry demand for intermediate inputs in capital creation is derived as a function of industry investment levels and relative input prices. Investing industries are assumed to minimize investment costs by choosing between domestic and imported intermediate inputs according to the elasticity of substitution for capital goods, σ^2_{ij}.

Though the specification in equation (5) identifies investment demands by industry, the available investment data are not disaggregated by industry. For this reason, the commodity composition for each industry is assumed to be the same as for the Mauritian economy as a whole as depicted by the economy-wide investment vector, following the Asian Interdependence Computable General Equilibrium model (Cabalu, *et al* 1991).

Equations (7) and (8) represent, respectively, expenditure minimizing and utility maximizing household demand. Equation (7) models utility maximizing household demand for commodities undifferentiated by source, subject to an expenditure constraint. Consumers are assumed to change the allocation of their expenditure on different commodities depending on the aggregate expenditure and the relative prices of commodities. The responsiveness of consumer demands to a change in total expenditure is measured by the expenditure elasticity, ε, whereas the responsiveness to relative price changes is measured by price elasticities, η_{ik}. In this equation demand functions are derived by maximizing a utility function of the Stone-Geary form, and so constitute a linear expenditure system. Under a linear expenditure system the ratio of the own price elasticity to expenditure elasticity will be the same for all goods.

Further, it is assumed that consumers minimize their expenditure on a commodity by substituting between domestic and imported goods as depicted by equation (6). In equation (6) household demand for commodities by source is expressed as a function of scale and substitution effects in minimizing expenditure. The volume of commodity demanded is determined by the scale effect, whereas the relative prices of domestic and imported commodities are determined by the substitution effect.

The price of each commodity to households is expressed in equation (8) as a share weighted average of domestic and imported prices. Equation (9) allows for consumption taxes or subsidies.

Mauritian exports its sugar to two distinct markets: the EC and the rest of the world. EC export demand is presented in equation (10), while export demand for the rest of the world is shown in equation (11). In both cases the foreign currency price of exports is a function of the volume of exports multiplied by the respective reciprocal of the foreign elasticity of demand and an exogenous shift term. The reciprocals of the foreign elasticity of demands determine the slope of the demand curve for Mauritian exports. As Mauritius is a small country, the reciprocal of the elasticity of export demand is almost infinitely small or zero, and Mauritian export volumes have little effect on its export prices. Equation (10) is only applicable to sugar exports. Elsewhere this equation collapses to zero and export demand is represented by equation (11).

Export prices are set endogenously. Therefore, changes in export prices can not be simulated directly. They are simulated indirectly by changing the shift term. The shift term changes the position of the demand curve for Mauritian exports and it allows simulation of changes in export prices.

Where export volumes and prices are determined largely by trade agreements, the reciprocal of the foreign elasticity of demand is set at zero. This implies that the export price is independent of the volume of exports. In addition, the export volume is set exogenously.

Government demands in equation (12) are directly tied to real household expenditure and a shift variable. The shift allows for a change in the government demand exogenously.

Commodity supplies

In contrast to the assumption that a given commodity can only be produced by one industry, and vice versa, in the real world, the same commodity can be produced by different industries and one industry can produce more than one commodity. These are specified in the model by equations (13) and (14). Equation (13) represents the supply of multi-product industries. Just as producers are assumed to have some degree of flexibility in choosing their input mixes, they are assumed to have some degree of flexibility in choosing their output mixes. The flexibility of producers in changing their output mixes is determined by output transformation possibilities. In the Mauritius input-output structure each industry is assumed to produce only one commodity. Therefore, the elasticity of transformation, σ^T, between different products of an industry is set to zero.

Hence the relative price change is also zero. Equation (13) is then reduced to $x_{(i1j)} = z_j$. This equality implies the output of a commodity is the same as the activity level of industry or the output of the industry in which it is produced. Equation (14) adds up the total production of each commodity in different industries. As one commodity is produced in only one industry $D_{(i1j)}= 1$ for i=j and $D_{(i1j)}= 0$ otherwise.

Zero pure profits conditions

Commodity pricing equations are presented in equations (15) to (19). They assume constant returns to scale and are obtained by assuming perfectly competitive behaviour so that no pure profits are earned. As profits accrue only to factors of production, total revenue equals total cost in production, investment (capital creation), importing and exporting.

With constant returns to scale, the condition that total revenue equals total cost simplifies to equation (15), where a unit value of producing an output equals the sum of input costs - intermediate, primary and fixed. Similarly, a unit value of capital is defined in equation (16) as the sum of intermediate input costs. Equation (17) relates the domestic selling price of an imported commodity to the cost of importing it. The cost of importing a commodity is composed of the foreign currency price, converted into domestic price via the nominal exchange rate and the tariff rate. Similarly, equations (18) and (19) equate the domestic currency price paid by foreigners for a unit of export to revenue from exporting to the EC and the rest of the world, respectively. Any divergence from pure profit in exports is captured by the subsidy variable (v_i). The revenue from exports is made up of the foreign currency f.o.b. price converted to local currency via the exchange rate, plus export subsidies. Equation (18) is only relevant to sugar exports. Elsewhere this equation collapses to zero as there is no distinct EC and the rest of the world market. For sugar, equations (18) and (19) imply that the export prices of sugar received by Mauritius from EC in excess of the world prices for sugar are treated as export taxes to the EC market. That is, $p^{eEC}_{11} - p^{eW}_{11} = v^{W}_{1} - v^{EC}_{1}$.

Market clearing

Market clearing equations specify that supply equals demand in every domestic market. Equations (20) to (23) equate demand to supply for domestically produced commodities, labour, fixed capital and agricultural land, respectively. Equation (20) equates supply of domestically produced commodities to total demand made up of intermediate inputs to current production, intermediate inputs to capital creation, final consumption, export and government demands.

APPENDIX

CGE MODEL - MAURITIUS

Appendix 1

Mauritius CGE Model equations

Identifier	Equation	Subscript range	Number	Description
	Industry demands			
1.	$x^1_{(is)j} = z_j - \sigma^1_{ij}(p_{is} - \sum_{s=1}^{2} s^1_{(is)j} p_{is})$	i=1,..,g s=1,2 j=1,...,h	2gh	Demands for intermediate inputs
2.	$x^P_{vj} = z_j - \sigma^P_j(p^P_{vj} - \sum_{v=1}^{3} s_{vj} p^P_{vj})$	v=1,2,3 j= 1,..,h	3h	Demands for labour (v=1), fixed capital (v=2) and land (v=3)
3.	$x^P_{1qj} = x^P_{1j} - \sigma^P_{1j}(p^P_{1qj} - \sum_{q=1}^{r} s_{1qj} p^P_{1qj})$	q=1, 2 j=1,..,h	rh	Demands for labour of each occupation: skilled (q=1) and unskilled (q=2)
4.	$x^o_j = z_j$	j= 1,..h	h	Other cost

Identifier	Equation	Subscript range	Number	Description
	Final demands			
5.	$x^2_{(is)j} = y_j - \sigma^2_{ij}(p_{is} - \sum_{s=1}^{2} s^2_{(is)j} p_{is})$	i=1,..,g s=1,2 j=1,.,h	2gh	Demands for input for capital creation both from domestic and import sources
6.	$x^3_{is} = x^3_i - \sigma^3_i(p^*_{is} - \sum_{s=1}^{2} s^3_{is} p^*_{is})$	i=1,..,g s=1,2	2g	Household demands for commodities by source
7.	$x^3_i = q + \varepsilon_i(c - q) + \sum_{k=1}^{g} \eta_{ik} p^*_k$	k=1,..,g	g	Household demands for commodities undifferntiated by source
8.	$p^*_k = \sum_{s=1}^{2} s^3_{ks} p^*_{ks}$	k=1,..,g	g	Price of commodities to households
9.	$p^*_{is} = p_{is} + f^3_{is}$	i=1,..,g S=1, 2	2g	Allows for taxes on consumption
10	$p^{eEC}_{i1} = -\gamma_{ECi} x^{4EC}_{i1} + f^{4EC}_{i1}$	i=1,..,g	g	Export demands (EC)
11.	$p^{eW}_{i1} = -\gamma_{Wi} x^{4W}_{i1} + f^{4W}_{i1}$	i=1,..,g	g	Export demands (rest of world)
12.	$x^5_{is} = c_R h^5_{is} + f^5_{is}$	i=1,..,g s=1,2	2g	Government demands

Identifier	Equation	Subscript range	Number	Description
	Commodity supplies			
13.	$x_{(i1)j} = z_j + \sigma^T_{(i1)j} \left(P_{i1} - \sum_{i=1}^{g} C_{(i1)j} P_{i1}\right)$	i=1,..,g j=1,..,h	gh	Commodity supplies by industry
14.	$x_{i1} = \sum_{j=1}^{h} D_{(i1)j}\, x_{(i1)j}$	i=1,..,g	g	Total output of good i.
	Zero pure profits conditions			
15.	$\sum_{i=1}^{g} C_{(i1)j}\, P_{ij} = \sum_{i=1}^{g} \sum_{s=1}^{2} H^1_{(is)j} P_{is} + \sum_{v=1}^{3} H^P_{vj} P^P_{vj} + H^O_j P^O_j$	j=1,..,h	h	Zero profit in production
16.	$\pi_j = \sum_{i=1}^{g} \sum_{s=1}^{2} H^2_{(is)j} P_{is})$	j=1,..,h	h	Zero profit in capital creation
17.	$P_{i2} = p^m_{i2} + t_i + \phi$	i=1,..,g	g	Zero profit in importing
18.	$P_{i1} = p^{eEC}_{i1} + v^{EC}_i + \phi$	i=1,..,g	g	Zero profit in exporting (EC)
19.	$P_{i1} = p^{eW}_{i1} + v^W_i + \phi$	i=1,..,g	g	Zero profit in exporting to the rest of the world

Identifier	Equation	Subscript range	Number	Description
	Market clearing			
20.	$x_{i1} = \sum_{j=1}^{h} B^1_{(i1)j} x^1_{(i1)j} + \sum_{j=1}^{h} B^2_{(i1)j} x^2_{(i1)j} + B^3_{i1} x^3_{i1} + B^{4EC}_{i1} x^{4EC}_{i1} + B^{4W}_{i1} x^{4W}_{i1} + B^5_{i1} x^5_{i1}$	i=1,..,g	g	Domestically produced commodities
21.	$l_q = \sum_{j=1}^{h} B_{1qj} x^P_{1qj}$	q=1,..,r	r	Labour of each occupation
22.	$k_j = x^P_{2j}$	j=1,...,h	h	Capital
23.	$n_j = x^P_{3j}$	j=1,...,h	h	Land
	Miscellaneous			
	Rates of return, investment and capital stocks			
24.	$r_j = Q_j (p^P_{2j} - \pi_j)$	j=1,..,h	h	Rate of return on capital in each industry

Identifier	Equation	Subscript range	Number	Description
25.	$i_R = \sum_{j=i}^{h} T_j y_j$		1	Aggregate real private investment
26.	$y_j = I^1 K_j + I^2 B_j (r_j - \lambda) + f^2{}_j$	j= 1,..,h	h	Investment by industry
27.	$i = i_R + \varepsilon^2$		1	Aggregate nominal investment
28.	$K = \sum_{j=1}^{h} k_j \Psi_{2j}$		1	Aggregate capital stock

Identifier	Equation	Subscript range	Number	Description
	Price indicies			
29.	$P_{j1} = \sum_{j=1}^{g} C_{(i1)j} P_{i1}$	j=1,..,h	h	Price of industry output
30.	$\varepsilon^1 = \sum_{j=1}^{h} a_{j1} P_{j1}$		1	GDP deflator
31.	$\varepsilon^2 = \sum_{j=1}^{h} T_j \pi_j$		1	Capital goods price index
32.	$\varepsilon^3 = \sum_{i=1}^{g} \sum_{s=1}^{2} W^3_{is} P^*_{is}$		1	Consumer price index
	Trade balance			
33.	$x_{i2} = \sum_{j=1}^{h} B^1_{(i2)j} x^1_{(i2)j} + \sum_{j=1}^{h} B^2_{(i2)j} x^2_{(i2)j} + B^3_{i2} x^3_{i2} + B^5_{i2} x^5_{i2}$	i=1,..,g	g	Import volume

Identifier	Equation	Subscript range	Number	Description
34.	$m = \sum_{i=1}^{q} (p^{m}_{i2} + x_{i2}) M_{i2}$		1	Aggregate foreign currency import
35.	$e^{EC} = \sum_{i=1}^{g} (p^{eEC}_{1} + x^{4EC}_{i1}) E^{EC}_{i1}$		1	Aggregate foreign currency export to EC
36.	$e^{W} = \sum_{i=1}^{g} (p^{eW}_{i1} + x^{4W}_{i1}) E^{W}_{i1}$		1	Aggregate foreign currency export to ROW
37.	$e = e^{EC} + e^{W}$		1	Aggregate foreign currency export (EC+ROW)
38.	$100\ \Delta B = Ee - Mm$		1	Balance of trade (real)
	Consumption-income link			
39.	$c = y_d + f_c$		1	Consumption function
40.	$y_d = gdp$		1	Household disposable income
	Other macroeconomic equations			
41.	$gdp^{r} = s_c c_R + s_i i_R + s_g x_G + s_e e - s_m m$		1	Gross domestic product (real)

Identifier	Equation	Subscript range	Number	Description
42.	$x_G = \sum_{i=1}^{g} \sum_{s=1}^{2} s^5_{is} x^5_{is}$		1	Aggregate government demand
43.	$l = \sum_{q=1}^{2} l_q \Psi_{1q}$		1	Aggregate employment
44.	$i_R = c_R + f_R$		1	Relationship between real consumption and real investment.
45.	$gdp = gdp^r + \varepsilon^1$		1	Nominal GDP
46.	$c = c_R + \varepsilon^3$		1	Aggregate nominal consumption
47.	$pp_{1j} = \sum_{q=1}^{2} pp_{1qj} s_{1qj}$	j=1,..h	h	Price of labour to each industry in general
48.	$p_{1qj} = h_{1q}\varepsilon^3 + f_{1qj} + f_{1q} + f_1$	q = 1,2 j=1,..h	rh	Flexible handling of occupational wages
49.	$p^o_j = h^o_j \varepsilon^3 + f^o_j$	j=1,..h	h	Sets price of other costs

Total number of equations = 5gh + 13h + 16g + 2rh + r + 19 = 605

Dimensions:
h = 8, g = 8, and r = 2

Appendix 2

Mauritius CGE model variables

Equation ident -ifier	Variables	Range	Number	Description
1.	$x^1_{(is)j}$		2gh	Demands for inputs for current production
	z_j	j=1,..,h	h	Industry activity levels
	p_{is}	i=1,..,g s=1,2	2g	Domestic prices of domestic and imported commodities
2.	x^P_{vj}	v=1,2,3 j=1,..,h	3h	Industry demands for labour, capital, land
	p^P_{vj}	v=1,2,3 j=1,..,h	3h	Price of labour, capital and land
3.	x^P_{1qj}	q=1,..,r j=1,..,h	rh	Industry demands for labour by occupation
	p^P_{1qj}	q=1,..,r j=1,..,h	rh	Price of labour by occupation for each industry
4.	x^o_j	j=1,..,h	h	Demands for government (other) costs
5.	$x^2_{(is)j}$	i=1,..,g s=1,2	2gh	Demands by source for capital creation
	y_j	j=1,..,h	h	Investment by industry
6.	$x^3_{(is)}$	i=1,..,g s=1,2	2g	Household demands by source
	x^3_i	i=1,..,g	g	Household demands undifferentiated by source
	p^*_{is}	i=1,..,g s=1,2	2g	Purchaser price of goods i to households
7.	q		1	Number of households
	c		1	Aggregate nominal household consumption
	p^*_k	i=1,..,g	g	Purchaser price of good to households
9.	f^3_{is}	i=1,..,g s=1,2	2g	Shift term for household consumption price
10.	$p^{eEC}_{(i1)}$	i=1,..,g	g	Foreign currency export prices f.o.b.(EC)
	x^{4EC}_{i1}	i=1,..,g	g	Export demands of EC
	f^{4EC}_{i1}	i=1,..,g	g	Shift term to EC exports
11.	p^{eW}_{i1}	i=1,..,g	g	Foreign currency export prices f.o.b.(ROW)
	x^{4W}_{i1}	i=1,..,g	g	Export demands of rest of the world

equation identifier	Variables	Range	Number	Description
	f^{4W}_{i1}	i=1,..,g	g	Shift term to the rest of the world exports
12.	x^{5}_{is}	i=1,..,g s=1,2	2g	Government (other) demands
	c_R	1	1	Aggregate real household consumption
	f^{5}_{is}	i=1,..,g s=1,2	2g	Government demand shift term
13.	$x_{(i1)j}$	i=1,..,g	gh	Commodity output by industry
14.	x_{i1}	i=1,..,g	g	Commodity output level
15.	$p^{(o)}_{j}$	j=1,..,h	h	Price of other costs
16.	π_j	j=1,..,h	h	Cost of unit of capital
17.	p^{m}_{i2}	i=1,..,g	g	Foreign currency import prices c.i.f.
	t_i	i=1,..,g	g	One plus the ad valorem tariff or tariff equivalent of quantitative restrictions
	ϕ	1	1	Nominal exchange rate (rupee/Foreign)
18.	v^{EC}_{i}	i=1,..,g	g	One plus the rate of export subsidy to EC
19.	v^{W}_{i}	i=1,..,g	g	One plus the rate of export subsidy to the rest of the world
21.	l_q	q=1,..,r	r	Occupational employment
22.	k_j	j=1,..,h	h	Industry capital stocks
23.	n_j	j=1,..,h	h	Agricultural land
24.	r_j	j=1,..,h	h	Industry rates of return to capital
25.	i_R	1	1	Aggregate real investment
26.	λ	1	1	Economy-wide expected rate of return
	f^{2}_{j}	j=1,..,h	h	Industry investment shift term
27.	i	1	1	Aggregate nominal investment
	ε^{2}	1	1	Capital goods price index

equation identifier	Variables	Range	Number	Description
28.	k		1	Aggregate capital stock
29.	p_{j1}	j=1,..,h	h	Industry output prices
30.	ε^1		1	GDP deflator
32.	ε^3		1	Consumer price index
33.	x_{i2}	i=1,..,g	g	Import volumes
34.	m	1	1	Aggregate foreign currency imports
35.	e^{EC}	1	1	Aggregate foreign currency exports to EC
36.	e^{W}	1	1	Aggregate foreign currency exports to ROW
37.	e	1	1	Aggregate foreign currency exports (EC+ROW)
38.	ΔB	1	1	Balance of trade (real)
39.	y_d	1	1	Household disposable income
	f_c	1	1	Consumption function shift term
40.	gdp	1	1	Nominal GDP
41.	gdp^r	1	1	Real GDP
	x_G	1	1	Aggregate government (other) demands
43.	l	1	1	Aggregate employment
44.	f_R	1	1	Ratio of real investment expenditure to real household consumption
48.	f_{1qj}	q=1,2 j=1,..,h	rh	Occupation by industry wage shift variable
	f_{1q}	q=1,2	r	Occupation wage shift variable
	f_1	1	1	Economy-wide wage shift variable
49.	$f^o{}_j$	j=1,..,h	h	Industry other cost shift variable

Total variables = 5gh + 17h + 26g + 3rh + 2r + 24 = 740
dimensions: g = 8, h = 8, and r = 2

Appendix 3

Parameters and coefficients of the Mauritian model

Equation identifier	Parameter or coefficients	Description	Source
1	σ^1_{ij}	Substitution elasticity between domestic and imported sources of good i used as a current input to industry j.	Set at default value of 2.0, Dixon *et al* (1982).
	$S^1_{(is)j}$	Share of good i from source s in industry j purchase of i for input to current production.	IO[a]. $S^1_{(is)j}$ is the ij^{th} element of A divided by the sum of the ij elements of A + F. $S^1_{(i2)j} = 1 - S^1_{(i1)j}$.
2	σ^P_j	Pairwise CES substitution elasticity between primary factors in industry j.	Set according to the relationship $\delta j = \sigma_p(1-S_{fj}) / S_{fj}*H_{xj}$ where δ_j is supply elasticity for industry j, S_{fj} is share of fixed factors in total factor costs and H_{xj} is share of primary factors inputs in total costs. σ_p was set such that δ_j values were less than 1.0 for each industry.
	S_{vj}	Cost share of primary factor v (v=1, labour; v=2, capital; v=3, land) in total primary factor cost in industry j.	IO. S_{1j} is j^{th} element of column sums of K divided by j^{th} column total of K+L+M. S_{2j} is j^{th} element of L divided by j^{th} column total of K+L+M. S_{3j} is j^{th} element of M divided by j^{th} column total of K+L+M.
3	σ^P_{1j}.	Pairwise CES substitution elasticity between different occupations in industry j.	Set at default value of 2.0, Dixon *et al* (1982).
	S_{1qj}	Share of labour of occupation q in total labour costs of industry j.	IO. S_{1qj} is qj^{th} element of K divided by j^{th} column total of K.
4		None.	

equation identifier	Parameter or coefficients	Description	Source
5	σ^2_{ij}	Substitution elasticity between domestic and foreign source of good i used as an input to capital creation in industry j.	Set at default value of 2.0, Dixon et al (1982).
	$S^2_{(is)j}$	Share of good i from source s in industry j's total purchases of i for inputs to capital creations.	IO. $S^2_{(i1)j}$ is the ij^{th} element of B divided the sum of the ij elements of B+G. $S^2_{(i2)j}=1-S^2_{(i1)j}$.
6	σ^3_i	Substitution elasticity between domestic and imported source of good i consumed by households.	Set at default value of 2.0, Dixon et al (1982).
	S^3_{is}	Share of the value of good i from source s in the total purchases of good i by households.	IO. $S^3_{(i1)}$ is i^{th} element of C divided by sum of the i^{th} elements of C+H. $S^3_{(i2)}=1-S^3_{(i1)j}$.
7	ε_i	Household expenditure elasticity for good i.	See text (Chapter 6).
	ηik	Household own and cross price elasticities for good i.	See text (Chapter 6).
8	S^3_{ks}	Defined in (6) = $S^3_{(is)}$.	
9		None.	
10	γ_{ECi}	Reciprocal of the foreign demand elasticity for Mauritius exports of good i to EC.	See text (Chapter 6).
11	γ_{Wi}	Reciprocal of the foreign demand elasticity for Mauritius exports of good i to the rest of the world.	See text (Chapter 6).

Equation identifier	Parameter or coefficients	Description	Source
12	$h^5_{(is)}$	Indexes government demands to aggregate real consumption.	Default setting is 1.0.
13	$\sigma^T_{(i1)j}$	Transformation elasticities between products produced by industry j.	Set zero. See text (Chapter 6).
	$C_{(i1)j}$	Revenue share of product i in the total revenue of industry j.	IO. $C_{(i1)j}$ is the ij^{th} element of O divided by the j^{th} column sum of O.
14	$D_{(i1)j}$	Share of the value of output of good i produced in industry j.	IO. $D_{(i1)j}$ is the ij^{th} element of O divided by the i^{th} row sum of O.
15	$C_{(i1)j}$	Defined in 13.	
	$H^1_{(is)j}$	Cost share of good i from source s in the total costs of industry j.	IO. $H^1_{(is)j}$ is the ij^{th} element of A divided by the total cost of industry j. These are computed as the j^{th} column sum of A+F+K+L+M+N. $H^1_{(i2)j}$ is the ij^{th} element of F divided by the total costs of industry j.
	$H^P_{(vj)}$	Cost share of primary factor v in the total costs of industry j.	IO. H^P_{ij} is the j^{th} column sum of K divided by the total costs of industry j. H^P_{2j} is the j^{th} entry of L divided by the total costs of industry j. H^P_{3j} is the j^{th} element of M divided by the total costs of industry j.
	H^O_j	Cost share of other costs in the total costs of industry j	IO. H^O_j is the j^{th} element of N divided by the total costs of industry j.

Equation identifier	Parameter or coefficients	Description	Source
16	$H^2_{(is)j}$	Cost share of good i from source s in the total costs of capital creation in industry j.	IO. $H^2_{(i1)j}$ is the ij^{th} element of B divided by the sum of the j^{th} column elements of B+G. $H^2_{(i2)j}$ is the ij^{th} element of G divided by the sum of the j^{th} column elements of B+G.
17		None.	
18		None.	
19		None.	
20	$B^1_{(i1)j}$	Share of the total sales of domestic good i absorbed by industry j as an input into current production.	IO. $B^1_{(i1)j}$ is the ij^{th} element of A divided by the total sales of domestic good i, i.e., the sum over the i^{th} row of A+B+C+D+E.
	$B^2_{(i1)j}$	Share of the total sales of domestic good i absorbed by industry j as an input into capital creation.	IO. $B^2_{(i1)j}$ is the ij^{th} element of B divided by the total sales of domestic good i.
	B^3_{i1}	Share of the total sales of domestic good i absorbed by households.	IO. B^3_{i1} is the i^{th} element of C divided by the total sales of good i.
	B^4_{i1}	Share of the total sales of domestic good i exported	IO. B^4_{i1} is the i^{th} element of D divided by the total sales of good i.
	B^5_{i1}	Share of the total sales of domestic good i absorbed by other demands.	IO. B^5_{i1} is the i^{th} element of E divided by the total sales of good i.
21	B_{1qj}	Share of the economy-wide employment in occupation q which is accounted for by industry j.	IO. B_{1qj} is the qj^{th} element of K divided by the q^{th} row total of K.

Equation identifier	Parameter or coefficients	Description	Source
22		None.	
23		None.	
24	Q_j	Ratio of gross (before depreciation) to net (after depreciation) rate of return for industry j.	Set at default value of 1.0.
25	T_j	Share of total investment accounted for by industry j.	IO. First sum the column elements of B+G. T_j is the j^{th} element in the array of the column sums of B+G divided by the sum of the elements in the array.
26	B_j	Industry investment parameter.	$B_j = 1/ \beta_j z_j$ is the elasticity of the rate of return schedule for industry j and z_j is the ratio of investment in the solution year to capital stock in the following year. Estimates compiled from Dixon *et al* (1982).
27		None.	
28	Ψ_{2j}	Share of the economy-wide capital stock represented by the capital stock in industry j.	From matrix of industry capital stocks (B+G matrices totals).
29	$C_{(i1)j}$	Defined in 13.	
30	a_{j1}	Share of the total value added represented by value added in industry j.	IO. a_{j1} is j^{th} column sum of K+L+M divided by sum of all elements in K+L+M.
31	T_j	Defined in (25).	IO.

Equation identifier	Parameter or coefficients	Description	Source
32	W^3_{is}	Weight of good i from source s in the CPI.	IO. $W^3_{(i1)}$ is the i^{th} element of C divided by the sum of all elements in C+H. $W^3_{(i2)}$ is the i^{th} element of H divided by the sum of all elements in C+H.
33	$B^1_{(i2)j}$	Share of the total sales of imported good i which is absorbed by sales to industry j for current production.	IO. $B^1_{(i2)j}$ is the ij^{th} element of F divided by the total sales of imported good i, i.e., the row sum of F+G+H+I.
	$B^2_{(i2)j}$	Share of the total sales of imported good i which is absorbed by sales to industry j for capital creation.	IO. $B^2_{(i2)j}$ is the ij^{th} element of G divided by the total sales of imported good i.
	$B^3_{(i2)j}$	Share of the total sales of imported good i which is absorbed by sales to households	IO. $B^3_{(i2)j}$ is the ij^{th} element of H divided by the total sales of imported good i.
	$B^5_{(i2)j}$	Share of the total sales of imported good i which is absorbed by sales other demands.	IO. $B^5_{(i2)j}$ is the ij^{th} element of I divided by the total sales of imported good i.
34	M_{i2}	Share of the total c.i.f. cost of imports accounted for by imports of good i.	IO. M_{i2} is the i^{th} row sum of F+G+H+I+(-Z) divided by the sum of all elements in F+G+H+I+(-Z).
35	EC_{i1}	Share of the total export earnings accounted for by exports of good i to EC	IO. EC_{i1} is the i^{th} element of D1 divided by the total of all elements in D1.
36	W_{i1}	Share of the total export earnings accounted for by exports of good i to the rest of world	IO. W_{i1} is the i^{th} element of D2 divided by the total of all elements in D2.
37		None.	

Equation identifier	Parameter or coefficients	Description	Source
38	E	Aggregate value of exports f.o.b.	IO. Sum of elements in D1 and D2.
	M	Aggregate value of imports c.i.f.	IO. Sum of elements in F+G+H+I+(-Z).
39		None.	
40		None.	
41	S_c S_i S_g S_e S_m	Respectively the shares in GDP of aggregate consumption; aggregate investment; aggregate government spending; exports; and imports.	Mauritius Central Statistical Office.
42	S^5_{is}	Share of the total other demands accounted for by other demand for good i from source s.	IO. $S^5_{(i1)}$ is the i^{th} element of E divided by the total of all elements in E+I. $S^5_{(i2)}$ is the i^{th} element of I divided by the total of all elements in E+I.
43	Ψ_{1q}	Share of occupation q in the total demand for labour.	IO. Ψ_{1q} is the q^{th} row sum of K divided by the sum of all elements in K
44		None.	
45		None.	
46		None.	
47	S_{1qj}	Defined in (3).	
48	h_{1q}	Occupational wage indexation parameter.	Default value is 1.0
49	h^o_j	Indexes other costs.	Default value is 1.0

[a] Input-output table

Appendix 4

Exogenous variables (short run sugar simulation)

Variable	Number	Description
p^m_{i2}	g	Foreign currency import prices
t_i	g	One plus the ad valorem tariff or tariff equivalent of quantitative restrictions
v^W_1, v^W_4, v^W_5, v^W_7	4	Export subsidy the rest of the world.
v^{EC}_{2-8}	7	Export subsidy (EC).
x^{4W}_2, x^{4W}_3, x^{4W}_6, x^{4W}_8	4	Export volume the rest of the world.
x^{4EC}_1	1	Export volume (EC).
k_j	h	Industry capital stocks
n_j	h	Agricultural land
l_1	1	Economy-wide employment level.
ϕ	1	Exchange rate
q	1	Number of households
f^o_j	h	Industry other cost shift variable
f^2_j	h	Industry Investment shift variables
f^3_{is}	2g	Shift term for household consumption prices
f^{4EC}_{i1}	g	Shift term for exports (EC)
f^{4W}_{i1}	g	Shift term for exports (rest of world)
f^5_{is}	2g	Other demand shift term
f_{iqj}	rh	Occupation by industry wage shift variable}
f_{1q}	r	Occupation wage shift variable
f_R	1	Ratio of real investment to consumption
f_c	1	Consumption function shift term

Total variables = 4h + 8g + rh + r + 21 = 135

Equation (21) equates the supply of labour of each skill to the demand for it. This implies that labour of the same skill is homogeneous and is mobile across industries. Equations (22) and (23) equate supply and demand for capital, and land, respectively in each industry. Both capital and land are assumed to be industry specific and fixed in supply in the short run.

Miscellaneous equations

Allocation of investment across industries

The allocation of investment across industries is described in equations (24) to (28). Equation (24) specifies the rate of return to capital in each industry as a function of the cost of using a unit of capital relative to the cost of producing or buying a unit of capital. Equation (25) defines aggregate real private investment as the sum of investment expenditures across industries. In equation (26) private investment by industry is determined as a function of capital stocks (k_j) and actual (r_j) relative to expected (l) rates of return on capital. Private investment is allocated across industries to equate expected rates of return across industries in equation (26). Depending upon assumptions $I^{(1)}_j$ and $I^{(2)}_j$ take the value of one or zero. In the short run, as k_j is set to zero, $I^{(2)}_j$ is set to one and $I^{(1)}_j$ can take either values. r_j and l are set endogenously. In the long run, $I^{(1)}_j$ is set to one and $I^{(2)}_j$ to zero as in Horridge and Powell (1984). By setting f^2_j exogenously, in the long run, $y_j=k_j$. Aggregate nominal investment is defined in equation (27). Equation (28) aggregates capital stocks across industries.

Price indices

The prices of industry outputs, the gross domestic product deflator, the capital goods price index and the consumer price index are defined in equations (29) to (32). They are expressed as weighted averages of the percentage changes in the prices of the component items.

Aggregate macroeconomic variables

Equation (33) describes aggregate volume of imports of commodity i as the sum of imports for each purpose (intermediate inputs, inputs for capital creation, household demand and government demand). Aggregate value of imports in foreign currency are defined in equation (34). The foreign currency value of exports to the EC market and to the rest of the world, respectively, are defined in equations (35) and (36). The aggregate value of exports is then calculated as the sum of the two markets in equation (37). The balance of trade in equation (38) is given as a difference between the value of exports and imports. As the nominal exchange rate is assumed to take the value of one, trade balance in foreign

currency equals trade balance in domestic currency. The balance of trade can move through zero and therefore can change sign. For this reason, a first difference rather than a percentage change is calculated to solve for the balance of trade. Aggregate imports, exports, and trade balance are represented in only foreign prices. The value of these variables in domestic currency are omitted to avoid redundancy. The nominal exchange rate is set to take the value of one.

Other macroeconomic variables include household consumption, household disposable income, real gross domestic product, other aggregate demands, aggregate employment and the ratio of real investment to real consumption. These are described in equations (39) to (44). Consumption is a function of disposable income in equation (39) and the rate of change in disposable income is set to be equal to the percentage change in nominal GDP in equation (40). In equation (41) real GDP is expressed as a sum of real household consumption, investment, government expenditure and exports less imports. Aggregate government demand is obtained by summing all commodities demanded in equation (42). In equation (43) aggregate employment is expressed as the sum of employment in different skills. Real investment is modeled to change in proportion to real consumption and a shift variable in equation (44).

Nominal gross domestic product and nominal aggregate consumption are presented in equations (45) and (46), respectively. They are set as functions of the respective real values and price indices. Equation (47) defines the price of labour to each industry.

Wage indexation

Equation (48) allows wages to be indexed to the consumer price index by occupation and by industry. The shift terms can be used in simulations involving variations in industrial and occupational wage relativities. If the indexing parameter, h, is set at 1 and the shift terms at zero, it represents full wage indexation. In this case real wages remain fixed in all occupations and in all industries. Equation (49) allows the simulation of changes in taxes on production by changing the shift variable f^{O}_{j}.

Model closure and simulation procedure

The linearised version of the model can be expressed as

$$AX = O \qquad 1$$

where A is the matrix of coefficients and X is the matrix of variables. X can be partitioned into a vector X_1 of endogenous variables and a vector X_2 of exogenous variables. The endogenous variables are determined within the model, whereas the exogenous variables are predetermined outside the system. The split between the endogenous and exogenous variables depends on assumptions about the economic environment. Matrix A can also be divided into corresponding coefficient submatrices A_1 and A_2.

$$A_1X_1 + A_2X_2 = 0 \qquad 2$$

Rearranging the equation and solving for X_1 yields

$$X_1 = - A_1^{-1} A_2 X_2$$

where:

X_1 is the vector of changes in endogenous variables (results);

X_2 is the vector of changes in exogenous variables (shocks);

A_1 is a matrix of coefficients on endogenous variables; and

A_2 is the matrix of coefficients on exogenous variables.

A solution for X_1 can be obtained only if A_1 is invertable; that is, the system of equations is neither over nor under identified.

Choice of exogenous variables

Appendices 1 and 2 indicate that the number of equations in the model (605) are less than the number of variables (740). Therefore, the model cannot be used to determine all the variables. This is overcome by reducing the number of endogenous variables to the number of equations by declaring (135) variables as exogenous (see Appendix 4).

The first set of exogenous variables are foreign currency prices of imports. The foreign currency prices of imports, p^m_{i2} are set exogenously because Mauritius is a small country and cannot affect the prices of its imports.

The second group of exogenous variables are tariffs, t_i, which are determined exogenously by government decisions. By setting tariffs exogenously the effects of projected changes in the government's policy of protection on various industries and macroeconomic variables, such as employment and inflation can be computed.

The third group of exogenous variables are either export volumes or export subsidies. Normally export volumes are endogenous in this type of model. But where the volume of exports is exogenously determined by trade agreements, or where only a small proportion of production is for export, the volume of exports is set exogenously. Its exogeneity is achieved by endogenizing export subsidies. By making subsidies endogenous subsidies are made to offset changes in the prices of exports. As a result, domestic prices, p_{i1}, are able to move independently of export prices, p^e_{i1}.

The fourth set of exogenous variables are industry capital stocks, k_j or rates of return. In the short run capital stocks are fixed, and therefore they are set exogenously, whereas industry rates of return, r_j, vary endogenously. In the long run, industries are able to expand or contract capital stocks. Consequently capital stocks become endogenous and rates of return exogenous.

The next group of exogenous variables are employment variables. As employment is approaching its full employment level in Mauritius, aggregate employment is set exogenously. The aggregate real wage rate is allowed to vary to maintain the given level of employment supply in the face of changing aggregate demand for labour. However, employment in each industry is set endogenously and allowed to adjust to satisfy changing industrial demand for labour.

Other exogenous variables, including the shifts in the various demand curves, are given in Appendix 4.

Data requirements and sources

The model requires estimated parameters. Almost all of the coefficients are obtained from an input-output table which is the main source of data. The input-output table presents the intermediate inputs and the primary factors of production (labour, capital and land) which go into the production of commodities. It also shows how the commodities produced are allocated among different users. They may be used as inputs into current production, domestic consumption, investment or exports. Both the production and usage relationships are expressed as fixed coefficients.

Input-output data

The 1987 Mauritius input-output table is the major source of data. As indicated above, it has been modified to meet the requirements of this study. First, the 15 by 15 table is recalculated into an 8 by 8 matrix according to the industry classification outlined above.

Second, the modified input-output table imports for intermediate inputs, investment and final consumption were disaggregated by commodities from raw data obtained from the Central Statistics Office. In the original input-output table the import data were not disaggregated by commodity. Instead the value of imports for current production were by industry. Imports for capital formation and for final consumption were also provided in aggregate values.

Third, investment data from domestic sources were available by commodity only, without being split among industries. The investment data were used as available by assuming that the investment rate by each industry was the same as the economy-wide investment rate.

Fourth, the original input-output table did not distinguish between different types of labour. In the modified input-output table labour was split between categories of skilled and unskilled labour on the basis of employment survey data obtained from the Central Statistics Office.

From the values given in the input-output table, costs and sales shares of industries were calculated. These are generally known as input-output coefficients or costs and sales shares. For example, $S^1_{(is)j}$ represents the share of the ij element of intermediate input from sources, s, (domestic or imported) in the total cost of producing j output.

Elasticities

In addition to these coefficients, the model requires pre-estimated elasticity parameters. As such estimates of elasticities are not available for Mauritius, values for these parameters were taken from economies similar to Mauritius (or set by default).

The elasticity of substitution between domestic and imported goods, i, is given the value of 2 for all tradable commodities except sugar and export processing enterprises products. Values close to this number are used for many commodities in other computable general equilibrium models, notably by Dixon *et al.* (1982), Martin (1990), and Vincent *et al* (1991). For sugar the value has been set to zero because there is no imported sugar in Mauritius and therefore no substitution between imported and domestic sugar. The elasticity of substitution for export

processing products is also set at zero. As export processing products are only for export, they do not compete with imported products in the domestic market. These characteristics should also be picked up in the $S_{(is)j}$ shares. The elasticity of substitution between domestic and imported goods is the same for all users: intermediate input, capital input and final consumption.

The elasticity of substitution between primary factors in the short run is set at 0.75 for all industries as in other CGE models such as Dixon *et al.* (1982). In the long-run simulation a value of 1.2 is assigned. The elasticity of substitution between different types of labour is given the value 2.0 by default.

Household expenditure elasticities were taken from a household behaviour study for Mexico (Jarque 1987). Consumer expenditure elasticities for Mexico were taken because of similarity of per capita income during Mexico's expenditure elasticities estimation year.

The household own and cross price elasticities of demand were estimated by using the Frisch formula of:

$$\eta_{ik} = -\varepsilon_i S^3_k(1+ \varepsilon_k/L) + \delta_{ik}\, \varepsilon_i/L \qquad 3$$

where:

ε_i is the consumer expenditure elasticity of demand for good i.

S^3_k refers to the household budget share of good i (domestic and imported).

L is the elasticity of the marginal utility of expenditure with respect to expenditure (the Frisch Parameter). The Frisch parameter for Mauritius was derived from the relationship between the Frisch parameter in Luch, Powell and Williams (1977) and per capita GNP of Mauritius.

δ_{ik} has the value of 1 for i=k and zero otherwise. The expenditure elasticity figures were then adjusted to fulfil Engel aggregation,

$$\sum_{k=1}^{g} S^3_k \varepsilon_k = 1 \text{ and homogeneity } \sum_{k=1}^{g} \eta_{ik} = -\varepsilon_1 \qquad 4$$

In equation 4 the sum of consumer expenditure elasticities on all consumer goods weighted by their respective household budget share equals to one. To satisfy conditions of homogeneity the sum of cross-price elasticities has to be equal to the elasticity of substitution (with negative sign). Export demand

elasticities are set to 20 for all exports. The reciprocal of the export demand elasticities is therefore 0.05. A large value is given to export demand elasticities for Mauritius because of the small country assumption.

The economic environment for simulations

The effects of a shock on economic variables depend largely on the economic environment assumed. A major distinction in the economic environment is drawn between the short run and the long run because of the extent of the respective mobility of resources. In the short run limited mobility of resources of capital and land is assumed. Because of this assumption substitution among primary factors is small. This in turn limits the adjustment of industries and resources to the shock. In the long run resources tend to move among industries allowing more adjustment to take place.

Short-run economic environment

The major assumptions influencing the economic environment in the short run concern aggregate employment, aggregate consumption, the exchange rate, capital and land.

Fixed employment is assumed because Mauritius has been at near full employment levels since 1987. Aggregate real wages adjust so that there is no change in aggregate employment. However, occupational and industrial employment are allowed to vary while maintaining occupational and industrial wage relativities fixed. This assumption specifies that the decrease in the export price for sugar affects the distribution of employment between different occupations and industries, but it keeps aggregate employment unchanged. The economy adjusts to changes in aggregate employment demand by varying the economy-wide real wage.

Capital and land are assumed to remain fixed in supply in the short run. In the short run, a decline in the export price of sugar is assumed to have no effect on the level of industry specific capital stock. This is because the current supply of capital stock in each industry is assumed to be determined by investment undertaken in the past. A fall in the export price of clothing now only affects current investment plans which determine capital stock in the long run. Therefore, the short-run effects of the clothing price fall are assumed to be felt in industries' rates of return (r_j) rather than in the sizes of their capital stock.

Real consumption is determined exogenously, and the shares of consumption and investment spending are fixed. It is also assumed that government spending changes by the same proportion as private consumption. These assumptions imply that aggregate consumption, government consumption and aggregate investment spending do not adjust to lower export prices of clothing in the short run. Instead, these variables are determined exogenously. The effect of lower export prices on aggregate expenditure is therefore determined as a difference between aggregate exports and aggregate imports and is reflected in the balance of trade. Initially in the base data the balance of trade was in surplus. Therefore a fall in the balance of trade may not mean a balance of trade deficit, but a deterioration in the trade balance.

Since the model does not have a monetary sector, the absolute level of prices is not determined. The model deals with relative price changes, that is, real price changes. For this reason, one of the price variables - the nominal exchange rate or the consumer price index (CPI) needs to be held constant as a numeraire. In this model the nominal exchange rate is held constant as in ORANI models. By holding the nominal exchange rate constant, changes in the CPI indicate changes in domestic price relative to world prices, that is, changes in the real exchange rate.

The real exchange rate is the ratio of the nominal exchange rate to the consumer price index. A fall in the export price of clothing depreciates the real exchange rate through deflation (a reduction in the CPI) leaving the economy to adjust through changes in relative prices and consumption patterns.

Long-run economic environment

In the long run, as in the short run, aggregate employment and the nominal exchange rate are assumed fixed. But the assumptions of fixed capital and aggregate consumption are relaxed. Though aggregate employment is assumed fixed in the long run, labour is assumed to move within industries. Skill categories are also assumed to expand and shrink. In the long run, rates of return on capital employed by each industry are assumed to remain unaffected by changes in the export price of clothing. Instead each industry adjusts its capital stock to maintain its real rate. Real aggregate consumption and other components of real domestic absorption are allowed to vary in the long run. The balance of trade is set exogenously to maintain the long-run equilibrium in external transactions.

Simulation scenarios and results

The Multifibre Arrangement allows free market access mainly to EC and US markets for a large proportion of Mauritian clothing exports. Since it is a small producer by global standards, Mauritius has been able to take advantage of this preferential treatment. With the exception of limited categories of clothing in the UK and US markets, Mauritius has not filled its export quotas. Consequently its export supply is not yet restricted by the Multifibre Arrangement to any marked extent. The Multifibre Arrangement raises the import price of textiles and clothing from Multifibre Arrangement member developing countries to Multifibre Arrangement restricted markets. The price increase arises from imposition of tariffs and supply constraints imposed by the voluntary export restraints (Table 10).

Table 10 Estimates of protection effects on import price of clothing (per cent)

	EC	United States	Average[a]
Hamilton, C. (1981-82)	38[b]	46	40
Suphachalasai, S. (1983)	48	37	44
Average	43	41.5	42

[a] Average of EC and the United States are import weighted.
[b] Refers to import price increase in France- the major export market for Mauritian clothing exports.
Sources: C. Hamilton, 'Voluntary export restriction on Asia: tariff equivalents, rents and trade barriers formation', seminar paper No 276, Institute for International Economic Studies, Stockholm, 1984; and S. Suphachalasai, 'The effect of government intervention and Multifibre Arrangement on Thailand clothing and textiles', Phd dissertation, The Australian National University, Canberra, 1989.

Assuming that Mauritian clothing exports to EC and US markets are perfect substitutes for clothing imports from other countries, the Mauritian clothing export price would increase by 42 per cent on average in the two markets due to the presence of the Arrangement (Table 10 above). As these markets absorb more than 95 per cent of Mauritian exports of clothing, a 40 per cent price increase on all clothing exports is a close approximation.

This implies that elimination of the Multifibre Arrangement would reduce the export price for Mauritius by about 40 per cent. The impact of this price fall on the clothing industry and the economy of Mauritius is simulated using the CGE model.

Short-run results

The principal effect of a decline in export prices of clothing would fall on the export earnings of the clothing industry.

One of the effects of a fall in export prices is a depreciation of the real exchange rate. With assumed constant nominal exchange rate (as numeraire), depreciation of the real exchange rate is reflected in lower domestic prices. Accordingly, the consumer price index falls by 0.6 per cent (Table 11).

Table 11 Effect of a 40 per cent reduction in export price of Mauritian clothing exports to the EC market

	Short run	Long run
	percentage changes	
Real GDP	-0.4	-1.3
Nominal GDP	-0.6	-1.7
Aggregate employment	exogenous	exogenous
Real wage	-1.1	-0.4
Import (foreign currency)	-1.3	-2.4
Export (foreign currency)	-1.7	-2.1
Trade balance (million rupee at 1987 prices)	-122.0	exogenous
Consumer price index	-0.6	-0.9
Price of capital	-0.4	-0.6
Real investment	exogenous	-2.8
Real consumption	exogenous	-1.2
Skilled employment	0.3	0.6
Unskilled employment	-0.7	-2.5
Output of:		
Sugar	0.7	1.2
Other agriculture	0.1	0.2
Non-export processing enterprises manufactures	0.2	0.4
Export processing enterprises clothing	-8.5	-14.0
Other export processing enterprises manufactures	4.3	9.0
Construction and utilities	-0.4	-1.8
Tourism	2.9	6.9
Other services	-0.2	-0.8
Export volume of:		
Sugar	0.7	1.1
Export processing enterprises clothing	-7.0.	-12.1
Other Export processing enterprises manufactures	4.9	11.4
Tourism	3.0	7.2

This relative decline in domestic prices is the driving force behind the changes in the economy. Export earnings of clothing are reduced substantially to the extent that aggregate export value falls by 1.7 per cent.

Lower domestic prices, induced by the fall in the price of exports, encourage substitution of domestic products for imported goods. This results in a 1.3 per cent decrease in aggregate imports. The fall in aggregate imports is more than offset by a much larger fall in aggregate exports to yield a trade balance deterioration of -122 million rupees at 1987 prices. This reduces the pre-shock trade surplus of 1917 million rupees to 1795 million rupees after the shock.

Further macroeconomic adjustment occurs in the labour market. The slowing down of overall economic activity tends to depress employment. With the assumption of full employment, however, the aggregate level of employment remains unchanged. Instead, the aggregate real wage rate falls by 1.1 per cent to maintain employment. As aggregate consumption and aggregate investment are assumed to be exogenous, real aggregate income is determined by aggregate exports and imports. The net outcome of these aggregates is a fall in real GDP by 0.4 per cent.

The fall in domestic prices makes tradables relatively more competitive than non-tradables. Exporting industries are expected to be more competitive in external markets because lower domestic prices reduce costs of production of these industries relative to their counterparts in trade-partner countries. Industries producing exportables (i.e. sugar, other export processing enterprises and tourism) expand by 0.7 per cent to 4.3 per cent. The clothing industry contracts because the fall in its export price has outstripped the gain in competitiveness.

Import-competing industries (i.e. agriculture other than sugar and non-export processing enterprises manufactures) have expanded as producers substitute cheaper domestic products for imported goods. Non-traded goods industries (i.e. construction, water, electricity and other services) are least affected by the shock. These industries have contracted marginally. The explanation is that the decrease in demand for their use in the contracting industry, clothing, is nearly offset by the increase in demand in the other expanding industries.

The contraction of the clothing industry results in a 4.0 per cent fall in its demand for labour inputs, the only input with short-run flexibility. This excess labour is employed elsewhere in the economy, with the largest share going to the industry that expands most (other export processing goods). As capital is industry specific and fixed in the short run, the contraction of the clothing industry results in a lower return to capital employed in the clothing industry and

capital intensity increases. If the shock actually occurred there could also be capacity underutilization, however this is not explicitly observed from simulation results.

Long-run results

The 40 per cent fall in export prices of clothing to the EC has similar results in the long run. The long-run simulation differs mainly because of the underlying assumptions about resource mobility. The assumed mobility of capital and land in the long run results in larger changes in most cases.

With flexible movement of capital in the long run, the contracting industries release some of their capital or do not replace their worn out capital. Overall real investment falls by 2.8 per cent leading to a slow down of economic activity. The slowing down of economic activity further results in a cut in real consumption. The decline in real investment and real consumption is reflected in a real GDP fall by 1.3 per cent.

The fall in domestic absorption lowers prices as indicated by the fall in the consumer price index. The fall in domestic prices makes export-oriented and import-substituting industries more competitive and they expand (except the clothing industry). However, non-tradables contract due to lower domestic demand.

Conclusion and policy implications

World clothing production involves numerous small and a few large producers. Although the production process of the clothing industry is highly labour-intensive, about half of world production still takes place in industrial countries. Despite their cost of production disadvantage, industrial countries manage to keep producing clothing by shielding their producers from external competition through quantitative restrictions and imposition of duties on imports, particularly from developing countries. However, some developing countries have favourable bilateral trade agreements. Mauritius is one of these countries. It has been able to exploit trade preference conditions through diversion.

The Mauritian benefits from ACP-EC trade agreements in clothing exports might be an isolated case. Had many ACP countries strengthened their clothing supply capabilities, as Mauritius did, the EC market might have been threatened with saturation. As a result trade preferences to ACP clothing exports might have been removed and stringent import restrictions (like those facing Hong Kong,

Republic of Korea and Taiwan) imposed. Hence, free access of clothing imports to the EC may not provide a viable export strategy for many ACP countries.

Factors responsible for success

Mauritius became outward oriented in the early 1970s. Macroeconomic stability was not only maintained but improved, and trade policies were liberalized so that an equilibrium exchange rate could be maintained. Exchange rate regimes were also liberalized. The economy responded to these changes positively growing at 8.3 per cent a year in real terms during 1984-87.

Domestic environment

Mauritius has had a stable and democratic system of government since independence. Its political stability has allowed the implementation of consistent economic policies and hence attracted domestic and foreign capital to export-oriented industries when the bias toward protectionist import-substituting policies was lessened.

For a small nation of around one million people, it was soon evident that export-led growth was the best development choice. This development strategy was successfully implemented by appropriate macroeconomic and trade policies.

Devaluations of the Mauritian rupee raised export proceeds in domestic currency terms, making production for exports more profitable.

Mauritius has retained low labour costs that reflect productivity and ensure competitiveness. Low inflation has damped down labour cost and stimulated export growth.

Trade policies have contributed to the international competitiveness. The elimination of quantitative restrictions on all imports and free of duty imports of inputs for clothing enterprises reduced the cost of production of goods for export. However, excessive protection is still in place on products used by non-exporting industries. The elimination of these protective structures and redundant subsidies offered to 'preferred industries', export processing and import-substitution industries alike, would lead to a more competitive economic environment. The main industry that would benefit would be tourism.

External environment

The export-led growth of the Mauritian economy is obviously sensitive to what happens in its export market for clothing. It has taken full advantage of

agreement with the EC. The Multifibre Arrangement, by restricting the entry of highly competitive large producers, allows Mauritius to have market access for a big proportion of its clothing exports to the EC and US markets. The Multifibre Arrangement supply restrictions raise prices, allowing Mauritius to sell its products at higher prices than it could otherwise.

Constraints to sustained economic growth

As a result of the Uruguay Round negotiations, the Multifibre Arrangement is due to be wound down substantially at the end of the 1990s. Competition from large suppliers of clothing such as Hong Kong, Taiwan and China which now have restricted entry for their exports to the EC and United States under the Multifibre Arrangement, would lower the prices of clothing. The effect of the elimination of the Multifibre Arrangement (clothing export price fall) on the Mauritian clothing industry and overall economy was simulated using the CGE model. While the main impact of the fall in export prices of clothing was felt on the industry itself, there were important consequences for other sections of the economy and these were captured by the model. The simulation results indicate that low export prices for clothing result in smaller clothing production. However, other exporting and import-competing industries expand due to improvement in their competitiveness while non-traded goods industries contract marginally.

The spillover effect on the macroeconomic aggregates is to reduce all the variables. The fall in export price induces a fall in the real exchange rate reflected in a fall in the consumer price index. Aggregate imports, aggregate exports, real consumption and real investment decline. As a result overall economic activity slowed down.

High concentration in terms of products and markets could make Mauritius vulnerable to small fluctuations in demand. The Mauritian clothing industry is highly concentrated in knitwear and thus vulnerable to changes in the demand for knitwear in its major markets (the EC and the United States). While the clothing industry has benefited from the trading arrangements and protectionist policies of the EC and United States, new application of trade restrictions presently imposed on other countries could potentially constrain future growth as Mauritius increases its supply.

The 1.3 per cent decline in real GDP which is induced by the dismantling of the Multifibre Arrangement, however, remains. The less severe but important impact of dismantling the Multifibre Arrangement on the economy remains.

Policy options

Expanding clothing exports to the EC and United States in categories that are not yet restricted by quotas has potential. Since quotas are set in volume rather than value terms, for items already affected by quota limitations there is the possibility of marketing higher value products, as Hong Kong, the Republic of Korea and other exporters have.

In the long run, the growth of Mauritius depends on the diversification of export products. To reduce the risk associated with fluctuations in demand in external markets, Mauritius needs to diversify its exports within and out of clothing.

Mauritius will lose its comparative advantage in labour-intensive clothing exports as the labour supply becomes more constrained. Future development is achievable only with increasing productivity, improved technology, movement to higher productivity industries, higher investment in human and physical capital, and greater managerial and worker efficiency. From a less nationalistic perspective and following the biggest clothing firm in Mauritius, the establishment of subsidiaries in the relatively labour abundant neighbouring countries of Madagascar and Seychelles could also maintain the profitability of the clothing industry.

The elimination of the Multifibre Arrangement is out of Mauritius control, however, Mauritius could mitigate adverse effects of these changes on its economy through changes in its domestic policies. One option is to further liberalize its trade policy.

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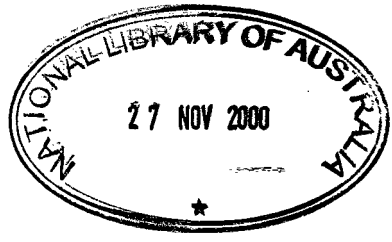

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