SOURCES OF INDUSTRIAL GROWTH, TRADE AND EMPLOYMENT : THE CASE OF TAIWAN

by

YEMANE WOLDERUFAEL

A Dissertation presented for the Award of the Degree Doctor of Philosophy in the Department of Economics, University of Strathclyde

Glasgow January, 1989

ACKNOWLEDGMENTS

In writing this dissertation I have been fortunate enough to be under the supervision of Professor Anthony Clunies Ross. Not only has he guided me and encouraged me to finish this dissertation; but he has also been very symphathetic and understanding to the many personal problems I faced during the writing of this dissetation. Had it not been for his continuous guidance and financial support I constantly received from him, it would have been very difficult for me to finish the project. I really appreciate his incredible degree of patience and kindness.

I also owe a debt of gratitude to every academic and non-academic members of staff of the Department and the Fraser of Allander Institue ; in particular to Professors David Simpson , David Forsyth, Mr. Richard Brooks, Dr. Roger Sandilands, Dr. James Love, Darryl Holden, Dr. Frank Harrigan, Stephen Boyle , Dr. Jim Love, Dr. Iain Jenkins, Mrs. M. Robertson, Mrs S. Branney and Dr. Kushari for their constant queries about the progress of my work.

All the data I used in this dissetation were directly mailed to me from Taiwan by the Directorate-General of Budget, Accounting and Statistics (DGBAS), and the Council of Economic Planning, Republic of China. I am greately indebted to them.

The financial support provided by WUS (World University Service) is gratefully acknowledged.

I would like also to thank staff of the Data Preparation Department of The Computer Centre, The Advisory Service, the Interlibray Loan Department of the University for their efficient services.

Special gratitude is due to my friends Adem, Demessie and Zeru, Tekeste, Yodit, Brigitte, and Peter; and also to Kibrayehu, Mulat, Yohannes, Girma, Mulu and Tsega; for their constant encouragement.

Finally, I thank Miss E.Robbie for typing a large part of the manuscript with great competence.

ACKNOWLEDGMENTS

TABLE OF CONTENTS

	page
CHAPTER 1 INTRODUCTION	1
1.1 Links Between Trade Strategy and Employment	
1.2 Objectives of The Study	7
CHAPTER 2 ECONOMIC POLICIES AND THE PATTERN OF GROWTH: THE CASE OF TAIWAN	11
2.1 Introduction	11
2.2 Historical Developments of Industrial Policy in Taiwan	12
2.2.1 The Rehabilitation and the Import Substitution Period	13
2.2.2 Efforts to Combat Inflation	14
2.2.3 Trade Policies	22
2.2.3.1 The Structure of Protection in Taiwan	28
2.2.3.2 Domestic Resource Cost	36
2.2.4 Exchange Rate Policy	41
2.2.4.1 Export Promotion Policies	46
2.3 Export-Oriented Strategy and Growth	52
2.3.1 Growth and Structural Change	52
2.3.2 Savings and Investment in Taiwan	60

2.3.3 The Role of Land Reform 67

2.3.4 Growth and Equity 73

2.4 Summary and Conclusions 78

CHAPTER 3 SOURCES OF INDUSTRIAL GROWTH AND STRUCTURAL CHANGE: CONCEPTS AND MEASUREMENTS 81

3.1 Pattern of Growth and Structural Change 81

3.2 Models of Sources of Growth Decomposition 86

3.2.1 The Chenery Method 88

3.2.2 The Chenery-Shishido-Watanabe Method 92

3.2.3 The Syrquin Method 98

3.2.3.1 Syrquin Direct Method 99

3.2.3.2 Syrquin Total Method 99

3.2.4 The Balassa Method 104

3.2.4.1 The Balassa Direct Method 106

3.2.4.2 Balassa Total Method 111

CHAPTER 4 SOURCES OF INDUSTRIAL GROWTH AND STRUCTURAL CHANGE IN TAIWAN, 1961:1981 114

4.1 Introduction 114

4.2 Sources of Growth and Structural Change in Taiwan: Economy-Wide Analyses 115

4.2.1 The Direct Decomposition Analyses 115

4.2.2 The Total Decomposition Analysis 117

4.3 Sources of Industrial Growth and

Structural Change in Gross Output: Analyses by Major Sectors 122

4.3.1 Growth of Output: first Difference 122

4.3.2 Sources of Growth Pattern in Manufacturing 127

4.4 Structural Change in Gross Output: Deviation Measures 141

4.5 Sources of Import Growth and Import Dependence in an Export-Led Economy: The Case of Taiwan, 1964-1984. 156

4.5.1 Introduction 156

4.5.1 Sources of Import Growth, 1964-1984 156

4.6 Import Content Analysis 167

4.6.1 Analysis of Import Dependence 170

4.6.2 Import Content of Final Demand 175

CHAPTER 5 TRADE DIRECTION AND FACTOR INTENSITY: ANALYTICAL CONSIDERATIONS 180

5.1 The Factor Proportions Model of Trade 180

5.1.1 Assumptions of the Model 183

5.1.2 The Deardorff Model 184

5.1.3 The Krueger Model 187

5.1.4 The Pattern of Exports 192

5.1.5 Relative Growth in One Country 195

5.2 The Effects of Commodity and Factor Market Distortions upon the Commodity Composition of Trade 198

5.2.1 The Goods-Market Distortion 199

5.2.2 The Factor-Market Distortion 205

5.2.2.1 An Economy-Wide Real Wage Floor: The Brecher Model 206

5.2.2.2 Sector-Specific Minimum Wage 215

5.2.2.3 Factor-Price Differential 221

5.3 Hypotheses to be Tested 226

CHAPTER 6 MEASUREMENT OF VARIABLES 230

6.1 Introduction 230

6.2 Trade Categories 230

6.3 Measurement of Factor Content of Trade 235

6.3.1 Direct-Plus-Home-Goods-Indirect Labour Coefficient 235

6.3.2 Value-Added and Factor Requirements Multipliers 239

6.3.3 Net Factor Content of Trade 242

6.3.4 Factor Content of Non-Import Competing Industries 243

CHAPTER 7 TRADE AND EMPLOYMENT IN TAIWAN 246

7.1 Introduction 246

7.2 Contribution of Exports to Employment 247

7.3 Trade Strategy and Employment 251

7.3.1 Direct Employment 252

7.3.2 Indirect Employment 254

7.5 Factor Content of the Trade Categories 258

7.5.1 Introduction 258

7.5.2 Factor Intensity of Taiwan's Trade in Manufactures 260

7.6 Trade Regime and Commodity Composition of Trade in a Multi-Commodity and Multi-Country Case:

Testing the Krueger and the Deardorff Models 264

7.6.1 Factor Intensity of Trade: Direct Requirements 266

7.6.1.1 Factor Intensity of Export Industries 266

7.6.1.2 Factor Intensity of Import-Competing Industries 268

7.6.2 Factor Intensity of Non-Import-Competing Industries 270

7.7 Factor Intensity in Trade: Direct-Plus-Indirect Requirements 271

7.7.1 Introduction 271

7.7.2 Factor Intensity in Trade: Direct-Plus-Home-Goods-Indirect Requirements 273

7.7.3 Factor Intensity in Trade: Direct-Plus-Total-Indirect Requirements 277

7.8 Net Factor Content of Taiwanese Trade 280

7.9 The Effects of Commodity Market Distortions on Employment 286

7.9.1 Introduction 287

7.9.2 Protection, Factor Requirements and Factor Proportions 288

7.10 Commodity Market Distortions and Capital Intensity 295

7.11 Concluding Remarks 296

CHAPTER 8 FACTOR ACCUMULATION AND CHANGES IN FACTOR INTENSITY OF TAIWAN'S TRADE IN MANUFACTURES, 1961-1981 298

8.1 Introduction 298

8.2 Changes in Resource Endowments in Taiwan 299

8.3 Factor Proportions in Taiwan's

Manufacturing Trade, 1961-1981 303

8.4 Determinants of the Structure of Taiwan's Foreign Trade in Manufactures, 1961-1981 309

8.4.1 Introduction 309

8.4.2 The Model 310

8.4.3 Empirical Results 315

8.4.4 Determinants of Taiwan's Regional Trade, 1966-1971 325

8.4.5 Determinants of the Changing Pattern of Taiwan's Trade, 1971-1981. 330

8.4.6 A Logit Analysis of the Factor Content of Taiwan's Foreign Trade in Manufactures, 1966-1981 333

8.5 Concluding Remarks 336

CHAPTER 9 SUMMARY AND CONCLUSIONS 339

9.1 Summary of Major Findings 339

9.2 Causes of Taiwan's Economic Miracle: A Summary 344

9.3 Factors in Taiwan's Economic Miracle: A Critical Summary 347

9.4 Lessons from the Taiwanese Experience 360

BIBILIOGRAPHY 369

LIST OF TABLES

2.1 Money Supply, Savings, Time and PIR Deposits, Interest rates and Wholesale Prices , 1950-54 19

2.2 Rate of Inflation and Money Expansion for Selected Countries 21

2.3 Evolution of Import Controls in Taiwan 24

2.4 Average Tariff Burden of Taiwan 25

2.5 Distribution of Tariff Rates in Taiwan 27

2.6 Nominal Protection and Effective Protection by 4 Major Sectors(1969) 30

2.7 Indicators of Incentives in Six Semi-Industrial Economies (%) 32

2.8 Effective Protection by End-Use Category 33

2.9 Frequency Distribution Of Results Price Comparison by Trade Category 35

2.10 Frequency Distribution of the Price Comparison by Primary and Manufactured Goods 35

2.11 Domestic Resource Cost Estimate, 1961 38

2.12 Composition of Domestic Products in the Foreign Trade, 1961 39

2.13 Domestic Resource Cost 1969 and 1971 40

2.14 Foreign Exchange Rate, May 1, 1955 42

2.15 Tax Reduction and Rebates 50

2.16 Purchasing-Power-Parity Effective Exchange Rate on Exports, 1956-1978 52

2.17 Gross National Product 53

2.18 Composition of GNP by Industrial Origin (%) 54

2.19 Merchandise Trade 55

2.20 Composition of Exports 55

2.21 Composition of Imports 57

2.22 Composition of Manufactured Exports: 1956-198159

2.23 Savings as Percent of National Income or Gross Domestic Product in Selected Countries 60

2.24 Gross Fixed Capital Formation as

Percentage of National Expenditure in Taiwan and Selected Countries 61

2.25 Distribution of Savings by Sector 63

2.26 Distribution of Savings by Sector for 14 Selected Countries (average for 1970-1978) 65

2.27 Growth Rate of the Agricultural Sector 69

2.28 Income Distribution in Taiwan (1953-1986) 74

2.29 Changes in Real Family Income (in 1976 prices %) 74

3.1 Sources of Industrial Growth for Selected Countries 85

4.1 Source of Growth and Structural Change in Gross Output, 1961-1981: A Summary of Aggregate results for Taiwan by Alternative Measures 118

4.2 Factors Contributing to Sectoral Output Growth, 1961-1966 (Balassa Total First Difference Method) 129

4.3 Factors Contributing to Sectoral Output Growth, 1966-1971 (Balassa Total First Difference Method) 130

4.4 Factors Contributing to Sectoral Output Growth, 1971-1976 (Balassa Total First Difference Method) 131

4.5 Factors Contributing to Sectoral Output Growth, 1976-1981 (Balassa Total First Difference Method) 132

4.6 Factors Contributing to Sectoral Output Growth, 1961-1971 (Balassa Total First Difference Method) 134

4.7 Factors Contributing to Sectoral Output Growth, 1971-81 (Balassa Total First Difference Method) 135

4.8 Factors Contributing to Sectoral Output Growth, 1961-1981 (Balassa Total First Difference Chained Method) 136

4.9 Source of Output Deviation from

Proportional Growth, 1961-1966 (Syrquin Total Method) 146

4.10 Source of Output Deviation from Proportional Growth, 1966-1971 (Syrquin Total Method) 147

4.11 Source of Output Deviation from Proportional Growth, 1971-1976 (Syrquin Total Method) 148

4.12 Source of Output Deviation from Proportional Growth, 1976-1981 (Syrquin Total Method) 150

4.13 Source of Output Deviation from Proportional Growth, 1961-1971 (Syrquin Total Chained Method) 151

4.14 Source of Output Deviation from Proportional Growth, 1971-1981 (Syrquin Total Chained Method) 152

4.15 Source of Output Deviation from Proportional Growth, 1961-1981 (Syrquin Total Chained Method) 153

4.16 Sources of Import Growth, 1964-84: Summary of Aggregate Results (First Difference Syrquin Direct Measure) 160

4.17 Sources of Import Growth, 1964-76: Summary of Disaggregate Results (First Difference Syrquin Direct Measure) 162

4.18 Sources of Import Growth, 1964-84: Summary of Disaggregate Results (First Difference Syrquin Direct Measure) 163

4.19 Sources of Import Growth, 1964-76: Summary of Disaggregate Results (First Difference Syrquin Total Measure) 165

4.20 Sources of Import Growth, 1964-84: Summary of Disaggregate Results (First Difference Syrquin Total Measure) 166

4.21 Summary Measure of Trade Dependence 171

4.22 Import Content of Final Demand 176

7.1 Labour Utilization in Domestic Final Demand and Exports: Direct-Plus-Total-Indirect, 1961-1984 249

7.2 Allocation of Wage Employment by Major Sectors, 1961-1981 250

7.3 Direct Labour Requirements per Million of NT$ Direct Value Added: 1966-1981 253

7.4 Direct-plus-total-indirect Labour Requirements in Exportables and Import-competing Manufactured Products (at Current Prices), 1966-1981 257

7.5 Direct Factor Requirements and Factor Proportions in Exportables and Import-competing Manufactured Products (at Current Prices), 1966-1981 261

7.6 Direct-plus-home Goods-indirect Factor Requirements and Factor Proportions in Exportables and Import-competing Manufactured Products (at Current Prices), 1966-1981 262

7.7 Direct-plus-Total-Indirect Factor Requirements and Factor Proportions in Exportables and Import-competing Manufactured Products (at Current Prices), 1966-1981 263

7.8 Direct Factor Requirements and Factor Proportions in Exportables and Import-Competing Products by Trade Destination and origin of Trade Flows, 1971 267

7.9 Direct-plus-homegoods-indirect Factor Requirements per NT$ one million of direct-plus-homegoods indirect DVA in Exportables and Import-Competing Products by Trade Destination and origin of Trade Flows, 1971 274

7.10 Direct-plus-homegoods-indirect Factor Requirements per NT$ one million of direct DVA in Exportables

and Import-Competing Products by Trade Destination and origin of Trade Flows, 1971 276

7.11 Direct-plus-total-indirect Factor Requirements per NT$ one million of direct-plus-total indirect DVA in Exportables and Import-Competing Products by Trade Destination and origin of 278

7.12 Direct-plus-total-indirect Factor Requirements per NT$ one million of direct DVA in Exportables and Import-Competing Products by Trade Destination and origin of 280

7.13 Direct Factor Requirements and Factor Proportions in Exportables and Import-Competing Products by at International Prices Trade Destination and origin of Trade Flows, 1971 283

7.14 Direct-plus-homegoods-Indirect and-direct-plus-total-indirect Factor Requirements in Exportables and Import-Competing Products at International International Prices by Trade Destination and origin of Trade Flows, 1971 284

7.15 Direct-plus-total-Indirect Factor Requirements in Exportables and Import-Competing Products at International International Prices by Trade Destination and origin of Trade Flows, 1971 286

7.16 Direct Factor Requirements and Factor Proportions and Protection Levels in Exportables by Trade Flow Destination for Taiwan Manufacturing, 1971 290

7.17 Direct-plus-homegoods-indirect Factor Requirements and Factor Proportions and Protection Levels in Import Competing products by Trade Flow origin for Taiwan Manufacturing, 1971 292

7.18 Direct-plus-total-Indirect Factor Requirements and Factor Proportions in Exportables by Trade Flow Destination and

Protection Levels, 1971 293

7.19 Protection and Capital-Intensity in Taiwan, 1966-1971 296

8.1 Employed Persons by Industry in Taiwan 1961-1981 300

8.2 Employed Persons by Educational Attainment in Taiwan 1967-1983 301

8.3 Changes in Relative Factor Endowment in Taiwan: 1952-1980 302

8.4 Some Indicators of Relative Factor Endowment of Taiwan and its Major Trading Partners, 1970 and 1980 303

8.5 Relative Factor Intensity of Taiwan's Exports and Imports 305

8.6 Relative Factor Intensity of Taiwan's Manufactured Exports and Imports 306

8.7 Physical and Human Capital Intensity in Taiwanese Manufacturing Trade, 1966-1981 307

8.8 Total Factor Intensity of Exports and Competitive Imports: 1961-1971 308

8.9 Indices of Value Added per Worker in Exports by Destination 308

8.10 Correlation Matrix Net Imports with Some Factor Inputs, 1966-1981 317

8.11 Correlation Matrix Imports with Some Factor Inputs, 1966-1981 317

8.12 Correlation Matrix Exports with Some Factor Inputs, 1966-1981 317

8.13 Scaled Regression on Direct Factor Inputs, 1966-1981 320

8.14 Scaled Regression on Direct Factor Inputs of Physical Capital, Human Capital, Unskilled Labour and Technological Variable, 1966-1981 324

8.15 Regression Results of Determinants

of Taiwan's Reginal Exports, 1966 327

8.16 Regression Results of Determinants of Taiwan's Regional Net Imports, 1971 328

8.17 Regression Results of Determinants of Taiwan's Regional Exports, 1971 329

8.18 Regression Results of Determinants of Taiwan's Changing Factor Endowments, 1971-1981 332

8.19 Logit Analysis of Taiwan's Net Exports, 1966-1981 335

8.20 Logit Analysis of Taiwan's Net Exports Using Four Factor Inputs, 1966-1981 336

APPENDICES

4.1 Input-Output Sectoral Classification 179

A8.1 Correlation Matrix Between Factor Inputs and Trade Performance, 1966 338

A8.2 Correlation Matrix Between Factor Inputs and Trade Performance, 1971 338

A8.3 Correlation Matrix Between Factor Inputs and Trade Performance, 1976 338

A8.4 Correlation Matrix Between Factor Inputs and Trade Performance, 1981 338

3.1 Decomposition of Sources of Output Growth 364

CHAPTER 1

1. TRADE STRATEGY AND EMPLOYMENT

1.1 Links Between Trade Strategy and Employment

The experience of many developing countries suggests that fast economic growth was not accompanied by the alleviation of abject poverty or by the creation of a proportional increase in gainful employment. Because of the wide disparity between the growth of output and the growth in employment some are questioning the wisdom of the past practice of treating growth *per se* as a central objective of economic policy. Instead of concentrating on growth alone, they are advocating that growth has to be sacrificed for a better distribution and a wider provision of gainful employment. Others see no apparent conflict between output growth on the one hand and distribution and employment on the other. To them, growth is a necessary condition for better distribution and employment. Instead of arresting development (growth) at its early stages for distributional purposes, they believe, by and large, that growth should proceed unabated and distributional issues should not be directly addressed at the possible expense of growth until and unless the national cake is big enough to warrant, in their opinion, a high enough priority for equity considerations. In this view, to be excessively concerned now about distribution of income and deliberate creation of employment by direct governmental action is

to redistribute poverty and not material well being.

The concern of both schools is quite legitimate in so far as their views depend on belief about the trickling down which occurs, empirical evidence is not unreservedly in favour of either of them. As Fields (1984) notes, "empirical evidence supports trickle down in some cases, but the evidence is contrary to trickle down in others". That is to say, the failure to create gainful employment and fair distribution of income is not common to all countries which have achieved a fair rate of growth of national income. The basic policy issue is not therefore to doubt or play down the trickle-down effect but to identify the key factors that have made growth, equity and employment go hand in hand in some and why the trickle-down effect has failed in others.

Available empirical evidence seems to suggest that "changes in poverty and inequality depend upon more than the rate of economic growth. A good working hypothesis is that the character of economic growth also matters" (Fields, 1984, p. 75). Empirical evidence from Balassa (1980) and Krueger (1979) seems to support the above hypothesis. In terms of output and employment creation, variations among countries seem to depend upon the trade and development strategy followed. The studies seem to indicate that countries following the outward-looking strategy do better in terms of employment creation and income distribution than countries following the import-

substitution strategy. The development strategy followed by Taiwan and South Korea has vividly demonstrated that growth need not be sacrificed for gainful employment and equitable distribution of income. In fact, to some observers it seems that the most appropriate policy that can simultaneously solve the twin problems of development (unemployment and maldistribution) of developing countries is the pursuance of outward-looking strategy.

In view of the fact that the experience of countries following the outward-looking strategy sharply contrasts with the experience of countries following the inward-looking strategy, it is natural to suspect that there is some relationship between employment growth and export-expansion strategy. According to Fields (1984) the disparity in the experience of these two groups of countries can be traced back to "... trade orientation of a country (whether export oriented or internally-oriented) and the wage policy pursued (whether public policy promotes market clearing wage rates or higher than market-clearing wages)".

In many of the countries where the "employment problem" is less pronounced, the source of industrial growth has largely been accounted for by export expansion (Kubo and Robinson, 1979; Dervis, de Melo and Robinson, 1982; Chenery, 1980; de Melo, 1983). In view of these findings, it is possible to hypothesise that the rapid

expansion of output resulting from export expansion may be the most important factor in explaining the association between high rates of output growth and comparable rates of growth of employment. In other words, it may be true that, other things remaining equal, the larger the share of output due to export expansion the higher is the growth rate of output and employment. This might be so because, "one strategy might result in a higher rate of growth of the overall economy owing to superior resource allocation, and faster growth would presumably entail more employment growth" (Krueger, 1981, p. 9).

Another possible link between trade strategy and employment is in the different compositions of output implied by different trade strategies. Different instruments are used to motivate output increases geared towards different markets. As is well documented in the literature on commercial policies of many developing countries (see Little et al, 1970; Bhagwati, 1978; Krueger, 1978; Donges and Riedel, 1976; Balassa et al, 1982), under the import-substitution strategy, import substitutes are favoured while export industries are discriminated against. On the other hand, under the export-promotion strategy discrimination between industries that cater for the domestic market (import competing industries) and those that serve the international market (export industries) may not be significant.

In an export strategy a larger share of total output is accounted for by export-oriented industries than under the import-substitution strategy (see Chenery et al, 1988). As Krueger (1981) rightly remarks, therefore, "if employment per unit of output and value added is greater in one set of industries than in the other, then employment growth will be faster, on this account, under the strategy that lets the labour-intensive industries grow relatively faster" (Krueger, 1981, p. 9). Thus, the growth in employment will be higher (a) the larger the share of labour-intensive industries in total output, and (b) the faster is the growth of the labour-intensive industries. Therefore, the question is whether "import-substitution implies more or less labour-intensive industries than export promotion" (Krueger, 1977, p. 53).

Apart from the difference in growth rates and composition of output implied by the different trade strategies, the choice of technique and hence the capital-labour ratio may be different from one strategy to the other. To encourage the domestic production of importables, various incentive measures that distort the prices of both capital and labour have been used in many developing countries.

Available empirical evidence seems to suggest that industries that face international competition (exports) have lower capital-labour ratios than industries geared

towards the domestic market (White, 1976, p. 588). Balassa (1980) is also of the opinion that "in countries for which data is available, capital-labour ratios were substantially lower in export industries than import-substituting industries. At the same time, there was a shift towards labour-intensive export industries in countries following an outward-oriented development strategy, such as Korea, while a shift in the opposite direction occurred in countries pursuing inward-oriented strategies, such as India" (Balassa, 1980, p. 25).

In contrast with the import-substitution strategy, the choice of technique is very crucial to an export-oriented strategy. In countries following the latter strategy the key sector to focus on is the manufacturing sector. Since growth of manufacturing exports is a major element in certain countries' spectacular growth rates, what happens to manufacturing may have more far-reaching consequences than what happens to any other sector of the economy. It may be therefore that, if these countries are to maintain their enviable growth momentum and stay as exporters of manufacturers, they have to keep 'prices right'. As many critics of the import-substitution strategy point out, the absence of both internal and external competition means that higher wages can easily be passed to consumers in the form of higher prices in an import-substitution strategy. It is therefore plausible to suggest that, while getting prices right is not the only remedy for the unemployment problem and uneven

distribution of income, there is no doubt that it can fundamentally reduce such social evils.

The hypotheses to be tested in this dissertation can be summarised broadly as follows:

1. Employment generation and trade strategy are related, i.e. the amount of employment generated is not independent of trade strategy.
2. Export-promotion strategy generates significantly more employment growth than import-substitution strategy.
3. If the removal of distortions (both commodity and factors) can increase employment, then it does not matter very much which strategy to follow as long as the same rates of growth of output are maintained.

1.2 Objectives of This Study

While the implications of alternative trade strategies on various issues of development have been fairly analysed, examinations of the impact of trade strategy on employment is of recent origin. Recent studies made on several developing countries indicate that trade strategy is an important variable in explaining employment growth (Krueger, 1979 and 1983). The present study attempts to supplement these studies by assessing the employment of performance of the Taiwanese economy for the period 1961-1984. The analysis will be carried out as follows:

As a background to the study, in Chapter 2, we shall briefly look into the development policies followed by Taiwan and the progress that has been achieved over the past three decades. Attention will be focused on the structure of the economy and the trade and payment regimes that made Taiwan a success story. In Chapter 3 for the basis of analysing the sources of growth and structural change that accompanied the Taiwanese development experience, we review the models of sources of industrial growth and structural change starting from the methodology pioneered by Chenery (1960) and Chenery, Shishido and Watanabe (1962). Chapter 4 analyses the sources of growth and structural change in gross output in comparative static analysis using comparable input-output tables for Taiwan for the period 1961-1981. In a similar manner, the sources of import growth are also analysed to shed some additional light on the import-dependent-export-led development process in Taiwan. In addition, the import content of the export-led growth is assessed in order to measure the effects of the industrialization process on the structure of imports and in order to examine the changes in import dependency of Taiwanese economy.

In the second part of the dissertation the factor proportions model of international trade in a multi-country, multi-commodity framework as espoused by Krueger (1977) and Deardorff (1979) is discussed and

empirically.tested. Emphasis will be given to making the above theories appropriate to the realities of developing countries. This includes assessing the impact of factor and commodity market distortions as they pertain to employment generation. The hypotheses that emerge both with and without commodity and factor market distortions are then spelled out for the empirical testing in Chapter 7.

The main thrust of this second part is to assess the impact of alternative trade strategies on employment for the period 1961-84. The analysis will proceed as follows:

1. For the years we have selected for our study, industries will be classified into exportables, import competing, non-import competing and non-traded goods according to the criterion set in Chapter 6.

2. Factor intensity of each group of industries will then be estimated in the form of (a) direct factor inputs (labour, physical capital and skilled labour) per unit of direct domestic value added, (b) direct-plus-home-goods-indirect factor input per unit of direct-plus-home goods domestic value added, and (c) direct-plus-indirect factor inputs per unit of direct-plus-indirect domestic value added. These estimates will be made for the 1966-1981 period. Factor inputs per unit of international value-added will also be estimated for the 1971 period.

(3) The trade figure for 1971 (at the four-digit ISIC level) is then disaggregated into different country

grouping for the purpose of testing the impact of trade partners on employment.

(4) The impact of commodity market distortions on employment is then assessed by relating the effective rate of protection of each tradeable sector to its employment performance.

The study will also investigate (in Chapter 8) the relationship between the pattern of trade and the relative resource endowment of Taiwan and test empirically the validity of the factor proportions theory for explaining the changing pattern of comparative advantage in the course of Taiwan's rapid accumulation of physical and human capital.

In the concluding parts of the dissertation attempts will be made to highlight some of the relevant lessons to be learned from the Taiwanese experience. In particular, attention will be focused on developmental role of the state and stress that Taiwan and the other group of the 'Gang of Four' developed not because of the absence of state intervention but because of the 'right' kind of selective state intervention.

CHAPTER 2

ECONOMIC POLICIES & PATTERN OF GROWTH: THE CASE OF TAIWAN

2.1 Introduction

The economic progress achieved by Taiwan is the envy of many if not all developing countries. Within a period of three decades, Taiwan has been transformed from an agrarian society to a modern society. Growth in both national and per capita income recorded in this period is almost unheard of in the history of modern economic growth. Equally dramatic was the structural transformation that took place in this natural-resource-poor country.

This chapter reviews some of the experiences of Taiwan's industrialization strategy from the late forties to the early eighties. First, the rational behind the shift in strategy from import substitution to export promotion is discussed. Attempts will be made to show that Taiwan's spectacular growth owes much to the rejection of some misguided but popular policies of the forties and early fifties. In particular it will be shown that Taiwan's attempt to industrialize through high tariff walls and quantitative restrictions coupled with low interest rates on savings and investment was recognized to be detrimental to the long-run economic growth of the country. This early shift in trade strategy from import substitution to export promotion is perhaps one of the distinguishing characteristics of Taiwan's industrial

strategy. Without this shift it would have been difficult if not impossible for Taiwan to launch her strategy towards sustained economic progress.

The entire Taiwanese experience in development strategy is of great interest to many less developed countries who are still struggling to combat mass unemployment and abject poverty. While some of the lessons to be drawn from the Taiwanese experience are to be dealt with in the concluding remarks of this thesis, the transferability and relevance of some aspects of economic policies discussed in this chapter will be highlighted towards the end of the present chapter.

2.2 Historical Developments of Industrial Policy in Taiwan

There are three phases of Taiwan's industrialization policy over the period from the end of the Second World War to the present. The first phase, which begins with the immediate end of the War and continues until 1958, may be characterized as a period of reconstruction and rehabilitation accompanied by the easy phase of import substitution. The second phase covered only a short period from 1958 to 1961, and was a transition between import substitution and export promotion. The period beginning the 1960s can be taken as the third phase, in which the export-oriented strategy of industrialization was in a full swing.

2.2.1 The Rehabilitation and Import-Substitution Period

During the first phase of this period economic policy and resources were geared towards the rehabilitation of the war-ravaged economy, which had reached a state of paralysis as a result of the war. When Taiwan was retroceded to the Republic of China [Mainland China], about three-fourths of its industrial productive capacity were destroyed, over one half of the existing railways, bridges and station facilities were incapacitated, and only one-fourth of the highways remained serviceable for motor vehicles, while harbours were largely ruined and blocked by sunken ships. Because of the effects of the war agricultural output dropped to 45 per cent and industrial output to less than one-third of their respective pre-war levels (Hsing, 1971, p. 149).

Apart from the above, Taiwan was also plagued by rampart inflation that almost got out of hand. The Taipei wholesale price index increased 260 per cent in 1946, 360 per cent in 1947, 520 per cent in 1948, and 3500 per cent in 1949 (Ho, 1978, p. 104). Therefore during this period Taiwan authorities not only had to rebuild the war-devastated economy but also they had to control inflation which had affected drastically the morale of the private sector.

The rehabilitation of the economy was carried out in stages. Traditional Taiwanese public industries such as

sugar, cement, paper and fertilizer were restored, while the recovery of the other industries was postponed. However, with the increasing rate of inflation, many productive enterprises found it difficult to maintain and undertake normal operations. And except for the above mentioned public enterprises production by private enterprises was brought to a halt.

2.2.2 Efforts to Combat Inflation

The greatest lesson the Taiwan authorities learned from this chaotic situation was the recognition that economic stability was not only important for itself but fundamentally essential to economic development. Stabilizing the economy and building the morale of the private sector was considered as the main national objective during this period (see Hsing, 1971, pp. 184-5). During this period it was generally recognized that the root cause of the runaway inflation was the excessive money expansion during and after the war. Consequently, Taiwanese authorities decided in 1949 to adopt a well-thought-out monetary reform and institute a system of controls over foreign trade and exchange as supporting measures (Hsing, p. 151). These measures were to "... propel the Taiwanese economy forward at a rate few other countries have ever matched" (Scott, 1979, p. 314). In other words, the success of bringing inflationary forces under control in the 1950s and maintaining relative price stability was one of the main reasons for the

phenomenal economic growth achieved in Taiwan over the past three and a half decades.

The rampant inflation that virtually stifled particularly the private sector was brought about by two measures. The first of these was US aid, which resumed in 1951 and was not only used to accelerate general economic development but was partly used to combat the galloping inflation. Sales proceeds of aid commodities (and inputs) were partly used to finance the budget deficit and partly were impounded in the Bank of Taiwan as Counterpart Fund Deposits, which according to Tsiang (1980) gradually accumulated to a total of NT$724 million at the end of July 1954 or 40 per cent of the money supply (currency plus demand deposits) then in circulation. Thus, the proceeds of US aid had contributed enormously to the contraction, or rather the prevention of more rapid increase, of the money supply (Tsiang, 1980). Apart from keeping in the contraction of the money supply, US aid had also helped to relax the binding foreign exchange constraint and permitted higher levels of capital formation. Many observers believe that had it not been for US aid the trade gap would have been a serious factor limiting Taiwan's economic development. Needless to say, US aid had helped Taiwan tremendously by breaking the foreign-exchange bottleneck, which to many was a crucial impediment to Taiwan's take-off. In fact, some attribute the tremendous success achieved in Taiwan primarily to the US aid and aid inspired economic

policies (Jacoby, 1966). It cannot be denied that US aid was necessary to Taiwan during her most severe economic problems, "but it was needed most as a reconstruction and short-run stabilization aid rather than as a longer-term development aid", (Myint, 1981, p. 111). If the mere availability of aid were a necessary condition for economic development, countries that have received more aid on per capita basis than Taiwan would have progressed fast. For instance South Vietnam, Korea, Turkey, Yugoslavia and Egypt were receiving more economic aid per head than Taiwan and yet their economic progress (except Korea's) is not comparable to that of Taiwan (see Little, 1979, p. 457-458). Furthermore, as the experience of Korea indicates, aid may not be a crucial factor in combating inflation. South Korea was receiving US aid while inflation was rising (Myint, 1981). Thus as Myint remarks, "one should realize that the mere availability of aid by itself would not have been sufficient to stop inflation." (Myint, 1981, p. 112).

The second measure taken to curb inflation was to control the money supply by high-interest-rate policy and strict credit restriction, which were unconventional to many proponents of fast economic development at that time. This policy was unfashionable in the sense that economic advisors in Taiwan unlike their counterparts in many developing countries advocated not cheap credit to nurture few import substitute industries but rates that

would reflect the true marked prices of financial credit. Correspondingly, to mobilize savings and curb the excess money supply from the public, financial institutions offered generous interest rates on saving deposits (see Tsiang, 1979).

In March 1950, the Bank of Taiwan introduced a special system of time deposits called the Preferential Interest Rate Deposits (PIRD), where depositors were offered an extraordinary nominal interest rate of 7 per cent per month for one month saving deposits. When compounded monthly, this comes to 125 per cent per year against 20 per cent per annum on traditional one year time deposits offered by the same bank since September of the preceding year (Tsiang, 1980, p. 311).

According to figures supplied by Tsiang (1981), the impact of the high-interest-rate saving deposits policy was very successful and prompt. Time and saving deposits including PIRD in the whole banking sector increased from a meagre NT$6 million, or barely 1.7 per cent of the contemporary money supply (currency plus demand deposits), at the end of March 1950 to NT$28 million at the end of June 1950, which was 7.1 per cent of money supply at that time. What is remarkable is that price inflation was rapidly brought to a halt. From March to July 1950, the cumulative price rise was hardly 1 per cent and, indeed, starting from may 1950, prices were actually declining a little (Tsiang, 1980, p.

312). This surprising result happened before the resumption of US aid, thus showing that aid was not necessary to stop inflation (see Table 2.1).

After a brief period, however, interest rates on one month deposits were lowered by half to 3.5 per cent in July and 3.0 per cent in October 1950. Consequently, the public reacted by stopping the flow of their savings into the banks and even started to withdraw their deposits (Tsiang, 1980, p. 312) and as a result of these actions total savings and time deposits had fallen to only NT$26 million or 4.5 per cent of the December 1950 money supply. Prices also began to rise and from August until February 1951 they were 65 per cent higher than in July 1950, when cut in interest rates were announced (see Table 2.1).

Taiwanese authorities were quick to realize the effects of the fall in interest rates and the accompanying rise in prices. Consequently, in March 1951 the monthly rate on one month deposits was raised again to 4.2 per cent (equivalent to a yearly rate of 64 per cent). According to Tsiang (1980), "the flow of savings into the banking system then resumed at such a spectacular pace that by the end of March of the next year [1952], total savings and time deposits had already reached NT$271 million, or 31.2 per cent of the contemporary money supply and prices were once more stabilized.", (Tsiang, 1980, p. 312, and see also Table 2.1). At the end of September of 1952,

Table 2.1 Money, Supply, Savings, Time and PIR Deposits, Interest Rates and Wholesale prices 1950-54

End of Period	Money Supply (2)	Savings Time & PIR Deposits (3) (in millions	Col (3) as % of col (2)	Monthly Interest Rates on One-month PIR Deposits	Monthly Rate of Price Inflation During Quarter (%)
1950 March	348	6	1.7	7.00 (effective)	10.3
June	401	28	7.0	7.00 (from March 25)	0.4
September	595	36	6.1	3.50 (from July 1)	6.0
December	584	26	4.5	3.00 (from October 1)	5.4
1951 March	732	30	4.1	4.20 (from March 26)	4.8
June	942	59	6.3	4.20	3.9
September	687	164	23.9	4.20	1.8
December	940	163	17.3	4.20	3.9
1952 March	867	271	31.2	4.20	2.6
June	942	494	52.4	3.80 (from April 29)	-1.0
				3.30 (from June 2)	
September	959	541	56.4	3.00 (from July 7)	-0.4
				2.40 (from September 8)	
December	1,336	467	34.9	2.00 (from November 30)	0.0
1953 March	1,074	499	46.5	2.00	1.5
June	1,198	640	53.4	2.00	1.4
September	1,292	671	51.9	1.50 (from July 16)	1.6
December	1,683	599	35.6	1.20 (from October 10)	0.5
1954 March	1,622	667	41.1	1.20	0.0
June	1,809	747	41.8	1.20	-1.4
September	1,923	782	40.6	1.00 (from July 1)	-0.6
December	2,300	816	35.5	1.00	2.7
1955 March	2,300	816	35.5	1.00	2.7

Source: Tsiang, 1985, p. 18

total savings and time deposits reached NT$541 million or 50.4 per cent of the contemporary money supply.

In addition to the above measures that were believed to curb the excessive inflation, the government also required importers to put up a marginal deposit equivalent to 50% of the amount of foreign exchange they were applying for. This was increased later to 100% in March 1953 and was to continue until June 29, 1964. Originally, the scheme was designed as a foreign exchange control measure, but because of its usefulness in calling a sizeable amount of money supply out of circulation, it became one of the important monetary tools available to the government (Kuo, 1983, p. 288).

The impact of the above various monetary and foreign-exchange policies is vividly seen from the fall in the inflation rate. During the first months of 1949 prices increased 30-fold; immediately after the monetary reform, however, prices increased only three-fold in 1950. Inflation was controlled further after 1951; the annual increase in prices was 8.8 per cent from 1952 to 1960: dropped to 2 per cent in 1961; and between 1962-72 the average inflation rate in Taiwan was 2.9 per cent (Lundberg, 1979, p. 271) which, combined with the high growth rates and price stability is almost unique among LCDs(only Thailand and Japan can compete, see Table 2.2).

Table 2.2. Rates of Inflation(Consumer Price Index) and Money Expansion (M1) for selected Countries (Average Rate Per Annum)

	1952-1961	1962-1972	1973-1975
Taiwan			
Inflation	12.3	2.9	16.1
Money Expansion	23.0	20.9	25.2
S. Korea			
Inflation	33.9	13.6	17.2
Money Expansion	54.2	29.0	34.0
Thailand			
Inflation	3.1	2.3	11.1
Money Expansion	8.4	7.1	14.0
Asian Countries (average)*			
Inflation	3.6	8.2	12.9
Money Expansion	8.1	11.5	16.7
Latin American Countries (average)*			
Inflation	21.4	21.0	48.9
Industrial Countries			
Inflation	1.9	3.7	9.6
Money expansion	4.4	7.5	8.4

Source: Lundberg, 1979, p. 271
* except OPEC and China.

As can be inferred from the preceding pages, Taiwan was able to control inflation through three policy measures: first, by restoring the morale of the inflation-stricken populace through stringent monetary policy; second, by absorption of money supply by manipulation of interest and other measures, and third by the maintenance of a balanced government budget (see Kuo, 1983) . The hyper-inflation that plagued the economy during the period

1949-58 was effectively curbed and one major hurdle in the way of a sustained growth was overcome during this decade. What is remarkable about the Taiwanese economy is that this foundation for rapid economic growth was achieved not through low interest rates and cheap credit policy which were fashionable in the thinking of many development economists, but through prudent monetary and fiscal policies that took market forces as their guiding principle (see Scitovsky, 1985). Needless to say, as the next section indicates, the economic achievements of the easy success cannot be explained solely by prudent monetary and fiscal policies - there was a fundamental shift in policy attitudes as well as actual policies (see Lundberg, 1979, p. 266). However, it cannot be denied that success in killing the rapid inflation of 1951 and the remarkable growth and relative stability achieved during the 1950s created the material basis for liberalization and other policy changes. One of the most important condition for this change in policy was the confidence in the viability of the Taiwanese economy that was built during the 1950s (Tsiang, 1980).

2.2.3 Trade Policies

Apart from the runaway inflation there were many obstacles that could hinder Taiwan from achieving sustained economic growth. The growth of the export sector was dull and as a result the trade balance was

deficit up to 1971, (except for 1965 where a surplus of US$5 million was recorded). During most of this period Taiwan was following the import-substitution strategy of economic development, and the usual policy packages that accompany import-substitution were adhered to. High tariffs and quantitative restrictions were broadly employed and the exchange rate was considerably overvalued. Between 1948 and 1955 the average nominal tariff rate for all imports more than doubled, rising from 20 to nearly 45 per cent (Tao, 1969). As in many developing countries, estimates of effective tariff rates were substantially higher than nominal rates and that protection was greater for non-durable consumer goods than either for intermediate or for capital goods.

After 1951 imports were classified into four broad categories for control purposes: permissible categories include essential capital goods, raw materials and essential consumer goods, all of which were imported within the prescribed quota (see Table 2.3). Imports that fall under the category of controlled and 'suspended' were either completely banned or could only be imported by government agencies. Prohibited imports consisted of items that were thought to be dangerous or luxury items.

As can be learned from Table 2.3, of the approximately 500 items classified into the form import categories in 1953, 55.2 per cent were in the permissible category,

Table 2.3 Evolution of Import Controls in Taiwan

	Permissible		Controlled Imports		Prohibited Imports		Others		Total	
	No. of Items	% of Total	No of Items	% of Total	No of Items	% of Total	No of Items	% of Total	No of Items	%
1953	280	55	185	37	28	6	14	3	507	100
1956	252	48	241	46	25	5	6		524	100
1960	506	54	381	41	33	4	22		942	100
1966	493	52	395	42	36	4	18	2	942	100
1968, 12	5451	58	3770	40	191	2	-	-	9412	100
1970, 7	5612	57	4030	41	190	2	-	-	9832	100
1972, 7	10860	82	2365	18	5	.04	-	-	13236	100
1964, 2	12645	98	293	2	4	.03	-	-	12942	100
1975, 1	12688	98	318	2	4	.03	-	-	13010	100
1976, 6	12846	97	362	3	13	.1	-	-	13211	100
1978, 7	15773	98	375	2	17	.1	-	-	16165	100
1979, 12	15836	98	380	2	17	.1	-	-	16233	100
1980, 12	15818	97	410	3	21	.1	-	-	16249	100
1981, 12	25681	97	833	3	17	.1	-	-	26531	100
1982, 12	25657	97	904	3	17	.1	-	-	26566	100
1983, 12	25664	97	921	4	17	.1	-	-	26602	100
1984, 6	25847	97	749	3	14	.1	-	-	26610	100
1984, 12	25972	97	744	3	14	.1	-	-	26750	100

Source: S C Tsiqng, W L Chen and A Hsieh, "Progress in Trade Liberalization, Taiwan, The Republic of China", Industry of Free China, Vol. 63, No. 6, 1985, p.8.

36.5 per cent in the controlled category, 5.5 per cent in the prohibited category and 2.8 per cent others. As controls become tighter the ratio of permissible items gradually decreased from 55.2 per cent in 1953 to 48.1 per cent, 53.7 per cent and 52.3 percent in 1956, 1960, and 1966 respectively, reflecting a switch from permissible to suspended and controlled. After 1970, however, there was a sharp increase in the share of permissible imports and by the end of 1984 permissible imports constituted 97.1 per cent of total imports.

Table 2.4 indicates the average tariff burden on imports, as measured by the ratio of total tariff revenue to the

Table 2.4. Average Tariff Burden of Taiwan (in NT$ Mill.)

YEAR	Total Tariff Revenue (1)	Total Imports (2)	Tariff Burden (%) (1)/(2)	Total Tariff Revenue %	Total Govern. Revenue
1952	575	2533	22.7		24.3
1953	643	2754	23.3		21.7
1954	1099	3304	33.3		25.3
1955	1201	3146	38.2		23.6
1960	1816	10797	16.8		20.6
1965	3895	22296	16.5		25.6
1970	9840	61110	16.1		26.8
1975	28148	226460	12.4		28.9
1980	68412	711433	9.6		26.2
1981	70997	778633	9.1		22.5
1982	68981	736084	9.4		19.7
1983	67659	813904	8.3		21.2
1984	82145	870861	9.5		21.6

Source: S.C. Tsiang, et al, p. 13 and Taiwan Statistical Data Book, 1985, p. 198.

total value of imports before tariffs. This ratio was

38.2 per cent in 1955, but thereafter declined quite steadily to only 9.4 per cent in 1984. While this ratio is not entirely satisfactory as an indicator of tariff protection, it seems that there has been a substantial decline in tariff protection over the period.

The shift towards liberalization can also be gauged from Table 2.5, which gives the frequency distribution of actual tariffs by placing them in brackets covering 15 per cent intervals from 1-15 per cent to 196-210 per cent. It is clear from this table that during the entire period the 16-30 per cent bracket always had the most tariffs. Over time, only the extreme range of the tariff distribution had been pulled back towards the 16-30 per cent mode. In 1955, for example 7 per cent of the tariffs were higher than 105 per cent; since 1982, however, no tariff has exceeded 105 per cent. In March 1985 the highest tariff rates were reduced to 75 per cent. The average nominal rate was approximately 30 per cent in 1984 and should have come to 27 per cent in 1985.

According to the Tariff Commission Authority's plan the average nominal tariff rate is to be reduced in stages to 20 per cent by 1989. By then, the average import-tariff burden will have fallen to less than 5 per cent, a level comparable to that in OECD countries (see Tsiang, et al, 1985, pp. 14-15).

TAble 2.5 Distribution of Tariff Rates in Taiwan

Tariff	August 1948		January 1955		August 1959		September 1965		August 1973		August 1977		September 1980				March 1985			
													A		B		A		B	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
Bracket		%		%		%		%		%		%		%		%		%		%
Free	10	0.9	13	1.20	22	2.0	31	2.7	129	3.2	164	428	183	5.11	30	1.8	211	5.3	73	3.51
1% - 15%	166	15.8	157	14.73	219	19.89	260	22.77	350	8.77	431	10.59	547	15.26	404	23.77	624	15.5	613	29.50
16%-30%	388	36.95	327	30.68	384	34.88	379	33.19	1110	27.81	1269	31.17	1351	37.70	673		1545	38.4	755	36.33
31%-45%	156	14.86	238	22.33	160	14.53	178	15.59	658	16.46	660	16.21	531	14.82	297		646	16.1	401	19.30
46%-60%	139	13.24	132	12.38	145	13.17	142	12.43	701	17.56	614	15.08	394	11.00	133		530	13.2	144	6.93
61%-75%	36	3.43	38	3.56	26	2.36	23	2.01	252	6.31	391	9.61	312	8.11	124		466	11.6	92	4.43
76%-90%	49		41	3.85	56	5.09	62	5.43	212	5.31	95	2.33	65	1.81	38		-		-	
91%-105%	45		46	4.32	65	5.90	64	5.60	267	6.69	294	7.22	201	5.61	1		-		-	
106%-120%	21		22	2.06	3	0.27	3	0.26	37	0.93	13	0.32	-							
121%-135%	-		-		-		-	-	206	5.16	71	1.74	-							
136%-150%	18		11	1.03	-		-		-		-		-							
151%-165%	-		41	3.85	21	1.91	-	-	69	1.73	69	1.69	-							
166%-180%	-		-		-		-	-					-							
181%-195%	-		-		-		-	-					-							
196%-210%	22	2.1	-		-		-	-					-							

Source: Tsidng, et al, 1985, p. 14.

2.2.3.1 The Structure of Protection in Taiwan

This section provides estimates of the various indicators of incentives including rates of nominal protection, and effective protection . The legal and even the nominal rates of protection are not good measures of protection. The nominal rate of protection is the price difference between the domestic and world markets, expressed as a percentage of the latter. It is, thus, an estimate of the degree to which incentive policies affect the domestic products prices relative to those that would exist under a free trade regime. The nominal rate of protection, however, is not a good measure of the degree of protection afforded to domestic producers when trade allows for intermediate products. This is so because the protection of certain production activities is affected not only by the nominal protection on the product itself, but also by nominal rates on traded inputs. To correct this defect, the concept of effective rate of protection is employed. Unlike the nominal rate of protection which measures the impact of tariffs on the price of a given product, the effective rate of protection measures the impact of tariffs on the industrial activity itself. As such, the effective rate of protection differs from the nominal rate of protection because it takes into account the tariff rates which the domestic producer must pay for his imported inputs as well.

The basic formula normally employed to calculate the

effective tariff rate (or effective rate of protection) is as follows:

$$ERPi = \frac{V_j - V'_j}{V'_j} = \frac{\dfrac{1 - a_{ij}}{1+t_j} - \dfrac{a_{ij}}{1+t_i}}{} - 1$$

where ERPi is the effective tariff rate of industry i, V_j domestic value added in domestic prices, V'_j domestic value added measured at world prices, a_{ij} the value input i per unit of output j, t_j and t_i are nominal tariffs on product i and input j, respectively.

There are two estimates for effective rates of protection for Taiwan - for 1966 and 1969 estimated by different people, consequently they are not strictly comparable. The effective rates of protection afforded to Taiwanese industries, even though reported to be high for Taiwan industries, they are relatively low when compared with other developing countries; but relatively high when compared with developed countries. For instance, average effective rates of protection of 44 per cent for the 44 manufacturing industries for 1966 is lower than any other developing country (for which data was available), except Mexico (Hsing, 1971, p. 244). Estimates made by Lee, et al. (1975) indicates that the weighted average effective rate of protection on all industries (61 industries) by the Balassa and Corden

Table 2.6. Nominal(NRP) and Effective Rate of Protection by Major Industrial Groups, 1969

	NRP		Effective rate of Protection					
			Balassa			Corden		
	D	A	D	E	A	D	E	A
A. Export Industries								
P	-	-	-11.5	-2.5	-8.5	-10.5	-2.3	-7.8
M	15.2	9.0	23.7	-5.4	13.1	14.8	-2.7	0.5
T	10.0	6.1	3.3	-3.8	0.7	2.5	-2.5	-11.5
B. Import-Competing Industries								
P	3.3	3.2	-1.1	-0.6	-0.1	-1.0	-0.5	-1.0
M	24.3	22.9	78.0	-9.7	76.0	23.7	-2.6	22.7
T	13.3	12.7	9.4	-3.0	9.3	6.8	-1.7	6.7
C. Export & Import-Competing Industries								
P	-	-	-3.7	-1.3	-3.3	-3.5	-1.2	-3.1
M	24.2	13.3	38.8	-4.3	23.2	22.0	-7.4	11.4
T	21.0	12.7	29.1	-4.0	18.3	18.2	-2.1	9.7
D. Non-Import Competing Industries								
P	1.7	1.7	-4.8	-0.6	-4.7	-4.1	-0.5	-4.1
M	9.9	9.3	-7.1	-1.4	-6.7	2.2	-0.9	2.0
T	4.7	4.3	-5.2	-1.0	-5.1	-2.7	-0.7	-2.6
E. All Industries								
P	1.9	1.7	-4.8	-2.1	-4.6	-4.3	-1.9	-4.1
M	18.8	12.9	27.9	-4.6	18.4	16.8	-2.3	10.2
T	12.1	9.2	6.4	-3.4	4.3	5.3	-2.2	3.3

Notes: A= average, D= domestic, E= exports, P= primary
M= manufacturing, T= total
Source: Lee *et al*, 1975.

methods were 4.3 per cent and 3.3 per cent respectively, which are quite low even by international standards. For the manufacturing sector, Lee *et al* (1975) estimated an 18.4 per cent by the Balassa method and 10.2 per cent by

the Cordon method, (see Table 2.6).

One of the distinguishing characteristics of an import-substitution regime is the unevenness of incentives given to different types of activities. Needless to say, export industries are discriminated against in relation to import substitute industries.

Hsing (1971) has calculated the import-substitution bias, defined as the ratio of value added at domestic prices to value added at world prices, for 177 manufactured products for 1966. He found that the ratio was predominantly greater than one: with one half greater than or nearly equal to 2, and 15 per cent greater than 3. Hsing also found that for most manufactured products among Taiwan's major exports the ratios were large. Therefore up to 1966 tariff protection in Taiwan had encouraged production of these products for sale on the domestic rather than the world market. Consequently, tariff policy up to 1966 was not very helpful to export promotion. And if tax rebates were removed, the export of most manufactured products would have been extremely difficult.

The fact that the ratio of value added at domestic prices to value added at world prices was greater than one for many commodities may be an indication that tariff policy up to 1966 probably led to a far less than optimal resource allocation (Hsing, 1971, p. 219).

Average nominal protection, effective protection and effective subsidiary rate for six semi-industrial economies (including Taiwan) for primary and manufacturing activities are shown in Table 2.7. As can be shown from Table 2.7, on the average, Taiwan, like her competitors, Singapore and South Korea, gave similar

Table 2.7. Indicators of Incentives in Six Semi-Industrial Countries (%)

	Incentive Rates			Relative Incentives to Domestic and foreign markets Markets		
	P	M	AI	P	M	AI
Argentina (1969)						
nominal prot.	3	70	36	1.2	1.8	1.5
effective prot.	0	112	47	1.2	3.4	1.9
effective subsidy	2	110	47	1.2	2.9	1.9
Colombia (1969)						
nominal prot.	-8	30	3	1.1	1.2	1.2
effective prot.	-10	35	-2	1.1	1.4	1.2
effective sub.	-9	31	-2	1.1	1.2	1.1
Israel (1968)						
nominal prot.	18	42	31	1.1	1.3	1.3
effective prot.	48	76	62	1.3	1.6	1.5
effective sub.	47	76	62	1.5	1.6	1.5
S. Korea (1968)						
nominal prot.	10	16	13	1.1	1.2	1.1
effective prot.	8	13	10	1.2	1.0	1.1
effective sub.	11	8	10	1.1	0.8	1.0
Singapore (1967)						
nominal prot.	3	3	3	1.1	1.1	1.1
effective prot.	9	4	6	1.1	1.1	1.1
effective sub.	12	2	6	1.1	1.1	1.1
Taiwan (1969)						
nominal prot.	6	12	9	1.1	1.2	1.1
effective prot.	0	14	4	1.0	1.3	1.1
effective sub.	-2	13	5	0.9	1.0	0.9

Source: Balassa, 1985.
notes: P=primary, M=manufacturing, and AI=all industries

incentives to export and import substitutes reflecting an outward oriented industrial strategy (see Balassa, 1982). Needless to say, in countries where the inward looking strategy was more pronounced, there was a considerable bias against primary activities as well as exports (see Table 2.7).

Table 2.8 provides yet another way of characterizing the structure of effective protection, this time by end use.

Table 2.8. Effective Protection by End-Use for Selected Developing Countries (%)

Country	Period	Consumer goods	Intermediate goods	Capital goods
Argentina	1969	96	127	162
Brazil	1958	246	65	53
	1967	66	39	52
Colombia	1969	33	15	80
Pakistan	1963/64	883	88	155
	1970/71	277	158	200
S. Korea	1969			
export		-2	9	-9
domestic sales		16	0	56
Thailand		19	25	77
Tunisia		74	29	104
Taiwan	1966	126	48	32
	1969			
exports		-2	-9	-2
domestic sales		33	38	37
average		20	27	28
Mexico		22	34	55

Source: Krueger, 1983 and Balassa, 1982.

Again here the cascading of tariffs is not so conspicuous as in countries such as Argentina, Brazil, Colombia and Pakistan, which to a greater extent followed the inward-looking strategy.

While the 1966 and 1969 effective rates of protection

cannot strictly be compared, there is nevertheless strong evidence to suggest that effective rates as estimated by end-use have fallen in Taiwan over these years. As Kuo remarks, while the most important features of the tariff structure remained unchanged between 1961 and 1971, the nominal rates of protection changed appreciably (Kuo, 1983). The nominal rate of protection for manufacturing (which is measured by a comparison of domestic prices with international prices at commodity level), weighted by domestic sales, dropped from 0.535 in 1961 to 0.395 in 1966 and then to 0.300 in 1971, (see Kuo, p. 303). Effective rates of protection estimated for 1969 seem to indicate that tariff and non-tariff protective measures were redundant to some extent for most of the commodities in the export industries and the export-import-competing industries. Among the 587 commodities for which price comparisons were made, 230 had world market prices that exceeded domestic prices. In addition, among these commodities for which domestic prices exceeded world market prices, the implicit rates of protection of 264 commodities fell below what would be explained from the adjusted tariff rates. That is to say, among commodities for which price comparisons were made, 39 per cent do not enjoy any benefit of tariff protection (see Lee et al, 1975, p. 66). As can be seen from Table 2.9 export prices exceeded domestic prices for many goods.

Table 2.9. Frequency Distribution of the Results of Price Comparisons by Trade Category, 1969

	X	XI	IC	NIC	Total
1. $p^w > p^d$	81	82	32	35	230
2. $p^w > P^d$					
a. ATR>IRP	66	104	61	33	264
b. ART<IRP	16	47	24	6	93
Total	163	233	117	74	587

Notes: X=Exportables, XI = export-import competing IC= import-competing, NIC= non-import competing IRP implicit rate of protection, ART= adjusted tariff rate, p^w= CIF import FOB export prices p^d= domestic ex-factory prices

Source: Lee et al 1975, p. 67.

Thus, from tables 2.9 and 2.10, it seems that many of the industries that were protected appeared to be those in which the country had comparative advantage, and the tariff and non-tariff protection had become partially or completely redundant because of improved production efficiency in a process of successful import-substitution

Table 2.10. Frequency Distribution of the Price Comparison by Primary and Manufactured Goods

	Primary Goods	Manft. Goods	Total
1. $P^w > p^d$	34	196	230
2. $p^w < p^d$			
a) ATR>IRP	2	262	264
b) ATR<IRP	8	85	93
TOTAL	44	543	587

Source: Ibid.

growth (see Lee et al, p. 68). Furthermore, in 1969 unlike 1966 the ratio of value added at domestic prices

to that of value added at world prices was not big for many industries, suggesting that there was more efficient resource allocation in 1969 than in 1966.

2.2.3.2 The Domestic Resource Cost

The effects of the cost of trade-distorting policies can also be assessed by the concept of domestic resource cost. Domestic resource cost concerns itself with the measurement of the total (direct plus indirect) opportunity cost of domestic resources expended to earn (exports) or save (import substitutes) a unit of net additional foreign exchange (see Bruno, 1972, Krueger, 1966).

Domestic resource-cost analysis has many useful applications. The most important is that it explicitly determines ex ante whether or not a given activity has a comparative advantage. If the domestic resource cost of a marginal unit of foreign exchange for a given product is lower than the accounting exchange rate then this product has a comparative advantage (Bruno, 1972). In addition by ranking industries according to domestic resource cost, it is possible to judge the degree of optimality or sub-optimality of resource allocation mong industries. Thus, a traded-goods industry would be considered efficient if it domestic resource cost of earning or saving one local currency unit (i.e. NT$) of foreign NT$. Since DRC of an industry represent the social cost

of producing one NT$ of traded good i or one NT$ of foreign exchange, it would be advantageous for the country or the economy to produce more of the good if DRC of i is less than one and a loss if DRC of i is greater than one. In other words, industry i is efficient if if industry i is earning (or saving) one NT$ of foreign exchange calls for less than one NT$ of domestic resource. On the other hand, industry i is inefficient if earning (or saving) one NT$ of foreign exchange calls for more than one NT$ of domestic resource.

The domestic resource cost for Taiwan industries has been estimated for 1961 and 1971 by Hsu (1981) and for 1969 by Lee et al (1975). As can be learned from Table 2.11, the

Table 2.11. Domestic Resource Cost, 1961

Industry	DRC	Type
Sugar	0.809	x
Canned foods	6.244	x
Textiles	0.997	x
Lumber & plywood	0.430	x
Rubber & rubber products	3.335	m
Chemical fertilizer	0.508	m
Misc. chemicals	1.612	m
Drugs	1.253	m
Petroleum Products	1.685	m
Cement & cement products	0.308	x
Misc. metal products	1.266	m
Machinery & instruments	8.458	m
Electrical machinery & instruments	3.854	m
Transport equipment	1.665	m
Misc. manufactures	1.400	m

Source: Hsu, 1981
note : x= exportable, m=import substitute

DRC for most industries for 1961 is greater than one and

in some cases much greater than one implying that most of these industries were inefficient by the DRC criterion.

Furthermore, during the import-substitution period [up to 1961 which is normally taken as the period in which the shift in policy to have occurred, (see Donges, 1976)], most of the industries that were inefficient were the import substitute industries (M), except the canned food - which was an inefficient export industry. For an export industry like canned food the DRC could well be overestimated as its capital coefficient is exaggerated by the high domestic input prices and relatively low world market price for its output (see Hsu, p. 236). On the other hand, export industries which were discriminated against had to be efficient if they were to compete internationally.

Hsu has also estimated the size of output generated by the two groups of industries. He found that in the export sector efficient industries contributed 45 per cent to total output for 1961 while the corresponding figure for the import-substitute industries was less than 9 per cent. The inefficient export industries share of total output was less than 4 per cent while that of the inefficient import substitutes was almost 44 per cent of total output for 1961 (see Table 2.12). Thus, during the import-substitution era, Taiwan's trade policy favoured inefficient import substitutes and resources were being attracted to these industries at the expense

of export industries.

Table 2.12. Composition of Domestic Products in the Foreign Trade Sector, 1961

	Efficient	Inefficient	Total
Export sector	44.74	3.35	48.9
Import substitution	8.74	43.44	51.91
Total	53.21	46.79	100.00

Source: Hsu (1981), p. 237.

The shift of trade policy from import-substitution to export promotion has resulted in reducing the number of inefficient industries and the divergence between the DRCs of industries. According to Lee et al (1975) out of the 61 industries whose DRC estimated, 25 had their DRC less than one and almost all the remaining industries had their DRC slightly greater than one (see Table 2.13 which is only for the manufacturing sector).

Turning to the estimates of DRC for 1971, we learn that they are much lower than in 1961 and 1969. As can be learned from Table 2.13, except for the miscellaneous metals and products, there was no big divergence between the DRCs of the 39 manufacturing industries. Out of the 39 industries, 30 industries had their domestic resource cost less than one, of which 23 were export industries.

The share of efficient import substitutes in total output in 1971 doubled to 17 per cent and that of efficient export industries increased from 45 per cent to 67 per

Table 2.13. Domestic Resource Cost, 1969 and 1971.

Industry		1969	1971	
1.	Sugar	0.827	0.4717	X
2.	Canned foods	0.953	0.7907	X
3.	Slaughtering of meat	n.a.	0.5208	X
4.	Monosodium Glutamate	1.527	0.6880	M
5.	Non-Alcoholic beverages	1.002	0.3177	X
6.	Tea	1.007	0.9333	X
7.	Miscellaneous food products	0.948	0.6783	X
8.	Artificial fibre	1.512	0.5524	M
9.	Artificial fabrics	1.102	0.7288	X
10.	Cotton fabrics	1.144	0.7466	X
11.	Woollen and worsted fabrics	1.111	0.4714	X
12.	Misc.. fabrics and apparel	1.304	0.8738	X
13.	Lumber	0.956	0.0785	X
14.	Plywood	0.965	0.5252	X
15.	Products of wood, bamboo and rattan	0.979	0.7079	X
16.	Pulp, paper, paper products	1.033	1.1910	M
17.	Leather and leather products	1.009	0.7552	X
18.	Rubber and rubber products	1.202	1.4023	X
19.	Medicine	1.548	1.2281	M
20.	Plastics and products	1.021	0.6979	X
21.	Petroleum products	1.130	0.1846	M
22.	Non-edible vegetable and animal oils	1.311	0.6360	X
23.	Industrial chemicals	1.286	0.7816	M
24.	Miscellaneous chemical manufacturers	1.298	0.7016	M
25.	Cement	0.924	0.4085	X
26.	Glass	1.200	0.5475	X
27.	Iron and steel	1.049	1.4677	M
28.	Iron and steel products	1.238	0.7077	X
29.	Aluminium	1.371	1.2491	M
30.	Aluminium products	0.962	1.0174	X
31.	Misc. metals and products	1.595	19.6622	M
32.	Machinery	1.046	1.889	X
33.	Household electrical appliances	1.222	0.8346	X
34.	Communication equipment	1.174	0.6345	X
35.	Other electrical apparatus	1.115	1.9136	M
36.	Shipbuilding	1.106	0.9493	M
37.	Motor vehicles	1.347	0.9026	M
38.	Other transport equipment	1.454	0.8324	X
39.	Miscellaneous Manufacturers	0.988	0.7001	X

Notes: X = export industry for 1971 only
M = import industry
Source: Hsu, 1983, p. 238 for 1971, and Lee et al for 1969.

cent between 1961 and 1971. Thus, whether by the DRC criterion or by the ERP criterion, Taiwan seemed to have exploited its comparative advantage.

2.2.4 Exchange Rate Policy

Like the trade policy foreign exchange policy during the 1950s was aimed at encouraging domestic production of substitutes for imported goods. In addition to high tariff walls and quantitative restrictions, a complex structure of multiple exchange rates was also used to avoid balance-of-payments difficulties. During this period the government kept the NT$ overvalued and maintained a multiple-exchange rate system that applied lower rates to exports than to imports, and, within imports, lower rates to capital equipment and raw materials. Traditional Taiwanese exports such as sugar and rice received a relatively unfavourable exchange rate (see Table 2.14).

Foreign exchange rates (NT$ per US$) applied to essential raw materials and capital equipment imported by end-users was NT$ 15.65 per US$ in 1953, NT$18.78 per US$ in 1954, NT$ 24.78 in 1955-57 and NT$ 36.38 per US$ in 1958. During these periods, the average market rate per US$ was 26.49 in 1953, NT$ 30.31 in 1954, NT$ 39.84 in 1955 and 38.53 in 1956, NT$ 38.400 in 1957 and NT$ 46.58 in 1958 (see Ho, 1978, p. 193). Apart from the disadvantage of overvaluation, the implementation of a complicated system

Table 2.14. Foreign Exchange Rates on May 1, 1955
(NT$ per US$).

I. Buying Rate:	
Rates for exports	
Exports by government enterprises	
Sugar, rice petroleum and Salt	15.55[a]
Others	20.35[b]
Exports by private enterprises	
Bananas	18.60[c]
Others	20.43[d]
Rates for Inward Remittances	
Government Agencies	15.55
Private	
Paid NT$ for whole amount	21.55[e]
Paid NT$ and certificate	21.65[f]
II. Selling Rate	
Rate for Imports	
Imports by Government and Government Enterprises whose prices are controlled	18.78[g]
Other Import by Government enterprises	24.78[h]
US aid imports	
Basic raw materials and industrial projects	18.78 24.78
Ordinary import under commercial procurement	24.78
Imports by private enterprise	
Raw materials and equipment for end-users	24.78
Others	24.78[i]
Rates for outward remittances	
Gov't agencies' ordinary remittance	14.78
Private ordinary remittances	24.78

Source: Liang and Liang, 1981.

notes: [a] official buying basic exchange rate
[b] $ 15.55(basic exchange rate)+ 80% *$6.00 official price certificate)
[c] $ 15.55+50% * $6(market price certificate)
[d] $ 15.55 +(80% *$6.1)
[e] $ 15.55 + $6.00
[f] $ 15.55 + $6.10
[g] $ 15.65+(official selling rate)+$3.13 (defence charge)
[h] $ 15.65 +$6.0 +$ 3.13
[i] $ 15.65 + $6.1 +$ 3.13

administrative cost. Foreign exchange allocation became selective and discriminatory among various categories of commodities without any economic rationale (see Liang and Liang, 1981). Estimates made by Lin (1973, pp. 50-51) indicate that under the strict foreign exchange and import controls, the premium over duty inclusive import costs of many industrial materials and consumer goods was substantial. For instance, wheat flour commanded a premium of 48 %, soybeans 141 %, cotton gain 33 %, cotton piece goods and poplin 152-163 % woollen wear 350 %, soda ash 275 %, ammonium sulphate 102 % and steel plate 35% cent in 1953.

While the overvalued currency and other restrictive controls had helped output of the manufacturing sector to double during the period 1950 to 1958, there were many adverse effects which in the long run could have had damaging effects on the Taiwanese economy. In the first place, entrepreneurs instead of attempting to minimize cost, diverted their attention to obtaining foreign exchange, and this is reported to have led to the usual corrupt practices prevalent in such a control regime. Liang and Liang are also of the opinion that preferential allocation of overvalued foreign exchange for imported raw materials and capital goods had created excess capacity and unduly highly capital-intensive modes of production. Scott (1979, pp. 315-16) reports that more than two thousand firms were engaged as importers,

although forty or fifty would have been sufficient to handle all the business. There was a loss of economies of scale in trading. Furthermore, inefficient-high cost manufacturing industries were allowed to survive because they were protected from foreign competition by import controls and they were protected from new entrants as the government was reluctant to license additional capacity, since existing capacity was already often excessive. Industrial survey for 1959 indicates that many plants producing simple manufactures were operating at only 23 to 67 percent capacity [and this may have lead to decelerating of the economy during the period 1955-60 where it grew by 6.7 percent against a growth rate of 9.0 percent during the previous period of 1952-55 (see Liang and Liang, 1981)].

These industries while reaping excessive profit did not attempt to control cost and drive out inefficient producers. Instead, as Scott (1979, p. 316) reports, "they formed monopolistic agreements to keep up prices and made little attempt to improve quality and cut costs".

Despite all these control measures, however, imports were not curbed and the country's balance-of-payments difficulty was not solved. To aggravate the problem further, the growth rate of GNP decelerated during the period 1956-60. Taiwan, like many countries that opted for the import-substitution strategy, was able to alter

the import structure by decreasing the imports of consumer goods and stimulating imports of intermediate and capital goods without reducing the total demand for imports. Indeed, during the 1950s imports increased at a faster rate than national income causing the share of imports in total supply (GNP + imports) to increase slightly from 14 per cent in 1951 to 15 per cent in 1961 (Ho, 1978, p. 193-4).

Such restrictive practices had undoubtedly penalized the export sector. It is reported that the overvalued currency and other control measures resulted in sluggish growth rates for the export sector (see Table 2.19). Between 1953 and 1960, food exports, which accounted for a lion's share of Taiwan's exports during this period grew at a meagre rate of only 2 per cent (Ho, 1978, p. 194). Exports of manufactured goods in general showed no advances for the period covering 1953 to 1956. As Ho reports, the most seriously affected export industry was textiles whose index of production (with 1954 = 100), after rising rapidly and steadily from 3 in 1946 to 100 in 1954, was only 105 in 1955 and 99 in 1957 and 109 in 1957 and 106 in 1958.

Thus, in the mid 1950s, with the easy phase of import substitution completed and the export sector depressed (export fell from US$128 million in 1953 to US$96 million in 1954 , it became increasingly difficult to maintain a rapid rate of economic growth. It soon became clear

that a change in policy had to be made either to embark upon the next stage of import substitution of the production of intermediate and capital goods or to dismantle the existing restrictive and discriminating trade practices and embark upon an export-oriented development strategy. Given the smallness of the domestic market and poor natural-resource endowment of the country, it was gradually realized that the possibilities of further import substitution were very much limited, anhat, as
we shall see in subsequent pages, resulted in miracles. We hasten to add, however, that the smallness of the economy was not the primary reason for change in strategy, but as Myint rightly argues, a deliberate policy choice. And this early shifts from the first phase of import-substitution to export promotion is one of the distinguishing characteristics of Taiwan's industrialization strategy.

2.2.4.1 Export-Promotion Policies

After the awareness that the future of Taiwan's economic development did not depend on inward-looking strategy, Taiwanese authorities soon realized that the distorted commodity and foreign-exchange prices were not conducive to the export-promotion drive. And to redress such distortions, between 1958 and 1963 the government of Taiwan initiated numerous reforms and new programmes to stimulate industrialization and exports. Chief among

these was the 19-point economic programme of 1960 (see Lin, 1973). Broadly speaking, this programme committed the government to reform the foreign-exchange and trade regimes with the view to liberalizing the trade controls. Gradually, over a period of seven years, the NT$ was devaluated and the multiple-exchange rate system dismantled, thereby ending the most discriminatory aspect of Taiwan's import-substitution strategy.

The biggest step towards liberalization was taken in 1958 when the government devalued the NT$ from NT$ 15.55 (to 1 US$) to NT$24.78 (selling). To rekindle export expansion further, private exporters would be awarded exchange-surrender certificates representing the full amount instead of 50 or 80 per cent of the exchange proceeds surrendered to the Bank of Taiwan. Prior to that introduction of the liberalization programme, exporters and importers enjoyed different effective exchange rates for their foreign exchange transactions. The effective rate applicable to private exporters was the basic buying rate of the Bank of Taiwan plus 50 per cent or 80 per cent of the prevailing market price of exchange-surrender certificates (per US dollar), which varied from NT$6.10 in 1955 to NT$16.80 in 1957 (see Table 2.14). Effective rates for private importers was the sum of basic selling rate, a defence surcharge (20 per cent of the basic selling rate), the current market price of the exchange surrender certificate and the market price of the import licence for the relevant category of imports (see Tsiang

et al, p. 3).

Parallel with the liberalization of the foreign exchange market, quota restrictions on all types of permissible imports were boldly removed, although, as we have seen in the previous pages, what were classified as controlled on prohibited imports were still restricted or explicitly forbidden (see Table 2.3). To end discrimination among commodities, it was also (November 1950) decided that sugar, salt and rice, the special products of Taiwan, were to be treated in the same way as all other exports. In addition, the requirement to present corresponding amounts of exchange certificates when applying for foreign exchange (which had been required for certain specified groups of essential imports, such as certain types of machinery, fertilizer, crude oil, cotton, soya beans, and wheat) was also abolished (see Tsiang et al, (1985). These measures according to Tsiang et al, "... spelled out the end of the complicated multiple-exchange-rate system and the rate of exchange was to all intents and purposes unified. It eliminated in one stroke the different implicit tariff rate on imports implied by the gaps between different effective rates of exchange for different imports" (Liang et al, p. 4). Furthermore, in order to comply with the regulations of the International Monetary Fund, the Bank of Taiwan in August 1959, stopped the practice of separating the effective rate into the two components of the basic rate and the market price of

exchange certificates, and declared that the latter was to be regarded as the exchange rate of the New Taiwan dollar (NT$). In 1960 the market price of the exchange certificate was allowed to creep up to NT$40.00 to US$1.00 (see Tsiang et al, p. 4).

Apart from the above measures the government also reduced the level of protection on a large number of durable consumer goods and relied increasingly on tariffs rather than quotas to restrict imports.

In order to promote the sluggish export sector, the government introduced a number of policy packages. Loans to exporters were extended at low preferential rates. In addition, tax rebates were given to exporters that included over 6000 exportable items. Tax rebates which stood at NT$39.3 million in 1956 rose to NT$2,320 million in 1967. As can be seen from Table 2.15 the reduction of taxes as a result of Status for Encouragement of Investment and the tax and duty rebates for exportation to a large proportion of levies, the largest income tax reduction being 25.2 per cent and 23.4 per cent for 1963 and 1967 respectively (see Kuo and Fei, 1985, p. 52). The liberalization of the trade regime also means that exporters can buy their inputs at new world market prices.

There were many other export-promotion schemes undertaken by the government. For instance, exporters were allowed to retain foreign exchange loaned for the importation of

Table 2.15. Tax Reduction and Rebates for Exports
(as percent of corresponding tax)

Fiscal Year	Income Tax	Stamp Tax	Custom Duties	Commodity Tax	Total Rebate of the four Taxes
1955			2.3	0.2	1.5
1956			4.2	0.3	2.6
1957			2.9	3.0	2.9
1958			6.6	2.8	5.1
1960			13.5	8.5	11.5
1961	2.4	25.3	14.5	12.5	11.9
1962	21.5	37.6	20.3	24.3	23.2
1963	25.2	16.5	21.6	13.0	19.0
1964	17.3	20.3	38.8	18.0	26.4
1965	17.2	20.3	31.0	21.2	24.5
1966	21.4	51.1	32.6	20.1	28.1
1967	23.4	49.7	40.5	22.0	32.2
1968	19.0	48.2	39.2	23.0	31.1
1969	14.6	45.4	36.2	18.7	26.6
1970	15.1	52.2	49.2	25.1	34.1
1972	14.9	60.0	86.1	37.3	52.4
1975	12.2	51.8	54.6	37.7	38.2
1981	9.7	17.8	39.2	5.7	18.7

Source: Kuo and Fei (1985), p. 52.

raw materials and machinery without having to go through the cumbersome and costly procedure of application for foreign exchange. They had also the privilege of selling the loaned foreign exchange to other importers.

The government also encouraged the formation of cartels for the purpose of controlling quality, production and export by means of export quotas and unified quotation of export prices. Government and semi-government agents have also assisted exporters in quality inspection, managerial, technical and trade-consultancy services, market research and participation in international trade fairs. In 1970 the China External Trade Development Council was found to promote exports and conduct market

research. This organization draws its finance from a levy of 0.0625 per cent of exporters revenue as United Funds for Promotion and Extension of Exports. (The rate was reduced to 0.04 per cent during the period July 1974 to August 1975 due to decline in world trade, see Liang and Liang, p. 165).

In order to attract foreign investment and primarily to reduce government administration difficulties, the Taiwan government has created tax-and-duty-free processing zones since 1965.

These and the measures taken to unify and stabilize the exchange rate, coupled with the liberalization of the trade regime, have helped exporters to become efficient and assured them of earnings free from exchange uncertainties. Table 2.16 shows the purchasing-power-parity effective exchange rate on exports. Liang and Liang define this rate as "the official exchange rate of NT$ per US dollar of exports, adjusted for change in export incentives, in wholesale prices in Taiwan and abroad and the exchange rate of Taiwan's major trading partners" (p. 160). As can be seen from Table 2.16 the policy measures taken to rekindle the export section such as devaluation, general incentives for exports, the unification of the exchange rate and price stability have maintained the purchasing-power-parity-effective exchange rate at a fairly stable rate.

Table 2.16. Purchasing-Power-Effective-Exchange Rate on Exports, 1956:1978

Year	1956	1957	1958	1959	1960	1961
	34.24	34.37	43.69	46.77	42.13	40.79
Year	1962	1963	1964	1965	1966	1967
	39.91	37.87	38.07	40.76	41.31	40.84
Year	1968	1969	1970	1971	1972	1973
	40.67	42.26	43.80	45.75	46.78	43.08
Year	1974	1975	1976	1977	1978	
	35.28	40.77	40.70	42.24	42.69	

Source: Liang and Liang (1981), p. 158-9.

2.3 Export Oriented Industrialization and Growth

2.3.1 Growth and Structural Change

Following the shift in industrial strategy from import substitution to export promotion, Taiwan attained a remarkable rate of economic growth when compared with the previous years in which the strategy of import substitution was emphasized. As can be shown from Table 2.17, real GNP grew at an average rate of 7.5 per cent between 1953-1962, 10.8 per cent between 1963-1972 and 8.2 per cent between 1973-1984, and for the period covering 1952-1987, the real average annual growth rate of GDP was 8.81 percent. As a result of this phenomenal growth rate the the national income of Taiwan, which stood at NT$150,026 million in 1952 rose to NT$2,517000 million in 1986 (at 1981 prices, see Table 2.17).

Table 2.17. Gross National Product of Taiwan, 1952-1986 (at constant 1981 prices)

Year	Amount in NT$ billion	Growth Rate (%)	Index 1952=100	Index 1981=100
1952	150	13.0	100	8.6
1953	165	9.8	110	9.5
1954	178	8.1	119	10.2
1955	193	8.6	129	11.1
1956	202	4.5	134	11.6
1957	217	7.4	145	12.5
1958	232	6.9	154	13.3
1959	249	7.4	166	14.3
1960	264	6.1	176	15.2
1961	282	6.7	188	16.2
1962	307	9.0	205	17.7
1963	344	12.0	229	19.8
1964	391	13.8	261	22.5
1965	421	7.6	281	24.2
1966	461	9.5	307	26.5
1967	512	11.1	341	29.4
1968	562	9.7	374	32.3
1969	623	10.8	415	35.8
1970	691	12.2	466	40.1
1971	789	13.0	526	45.4
1972	898	13.8	599	51.6
1973	1006	12.0	670	57.2
1974	981	-2.4	655	56.4
1975	1023	4.2	682	58.8
1976	1192	16.6	795	68.5
1977	1308	9.7	872	75.2
1978	1465	12.0	976	84.2
1979	1584	8.1	1056	91.0
1980	1650	4.2	1110	94.8
1981	1740	5.4	1160	100.0
1982	1810	4.0	1206	104.0
1983	1967	8.6	1311	113.0
1984	2190	11.4	1460	125.9
1985	2253	5.1	1502	129.5
1986	2517	11.6	1670	144.7

Source: DGBAS, Taiwan Statistical Data Book, 1985. and Quarterly National Income, vol. 40, 1988.

The rapid acceleration of the rate of economic growth in Taiwan was mainly led by the manufacturing sector. The manufacturing sector alone grew at an average annual growth rate of 14.5 percent between 1962-65, 18.0 percent between 1966-70, 11.6 percent between 1971-1975,

13.8 percent between 1976-80, and 7.9 between 1981-86.

Over the past three decades, the Taiwanese economy has undergone some drastic changes. Agriculture which accounted for 32.4 per cent of national income in 1952 declined to 5.6 per cent in 1986. On the other hand, the share of the manufacturing sector increased from 15.6 per cent of GNP in 1952 to 42.9 % in 1986 (see Table 2.18).

Table 2.18. Composition of GNP by Industrial Origin (%)

Period	Agri.	Mining	Manuf.	Cons.	Others	Total
1952	32.4	2.1	15.6	3.9	44.0	100.0
1960	28.7	2.3	21.7	3.7	43.6	100.0
1970	15.5	1.4	33.5	3.9	45.7	100.0
1980	7.8	1.0	41.5	6.4	43.3	100.0
1986	5.6	0.5	42.9	4.0	47.0	100.0

Source: DGBAS, Year Book Of Statistics, 1987.

The shift in industrialization strategy from import substitution to export promotion is evidenced by the growth of the export sector (see Table 2.19). Commodity exports which averaged US$117 in 1952 increased very rapidly in the sixties and seventies, particularly after 1962 (see Table 2.19). As a result of this unprecedented rise in exports, the share of exports in GNP increased from a bare minimum of 8.5 per cent in 1952 to 54.8 per cent in 1986 and the share of Taiwan's export trade in total world exports increased from 0.8 percent in 1972 to 2.0 percent in 1986.

Table 2.19. Average Annual Rate of Growth of GDP, Exports and Imports (%) (in Constant Prices)

Period	GDP	Exports	Imports
1952-55	9.7	3.8	6.5
1956-60	6.7	11.9	10.8
1961-65	9.5	21.6	14.4
1966-70	9.8	22.7	20.3
1971-75	9.0	15.9	14.5
1976-80	10.5	16.7	13.9
1981-86	7.3	12.0	6.0

Source: DGBAS, Statistical Year-book of ROC, 1987, p. 98.

As is shown in Table 2.20 the rapid growth in exports was also accompanied by a substantial change in the composition of exports. In the early fifties and sixties, the bulk of Taiwan's exports consisted of

Table 2.20 Composition of Exports for Selected Years(in US$ million)

Period	Total (1)	Agricultural Unprocessed amount (2)	Agricultural Unprocessed % (3)	Agricultural Processed Amount (4)	Agricultural Processed % (5)	Industrial Amount (6)	Industrial % (7)
1952	117	26	22	81	70	10	8
1960	164	20	12	91	56	53	32
1970	1461	127	9	190	13	1165	79
1980	19811	712	5	1109	7	17990	88
1984	30456	475	2	1384	4	28598	94
1986	39789	574	1	2027	5	37188	94

Source: DGBAS, Statistical Year-book of ROC, 1987.

agricultural and processed agricultural products. For instance, in 1952 agricultural and processed agricultural products accounted for 92 per cent of total exports, while industrial products accounted for only 8 per cent

of total exports. By 1986 the trend was completely reversed with industrial products accounting for 94 per cent and agricultural and processed agricultural products accounting for the balance.

The transformation of the Taiwanese export structure is shown in greater detail in Table 2.21. The the largest drop occurred in the export share of sugar, from 59 per cent of the total in 1952 to less than 0.1 per cent in 1984. Similarly, the share of rice dropped from 15.3 per cent in 1952 to only 0.14 per cent in 1984.

During the sixties, Taiwan's major exports were relatively simple manufactured goods. Textiles were the single most important export item followed by plywood and wood products and canned food. In the seventies, however, electrical machinery and apparatus, and metal manufacturers gained prominence. Exports of electrical machinery and apparatus, which were almost negligible up to the early 1960s assumed second place (after textiles) after 1968. In 1984, exports of electrical machinery and apparatus were leading even the textile industry. In 1960 textiles accounted for 14 per cent of total merchandise exports while the share of electrical machinery and apparatus amounted only to 0.6 per cent. In 1984, however, the share of textiles increased to only 20 per cent while that of electrical machinery and apparatus surged to 22 per cent of the total merchandise export in

Table 2.21. Composition of Major Taiwanese Exports

1956-1981 (%)

	1956	1961	1966	1971	1976	1981
I. Food, beverages & tobacco	48.7	13.5	11.1	0.7	0.2	0.2
Food	48.5	11.0	10.1	0.5	0.1	0.2
Beverages	0.2	0.2	0.1	-	-	-
Tobacco	-	2.3	0.9	0.2	0.1	-
II. Non-durable consumer goods	14.2	36.3	37.0	58.0	58.0	50.5
Textiles	9.4	28.1	19.9	14.6	14.0	10.1
clothing & footwear	3.9	5.8	9.6	27.0	25.7	21.4
Furniture	-	-	0.1	0.5	1.3	2.0
Printing & publi.	-	-	0.2	0.1	0.1	0.1
Misc. mfr.	0.9	2.2	7.2	15.8	16.9	16.9
III. Intermediate goods	26.3	36.3	29.6	14.1	12.3	13.1
Wood prod.	1.1	8.4	12.5	7.9	5.3	3.9
Paper & products	0.5	3.4	2.1	0.4	0.6	0.6
Leather & products	-	0.1	0.1	0.7	0.2	0.5
Rubber	-	0.5	0.6	0.5	1.6	2.2
Chemicals	20.6	12.7	6.0	2.3	2.4	2.7
Petro. & coal	4.1	5.5	1.1	0.5	1.6	2.2
Non-metalic	-	5.7	7.2	1.8	1.4	2.3
IV. Metal & machinery	10.8	14.1	22.3	27.2	29.5	36.2
Metals	2.8	1.3	3.0	2.5	3.4	5.0
Basic meta.	7.7	10.0	6.6	3.3	1.7	2.4
Non-elect.	0.3	0.9	4.0	4.1	4.7	5.1
Electrical	-	1.7	8.1	15.9	17.7	19.6
Trans. Equi.	-	0.2	0.6	1.4	2.7	4.1
V. TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

Source: Hou, 1985, p. 147.

1984. This phenomenal structural change in exports can also be seen from the share of other manufacturing goods. During the last three decades, the share of plastic products, chemicals, basic metals, machinery and metal

manufacturers increased tremendously. The export of plastic products was nil until 1971; during 1984 however, plastic articles constituted 7.9 per cent of merchandise exports.

While there was significant structural change in the composition of exports, diversification of export markets was not fundamental. The proportion of exports going to Japan has declined from 53 per cent in 1952 to 11.4 per cent in 1986. However, this decline in Japan's share was largely replaced by the US whose share in Taiwan's exports increased from 4 per cent in 1952 to around 48 per cent in 1986. Thus, the combined share of Japan and the US did not change: in fact, their combined shares increased slightly from 56 per cent in 1952 to 59 per cent in 1986. This contrasts with the South Korea case where about 65 per cent of Korea's exports were destined for either the US or Japan in 1962, but by 1978 this figure was reduced to 53 per cent (Kim, 1985, p. 63). The corresponding figures for Taiwan were 48.3 per cent and 57.9 per cent respectively.

During the period of rapid export expansion the growth rate of commodity imports were also substantial. Merchandise imports which accounted for 14.8 per cent of GNP in 1952, rose sharply to 33.3 per cent in 1984. (Though the ratio declined conatantly since 1980 from around 49.4 percent). Imports in value terms increased from US$187 million in 1952 to US$24,165 million in 1986

(see Table 2.22). However, changes in the composition of imports were not so conspicuous as that of exports. The share of agricultural and industrial raw materials in total imports rose from 66 per cent in 1952 to only 64

Table 2.22 Composition of Imports for Selected Years(in US$ million)

Period	Total amount (1)	Agricultural &Industrial Raw Mater. amount (2)	% (3)	Capital Equip. amount (4)	% (5)	Consumer Goods amount (6)	% (7)
1952	187	123	66	27	14	37	20
1960	297	180	64	83	28	24	8
1970	1524	958	63	958	32	74	5
1980	19733	13968	71	4623	23	1142	6
1984	21959	15115	69	5207	24	1637	7
1986	24165	15582	64	6497	27	2085	9

Source: DGBAS, Statistical Year-book of ROC, 1987.

per cent in 1986. Similarly, the share of capital goods imports increased from 14 per cent in 1952 to 27 per cent in 1986 (see Table 2.22).

Although commodity exports increased more rapidly than commodity imports throughout the period covering 1952-1986, the trade balance was negative for almost two decades (1952-1970); it improved substantially only during the seventies. However, during the oil crisis 1974-1976, the trade balance was again in deficit. Since 1979, however, again the balance was positive.

2.3.2 Savings and Investment in Taiwan

One of the most dramatic phenomena accompanying Taiwan's industrialization strategy is the ability of the economy to mobilize savings probably unprecedented in developed and developing countries. As can be learned from Table 2.23, within a few decades Taiwan has succeeded in changing from a "country with very low propensity to save into a country with a remarkably high savings propensity" (Tsiang, 1980, p. 343).

In 1952 the percentage of national income saved was only 5.2 per cent. In 1963 the corresponding figure which

Table 2.23. Savings as Percentage of Income or GDP in Taiwan and other selected countries.

Country	Period 1952	1960	1970	1980	1984
Japan	24.1	27.7	30.5	21.2	19.4
Singapore	-2.6	18.4	29.6	n.a	n.a
S. Korea	n.a	-4.8	13.2	13.3	14.3
UK	6.4	10.9	13.6	7.4	5.5
USA	10.4	8.6	7.6	5.6	2.4
Taiwan	5.2	7.6	23.8	32.9	27.7

Source: DGBAS, Statistical Year-book of ROC, 1987. and Statistical Data Book, 1984

stood at 13.2 per cent surpassed that of the United Kingdom (9.8 per cent) and the United States (8.4 per cent). By 1972 net savings as a percentage of national income had risen to an outstanding level of 31.6 per cent which was higher than Japan (28.0 per cent) and leaving behind both developed and developing countries (see Table

2.23).

This high propensity to save coupled with a moderate inflow of foreign capital has enabled Taiwan to invest a high proportion of the national product. Table 2.24 indicates that, like the saving rate, gross capital formation as a percentage of gross national expenditure has been very high even by international standards. In 1952 the share of gross domestic investment as a percentage national expenditure was only 14.4 per cent but by 1974 it had risen to 36.6 per cent. Though this share fell after 1974, it has never since been below 26.6 per cent and has remained higher than the corresponding figure for many developed and developing countries.

What made Taiwan a strong success in this aspect as in many other aspects of economic growth is very interesting. Savings is at the heart of economic development and how Taiwan managed to break the savings bottleneck can provide some very useful lessons for other developing countries.

Many students of the Taiwanese economy attribute the phenomenal saving rate to the change of industrialization strategy from import substitution to export promotion. Balassa (1982) argues that there is a correlation between the savings rate and exports ; countries that export a greater amount of their national income tend to generate more savings. Indeed, regression analysis not reported

here indicates that in the case of Taiwan there is high and significant correlation between the rate of savings and export earnings .

Table 2.24. Gross Fixed Capital Formation as Percentage of National Expenditure in Taiwan and Other Selected Countries

Country	Period				
	1952	1960	1970	1980	1984
Japan	27.8	34.2	39.8	32.4	30.6
S. Korea	n.a	n.a	n.a	28.2	25.0
UK	13.2	17.3	19.7	16.4	15.4
USA	17.1	17.7	17.5	18.0	16.0
Taiwan	14.4	18.6	26.0	33.9	26.6

Source: Tsiang, 1980 and DGBAS, 1987.

As we have seen in previous pages, the financial and fiscal policies that accompanied the liberalization drive were to a great extent responsible for the above phenomenon. Unlike many developing countries Taiwan set interest rates on savings and time deposits at fairly attractive rates. To encourage savings, individuals were exempted from paying income taxes on interest earned from saving and time deposits. Similarly, corporations were also exempted from income tax on profits ploughed back as investment. Furthermore, as the Taiwanese economy took off into spectacular growth during the sixties, voluntary savings got a very big boost "for with a rapidly growing gross national product and per capita income, savings became relatively effortless because of the ratchet effect in consumption, which enables domestic savings to

grow like a snowball", (Tsiang, 1980, p. 344).

While the above factors may be a prerequisite for a high savings rate, numerous studies carried out in regard to the Taiwanese savings function cast some doubts on the conventional explanation of the determinants of savings. For instance, according to Sun and Liang (1981) no one alone of the conventional factors that are thought to determine the savings function, such as levels of income, the growth rate of income, income distribution, interest rates and inflation, although they all have substantially significant effects on savings, could provide a satisfactory explanation for the high savings rate. To Sun and Liang, the most important factors were the role of the government, the relatively underdeveloped social security system and frugality stemming from Chinese culture and tradition.

Table 2.25 lists the percentages of total savings attributed to household and non-profit institutions; private corporations; and government and public corporations. As shown from the table, government and public corporations' savings accounted for a large share of total savings, almost always above 30 per cent. Thus, as Table 2.26 shows, this is high even by international standards. However, as Sun and Liang(1982) themselves admit, government saving cannot be regarded as the only explanation for the phenomenon. First, private savings (defined as total savings minus government savings),

Table 2.25. Distribution of Savings by Sector (average %)

Period	Household & Non-Profit Corp.	Private Corp.	Gov't & Pub. Corp.
1953-55	25.3	14.6	60.2
1956-60	37.6	10.4	52.0
1961-65	61.4	9.8	28.8
1966-70	57.5	9.6	32.8
1971-75	56.9	8.4	34.7
1976-79	49.9	8.4	41.7

Source: Sun and Liang, 1981, p. 414.

which stood at 19.5 per cent (average for 1970-78) of national income, is still high by international standards. Secondly, as Singh (1975) found out, there is high substitutability between private and government saving; the coefficient between the two being 0.57. Hence, the more the government saves by fiscal means, the less would be the share of the private sector. Thus, as Chow (1981) remarks, though government saving is very high in the case of Taiwan, it cannot be a major determinant of the savings function.

Sung and Liang (1982) have also argued that the lack of a well developed social security system is a very important factor accounting for the high level of savings in Taiwan. Indeed, in their empirical work, they found that an increase of 1 per cent in the ratio of government expenditure on social security benefits and public health to gross national products, will reduce the savings rate

by more than 4 per cent. Sun and Liang also found that the exceptionally high rate of savings in Taiwan is as a

Table 2.26. Distribution of Savings by Sector for Selected Countries (average for 1970-78)

Country	Household & Non-Profit	Private Corp. Corp.	Gov't & Pub. Corp.
Austria	60.6	13.1	26.3
Belgium	89.3	11.0	-0.3
Canada	55.6	43.7	13.9
France	73.3	7.5	19.0
W. Germany	64.7	13.3	22.1
Honduras	29.1	41.7	29.2
Japan	71.8	8.6	19.7
S. Korea	40.8	20.6	34.9
Malta	62.1	30.6	7.3
Netherlands	61.0	15.1	24.3
Philippines	62.7	15.6	21.6
S. Africa	54.5	26.0	21.8
UK	80.7	19.2	0.2
USA	90.8	23.5	-13.7

Source: Sun and Liang, 1981, p. 415.

result of the Chinese people's being relatively more diligent, industrious and frugal by international standards. To support their claim they found that, contrary to other studies on other countries, a high dependency rate does not depress savings (see Leff, 1969). In the case of Taiwan, Sun and Liang showed that the coefficient of the variable representing the proportion of the population under 14 years when regressed against the saving rate was positive, highly significant, and quite large. This implies that the more dependents there are, the higher the level of savings.

Sun and Liang (1981) and Liang (1983) provide a number of plausible explanations as to why there is a positive relationship between dependency ratios and saving rates in the case of Taiwan. Frugality of the Chinese people is prominent in their list of explanations. True, the tradition appreciates thrift but such praise for thrift can also be found in other societies. However, while such behaviour can be found in other societies, Sun and Liang are of the opinion that in the case of Taiwan it is universal.

While the above factors may be deficient in explaining the phenomenal rise in savings rate during the last three decades, it cannot be denied that without the unprecedented rise in national income these savings and investment rates would not have been possible. Furthermore, the size of savings in itself is not enough. The size as well as the model of utilization of the economic surplus is one of the determining factors of economic development (see Baran, 1957). Furthermore, as Galenson (1981) rightly remarks higher investment does not necessarily lead to high growth rates. Thailand and the Philippines, for example, invested comparable proportions of their domestic products without achieving Taiwan's growth rates. "Indeed, high investment can be frustrated by erroneous policies in other respects. But a sufficient level of investment is a sine quo non for a country that has rapid economic growth as its goal"

(Galenson, 1981, p. 71).

2.3.3 The Role of Land Reform

It is often alleged that the battle for economic growth for many developing countries could be won or lost depending on what happens to the agricultural sector (Myrdal, 1957). Despite this recognized fact however, agriculture in many developing countries has been treated as a stepchild in the development process.

One of the distinguishing characteristics of Taiwan's industrialization strategy is the recognition that agriculture is the basis on which the country depends for its economic progress. Historically, Taiwan's agricultural sector was more advanced than that of many countries. Japan's agricultural administration was able to transform Taiwan's agriculture into a major source of food supply to help Japan's industrialization drive (see Amsden, 1985; and Grabowski, 1988). As Thornbecke(1979) rightly remarks, the fact that output growth was not constrained by domestic demand is an important element in understanding the agricultural development process in Taiwan's industrialization drive.

This well developed colonial agriculture was further enhanced by the nationalist government. First and most important of all, a land reform program was carried our in three steps. In 1949 the government of Taiwan

limited farm rents to a maximum of 37.5 percent of the produce of the annual yield of the major crops. This was followed in 1959 by the sale of public land to tenants. The most dramatic feature, as Ho (1978) calls it, however, was the land reform of 1953. Under this programme, land owned by landlords in excess of 2.9 hectares of medium-quality paddy field or its equivalent was to be compulsorily purchased by the government and redistributed.

The rent reduction programme benefited more than 40 per cent of Taiwan's farm households, or more than 70 per cent of the tenant and part-time farm households (Ho, 1978, p. 163). In addition, the land reform programme decreased the share of tenant farm households to total farm households from 41 per cent in 1947 to 21 per cent in 1953, and 10 per cent in 1970. Owner-cultivation households as a percentage of total farm households were 32 per cent in 1947, 55 per cent in 1953, and 78 per cent in 1970. (Ho, 1978, p. 164).

Taiwan's agricultural policy not only helped to redistribute income from the rich to the poor but had a direct bearing also on the economic development of the country. Taiwan's agricultural policy, unlike that of many countries, appears to have achieved both high growth and better distribution of income. During the early stages of industrial growth, overall economic growth was very much helped by the growth of the agricultural

sector. This is evidenced from Table 2.27.

Table 2.27. Comparative Growth rates: Agriculture vs GDP

	Growth rate of GDP	Growth rate of of Agricultural GDP
1946/48 - 1951/53	13.2	9.1
1951/53 - 1964/67	7.7	5.7
1964/67 - 1971/73	10.1	2.4
1976-80	10.5	2.7
1981-86	6.8	0.6

Source: Thorbecke (1979), p. 139 and DGBAS, 1987.

Taiwan's agriculture has transferred human and material surplus to the modern sector, but unlike many less developed countries Taiwan has not forced these transfers upon the agricultural sector. They were part of the 'natural' reaction to the development process. The transfer of resources from agriculture to industry was to a large extent accomplished by a deliberate government policy that fostered agriculture to accomplish this mission (see Grabowski, 1988). "Developing agriculture by virtue of industry and fostering industry by virtue of agriculture", was the official slogan of the government. Unlike many developing countries, Taiwan rather than only extracting surplus from agriculture, adopted a balanced strategy of joint agricultural and industrial growth (see Ho, 1979, p. 105).

Taiwan's agricultural strategy is unimodal (see Thornbecke, 1979, p. 198). The main feature of this strategy is to develop agriculture from the "bottom up".

This approach to agricultural development "relies on the widespread application of labour-intensive technology to the whole of agriculture. Through a combination of agricultural research, land redistribution, the provision of rural infrastructure, the growth of rural institutions, and other measures, agricultural development is spread relatively evenly over the mass of the people" (Thorbecke, 1979, p. 199).

It is argued by many agricultural economists that in such a type of strategy there is no conflict between output growth and distributional objectives (see Johnson and Kilby, 1975, and Thorbecke and Dambe, 1974). Indeed, the experience of Taiwan seems to suggest that such a strategy is superior to the other strategies of agricultural development (for the other alternative strategies, see Pyatt and Thorbecke (1979). In terms of growth, employment and income distribution Taiwan's agricultural progress has been exemplary. (See Kuo Fei and Ranis, 1981 and Thorbecke, 1979).

Since the introduction of land reform, income distribution among farm families has become even more, full employment had been reached in the sense that the labour slack and seasonal underemployment had been replaced by a labour shortage (see Thorbecke, 1979). Secondly, unlike many countries not only has Taiwan succeeded in becoming self-sufficient in food production but also food exports were the major export item until

the early sixties.

Assessing the impact of agricultural strategy on the economic development of Taiwan is beyond the scope of this thesis. Nevertheless, we shall attempt to pin-point some of the important lessons that can be learned from the experience of Taiwan.

Land reform has been a major factor in Taiwan's agricultural development, but the mere possession of land may not be enough. First, it should be recognized that rural development through peasant agriculture is a viable strategy and agriculture is the backbone of industrial strategy. In many developing countries, agriculture, despite its importance in the national economy, has been neglected for too long. For instance, in Ethiopia (prior to the revolution of 1974) the agricultural sector had always received less than 5 per cent of the national budget despite the fact that more than 90 per cent of the Ethiopian people depend on it. By contrast, in Taiwan there was a massive investment in agriculture (see Thorbecke, 1979), both from the government of Taiwan and from the US aid mission.

The land reform process in Taiwan was followed by a set of complementary policy measures that were primarily aimed at strengthening, not undermining, peasant agriculture. The provision of credit, extension services and strong organizational support in strengthening farmers' associations were at the heart of the

agricultural strategy. Of course, such services do exist in many developing countries. However, evidence indicates that in some other countries such provisions had in fact led to worsening of the plight of many farmers. The credit and other provisions were appropriated by big landlords and since these landlords saw the benefit of these facilities many tenants were evicted. This is particularly true of the Ethiopian situation prior to the Revolution of 1974.

Agricultural strategy that does not recognize the underlying resource endowment of a country can face many problems. In many countries, before labour becomes a binding constraint, agricultural technology has become capital-intensive; consequently, new agricultural inputs, instead of augmenting labour, have supplanted it. Thorbecke (1979), in his careful assessment of the transferability of the Taiwanese experience to other developing countries, remarks that Taiwan' agricultural strategy, in contrast to that of many less developed countries, was based on utilization of the abundant factor, labour.

The most important lesson to be learned from Taiwan's development strategy concerning the agricultural sector is the process by which capital resources were transferred from the agricultural to the industrial sector. Throughout its history, Taiwan's agricultural sector received gross resources from nonagriculture in a

variety of ways that by increasing its productivity allowed it to provide a net transfer to the rest of the economy. Therefore an essential lesson many developing countries can learn from the Taiwan experience is that "the goose cannot be starved before it has laid a golden egg" (Thorbecke, 1979, p. 203). In the case of Taiwan, although agriculture was squeezed by fulfilling its mission of supplying initial domestic capital for industry as well as critical foreign exchange through exports of agricultural products, it was not absolutely disadvantages as is the case with many less developed countries (see Grabowski, 1988).

2.3.4 Growth and Equity

Economic growth in Taiwan in contrast to what has happened in many less developed countries was accompanied by a high degree of equality in income distribution and rapid expansion in employment. It is therefore important to glean over the experience of Taiwan in order to learn why growth and equity could be complementary and mutually reinforcing rather than competitive as the experience of many less-developed countries suggest.

The pattern of income distribution for the 1952-86 period is summarised by the Gini coefficient Table 2.28. The table shows that the reduction in income inequality was substantial. During the 1953-86 period the income share of the poorest 20 per cent of families increased from 3.0

per cent to 8.3 per cent in 1986; while the share of the richest 20 per cent of families decreased from 61.4 per cent to 38.2 per cent (see Table 2.28). Furthermore,

Table 2.28. Personal Income Distribution by Five Equal Divisions of Households and Gini Coefficient

Period	I (1)	II (2)	III (3)	IV (4)	V (5)	VI (1)/(5)	Gini Co-efficient
1953	61.4	18.2	9.1	8.3	3.0	20.47	0.558
1959	51.0	19.7	13.9	9.7	5.7	8.95	0.440
1961	52.0	19.8	14.0	12.6	4.5	11.56	0.461
1964	41.1	22.0	16.6	12.4	7.7	5.34	0.360
1966	41.5	22.0	16.2	12.2	7.9	5.25	0.358
1968	41.4	22.3	16.3	12.3	7.8	5.31	0.362
1970	38.7	22.5	17.1	13.3	8.4	4.61	0.321
1972	38.6	22.5	17.1	13.2	8.6	4.49	0.318
1974	38.6	22.1	17.0	13.5	8.8	4.39	0.319
1976	37.3	22.7	17.5	13.6	8.9	4.19	0.307
1978	37.2	22.7	17.5	13.7	8.9	4.18	0.306
1980	36.8	22.8	17.7	13.9	8.8	4.17	0.303
1982	37.3	22.7	17.6	13.8	8.7	4.40	0.308
1984	37.4	22.8	17.6	13.7	8.5	4.40	0.312
1985	47.6	22.9	17.5	13.6	8.4	4.40	0.317
1986	38.2	22.7	17.4	13.5	8.3	4.60	0.322

Source: Kuo, 1983 and DGBAS, Quarterly National Income, vol. 40. 1988.
notes: I= the first highest (20%) income group,
II= the second highest (20%) income group
III= the third highest (20%) income group
IV= the forth highest (20%) income group
V= the fifth highest (20%) income group

the rate of increase in family income was greatest for those in the poorest income bracket and smallest for those in the richest income bracket (see Table 2.29).

The factors that were responsible for growth with equity in Taiwan are well documented (Fei, Ranis and Kuo (1979), Kuo, Ranis and Fei (1981), Kuznets (1981), and Galenson (1979 and 1982). Many students of the Taiwanese economy

believe that the absence of an apparent conflict between growth, equity and employment is the result of the strategy of export promotion followed by Taiwan.

Table 2.29. Changes in the Real Family Income (in 1976 Prices, %)

Five Equal Divisions of Family Numbers	Rate of Increase During 1964-1980
The richest 20% of families	112
The second richest 20% of families	147
The third richest 20% of families	151
The fourth richest 20% of families	158
The poorest 20% of families	165

Source: Kuo, 1983, p. 98.

Economic policies implemented during the early fifties and early sixties, while they were not deliberately pursued to solve the problem of mal-distribution and unemployment, were from their nature inevitable to lead to harmony among growth, equity and employment.

Prominent among these policy packages was the introduction of land reform. Through the reduction of rents, redistribution of assets and the associated supply of infrastructural facilities, land reform had a marked effect on functional distribution of income. According to estimates made by Hsieh and Lee (1966), between 1941 and 1956 the combined share of property income (land plus capital) in total agricultural income fell from 63.7 per cent to 44.3 per cent. Hsieh and Lee have also estimated the shares of farm income by type of recipient

before land reform, using the 1936-40 average, and after land reform, using the 1956-60 average. According to these estimates, the cultivators' share of farm income increased from 67 per cent to 82 per cent but the share of landlords and money lenders declined from 25 per cent to 6 per cent (see also Kuo, Ranis and Fei, 1981).

The shift of strategy from import substitution to export promotion was also expected to contribute to the improvement of the distribution of income in favour of labour for two reasons. First, the strategy helped Taiwan to shift the emphasis from land-intensive to labour-intensive production and exports to which Taiwan's endowments are truly suited. The movement of surplus labour from agriculture to the modern sector was a natural reaction to the normal process of economic development that accompanies structural transformation. Consequently, the surplus labour was absorbed without much difficulty and full employment is reported to have been achieved in Taiwan since the late sixties (see Kuo, 1983) . The shift from agriculture with low labour productivity to industry with higher labour productivity at full employment and hence an increase in the real wage, had helped the distribution of income in favour of labour in the industrial sector (see Tsiang, 1985, p. 52). Indeed, between 1952 to 1979 real wages in the manufacturing sector increased by an average rate of 5.82 percent.

It was also correctly perceived by Taiwan that both agriculture and industry should be based on labour-intensive technologies. As we have seen in the preceding pages, the trade and payment regimes were adjusted to exploit the country's comparative advantage in the production and export of labour-intensive products. Therefore, the excessive indulgence through cheap credit policies prevalent in many less-developed countries, that favours the use of capital at the expense of labour was mitigated during the transitional period. Since the industrial strategy in Taiwan favours the export sector and since the export sector is labour intensive, it helped tremendously to generate more employment opportunities for the Taiwanese labour force (for detailed examination of the contribution of exports to employment see Chapter 7).

Finally, the nature of Taiwanese industrial and agricultural strategy, which relied heavily on small and medium-sized enterprises, was one of the main factors responsible for reducing regional income inequality (see Galenson (1979), Scitovsky (1985), Thorbecke (1974) and Ho (1978). The emphasis on large-scale industry and the relative neglect of agriculture in Korea could be one of the reasons why Taiwan's distribution of income seems to be superior to that of Korea, Singapore and Hong Kong. For more details see Scitovsky (1985) and Fields (1985).

Thus the type of policies followed by Taiwan not only made

her grow fast at an almost unprecedented rate but did so without the customary greater and increasing inequalities and the emergence of mass unemployment. Indeed, by the double criterion of equity and growth Taiwan's experience seems to be unparalleled in the history of economic growth of less developed countries.

2.4 Summary and Conclusions

Like many less developed countries, Taiwan followed the import-substitution strategy during its early years of industrialization. During the 50s, however, the possibilities of further import substitution were limited and unlike most developing countries Taiwan did not embark upon the next stage of import substitution. Instead, it opted for an outward-looking strategy and since the early 60s export promotion and growth have been the overriding goal of the Taiwanese government.

The change in trade strategy entailed many policy changes in the trade and payments regime. In order to rekindle exports, the government liberalized the trade regime and unified the multiple exchange rate system. Importing was significantly liberalized as both quantitative restrictions and the average tariff on imports were gradually reduced. Concomitantly, the NT dollar was devalued by more than 60 per cent from NT$15.55 to US$1.00 in 1954 to NT$40.00 to US$1.00 in 1960.

These and other incentive measures to encourage exports

truly worked wonders. Taiwan's exports which had been stagnant in the fifties grew at spectacular rates. The value of exports (in US$), which grew at an average rate of 6 per cent during the last part of the fifties, grew by 21.7 per cent per annum in the sixties, and by 32.6 per cent per annum in the seventies. The structure of exports also significantly changed. Exports of manufactured products, which accounted for an insignificant proportion of exports in the early fifties accounted for more than 90 per cent in 1986. Total exports also accounted for more than half of the national income.

This rapid growth in exports greatly stimulated the growth of the domestic economy. Gross national product grew by an average annual rate of 9.1 per cent for the decade 1961-70, by 9.5 per cent for the decade 1971-80 and by 7.3 percent for the 1981-86 period.

Both in terms of growth and equity, Taiwan's experience is exemplary. Taiwan's development strategy of export expansion seems to be conducive to growth in employment and equitable distribution.

The various incentive policies accorded to industries do not seem to lead to misallocation of resources. In fact, there is evidence to suggest that resource allocation in Taiwan was more efficient than in many less-developed countries. The effective rate of protection estimates are low even by international

standards. By the effective rate of protection and the domestic resource cost criterion, Taiwan seems to have favoured industries in which she has a comparative advantage.

Of course, getting prices right is not the alpha and omega for economic progress. However, it must be emphasised that Taiwan and a few other countries have benefited by liberalizing their trade and payments regime, but surely this alone is not responsible for the spectacular growth rates of these economies.

The actual role played by the state is perhaps most important. One can hardly call Taiwan's economy laisser faire. Like most of the gang of four countries the Taiwanese knew perfectly well how to use market forces to suit their objectives (see Scitovsky, 1985). Taiwan pursued active and selected interventionist policies, and market forces were not given a free rein to allocate resources. Nor was the strategy purely export-oriented but a combination of both import substitution and export promotion. In general, Taiwan developed not because of the 'invisible hand' but because of the state's active role in ensuring that the country's resources were allocated according to the principles of comparative advantage.

CHAPTER 3

SOURCES OF INDUSTRIAL GROWTH: CONCEPTS AND MEASUREMENT

3.1 Patterns of Growth and Structural Change

Chenery and Syrquin (1975), [antecedents going to Clark (1957) and Kuznets (1971)] have demonstrated that the structure of production changes as per capita income rises with the share of industry rising and levelling off at higher levels of income while that of agriculture falls continuously. This regularity in the pattern of development is not however brought about by the same factors in all countries. The absence or presence of certain key factors can have an appreciable effect on the path and timing of the transition from a backward to a modern economy. According to Chenery and associates, while there are considerable similarities among several countries in their pattern of structural change, there are also systematic differences associated with government policies. Apart from natural resources and country size (as measured by population size and per capita income), the pattern that sectoral changes will follow depends, to a certain extent on international trade participation and the role trade plays in mitigating some of the disadvantages associated with country size and natural resources. Country size and trade policies have significant effects on the time path and nature of structural change. Chenery asserts that "... substantial variations in the composition and timing

of industrialization is associated with different patterns of specialization" (1979) and "given the fairly uniform changes in internal demand that take place with using levels of income, the main sources of variations in this transformation [from backward to modern economy] lies in the opportunities for trade" (1979). When to industrialize and which sectors depend upon natural advantages and on an individual country's choice (Chenery, 1979). For instance, large and small industry-oriented countries [measured by the share of manufactured exports in GNP] undergo rapid industrialization while small primary-oriented countries tend to delay or even completely reverse the normal process of structural change (Chenery and Taylor, 1968).

Despite the apparent similarity in the time path of the transition in production structure between large - and small-industry-oriented countries, however, the trade and development strategy followed by these two groups of countries is quite different. By and large, the former emphasize production for the home market and follow the inward-looking strategy; while the latter tend not to discriminate between the domestic and the international market. Because of their relatively big domestic market, large countries can easily gear production for the domestic market through import replacement. Small industry-oriented countries however have to rely on the external market for their sustained growth because of

limited natural resources and the smallness of the internal market. This does not mean that every small country affected by these negative and positive factors follows the outward-looking strategy. Even with some of the constraining factors that allegedly preclude countries from successfully embarking on the import substitution strategy, there are many small countries that follow the inward-looking strategy. Some countries, such as Hong Kong on the other hand, with a much higher per capita income in 1950 than many developing countries that followed the import substitution strategy, opted for the outward-looking strategy (Balassa and associates, 1982).

Recent empirical evidence shows that "success in developing manufactured exports is critical to this [transformation of the structure of production], and conversely that continued emphasis on import substitution will ultimately lead to a slowing down of growth (Chenery, 1980). And since countries following the outward-looking strategy are performing better in terms of output growth, employment and income distribution than countries following the "alternative" strategy, import substitution is out of favour. In fact, in some circles, as Ahmad (1978) succinctly puts it, "import substitution is portrayed as the single greatest disaster that has ever happened to the less developed countries" (p.8). While such an accusation is extreme and myopic, there is no denying the fact that the progress achieved

by the outward-oriented countries is the envy of many developing countries following the import-substitution strategy. Thus, given the disparities achieved in terms of growth of output and employment the study of the process of these two "alternative" development strategies and their implications and repercussions on these aggregates and in particular on employment and distribution of income is becoming more relevant than ever.

Another piece of empirical evidence which is more relevant to this chapter, indicates that there are "distinct variations among economies and over time in the important sources of growth and these variations are related to the different development strategies that have been pursued" (Kuo and Robinson, 1984, p. 233). As can be learned from Table 3.1, in countries following the import substitution strategy, industrial growth tends to depend heavily on domestic demand expansion, with import-substitution and changes in input-output coefficients mostly accounting for the balance. On the other hand, in countries following the outward-oriented strategy, industrial growth is largely accounted for by export expansion and domestic-demand expansion. A close look at the table suggests that it is consistent with the view that the "countries that achieved the sequential combination of a large contribution to growth of import substitution followed by a large contribution of export

Table 3.1. Source of Industrial Growth of Selected Countries

Country	Period	Average Annual Growth Rate	Per cent of Total: Domestic Demand Expansion	Export Expansion	Import Substitution	Changes in I-O Coeff.
Korea	1955-63	10.4	57	12	42	-11
	1963-70	18.9	70	30	0	0
	1970-73	23.8	39	62	-3	2
Taiwan	1956-61	11.2	35	28	25	12
	1961-66	16.6	49	44	2	5
	1966-71	21.1	35	57	4	4
Israel	1958-65	13.6	62	27	13	-2
	1965-72	11.3	71	49	-37	17
Norway	1953-61	5.0	65	36	-16	15
	1961-69	5.3	51	58	-19	10
Yugo-slavia	1962-66	16.6	74	25	-5	6
	1966-72	9.1	72	38	-22	12
Japan	1914-35	5.5	70	33	5	-8
	1935-55	2.8	71	-7	15	21
	1955-60	12.6	76	12	-3	15
	1960-65	10.8	82	22	0	-4
	1965-70	16.5	74	18	-1	9
Colom-bia	1953-66	8.3	60	7	22	11
	1966-70	7.4	76	5	4	15
Turkey	1953-63	6.4	81	2	9	8
	1963-68	9.9	75	5	10	10
	1968-73	9.4	71	16	-2	15
Mexico	1950-60	7.0	72	3	11	14
	1960-70	8.6	86	4	1	-1
	1970-75	7.2	81	8	3	8

SOURCE: Chenery, 1980, p. 284.

expansion have achieved the highest rates of growth and structural change" (Dervis et al, 1982, p. 110).

The above statement may suggest the following hypothesis:

an earlier period of import substitution is a necessary condition for export expansion. Indeed, there is some scanty empirical evidence to suggest that for a limited number of countries, import substitution has been a necessary condition for export expansion. (See Ahmad, 1976).

As was pointed out in the introductory remarks of this chapter, structural change is a reflection of changes in final demand and the changing composition of comparative advantage (Chenery, 1979). This means that the growth of industrial output can be explained partly by the growth of domestic demand and partly by changes in comparative advantage that lead to import substitution and export expansion. According to Chenery, the combination of these factors leads to specification of the growth of industrial output in terms of changes in the composition of demand, changes in the pattern of trade and changes in input-output coefficients.

3.2 Models of Sources of Growth Decomposition

The purpose of this chapter is to review some of the methods used in the measurement of the sources of industrial growth. The sources of industrial growth are analyzed here from the demand side, not from the supply side where the sources of growth are measured by the accumulation of both human and physical capital along with technological progress. From the demand side,

which is the concern of this chapter, changes in the structure of production are decomposed into changes in intermediate and in final demand with changes in final demand further broken down into changes in domestic demand and in trade.

According to Chenery, given a material balance equation of the Leotief type, it is possible to decompose the factors that cause differences in the rates of growth in the various sectors of the economy. The shifts in the sectoral structure of production are attributed to the autonomous elements of domestic demand, import substitution, export expansion and technological change (more precisely, changes in input-output coefficients).

There are two approaches that have been used to analyze sources of growth from the above perspective. The first approach originally used by Chenery, Shishido and Watanabe (1962) is called the constant-composition measure. In this approach the non-proportional expansion of sectoral output is explained in terms of the non-proportional growth of causal factors observed in individual sectors. Non-proportional growth is defined in terms of deviations from balanced (norm) growth path, in which all elements (or sectors) expand proportionally at the growth rate of national income or aggregate demand. In the constant-composition measure import substitution is measured in terms of deviations of sectoral imports from the expected growth path.

By contrast, the share method defines the constant (initial-year) share of imports in domestic demand as the norm in individual sectors and defines import substitution in terms of changes in the import (a symmetrically, domestic demand) shares rather than the changes in the commodity composition of imports.

3.2.1 The Chenery Method

The starting point of Chenery's measure of the sources of industrial growth is the basic demand-supply equation:

$$X_i = D_i + W_i + E_i - M_i \qquad (3.1)$$

where

X= domestic production of sector i

D= domestic final use of sector i

W= domestic intermediate use of sector i

E= exports from sector i

M= imports of sector i

Define m_i, the import content of the total use of i, as

$$m_i = M_i / (D_i + W_i + E_i) \qquad (3.2)$$

Then, substituting equation (3.2) into equation (3.1), we have:

$$X_i = (1 - m_i)(D_i + W_i + E_i) \qquad (3.3)$$

Chenery's main concern is to explain the causes of the disparity between the growth rates of the different

sectors and that of national income or aggregate demand. By use of the above model of inter-sectoral relationships the deviation of the actual growth of a sector from the equiproportional growth (or the norm) can be explained in terms of demand and supply factors. According to Chenery the deviation of actual sectoral output growth from equiproportional growth between two periods is defined as:

$$\delta X_i = X_{i2} - \phi X_{i1} \qquad (3.4)$$

where δ refers to the deviation from equiproportional growth, X is domestic production of sector i, ϕ is defined as Y_2/Y_1, where Y stands for national income or aggregate demand and the subscripts 1 and 2 refer to time periods. The deviations from equiproportional growth of the actual rate of growth can be defined in the same way as in equation (3.4)

$$\delta D_i = D_{i2} - \phi D_{i1}$$

$$\delta W_i = W_{i2} - \phi W_{i1}$$

$$\delta E_i = E_{i2} - \phi E_{i1}$$

$$\delta M_i = M_{i2} - \phi M_{i1}$$

The deviation of a sector's growth of output from equiproportional growth is the difference between the sector's output in year t = 2 and what it would have been had the sector's output risen from year t = 1 to year t = 2 at the average growth rate of all sectors.

In terms of the deviations from equiproportional growth

defined above and the balance equation given in equation (3.1) the deviation in sectoral output from equiproportional growth between two periods can be decomposed as follows:

$$\delta X_i = (1-m_{i1})\delta D_i + (1-m_{i1})\delta W_i + (1-m_{i1})\delta E_i + (m_{i1}-m_{i2})Z_{i2} \qquad (3.5)$$

where $Z_i = (W+D+E)_i = (X+M)_i$, the total supply.

According to Chenery the first term on the right hand side of equation (3.5) measures the non-proportional increase of domestic demand, the second intermediate demand, the third export demand and the last term measures import substitution of sector i. In other words, this last term, assuming a constant proportion of total supply is imported, measures the difference between actual imports in year 2 and hypothetical imports if their proportion in total supply had remained equal to that in the base year. It is a measure of the increased share of domestic product in total supply. Alternatively, import substitution occurs when there is a decline in the ratio of sectoral imports to total sectoral supply.

The decomposition method proposed above is suitable for analyzing the sources of change in the composition of output. Chenery also proposed another method, the first difference, which is used to capture the causes of the sources of sectoral growth. From equations (3.1) and (3.2) the change in sectoral output between two periods

can be written as:

$$\Delta X_i = (1-m_{i1})(\Delta D_i + \Delta W_i + \Delta E_i) + (m_{i1} - m_{i2}) Z_{i2} \qquad (3.6)$$

The above relationship like the previous one apportions the growth in sectoral production into four sources: domestic demand, intermediate demand, export expansion and import substitution.

As can be readily observed, equations (3.5) and (3.6) arbitrarily assume the values of m in the initial period (that is m_{i1}) is the norm, and recognizes the changes in domestic production on the basis of this norm; but the value of m in the final period (that is m_{i2}) is another equally viable norm. Hence, equations (3.5) and (3.6) can be written as:

$$\delta X_i = (1-m_{i2})(\delta D_i + \delta W_i + \delta E_i) + (m_{i1} - m_{i2}) \phi Z_{i1} \qquad (3.5')$$

$$\Delta X_i = (1-m_{i2})(\Delta D_i + \Delta W_i + \Delta E_i) + (m_{i1} - m_{i2}) Z_{i1} \qquad (3.6')$$

The difference between equations (3.6) and (3.6') lies in how the interaction term $(m_{i1} - m_{i2})\Delta Z_i$ is handled ($Z_{i2} = Z_{i1} + \Delta Z_i$). Specifically, equation (3.6) attributes this term totally to import substitution whereas (3.6') ascribes none of the interaction to import substitution. This clearly shows that we have an index number problem and calculations based on only one of the above formulas can be biased. To minimize the bias actual calculations should be made as an average of the two, i.e. average of equations (3.5) and (3.5') for the deviation measure and

average of equations (3.6) and (3.6') for the first difference formulation. Or more precisely, average of Passche and Laspeyres indices.

3.2.2 The Chenery-Shishido-Watanabe Method

One of the major drawbacks of the direct method of decomposing the sources of industrial growth presented above is that it treats changes in intermediate demand as an independent source of growth. However, changes in intermediate demand reflects not only changes in input-output coefficients but also indirect repercussions of final demand and import-substitution effects. Therefore the measure of import substitution proposed above is inadequate as the import-substitution effect is limited to the direct effect of substitution in an industry and does not take into account the increases in output which may be due to substitution elsewhere (Blumel-Thomas, 1982). As a result, what could have been due to import substitution or domestic demand expansion could wrongly be attributed to changes in input-output coefficients and the contribution of both import substitution and domestic demand could be understated. If the share of the various sources of growth is to be properly assessed, then, intermediate demand should not be taken as an independent source of growth but as one determined by input-output coefficients and production levels (see Dervis et al, 1982). Hence we define intermediate

demand, W as:

Domestic Inter. Inputs

$$W_t = A_t X_t \qquad (3.7)$$

where A is an input-output coefficient matrix and X is domestic output. Substituting equation (3.7) into equation (3.1) and solving for X, we get:

$$X_t = (I-A_t)^{-1}(D+E-M)_t \qquad (3.8)$$

Thus, from equation (3.8) sectoral deviation from equiproportional growth between two periods can be expressed as:

$$\delta X = R_2\delta D + R_2\delta E - R_2\delta M + R_2 A\phi X_1 \qquad (3.9)$$

where R_2 is the element of the inverted Leontief matrix $(I-A)^{-1}$ in period 2.

According to Chenery, Shishido and Watanabe,

(i) $R_2\delta D$ measures the total effects of deviation in domestic demand

(ii) $R_2\delta E$ is deviation attributed to exports

(iii) $-R_2\delta M$ is the effects of deviation in imports, and

(iv) $R_2 A\phi X_1$ is the effect of technological change or changes in input-output coefficients.

In Paasche terms equation (3.9) can be written as:

$$\delta X = R_1\delta D + R_1\delta E - R_1\delta M + R_1 AX_2 \qquad (3.10)$$

The first difference formulation can also be written as follows:

$$\Delta X_L = R_1\Delta D+R_1\Delta E-R_1\Delta M+R_1\Delta AX_2 \quad (3.11)$$

$$\Delta X_P = R_2\Delta D+R_2\Delta E-R_2\Delta M+R_2\Delta AX_1 \quad (3.12)$$

Where import matrix is available, we can distinguish between imported intermediate goods, $M^W{}_{it}$, and imports of final goods, $M^F{}_{it}$. Then the balance equation can be written as:

$$X_t = A_t{}^d X_t + D_t + E_t - M_t{}^F \quad (3.13)$$

From the above, deviations from equiproportional growth in Laspeyres formulation can be decomposed as follows:

$$\delta X_L = R_1{}^d\delta D + R_1 d\delta E - R_1{}^d\delta M^F$$
$$-R_1{}^d A^M X_2 + R_1{}^d AX_2 \quad (3.14)$$

and the Paasche version can also be decomposed as:

$$\delta X_P = R_2{}^d\delta D + R_2{}^d\delta E - R_2{}^d\delta M^F$$
$$-R_2{}^d A^M X_1 + R_2 A\phi X_1 \quad (3.15)$$

In equations (3.14) and (3.15) the first term is domestic demand expansion, the second is export expansion, the third is import-substitution in final goods, the fourth is import-substitution in intermediate goods, and the fifth is technological change.

The first different formulation in Laspeyres and Paasche forms can be written respectively as follows:

$$\Delta X_L = R_1{}^d\Delta D+R_1{}^d\Delta E-R_1{}^d\Delta M^F-R_1{}^d\Delta A^M X_2+R_1{}^d\Delta AX_2 \quad (3.16)$$

$$\Delta X_p = R_2{}^d\Delta D + R_2{}^d\Delta E - R_2{}^d\Delta M^F - R_2{}^d\Delta A^M X_1 + R_2{}^d\Delta A X_1 \quad (3.17)$$

The measure of import substitution proposed above by Chenery and Associates has been criticized by a number of writers. According to Chenery, Shishido and Watanabe import substitution or the effects of deviation of imports is measured by - $R_2\delta M$. While the major drawback of the direct method (of treating intermediate demand as a separate source of growth) is avoided by the above measure, it still is not the best way of measuring the impact of import substititution. In fact, as Morley and Smith (1970) have shown, the measure of import substitution proposed by Chenery, et al, instead of measuring the contribution of the changes in imports to total supply or total demand as originally proposed by Chenery, measures the effects of changes in the rates of sectoral imports to total income.

On the other hand, Morley and Smith argue that the treatment of imports, both in the original Chenery formulation and in his formulation with Shishido and Watanabe is not the right one. According to Morley and Smith, imports are not measured in the same way as gross output. "Whereas imports may be used in toto outside the sector, a portion of domestic production (a_{ij} - observed input-output coefficients) must be reserved to produce itself" (p. 728).

Secondly, to replace imports, production must rise not

only in the processing industry but also in the industries supplying its inputs, i.e. import replacement stimulates output for the industries that supply inputs to the import substituting industries. If this does not happen, however, Morley and Smith argue that there will be an induced rise in imported intermediates and/or reduction in the supply of goods available for final demand in other sectors. The implicit assumption Morley and Smith make is that the newly required intermediates were previously supplied directly or indirectly by the importation of final products. Thus, there is an implicit import substitution which is brought about by the home production of industries supplying inputs to the import replacing sector. The basic argument of Morley and Smith is that the Chenery measure of sectoral import substitution misses the linkages created by the implicit import substitution suggested above. As a result, the Chenery measure will understate the role of sectoral import substitution in the decomposition process. In order to correct some of the deficiencies of the Chenery measure of sectoral import substitution, Morley and Smith introduce the idea of implicit imports in measuring the phenomenon. Thus, they define new vectors of imports and total supply as:

$$M^* = [I - A]^{-1} M$$

$$Z^* = X + M^*$$

Thus, the alternative method of decompositing the source of sectoral growth according to Morley and Smith can be

written as:

$$\delta X_i = (Z^*_{i2} - \phi Z^*_{i1})(I - M^*_{i1}/Z^*_{i1}) + (M^*_{i1}/Z^*_{i1} - M^*_{i2}/Z^*_{i2})Z^*_{i2} \quad (3.18)$$

Import substitution is measured by the second term in the right hand expression of the above equation. According to Morley and Smith, gross production and imports are now valued on a comparable basis. And the new vector of imports " M* converts imports to gross production basis and allocates them to their proper domestic sectors. It can be viewed as the domestic production necessary to substitute completely for imports, holding all final demands constant " (p. 729).

While Morley and Smith are right in arguing that the intermediate repercussions of replacing units of import have to be considered; the claim that they made that their redefined imports could be viewed as the domestic production necessary to substitute for imports is extreme. As Guillamount (1979) argues, the substitution implied by Morley and Smith may or may not exist at all. Furthermore, "in addition to assuming that domestic and imported goods are perfect substitutes, their approach has the unusual property that import substitution can be observed in industries in which there are no imports" (Kubo and Robinson, 1984, p. 234). On the other hand, if imports and gross production are not treated on the same basis as claimed by Morley and Smith, it can also be

equally argued that exports are not treated in their formulae on the same basis as gross production.

3.2.3 The Syrquin Method

One of the fundamental weaknesses of the measures of sources of industrial growth suggested by the various researchers reviewed in the last section is that imports are not treated properly in their models. In the balance equations presented by these writers, all imports are treated as competitive and hence lumped together with domestic production as perfect substitutes. Such treatment of imports is extreme and can lead to serious errors (UN, 1973).

On the other hand, since imported intermediate inputs constitute a significant portion of total intermediate inputs, the total input-output coefficient matrix, A, may not be the appropriate one to use in explaining sources of growth decomposition (see Riedel, 1976). Such a matrix implicitly assumes that all intermediates are domestically supplied. For a country that relies heavily on imported intermediate inputs, the appropriate input-output coefficient matrix is the Leontief matrix of domestic transactions, not the total matrix of technical coefficients. If there is no separate domestic input-output coefficient matrix, it has to be approximated by appropriate means. (See following pages for various ways of approximating the domestic input-output technical coefficients).

3.2.3.1 Syrquin's Direct Decomposition Method

In order to avoid an arbitrary classification of imports (either as competitive or as non-competitive), a different approach that keeps the treatment of imports separate from the treatment of domestically produced goods has been suggested by Syrquin (1976). Instead of the usual balance equation of the type presented in equation (3.1), where imports are treated as competitive, Syrquin rewrites the balance equation exclusively in domestic terms. In this method Syrquin defines imports in terms of total supply and output as a proportion of this supply. Symbolically,

IWI FD

$$X_i = u_i (W_i + D_i) + E_i \qquad (3.19)$$

$$M_i = m_i (D_i + W_i) \qquad (3.20)$$

where u_i is the ratio of domestic supply of commodity i for domestic use to ~~to~~ total supply of i for domestic use, and m_i is the proportion of domestic demand supplied by imports.

From the above two equations, the following decomposition formula in deviation and in first difference formulation in Laspeyres form can be derived:

$$\delta X_i = u_{i1}\,\delta(D_i + W_i) + \delta E_i + \Delta u_i (W_{i2} + D_{i2}) \qquad (3.21)$$

$$\Delta X_i = u_{i1}\Delta(D_i + W_i) + \Delta E_i + \Delta u_i (W_{i2} + D_{i2}) \qquad (3.22)$$

In both equations the first term on the right-hand side

measures the effect of domestic and intermediate demand, the second export expansion and the third import substitution.

By decomposing final demand into consumption, C, and investment B, Syrquin refines further his decomposition equations. Syrquin does not present a direct method of decomposition with consumption and investment given separately, but it is not hard to derive one. Define,

$$ui^{C} = Ci^{d}/(Ci^{d} + Ci^{m}) \qquad (3.23)$$

$$ui^{B} = Bi^{d}/(Bi^{d} + Bi^{m}) \qquad (3.24)$$

$$ui^{W} = Wi^{d}/(Wi^{d} + Wi^{m}) \qquad (3.25)$$

where ui^{C}, ui^{B} and ui^{W} are the domestic-supply ratios of consumption, investment and intermediate inputs respectively. Given the above expressions the balance equation in domestic terms becomes:

$$Xi = ui^{W}Wi + ui^{C}Ci + ui^{B}Bi + Ei \qquad (3.26)$$

From equation (3.26), we can get the following decomposition equations in deviation and first difference formulations:

$$\delta Xi = ui1^{W}\delta Wi + ui1^{C}\delta Ci + ui1^{B}\delta Bi + \delta Ei$$
$$+ ui^{W}Wi2 + ui^{C}Ci2 + ui^{B}Bi2 \qquad (3.27)$$

$$\Delta Xi = ui1^{W}\Delta Wi + ui1^{C}\Delta Ci + ui1^{B}\Delta Bi + \Delta Ei$$
$$+ \Delta ui^{W}Wi2 + \Delta ui^{C}Ci2 + \Delta ui^{B}Bi2 \qquad (3.28)$$

In both equations the first expression on the right-hand

side measures intermediate-demand expansion, the second consumption expansion, the third investment expansion, the fourth import substitution in intermediate demand, the fifth import substitution in final consumption, and the last import substitution in investment goods.

3.2.3.2 Syrquin's Total Decomposition Method

The decomposition methods discussed in the previous sections yield only the direct contribution of the various sources of growth. Indirect contributions which could be important and substantial are missed out. Furthermore, as Westphal and Kim (1977) argue the direct method is more relevant than the total measure in assessing the response of producers to a given policy incentive . Thus, if proper assessment is to be made concerning the overall impact of the various sources of output and and structural changes, we should include both direct and indirect contributions of the sources or the causes of growth of output. For this purpose, the most suitable method is to decompose output changes in an input-output framework. The major difference between the balance equations used in the direct method and the total method to be presented below is that unlike those of the former the balance equations are written in an input-output framework. The balance equation (3.23) in vector terms then becomes:

$$X_t = R^*_t(\hat{u}_t D_t + E_t) \qquad (3.29)$$

where $R^*_t = [I-\hat{u}_t A_t]^{-1}$ and $\hat{u}_t$ = diagonal matrix of

$(X-E)/(W+D)_i$ elements. Then the Laspeyres version of the deviations in output from equiproportional growth can be decomposed as follows:

$$\delta X = R^*_1 u_1 \delta D + R^*_1 \delta E + R^*_1 u(D_2 + W_2) + R^*_1 u_1 AX_2 \quad (3.30)$$

The first difference formulation can also be derived as:

$$\Delta X = R^*_1 u_1 \Delta D + R^*_1 \Delta E + R^*_1 \Delta u(D_2 + W_2) + R^*_1 u_1 \Delta AX_2 \quad (3.31)$$

In eqations (3.30) and (3.31), the first term on the RHS is domestic demand expansion, the second is export expansion, the third is import substitution, and the last is changes in input-output coefficeient.

The above decomposition equations were derived on the assumption of the non-availability of matrix of imported coefficients. If such a matrix is available the decomposition equation can be further refined. Syrquin (1976) decomposes final demand into investment and consumption goods;and with the availabitlity of an import matrix the balance equation becomes:

$$X_t = A_t X_t + A_t^M X_t + C_t + B_t + E_t - M_t^W - M_t^F \quad (3.32)$$

or in domestic terms:

$$X_t = A_t^d X_t + u_t^C C_t + u^B B_t + E_t \quad (3.33)$$

Where the u^C's and u^B's are the proportion of consumption and investment supplied from domestic production [see expressions (3.23) and (3.24)].

Using the above equation (3.33) we can decompose the non-proportional growth in output in the following way (see Appendix 3.1 for the derivation of the formulas and the first difference formulations as well):

$\delta X = R_1{}^d u_1{}^C \delta C$	Consumption expansion with fixed import structure
$+ R_1{}^d u_1{}^B \delta B$	investment expansion with fixed import structure
$+ R_1{}^d \delta E$	export expansion
$+ R_1{}^d u^C C_2$	IS of consumption goods
$+ R_1{}^d u^B B_2$	IS of investment goods
$+ R_1{}^d [u_{ij}{}^W a_{ij2}] X_2$	IS of intermediate goods
$+ R_1{}^d [u^W{}_{ij1} a_{ij}] X_2$	technological change

(3.34)

The formulae for estimating the sources of equi-proportional growth in Paasche term can be derived as:

$\delta X = R_2{}^d u_2{}^C \delta C$	Consumption expansion with fixed import structure
$+ R_2{}^d u_2{}^B \delta B$	investment expansion with fixed import structure
$+ R_2{}^d u_2 \delta E$	export expansion
$+ R_2{}^d u_2{}^C \phi C_1$	IS of consumption goods
$+ R_2{}^d u_2{}^B \phi B_1$	IS of investment goods
$+ R_2{}^d u_2 [u_{ij}{}^W a_{ij}] \phi X_1$	IS of intermediate goods
$+ R_2{}^d u_2 [u_{ij2}{}^W a_{ij}] \phi X_1$	technological change

(3.35)

The first difference formulation can be written as:

$\Delta X = R_2^d u_2^C \Delta C$	Consumption expansion with fixed import structure
$+ R_2^d u_2^B \Delta B$	investment expansion with fixed import structure
$+ R_2^d \Delta E$	export expansion
$+ R_2^d \Delta u^C C_1$	IS in consumption goods
$+ R_2^d \Delta u^B B_1$	IS in investment goods
$+ R_2^d [\Delta u^W_{ij} a_{ij1}] X_1$	IS in intermediate goods
$+ R_2^d [u^W_{ij2} \Delta a_{ij}] X_1$	TC with import structure at intermediate level

(3.36)

3.2.4 The Balassa Method

The methodology of decompsing the sources of industrial growth presented above may be dismissed as a "statistical artifact without theoretical meaning or underpinning" (Bhagwati, 1978). It is true that the methodology used here cannot alone determine whether a country is following an inward or outward-looking strategy. However, as was pointed out elsewhere in this chapter, recent empirical evidence has shown that there are distinct variations among countries and over time in the important sources of growth development policies that have been pursued, we may be safe to assume that the methodology

can give an insight into the different development strategies followed by many less developed countries (see Chenery, 1979, pp. 108-110).

In a recent article Balassa (1979) has tried to buttress the decomposition methodology by relating it to Johnson (1952) theoretical exposition of trde and development of a developing economy. Johnson distinguishes three possibilities of the effects of growth on the demand for imports: growth increasing the demand for imports (i) more than proportionally to, (ii) in the same proportion as, or (iii) less than proportionally to, the increase in the value of the national product. These three possibilities can be conceptualized in terms of three types of growth: pro-trade-biased growth, which increases the country's demand for imports and supply of exports more than proportionally to output; 'neutral' or unbiased growth, which increases the country's demand for imports and supply of exports in proportion to output; and anti-trade-biased growth, which increases the country's demand for imports and the supply of exports less than proportionally to output. The growth of production will be anti (pro)-trade biased and positive (negative) import substitution in production will occur, if the supply of importables is growing more (less) rapidly than the national product. In turn, the growth of consumption will be anti (pro)-trade biased, and positive (negative) import substitution in consumption will occur, if the demand for importables is rising less

(more) rapidly than the national product. In combining these biases, we obtain total anti-trade bias (positive import substitution) a pro-trade bias (negative import substitution) in production and consumption combined.

3.2.4.1 Balassa's Direct Method

Unlike the share method pioneered by Chenery (1960), where import substitution is defined in terms of the changes in the share of imports to total supply or the share of domestic supply in terms of total supply, Balassa defines import substitution in terms of total anti (pro)-trade bias in consumption and production combined. That is, import substitution is defined in terms of deviations of the growth rates of industry's production and consumption from the growth rate of the national product.

In order to estimate import substitution Balassa uses the following concepts and definitions:

M_t^* = hypothetical imports in the case of neutral growth in production with consumption at observed levels

M_t^{**} = hypothetical imports in the case of neutral growth in consumption with production at observed levels

M_t^{***} = hypothetical imports in the case of neutral growth in both production and consumption

t = time period

Y = national product

S = production for domestic use

D = consumption

M = imports

m,y,s,d = growth rates of imports, national product, production for domestic use and consumption respectively.

Define:

$$M_{i1} = D_{i1} - S_{i1} \qquad (3.37)$$

$$M_{it} = D_{it} - S_{it} \qquad (3.38)$$

$$M_{i2} = (1+d_i)D_{i1} + (1+s_i)S_{i1}$$

$$= (1+m_i)M_{i1} \qquad (3.39)$$

$$\text{where } m_i = \frac{(1+d_i)D_{i1} - (1+s_i)S_{i1}}{(D_{i1} - S_{i1})} - 1 \qquad (3.40)$$

Balassa defines the following:

$$M_{i2}^* = (1+d_i)D_{i1} - (1+y)S_{i1} \qquad (3.41)$$

$$M_2^{**} = (1+y)D_{i1} - (1+s_i)S_{i1} \qquad (3.42)$$

$$M_{i2}^{***} = (1+y)D_{i1} - (1+y)S_{i1}$$

$$= (1+y)M_{i1} \qquad (3.43)$$

Anti-trade bias (import substitution) in production is as:

$$IS_{ip} = M_{i2}^* - M_{i2} = (1+s_i)S_{i1} - (1+y)S_{i1}$$

$$= (s_i - y)S_{i1} \qquad (3.44)$$

And anti-trade bias (import-substitution) in consumption can defined be written as:

$$IS_{ic} = M_{i2}^{**} - M_{i2} = (1+y)D_{i1} - (1+d_i)D_{i1}$$
$$= (y-d_i)D_{i1} \qquad (3.45)$$

Combining equations (3.44) and (3.45) we get total anti-trade bias (import substitution), which is the sum of anti-trade bias in production and consumption:

$$IS_{it} = M_{i2}^{***} - M_{i2} = [(1+y)D_{i1})-(1+y)S_{i1}]$$
$$-[(1+d_i)D_{i1}-(1+s_i)S_{i1}]$$

which is equal to:

$$= (1+y)M_{i1} - (1+m_i)M_{i1} = (y-m_i)M_{i1} \qquad (3.46)$$

Since total import substitution bias (IST) is the some of the two biases, we have:

$$IST = (y-m_i)M_{i1} = (s_i-y)S_{i1} + (y-d_i)D_{i1} \qquad (3.47)$$

Thus, according to Balassa, import substitution is measured as the difference between hypothetical (yM_{i1}) and actual (m_iM_{i1}) increments in imports. Increases in output (x_iX_{i1}) can now be decomposed in terms of the contributions of domestic demand, import substitution and exports. The contribution of domestic demand is estimated by deducting the hypothetical import-increment (yM_{i1}) from the actual increase in domestic demand (d_iD_{i1}). The contribution of exports is taken to be e_iE_{i1}.

Combining the three contributing factors to the increase in output, we can write the decomposition formula as:

$$\Delta X_i = (d_i D_{i1} - y M_{i1}) + eE_i - (m_i M_{i1} - y M_{i1}) \quad (3.48)$$

which can be written as:

$$\Delta X_i = (\Delta D_i - y M_{i1}) + \Delta E_i - (\Delta M_i - y M_{i1}) \quad (3.49)$$

The first term on the right-hand side of equation (3.49) is domestic demand expansion, the second import expansion and the third measures import substitution.

The above decomposition formulae do not include intermediate demand. For the direct decomposition measure, intermediate demand is taken as an independent source of growth. When intermediate demand is included in the model, the Laspeyres decomposition formula becomes:

$$\Delta X_i = (\Delta D_i + \Delta W_i - y_i M_{i1}) + \Delta E_i - (\Delta M_i - y_i M_{i1}) \quad (3.50)$$

or, decomposing the import substitution term into production and consumption effects as in Balassa (1979), we have :

$$\begin{aligned} \Delta X_i = {} & (\Delta D_i + \Delta W_i - y_i M_{i1}) && \text{DDE} \\ & + \Delta E_i && \text{EE} \\ & + [(\Delta X_i - \Delta E_i) - y_i (X_{i1} + E_{i1}] && \text{IS-production} \\ & + [(\Delta D_i + \Delta W_i) - y_i (D_{i1} + W_{i1}) && \text{IS-consumption} \end{aligned} \quad (3.51)$$

In the case where imports for final uses (M^F_{it}) and those

for intermediate uses (M^W_{it}) are distinguished, we can write $M_{it} = M_{it}^F + M_{it}^W$. Then, the Laspeyres equation in this case is written as:

$$\begin{aligned}
\Delta X_L = {} & (\Delta D_i - y_1 M_{i1}^F) && \text{DDE - final goods} \\
& + (\Delta W_i - y_1 M_{i1}^W) && \text{DDE - intermdiate goods} \\
& + \Delta E_i && \text{EE} \\
& + (y_1 M_{i1} - \Delta M_i^F) && \text{IS-final goods} \\
& + (y_1 M_{i1}^W - \Delta M_i^W) && \text{IS-intermediate goods}
\end{aligned} \tag{3.52}$$

For the direct method of decomposing output growth, Balassa does not provide a deviation from proportional measure. However, it is not difficult to derive from his Model III formulation.

For any variable α, the deviation from proportional growth in the Laspeyres version can be defined as:

$$\delta\alpha = \Delta\alpha_i - y_1 \alpha_{i1}$$

The Paasche version is defined as:

$$\delta\alpha = -\Delta\alpha_i + y_2 \alpha_{i2}$$

In the case where imports of final uses and those for intermediate use are not available, the Laspeyres deviation from equiproportional growth decomposition equation can be written as:

$$\begin{aligned}
\delta X_L = {} & (\Delta D_i - y_1 D_{i1}) && \text{DDE} \\
& + (\Delta W_i - y_1 W_{i1}) && \text{intermediate demand expansion}
\end{aligned}$$

$$+ (\Delta E_i - y_1 E_{i1}) \quad \text{EE}$$

$$+ [(\Delta X_i - E_i) - y_1 (X_{i1} - E_{i1}) \quad \text{IS - production}$$

$$- [(\Delta D_i + \Delta W_i) - y_1 (D_{i1} + W_{i1}) \quad \text{IS - consumption}$$

(3.53)

When imports for final use (M_i^F) and intermediate (M_i^W) use are available, the decomposition equations can be refined into the following:

$$\delta X_L = (\Delta D_i - y_1 D_{i1}) \quad \text{DDE}$$

$$+ (\Delta W_i - y_1 W_{i1}) \quad \text{Intermediate demand expansion}$$

$$+ (\Delta E_i - y_1 E_{i1}) \quad \text{Export expansion}$$

$$+ (y_1 M_{i1}^F - \Delta M_i^F) \quad \text{IS - final goods}$$

$$+ (y_1 M_{i1}^W - \Delta M_i^W) \quad \text{IS - intermediate goods}$$

(3.54)

3.2.4.2 Balassa's Total Method

When intermediate demand is not taken as an independent source of growth, the balance equation in vector terms can be written as:

$$X_t = A_t X_t + D_t + E_t - M_t \qquad (3.55)$$

From this equation we can derive the following version of the Balassa total decomposition first difference measure as:

$$\Delta X = \underbrace{R_1 (\Delta D - y_1 M_1)}_{\text{DDE}} + \underbrace{R_1 \Delta E}_{\text{EE}} - \underbrace{R_1 (\Delta M - y_1 M_1)}_{\text{IS}}$$

$$+ \underbrace{R_1 \Delta A \; X_2}_{\text{TC}}$$

(3.56)

where $R_1 = [I-A]^{-1}$

In the case where the imported input-output coefficient matrix is available, the Laspeyres equation of the Balassa total first difference measure for the above case can be derived as:

$$\begin{aligned}
\Delta X_L &= R_1^d(\Delta D - y_1 M_1^F) && \text{DDE} \\
&+ R_1^d \Delta E && \text{EE} \\
&- R_1^d(\Delta M^F - y_1 M_1^F) && \text{IS of final goods} \\
&- R_1^d \Delta A^m X_2 && \text{IS of intermediate goods} \\
&+ R_1^d \Delta A X_2 && \text{TC}
\end{aligned} \tag{3.57}$$

The corresponding Paasche version is:

$$\begin{aligned}
\Delta X_P &= R_2^d(\Delta D - y_2 M_2^F) && \text{DDE} \\
&+ R_2^d \Delta E && \text{EE} \\
&- R_2^d(\Delta M^F - y_2 M_2^F) && \text{IS final goods} \\
&- R_2^d \Delta A^m X_1 && \text{IS intermediate goods} \\
&+ R_2^d \Delta A X_1 && \text{TC}
\end{aligned} \tag{3.58}$$

where $y_2 = (Y_2 - Y_1)/Y_2$, $y_1 = (Y_2 - Y_1)/Y_1$.

Balassa also provides the deviation measure. The equation for the Laspeyres version is:

$$\delta X = R_1^d[\Delta D^F + \Delta E - \Delta M^F - \Delta A^m X_2 + \Delta A X_2] \tag{3.59}$$

where $\delta X_i = x_i X_{i1} - y_1 X_{i1} = \Delta X_i - y_1 X_{i1}$, and $x = (X_2 - X_1)/X_1$. Given the above expressions, equation (3.59) can be

decomposed as:

	Effects of X on
$\delta X = R_1{}^d(\Delta D^F - y_1 D_1)$	DDE
$+ R_1{}^d(\Delta E - y_1 E_1)$	EE
$+ R_1{}^d(y_1 M_1{}^F - \Delta M^F)$	IS - final
$- R_1{}^d \Delta A^m X_2$	IS - intermediate
$+ R_1{}^d \Delta A X_2$	TC

(3.60)

The Paasche version of the above is:

$$\delta X_p = R_2{}^d[\Delta D^F + \Delta E - \Delta M^F - \Delta A^m X_1 + \Delta A X_1] \qquad (3.61)$$

where $\delta X = -x_i X_{it} + y_t X_{it} = -\Delta X_t + y_t X_{it}$

The above can be decomposed into:

	Effects of X on
$\delta X = R_2{}^d(y_2 D_2{}^F - \Delta D^F)$	DDE
$+ R_2{}^d(y_2 E_2 - \Delta E)$	EE
$+ R_2{}^d(\Delta M^F - y_2 M_2{}^F)$	IS- final
$+ R_2{}^d \Delta A^m X_1$	IS- intermediate
$- R_2{}^d \Delta A X_1$	TC

(3.62)

CHAPTER 4

SOURCES OF INDUSTRIAL GROWTH AND STRUCTURAL CHANGE IN TAIWAN, 1961-1981

4.1 Introduction

The purpose of this Chapter is to shed some additional light on the pattern of economic development described in Chapter 2. This objective is attempted to be fulfilled by analyzing the sources of growth and structural change in terms of the relative contribution of demand factors, import substitution and technological change (or more precisely, changes in input-output coefficients). The analysis is undertaken at two levels. First, at the more aggregated level, the sources of growth and structural change of the whole Taiwanese economy are discussed. Second, at the more disaggregated level, the sources of growth and structural change in the major sectors of the Taiwanese economy are discussed. Besides output composition, attempts will be made to estimate the sources of import growth in order to shed some additional insight on the process of export-led-import-dependent experience of Taiwan.

The estimates of the sources of growth and structural change are derived from the various subperiods of 1961-1981 in constant 1976 prices. Six input-output tables aggregated to 32 sectors are the basis for our analysis. As outlined in Chapter 3, in this analyses we shall distinguish between a sector's gross output growth and

its gross output deviation from proportional growth. The first form of decomposition measures the sectoral source of growth, while the second measures the sources of changes in the composition of output (see Chenery, 1979, p. 114).

4.2 Sources of Growth and Structural Change in Taiwan: Economy-Wide Analysis

This section presents empirical evidence on the sources of growth and structural change in Taiwan for the whole economy. For this purpose we have used not a single method but three alternative methods: (1) Chenery-Shishido-Walanabe (CSW) (1962), (2) Syrquin (1976) and (3) Balassa (1979). The formulas used for the analysis are discussed in Chapter 3.

4.2.1 The Direct Decomposition Analysis

Table 4.1 represents a summary of results of decomposition for identifying the sources of growth and structural change for the period 1961-1981 for Taiwan by the three alternative methods. The table shows results obtained by the use of Laspeyres and Paasche formulas for the 1961-1966, 1966-1971, 1971-1976, 1976-1981 subperiods as well as chained results for 1961-1971, 1971-1976 and for the entire period (1961-1981) (see Table 4.1 for more explanation). In the following we first discuss the estimates obtainad under direct decomposition.

As can be learned from Table 4.1 the direct decomposition

by the three alternative methods reveals that internal factors were responsible for the rapid growth and structural changes in output in Taiwan. In all subperiods and for the whole period, domestic final and intermediate demand were the most important sources of growth and structural change in Taiwan. Both factors contributed 79 percent by the Syrquin method and 99 and 86 percent by the CSW and Balassa method respectively. Of the two factors, however, intermediate demand expansion contributed more to output growth and structural change than domestic-final-demand expansion.

Next to domestic demand expansion, export expansion was the most important source of growth and structural change. In the first subperiod export expansion by the three methods contributed 20 percent of output increase. Its share increased to 24.4 and 25.1 percent in the 1966-1971 and 1971-1976 periods respectively but again declined to around 21 percent in the last period, 1976-1981. For the entire period (1961-1981), exports expansion contributed to 22.6 percent of the growth in output.

The contribution of import substitution to output growth by Syrquin method was negatively very low in almost all subperiods. During the last five year subperiod import substitution contributed 0.5 percent of the increase in output. As can be seen from Table 4.1, for all the chained results referring to ten-year periods and twenty

year periods import substitution's contribution to output growth was negative.

4.2.2 The Total Decomposition Measure

As has been pointed out in Chapter 3, the direct measures are relevant for assessing the effects of various incentive policies on individual sectors, while the total measures are considered to be more relevant to the relative contributions of export expansion and import substitution to economic growth as they reflect the total effective demand for the products of various sectors induced by given changes in autonomous factors (see Kim, 1977).

According to the Syrquin total decomposition measure, domestic-final-demand expansion was the dominant source of growth for each subperiod and for the twenty year period. This is also true by the CSW decomposition measure. However, by the Balassa method, the single most important source of growth for almost all periods was export expansion. According to these three alternative methods domestic final demand for the twenty year period averaged 52, 80 and 49 percent by the Syrquin, CSW and Balassa methods respectively, while export expansion accounted for 43, 59 and 59 percent respectively. As in the case with the direct measure, the total measure of import substitution was negative for almost all periods.

Table 4.1. Sources of Growth and Structural Change 1961-1981: Summary of Aggregate Results for Taiwan by Three Alternative Measures (percent)

	DDE		EE		IS		IW	I-O
	D	T	D	T	D	T	D	T
I. Balassa Method								
A. First Difference								
1961-66	14.9	42.3	20.1	43.3	-3.5	-10.7	68.6	25.2
1966-71	30.6	61.9	24.4	60.5	-9.1	-22.1	54.2	-0.3
1971-76	22.4	42.8	25.1	65.6	-10.2	-19.7	62.3	11.4
1976-81	23.6	48.8	20.6	55.5	-7.4	-15.5	63.3	11.2
1961-71*	25.3	55.3	22.9	54.7	-7.2	-18.3	59.0	8.3
1971-81*	23.1	46.3	22.4	59.7	-8.6	-17.2	63.1	11.3
1961-81*	23.6	48.5	22.6	58.5	-8.3	-17.5	62.1	10.6
B. Deviation Measure								
1961-66	51.6	50.2	11.3	16.3	6.0	6.4	31.1	27.1
1966-71	25.5	33.6	24.0	34.7	9.4	10.4	41.2	21.3
1971-76	20.6	23.7	26.2	41.5	13.5	13.9	39.7	20.9
1976-81	21.9	28.9	20.0	28.8	14.7	17.5	43.4	24.8
1961-71*	38.4	41.7	17.7	25.8	7.7	8.4	36.2	24.1
1971-81*	17.8	26.7	28.5	34.3	-2.4	15.9	56.1	23.1
1961-81*	27.6	32.2	20.8	31.2	11.8	13.2	39.8	23.5
II. Syrquin Method								
A. First Difference								
1961-66	21.7	46.4	20.0	35.5	-1.4	-2.2	59.7	20.3
1966-71	37.0	61.9	24.4	46.9	-4.2	-6.2	42.8	-2.6
1971-76	29.7	48.3	25.1	48.5	-2.4	-2.2	47.7	5.4

table 4.1 continued

1976-81	31.5	52.1	20.6	38.9	0.5	1.6	47.4	7.4
1961-71*	31.9	56.7	22.9	43.0	-3.2	-4.9	48.5	5.1
1971-81*	30.8	50.5	22.4	42.9	-0.7	0.0	47.5	6.6
1961-81*	31.0	52.0	22.5	43.0	-1.3	-1.2	47.8	6.2

B. Deviation Measure

1961-66	51.6	50.2	11.3	16.3	6.0	6.4	31.1	27.1
1966-71	25.5	33.6	24.0	34.7	9.4	10.4	41.2	21.3
1971-76	20.6	23.7	26.2	41.5	13.5	13.9	39.7	20.9
1976-81	21.9	28.9	20.0	28.8	14.7	17.5	43.3	24.8
1961-71*	34.8	41.7	17.7	25.8	7.7	8.4	36.2	24.1
1971-81*	17.8	26.7	28.5	34.3	-2.4	15.9	56.1	23.1
1961-81*	27.6	32.2	20.8	31.2	11.8	13.2	39.8	23.5

III. Chenery-Shishido-Watanabe Method

A. First Difference

1961-66	26.5	69.6	20.0	43.3	-15.1	-38.0	68.6	25.2
1966-71	43.9	93.0	24.4	60.5	-22.5	-53.2	54.2	-0.3
1971-76	34.2	70.9	25.1	65.6	-22.0	-47.9	62.7	11.4
1976-81	38.0	84.4	20.6	55.5	-21.9	-51.1	63.3	11.2
1961-71*	38.1	85.2	22.9	54.7	-20.0	-48.1	59.0	8.3
1971-81*	36.4	78.8	22.4	59.7	-21.9	-49.8	63.1	11.3
1961-81*	36.8	80.3	22.6	58.5	-21.5	-49.4	62.1	10.6

B. Deviation Measure

1961-66	51.3	60.5	10.5	21.1	5.6	9.1	32.6	9.4
1966-71	25.5	35.2	20.1	34.8	13.0	23.0	41.5	6.9
1971-76	22.3	24.3	23.9	42.9	4.2	27.3	49.5	6.3
1976-81	24.8	37.6	18.5	32.2	3.0	24.1	53.7	6.1

table 4.1 continued

1961-71*	37.7	45.6	15.6	29.1	9.5	17.3	37.3	7.9
1971-81*	20.6	31.5	18.0	36.7	16.4	25.6	45.0	6.2
1961-81*	26.3	36.2	17.2	34.2	14.1	22.9	42.4	6.8

Notes: all measure represent arithmetic averages of the estimates obtained from the Laspeyres and Paasche indices. The estimates for the period marked by * are chained results [1961-71)=(1961-66)+(1966-71). The calculatiosn are based on 32-sector I-O data in constant 1976 prices.
DDE = domestic demand expansion, EE= export expansion, IS= import substitution, IW= intermediate demand expansion, I-O = changes in input-output coefficient, D=direct method, T= total method,

Source: author's estimate

The contribution of technological change was positive for almost all periods. Changes in input-output coefficients were particularly significant during the first (1961-1966) subperiod and contributed more than 20 percent of the growth in gross output during this period. In other subperiods, however, the contribution of technological change was modest. The changes in the input-output coefficients represent a widening and deepening of the inter-industry relations brought about by the changing mix of required intermediate inputs. These changes are caused by changes in production technology as well as substitution among inputs (see de Melo, 1985). As will be discussed in detail in the next section, technological change was the second most important factor in the sources of output growth in the

agricultural sector during the first subperiod. In subsequent subperiods, however, the contribution of technological change to output growth in the agricultural sector was negative which could explain the decline in the importance technological change for the whole economy.

Coming to the sources of gross output deviations from equiproportional growth we observe a similar pattern. Both by the direct and by the total method of decomposition, domestic demand expansion dominated according to the estimates made by the three alternative methods. For the whole period, the contributions of domestic-demand expansion were 32.2, 48.3 and 36.2 by the Syrquin, CSW and Balassa methods respectively and export expansion accounted for 31.2, 45.7 and 34.2 percent respectively (see Table 4.1).

The contributions of import substitution and technological change differed according to the method used. Import substitution by the total deviation from equiproportional method was estimated at 13.2 , -17.8 and 22.9 percent by the Syrquin, CSW and Balassa methods respectively (for the 1961-1981 chained results).

Thus, despite the differences and similarities among the results by the three alternative methods, all results indicate that both domestic demand and export expansion were major sources of growth and structural change in Taiwan. Furthermore, regardless of the different measures

used, the relative contribution of export expansion increased for at least the period covering 1961-1976. It was at its peak of importance in 1971-76 and fell thereafter.

4.3 Sources of Growth and Structural Change in Gross Output: Analysis by Major Sectors

The analysis of growth and structural change for the whole economy presented above may conceal the relative importance of causal factors for individual sectors. In order to bring this out, and since the major feature of structural change in Taiwan is the rapid expansion of the manufacturing sector, attention will be focused on the sources of growth of some sectors of the economy.

4.3.1 Growth of Output-First Difference

The purpose of this section is to discuss the sources of output growth of major sectors of the Taiwanese economy. The aim is to see the relative importance of causal factors as the evolving comparative advantage of Taiwan changes.

In the model of the factor-proportions theory discussed in the following chapter, it is hypothesized that, as Taiwan accumulates more capital relative to labour, the factor intensity of its exports relative to its imports will change. Secondly, partly as a result of this, the commodity composition of its trade will also change. Because of these factors, we shall attempt to

show that not only the relative importance of the major sources of growth such as export expansion to change; but also the relative importance of some industrial sectors to change with the changing comparative advantage of Taiwan.

In this section the sources of growth and structural changes of the major sectors of the Taiwanese economy are discussed. The anlysis shall concentrate on changes of the sources of growth in these major sectors.

In the case of the agricultural sector the direct method of decomposing output indicates that the dominant source of growth in each subperiod in that sector's output by the three alternative methods, was intermediate-demand expansion(data is not included here). Final domestic demand's contribution to output growth was negative. However, total-domestic-demand (final-domestic-plus-intermediate-demand) expansion was positive through the subperiods and for the period as a whole. According to the total Syrquin and CSW decomposition measures, domestic demand accounted for the largest share in the increase in gross output for that sector. By the Balassa method, however, export expansion followed by domestic demand was the dominant sources of growth for the chained result of 1961-1981.

One of the distinguishing features of the agricultural sector in Taiwan is the continuous decline in the demand

for intermediate inputs by the agricultural sector from the rest of the economy. The direct share of intermediate demand expansion in agricultural output growth has been declining consistently throughout the whole period. In the first subperiod, intermediate demand expansion accounted for more than 254 percent (by the Balassa method) . In subsequent periods, however, its share was reduced though it was more than 100 percent. This is also evident from the fall in the share of technological change. During the first subperiod, technological change accounted for more than 114 percent of the increase in gross output of the agricultural sector. In all the other subperiods, however, the contribution of technological change was negative.

By the total decomposition measure the contribution of import-substitution to gross output growth of the agricultural sector was negative for the first three subperiods. In the last subperiod, however, this factor's contribution to output expansion in the agricultural sector was more than 10 percent. The fact that the share of import substitution in the agricultural sector's growth was negative for the first three periods may suggest that Taiwan's comparative advantage does not lie in the production of agricultural products. Secondly, since Taiwan is a natural-resource-poor country, imports of agricultural products may increase on this account and also because of trade liberalization. Furthermore, the decline in the share of agricultural output in total

output may be due to the compositional shift in domestic demand caused by the low income-elasticity of demand for primary products (Chenery, 1979, and de Melo, 1985). Nevertheless, since import-substitution in the last period was positive, implying that the ratio of imports to total supply was greater in 1976 than in 1981, it can be argued that Taiwan, with regard to the agricultural sector was becoming, presumably, less liberalized.

The mining industry is not big in Taiwan. An examination of the sources of growth for this sector seems to indicate, to borrow Balassa's words an "aberrant case" in the sense that the four causes of output growth show large percentages of wide magnitude, which are quite different when compared with the other sectors. Nevertheless, by the direct method, the most important source of growth was intermediate demand expansion followed by import substitution. By the total method, however, export expansion made the largest contribution during the first and second subperiods while import-substitution dominated in the third and fourth subperiods and made a negative contribution of a wide magnitude throughout the entire period.

The service sector has made a relatively modest contribution to output growth in Taiwan. As expected, however, domestic-demand expansion accounted for the largest share in gross output expansion. Next to domestic-demand expansion, export expansion contributed

most to output expansion.

When it comes to the manufacturing sector, a clear picture emerges. Except for the first subperiod, the contribution of export expansion was prominent. According to the Balassa and CSW methods, the share of export expansion in manufacturing output growth increased from 36 percent in the first subperiod to 67 and 82 percent during the second and third subperiods respectively (data is not reported here) , while by the Syrquin methods it accounted for 29, 52 and 63 percent respectively, for the same periods. For the whole twenty year period export expansion accounted for more than 69 percent by the Balassa and CSW methods and for 53 percent by the Syrquin method. On the other hand, the share of domestic-demand expansion continuously declined until the third period and then increased in the fourth period (1976-1981), and accounted for 35, 67 and 37 percent by the Balassa, CSW and Syrquin methods respectively for the whole period under consideration.

By the three total methods, import substitution in the manufacturing sector made a negative contribution to output growth for the subperiods and for the period as a whole. The negative values for import substitution indicate rising ratios of imports to domestic production which would be consistent with import-liberalization policy during these periods. As will be discussed in the section on sources of import growth, a characteristic

feature of the export-led growth in Taiwan is the high level of imported inputs in export production.

One additional point to mention about the sources of growth in the manufacturing sector is that, throughout the whole period, technological change made a positive contribution to output growth. By the Balassa, CSW and Syrquin methods, technological change accounted for 11 and 7 percent of the increase in gross output respectively for the whole period under consideration.

Despite the similarities and differences in the sources-of-growth decompositions discussed above, all results for the manufacturing sector indicate that export expansion was the single most important source of growth for the twenty year period (1961-1981). Domestic-demand expansion was also a major source of growth, while import substitution and technological change played a relatively minor role. However, the role of technological change was positive while that of import-substitution was negative.

4.3.2 Sources of Growth Pattern: Sectoral Analysis

For a more detailed examination of the pattern of growth, Tables 4.2 to 4.9 provide a disaggregate estimate for the sources of output growth at the level of individual industries.

As can be observed from the above tables, there is a wide

variation in the relative importance of the sources of growth among sectors and over time. For most of the major sectors (not reported here) the analysis reveals that export expansion was the dominant source of gross output growth in these sectors. The effect of export expansion was particularly significant in the textile and leather sector. For the twenty year period (i.e. chained result for 1961-1981), export expansion in the textile and leather sector accounted for 96 per cent which was the highest among the major industrial groups. In the textile industry alone, [sector no. (11), (see Appendix 4.1 for the names of the sectors)] export expansion accounted for 93 percent of output growth for the 1961-1981 period while in the leather industry (14) it accounted for 100 percent (see Table 4.8). Furthermore, as can be learned from Tables 4.2 to 4.8, the contribution of export expansion for the textile and leather sectors was rising from the first subperiod to the third. This is particularly true of the textile industry, where, as Tables 4.2, 4.3 and 4.4 indicate the contribution of export expansion to output growth increased from 57 percent to 72 percent and 137 percent during the first, second and third subperiods. Similarly, the share of output increase attributed to export expansion by the textile industry increased from 10 percent in the first subperiod to 23 percent and to 22 percent in the second and third subperiods (see column five of Tables 4.2 to 4.3). As is evident from Tables 4.2

Table 4.2. Factors Contributing to Sectoral Output Growth: 1961-66 (Balassa Total First Difference Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	-595	-18	12	0	25	-3	659	34
2	-17	0	-18	0	-2	0	137	6
3	150	8	149	8	5	-1	-204	-19
4	-53	-7	12	1	-7	3	147	31
5	-74	-1	250	3	-108	5	32	1
6	62	2	46	1	-7	1	-2	0
7	13	1	58	3	-22	4	51	4
8	28	0	117	-1	8	0	-53	1
9	15	1	98	5	-10	2	-3	0
10	86	65	9	6	-3	8	7	9
11	22	5	57	10	-11	8	31	9
12	26	2	82	5	-4	1	-4	0
13	18	1	32	2	-8	2	58	6
14	108	0	148	0	-24	0	-133	0
15	62	1	73	1	-21	1	-14	0
16	16	0	28	1	-6	1	62	3
17	2	0	33	3	-2	1	68	10
18	31	2	58	3	-17	4	28	3
19	31	2	22	1	-11	3	57	6
20	24	1	71	2	-2	0	7	0
21	43	1	43	1	-17	2	30	1
22	66	4	161	9	-148	35	22	2
23	12	0	214	2	-11	0	-115	-2
24	58	4	31	2	-14	4	25	3
25	34	3	31	3	10	-3	26	4
26	113	6	17	1	-72	15	42	4
27	69	-2	-31	1	-10	-1	72	-4
28	51	5	27	3	0	0	22	4
29	38	2	30	2	-8	2	40	4
30	102	1	16	0	-6	0	-13	0
31	36	11	66	20	-4	5	1	1
32	-40	2	-43	3	13	3	170	-18
		100		100		100		100

Notes: sum of column (2)+(4)+(6)+(8)=100.
DDE=domestic final demand, EE= export expansion
IS= import substitution, TC= technological change, and Sec= sector.
The rest of the columns represent the sectoral contribution of the sectors to output growth attributed to the sources of growth. For instance column (3)= DDEi/ΣDDE.

Table 4.3. Factors Contributing to Sectoral Output Growth: 1966-71 (Balassa Total First Difference Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	-55	1	-33	1	23	0	185	918
2	-24	0	-1	0	4	0	122	209
3	125	0	2457	3	-1389	4	-1093	314
4	105	2	52	1	-4	0	-53	300
5	85	1	159	2	-86	3	-58	162
6	37	1	63	2	-5	0	5	-33
7	514	1	1060	2	-574	3	-900	432
8	89	0	-7	0	-9	0	27	-20
9	-28	0	107	1	25	-1	-3	9
10	62	5	23	2	0	0	15	-306
11	28	9	72	23	-12	11	12	-940
12	35	2	61	4	-5	1	9	-122
13	43	2	38	2	-13	2	31	-353
14	57	1	50	1	-19	1	12	-32
15	42	1	112	2	1	0	-53	225
16	70	0	-45	0	-90	-1	164	187
17	26	1	92	4	-41	5	22	-233
18	30	2	64	5	-12	3	18	-357
19	39	2	55	3	-29	4	34	-414
20	152	1	-17	0	-5	0	-31	71
21	104	1	56	1	-7	0	-53	155
22	73	4	120	8	-109	19	16	-249
23	50	1	104	2	-59	3	5	-26
24	107	4	57	2	-66	6	2	-15
25	46	7	74	11	-34	14	15	-535
26	69	3	29	1	-17	2	20	-229
27	33	1	75	3	-13	2	5	-53
28	105	11	-5	-1	-1	0	2	-45
29	82	2	69	2	-27	2	-23	155
30	111	1	20	0	-14	0	-17	32
31	88	31	37	14	-12	12	-13	1129
32	67	1	67	1	-84	4	49	-237
		100		100		100		100

Notes: see Table 4.2.

Table 4.4. Factors Contributing to Sectoral Output Growth: 1971-76 (Balassa Total First Difference Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	124	5	18	0	-4	0	-37	-5
2	58	0	43	0	-6	0	5	0
3	20	0	200	2	-130	4	10	0
4	85	3	30	1	-5	0	-10	-1
5	63	0	-208	1	76	1	169	-4
6	25	1	62	1	-10	1	22	2
7	40	1	170	3	-379	26	269	31
8	42	1	47	0	-7	0	18	1
9	1	0	95	0	1	0	3	0
10	67	14	14	2	-3	1	22	17
11	-24	-6	137	22	10	-5	-23	-21
12	53	2	96	2	-15	1	-34	-4
13	48	2	87	2	-17	1	-18	-2
14	14	0	95	1	-13	1	4	0
15	25	0	84	1	-18	1	9	1
16	93	0	100	0	-87	1	-6	0
17	13	1	112	4	-35	4	10	2
18	5	1	95	7	-9	2	9	4
19	29	4	54	5	-41	13	59	32
20	96	2	-7	0	-2	0	13	1
21	58	2	49	1	-12	1	6	1
22	24	3	91	7	-37	10	22	10
23	15	1	102	3	60	5	43	7
24	114	4	88	2	-100	8	-2	0
25	12	2	96	11	-23	8	15	9
26	25	2	60	2	13	-2	3	1
27	12	1	96	5	-24	4	15	4
28	99	17	2	0	-1	0	0	0
29	36	2	62	2	-24	2	25	4
30	101	1	14	0	-4	0	-11	0
31	76	35	31	9	-11	11	4	8
32	16	1	62	2	1	0	21	4
		100		100		100		100

Notes: see Table 4.2.

to 4.5 the contribution of export expansion to output growth in the textile industry has declined from 137 percent in the third period to 72 percent in the last period. Consequently, the share of output growth attributed to export expansion also declined from 22 percent in the third subperiod to 9 percent in the last subperiod (see column 5 of Tables 4.2 to 4.4).

Next to the textile and leather sector, export expansion made the largest contribution to machinery, light intermediates and basic intermediates. In the food industry, as expected, domestic demand expansion accounted for the largest share in gross output expansion of 74.3 percent. While domestic-demand expansion was the dominant source of growth in the food sector as a whole, Tables 4.2-4.8 reveal that this was not true for all the industries that constituted the food sector. For instance, for the canned food industry, export expansion accounted for 98 percent of the growth in output for the whole period under review, and export expansion has been the dominant sources of growth for the individual subperiods. On the other hand, domestic-demand expansion was the prominent source of growth in the sugar industry.

Data not reported here reveal an interesting characteristic of the evolving comparative advantage in Taiwan. In the first sub-period, the growth of gross output of the food sector accounted almost fifty percent of the growth of gross output of all the sectors; but

Table 4.5. Factors Contributing to Sectoral Output Growth: 1976-81 (Balassa Total First DifferencMethod) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	-65	1	-19	0	19	1	165	-9
2	-4	0	66	0	12	0	25	0
3	46	0	94	1	149	-3	-189	-6
4	93	2	20	0	-18	1	4	0
5	360	-1	-557	1	271	1	26	0
6	70	1	0	0	11	-1	18	1
7	-59	-1	428	6	-741	38	472	33
8	-58	0	133	0	24	0	1	0
9	-3	0	108	0	8	0	-14	0
10	87	5	21	1	-25	5	17	4
11	36	5	72	9	-1	0	-7	-5
12	28	1	73	2	-14	1	13	2
13	42	2	45	2	-15	3	28	6
14	-10	0	121	2	-3	0	-9	-1
15	9	0	75	1	-1	0	17	1
16	-75	0	-107	0	-92	0	374	-1
17	33	1	128	3	-13	1	-47	-6
18	6	1	76	8	-4	2	22	11
19	24	5	40	7	-10	7	47	40
20	67	2	12	0	-3	0	25	3
21	5	1	75	1	-24	2	4	0
22	25	4	84	12	-7	4	-1	-1
23	15	0	121	3	-33	3	-3	0
24	58	3	69	3	-31	5	5	1
25	30	4	100	12	-12	5	-18	-11
26	77	7	31	2	-4	1	-4	-2
27	23	2	87	5	-11	2	0	0
28	94	10	3	0	-1	0	3	1
29	39	3	34	2	-7	2	34	11
30	82	1	12	0	-2	0	8	0
31	67	38	25	13	-4	7	11	28
32	2728	3	1458	2	-3180	13	-907	-5
		100		100		100		100

Notes: see Table 4.2.

Table 4.6. Factors Contributing to Sectoral Output Growth: 1961-71 (Balassa Total First Difference Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	573	4	-84	1	-23	0	-367	17
2	16	0	-95	0	-25	0	204	2
3	149	2	282	4	-76	3	-256	-25
4	2	0	26	1	-6	1	78	25
5	40	0	185	2	-92	3	-33	-3
6	44	1	58	2	-5	0	3	1
7	69	1	170	2	-84	3	-55	-5
8	426	0	-691	0	-101	0	465	1
9	-1	0	101	2	3	0	-3	0
10	81	20	12	3	-2	2	9	16
11	27	7	70	19	-12	10	15	28
12	33	2	67	4	-5	1	5	2
13	36	2	36	2	-11	2	39	13
14	59	0	54	0	-19	0	6	0
15	45	1	105	2	-5	0	-46	-5
16	-36	0	97	0	73	-1	-35	-1
17	16	1	68	4	-25	4	41	14
18	31	2	63	5	-13	3	20	10
19	37	2	44	2	-23	4	42	15
20	88	1	27	0	-3	0	-12	-1
21	78	1	51	1	-11	0	-18	-2
22	71	4	130	8	-119	22	18	7
23	44	1	122	2	-51	3	-14	-2
24	88	4	47	2	-46	6	11	3
25	44	6	66	9	-27	11	17	15
26	81	4	25	1	-33	5	26	8
27	22	1	107	3	-14	1	-16	-3
28	91	9	3	0	-1	0	7	5
29	64	2	53	2	-19	2	3	1
30	108	1	19	0	-11	0	-16	-1
31	76	26	44	15	-10	11	-9	-22
32	-982	2	-1011	2	861	4	1232	-13
	100		100		100		100	

Notes: see Table 4.2.

Table 4.7. Factors Contributing to Sectoral Output Growth: 1971-81 (Balassa Total First Difference Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	354	2	62	0	-33	1	-283	-8
2	180	0	-3	0	-43	0	-34	0
3	32	0	150	1	0	0	-83	-3
4	88	2	26	1	-10	1	-4	0
5	148	-1	-308	1	132	1	128	-2
6	46	1	33	1	0	0	20	2
7	-5	0	287	5	-543	32	361	33
8	104	0	-7	0	26	0	23	0
9	6	0	80	0	-7	0	20	0
10	74	9	16	1	-10	3	20	10
11	5	1	106	15	5	-2	-15	-12
12	37	1	82	2	-14	1	-5	-1
13	44	2	58	2	-16	2	14	3
14	2	0	108	2	-8	0	-2	0
15	15	0	78	1	-7	0	15	1
16	241	0	281	0	-83	0	-340	-1
17	22	1	119	3	-24	2	-17	-3
18	5	1	84	8	-6	2	17	8
19	26	5	44	6	-20	10	50	37
20	78	2	5	0	-3	0	20	2
21	51	1	63	1	-19	1	5	0
22	25	4	86	10	-17	7	6	4
23	15	1	113	3	-45	4	17	3
24	75	3	75	3	-52	6	3	0
25	22	3	98	11	-17	7	-4	-2
26	61	5	40	2	1	0	-2	-1
27	19	1	91	5	-16	3	6	2
28	97	13	3	0	-1	0	1	1
29	39	2	42	2	-12	2	32	8
30	90	1	13	0	-3	0	0	0
31	70	37	27	11	-6	9	9	20
32	127	2	119	2	-129	7	-17	-1
		100		100		100		100

Notes: see Table 4.2.

Table 4.8. Factors Contributing to Sectoral Output Growth: 1961-81 (Balassa Total First Difference Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	201	1	164	0	-40	0	-225	-3
2	125	0	-34	0	-37	0	45	0
3	76	1	200	2	-28	1	-148	-7
4	51	2	26	1	-8	1	31	5
5	-470	0	2507	1	-1148	2	-788	-2
6	46	1	41	1	-2	0	15	2
7	8	0	266	4	-459	25	284	25
8	117	0	-35	0	-29	0	46	1
9	0	0	98	1	2	0	0	0
10	77	12	15	2	-6	3	15	11
11	13	3	93	16	-1	1	-4	-4
12	35	1	76	2	-10	1	-1	0
13	41	2	52	2	-14	2	22	5
14	11	0	100	1	-10	0	-1	0
15	22	0	85	1	-6	0	0	0
16	47	0	152	0	26	0	-126	-1
17	20	1	101	3	-25	3	4	1
18	10	1	80	7	-8	2	18	8
19	27	4	44	5	-20	8	49	33
20	79	2	9	0	-3	0	15	1
21	56	1	61	1	-17	1	0	0
22	31	4	92	10	-31	11	8	5
23	20	1	114	3	-46	4	12	2
24	78	3	67	2	-50	6	5	1
25	28	4	90	11	-19	8	2	1
26	65	5	37	2	-5	1	3	1
27	19	1	93	5	-16	3	4	1
28	95	12	3	0	-1	0	3	2
29	43	2	43	2	-13	2	27	7
30	94	1	14	0	-5	0	-4	0
31	71	34	31	12	-7	9	5	12
32	165	2	158	2	-163	6	-60	-4
		100		100		100		100

Notes: see Table 4.2.

this share was drastically reduced to 4.4 percent in the 1976-1981 period. This was due to the fall in the relative importance of the sugar industry, whose share in total exports declined from 38.6 percent in 1961 to only 0.7 percent in 1981.

From the above observation it is evident that the comparative advantage of Taiwan is changing from activities that require simple processing to activities that demand more capital and more sophisticated technology. Consequently, the decline in the relative importance of the textile and the food industries was increasingly overtaken by light and basic intermediates and machinery.

In the light intermediate sector, which consisted of wood, paper and publishing, and rubber and plastic products, export expansion was the dominant source of growth and accounted for 78.7 percent of output expansion during the 1961-1981 period.

Turning to the sources of growth by industry within the light intermediate sector, we observe that the plastic industry (18) is the dominant one. In this industry, export expansion was the prominent source of growth both for the subperiods and for the period as a whole (see Tables 4.2-4.8). For the 1961-1981 period export expansion contributed 79.7 percent of the industry's

output. Furthermore, the increase in output due to export expansion as a percentage of the total output increase attributed to export expansion for the whole economy was increasing throughout the subperiods. For the same period, next to export expansion technological change accounted for 17.5 percent of the industry's output. Domestic demand contributed only 10.3 percent of the increase of output of this industry.

For the remaining industries that constituted the light intermediate sector, export expansion was also the major source of growth of their output. This was more conspicuous in the lumber and plywood (12) industry where export expansion accounted for 75.8 percent of the increase in output of the industry for the chained result of 1961 to 1981. With the increasing role of export expansion, the relative importance of the light intermediates sector was increasing. Estimates which are not reported here also reveal that during the first subperiod, the share of this sector's output increase in total manufacturing output was 94 percent; during the last subperiod, however, its share increased to 23.5 percent.

In the case of basic intermediates, which constituted chemicals, non-metallic mineral products and basic metals, there was a wide variation in the sources of growth. In general, export expansion was the dominant source of growth accounting for 60.9 percent of the

increase in gross output for the first subperiod and 66.6 percent for the whole period.

In the fertilizer industry (16) the sources of output growth was dominated by technological change in the first, second and fourth subperiods. For the whole period, however, there was growth in which export expansion dominated, and to which technological change made a large negative contribution. This trend was also true of the petroleum products industry (19). Except for the 1966-1971 subperiod technological change was the main source of growth.

For the cement industry (20) domestic-demand expansion was the dominant source of growth, accounting for 79.5 percent of the increase in output of this sector for the entire twenty year period. In the case of non-metallic mineral products (21), however, export expansion was the main source of growth.

Exports made the largest relative contribution to output growth in the iron and steel industry (22) for the period as a whole. Import substitution was also relatively high; however, its relative importance declined through the subperiods. For the whole period export expansion, import substitution and domestic-demand expansion accounted for 92.1, 30.9 and 30.9 percent respectively.

Another observation concerning the basic intermediate sector relates to the continuing relative importance of

this sector in manufacturing growth. This sector's contribution to output growth increased from 17.6 percent during the 1961-1966 subperiod to 35.0 percent during the last subperiod (1976-1981) (the data is not supported here).

One of the most striking observations from the decomposition analysis is that the machinery sector in Taiwan appears consistently to improve its relative position among all sectors of the Taiwanese economy. This is particularly true of the electrical machinery and equipment industry (25). The share of this industry in total exports was 1.2 percent in 1961, but in 1981 its share was increased to 17.7 percent. Similarly, the share of the sector's export expansion in total export expansion increased from 2.7 percent in the first period to 12.3 percent in the last period. During the first subperiod, domestic-demand expansion which accounted for 33.9 percent of the increase in this sector's gross output, was the dominant source of growth; export expansion accounted for only 30.6 percent. In the last subperiod, however, export expansion's share increased to 100.1 percent, and for the 1961-1981 period, export expansion contributed 98.3 percent of the total increase in the sector's output. Domestic demand expansion and import substitution constituted a small share of output growth in this sector (see Tables 4.2-4.8).

In the transport-equipment industry (26) import

substitution was the dominant source of gross-output increase during the first and second periods. As can be seen from Tables 4.2-4.8, however, the situation was completely reversed in the third period, with export expansion becoming the most important source of growth in this industry, but sinking back below domestic demand expansion in the fourth period.

The role of import substitution in the sources of growth in Taiwanese manufacturing industry is very limited. For the whole period under review, import substitution made a positive contribution only in the fertilizer industry. In all other industries it has made a negative contribution of varying magnitude (see Table 4.8).

Unlike import substitution technological change has made a positive contribution in almost all sectors of the manufacturing industry. Technological change made a positive modest contribution in petroleum products, pulp and paper products, plastic products and miscellaneous foods.

4.4 Structural Change in Gross Output: Deviation Measures

The focus of this section is to analyze the causes of nonproportional growth in gross output for the Taiwanese economy. This analysis may enable us to entangle the factors that cause some sectors to grow faster than the average growth of all sectors and others to grow at a

slower-than-average rate. As was indicated in the preceding chapter, the basic framework of the analysis used in this section is similar to the one used in the analysis of sectoral growth. The deviation from equiproportional growth is decomposed, as was the case with the sectoral growth, into four components: domestic-demand expansion, export expansion, import substitution, and technological change.

Tables 4.9 to 4.15 present estimates for the non-proportional output expansion in major and individual sectors for the period covering 1961-1981 (according to Syrqin's decomposition formula). As is evident from these tables, the deviations of output from balanced growth show wide variations among sectors and over time. In general, the sectoral estimates for the sources of structural change support the conclusions reached on the basis of overall analysis discussed in the last sections.

The compositional shift in domestic final demand accounted for 68.2 percent of the positive deviations in agricultural gross output for the entire twenty year period. Within the agricultural sector this factor was dominant in the fisheries and livestock sectors. For the agricultural sector as a whole, import substitution was the second important source of structural change, accounting for 23.3 percent of the deviation of the sector's output from equiproportional growth. In contrast, as Taiwan is a natural-resource-poor country,

the non-proportional growth of exports had a negligible impact on the compositional shift in agricultural output for the chained result of 1961-1981. In fact, except for the last subperiod, export expansion made a negative contribution to the sector's output deviation from proportional growth, implying that for these periods agricultural exports grew by less than the national income and hence they tended to reduce sectoral growth below the average growth.

By contrast with the agricultural sector, the significant positive deviation in the service sector's output from balanced growth was largely attributable to the rapid expansion of exports. For the period under review, export expansion explained 40.8 percent of the positive deviation of the sector's output, while domestic demand and technological change contributed 37.4 percent and 25.5 percent respectively.

When we turn to the manufacturing sector, a finding apparently consistent with the outward-oriented strategy of the Taiwanese economy emerges. Except for the first subperiod and apart from food, export expansion was the most important factor in explaining the deviation of output from equiproportional growth in the five main categories of the manufacturing sector. For the chained result of 1961-81, this factor alone explained 64.9 percent of deviation from balanced growth. As in the case of the first-difference measures, there was a wide

variation in the sources of output deviations among sectors and over time. For the first subperiod, export expansion accounted for 34.5 percent of the deviation of output in the manufacturing sector. In subsequent periods, however, this factor dramatically increased to 92.3 percent and to 84.8 percent in the 1966-1971 and 1971-76 periods. In the last period (1976-1981), however, while export expansion was still higher than in the first period, it explained only 42.7 percent of the deviation of manufacturing output from equiproportional growth. As will be explained later, this phenomenon can be explained by the inability of the food and textile exports to grow as fast as the rest of the manufacturing sectors during the last sub-period.

The disaggregated estimates also indicate that export expansion was the dominant source of structural change in the major sectors of manufacturing industry. According to the chained results (1961-1981), except for the food sector, export expansion accounted for the largest share of the positive deviations from equiproportional growth of the major sectors of the manufacturing industry. Even within the food sector, export expansion was positive and dominant in the sugar and canned food industry. However, in the miscellaneous food industry, which constituted the largest sector, export expansion made a negative contribution to the sector's structural change.

In the rest of the major sectors of the manufacturing industry, export expansion was the dominant source of growth of output deviation from balanced (or equiproportional) growth. For the machinery sector, domestic demand made a negative contribution to the deviation of output from equiproportional growth of the output of these sectors. In contrast, export expansion explained 87.6 percent, 227.9 percent and 61.5 percent of the (positive) deviations observed in the textile and leather, light intermediates and basic intermediate sectors in the first subperiod. Even in the last subperiod, still export expansion accounted for the positive deviation of output from equiproportional growth in these sectors.

As was explained in the discussion on the sources of gross output growth, the relative deviations of sectors from balanced growth is changing with comparative advantage in Taiwan. Most of the positive deviations of output from equiproportional growth toward the end of the period were explained by activities that seem to require skilled labour and advanced technology. For instance, the nonproportional growth of exports in the textile industry made a positive contribution of 10 percent, 33 percent and 29 percent of the share of exports in the nonproportional growth of output in the first, second and third periods (see column 5, Tables 4.9-4.15).

Table 4.9. Source of Output Deviation from Equiproportional Growth : 1961-66 (Syrquin Total Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	244	33	3	-1	-6	-13	-141	39
2	486	2	692	-5	5	0	-1084	8
3	30	3	-27	6	18	30	79	-17
4	-1583	16	73	2	-75	12	1685	36
5	128	2	-102	4	88	23	-14	0
6	148	2	-65	2	11	3	5	0
7	-353	1	116	1	41	-2	296	2
8	35	2	73	-10	0	0	-9	1
9	2	0	120	8	-17	8	-5	0
10	79	38	10	11	0	2	12	11
11	-46	3	82	10	-17	15	81	10
12	-17	0	149	7	-13	4	-18	-1
13	-103	2	49	2	-11	3	165	6
14	58	0	-64	0	23	1	83	0
15	-63	0	156	1	116	-3	-109	0
16	-127	1	6	0	-17	2	239	3
17	-37	2	9	1	52	-33	76	6
18	15	-1	63	5	-13	8	35	3
19	-51	1	25	1	-9	3	135	7
20	-1145	1	1090	3	3	0	151	0
21	-18	0	67	1	-14	2	65	1
22	25	0	291	6	-218	32	1	0
23	80	1	-143	2	26	3	137	-2
24	15	-1	26	2	47	-30	12	1
25	8	0	28	4	45	-44	19	2
26	80	-2	20	1	-49	21	49	3
27	34	2	-10	1	55	40	22	-2
28	332	7	-113	5	1	0	-120	5
29	-40	1	37	1	-13	3	116	4
30	107	-1	22	0	-12	1	-16	0
31	117	59	-22	24	1	11	3	-3
32	13	2	-12	3	0	-1	99	-23
Total		100		100		100		100

Sourec : see Table 4.1

Table 4.10. Source of Output Deviation from Equiproportional Growth : 1966-71 (Syrquin Total Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	49	34	0	0	3	2	48	92
2	15	2	36	-2	1	0	48	21
3	39	21	6	-1	42	27	13	20
4	67	22	-6	1	9	3	30	28
5	-106	-3	-110	1	184	6	131	10
6	-837	8	971	3	-150	2	126	-3
7	4	1	-15	1	50	9	61	27
8	26	3	78	-3	1	0	-5	-2
9	74	4	46	-1	-25	-2	5	1
10	105	114	0	0	5	6	-10	-30
11	18	-27	68	33	-1	1	15	-65
12	24	-5	60	4	-2	0	18	-11
13	-6	1	28	1	0	0	77	-27
14	46	-3	49	1	-9	1	14	-2
15	23	-2	132	3	17	-1	-73	15
16	50	6	12	-1	-6	-1	44	15
17	-39	3	125	3	-53	4	67	-13
18	17	-7	57	8	4	-2	22	-26
19	-19	3	74	3	-39	6	84	-31
20	-70	-3	111	-2	4	0	56	7
21	486	-3	366	1	185	-1	-936	14
22	43	-9	66	4	-20	5	11	-7
23	20	-1	64	1	16	-1	0	0
24	73	-7	56	2	-31	3	1	0
25	28	-24	72	19	-12	12	12	-29
26	30	-5	31	2	18	-4	22	-11
27	12	-3	71	6	16	-5	2	-1
28	138	-29	-44	-3	-1	0	7	-4
29	115	-2	365	2	-30	1	-350	16
30	152	-3	27	0	-22	0	-57	3
31	48	17	-99	11	39	16	113	111
32	54	-2	116	1	-260	11	190	-19
Total		100		100		100		100

Source: see Table 4.1

Table 4.11. Source of Output Deviation from Equiproportional Growth : 1971-76 (Syrquin Total Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	1703	12	199	0	-104	2	-1698	-12
2	256	1	-166	0	-71	1	81	0
3	30	-7	3	0	69	39	-2	1
4	65	-3	-64	1	25	3	75	-4
5	10	-1	-6	0	60	21	35	-5
6	-119	-5	157	1	-52	6	113	5
7	51	6	44	1	-211	63	216	25
8	-22	0	-447	0	-162	1	731	2
9	22	-1	81	-1	0	0	-2	0
10	-24	-7	20	1	-9	7	113	34
11	-94	-57	228	29	27	-43	-61	-37
12	-164	3	-303	1	95	5	473	-9
13	-18	0	366	2	-25	1	-224	-5
14	5	1	95	3	-5	2	5	1
15	23	1	73	1	-12	2	16	1
16	-15	0	4	0	103	5	8	0
17	-6	-1	80	2	19	-6	7	1
18	-8	-4	96	11	1	-1	11	6
19	19	15	32	5	-15	30	64	48
20	108	9	-35	-1	-1	0	28	2
21	51	6	44	1	-1	0	6	1
22	12	7	32	4	46	-69	11	7
23	11	2	55	2	-2	1	35	7
24	95	8	104	2	-91	20	-9	-1
25	3	2	87	13	-3	6	14	9
26	-12	-3	74	4	36	-22	1	0
27	6	2	91	7	-7	7	10	4
28	101	66	1	0	-1	1	-1	-1
29	5	1	54	2	-2	1	43	6
30	111	4	9	0	7	-1	-27	-1
31	64	45	45	7	-23	43	14	10
32	-3	-1	42	2	38	-22	22	5
Total		100		100		100		100

Source: see Table 4.1

By contrast, in the last subperiod (1976-1981), the share of nonproportional growth in exports of the textile industry in total deviation of exports from equiproportional growth made a (negative) contribution of -18 percent. A similar trend to that in the textile industry was observed in the individual industries of the food sector (see Tables 4.9-4.15). Thus, both the textile and the food industry, in the last subperiod, seem to reduce sectoral output growth rates.

Unlike the textile sector , the share of export deviations from balanced growth in the basic intermediate and the machinery industries made a positive and significant contribution to structural changes in these sectors. In the first subperiod, the share of output deviation from balanced growth of the iron and steel industry accounted for only 5 percent of the total deviations of output due to export expansion. In the last subperiod, however, this share increased by nearly five-fold to 22 percent. Similarly, the share of deviations of exports of plastic, and electrical machinery and equipment in total deviations of output from balanced growth increased from 5 and 4 percent in the first subperiod to 16 and 23 percent, respectively, in the last subperiod. Despite these trends, however, when the whole period from 1961 to 1981 is considered, the textile sector still dominates the deviation of output from balanced growth, accounting for the largest

share of exports deviations from balanced growth (see Tables 4.9-4.15).

Table 4.12. Source of Output Deviation from Equiproportional Growth : 1976-81 (Syrquin Total Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	31	-7	2	0	8	-9	59	-14
2	29	-1	56	-2	5	-1	10	0
3	19	-2	25	-2	20	-11	36	-4
4	64	-7	14	-1	26	-14	-4	1
5	11	0	7	0	78	-14	4	0
6	-3	0	247	-4	-60	6	-84	2
7	-1425	2	-1298	1	9265	-61	-6442	9
8	20	-1	74	5	7	-3	0	0
9	8	0	93	5	2	-1	-3	0
10	78	-35	9	3	27	-61	-13	6
11	-204	16	265	-8	-31	13	70	-6
12	-1	0	71	2	-51	-7	81	2
13	20	3	26	3	-3	-2	57	8
14	-41	-1	168	4	-6	-1	-22	-1
15	-11	-1	53	2	28	7	29	2
16	10	0	11	0	29	-4	50	-1
17	-22	0	-139	2	5	-1	255	-6
18	-5	-2	55	16	10	17	40	15
19	12	9	11	7	23	87	54	43
20	29	2	15	1	-3	-1	59	4
21	17	1	108	3	-38	-7	14	1
22	10	6	45	22	47	136	-2	-1
23	11	1	71	5	22	9	-4	0
24	24	4	58	7	17	13	1	0
25	31	9	92	23	2	3	-25	-8
26	59	18	21	5	26	40	-6	-2
27	16	3	71	13	12	14	0	0
28	64	5	7	0	2	1	27	2
29	27	7	11	2	7	10	55	16
30	66	1	6	0	10	1	19	0
31	47	60	20	22	4	28	28	3
32	-113	12	1	0	162	-86	50	-6
Total		100		100		100		100

Source: see Table 4.1

Table 4.13. Source of Output Deviation from Equiproportional Growth : 1961-71 (Syrquin Total Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	120	33	1	0	-1	-1	-20	21
2	42	2	74	-3	1	0	-17	3
3	36	8	-6	1	34	28	37	-30
4	232	18	-14	1	17	5	-135	39
5	42	1	-105	2	123	9	39	-3
6	395	4	-322	3	52	2	-25	1
7	30	1	-25	1	51	7	44	-6
8	31	2	75	-5	0	0	-7	2
9	-119	1	244	2	-4	0	-21	-1
10	-19	1	48	3	-20	6	91	26
11	11	-5	69	27	-2	4	22	36
12	15	-1	80	5	-4	1	10	3
13	-35	2	35	1	-3	1	104	18
14	45	-1	63	1	-13	1	5	0
15	18	0	134	2	24	-2	-75	-6
16	81	2	14	0	-5	0	10	-1
17	-38	2	51	2	14	-2	73	13
18	16	-2	58	7	1	0	25	13
19	-30	2	57	3	-29	6	102	20
20	17	0	32	0	4	0	48	-2
21	66	-1	116	1	19	-1	-101	-3
22	41	-2	93	5	-44	10	10	2
23	-1	0	137	2	12	-1	-49	-2
24	41	-2	40	2	12	-3	7	1
25	25	7	64	15	-2	2	13	13
26	45	-3	28	2	-2	1	30	8
27	-7	0	142	5	-19	3	-16	-2
28	65	-3	-18	-1	-2	0	54	8
29	-2	0	118	2	-17	1	1	0
30	132	-1	24	0	-18	1	-39	-1
31	103	48	-37	15	9	15	25	-43
32	9	1	-28	2	31	9	89	-25
Total		100		100		100		100

Source: see Table 4.1

Table 4.14. Source of Output Deviation from Equiproportional Growth :1971-81 (Syrquin Total Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	6	-1	-1	0	10	-220	86	-13
2	21	-1	63	-1	8	-34	8	0
3	25	4	14	-1	44	-979	17	-3
4	64	-6	0	0	26	-351	10	-1
5	10	-1	-1	0	67	-691	24	-2
6	4435	-2	3657	-1	-371	20	-7622	3
7	86	3	76	1	-437	2465	375	14
8	20	-1	83	-2	9	-73	-12	1
9	12	-1	90	-2	1	-12	-3	0
10	128	-26	3	0	44	-1374	-75	16
11	-53	-8	213	13	49	1098	-110	-17
12	80	1	258	1	-123	-243	-114	-2
13	17	2	52	2	-5	-74	35	4
14	-10	-1	119	3	-5	-48	-4	0
15	0	0	60	1	15	115	25	1
16	3	0	9	0	49	-174	39	-1
17	2	0	191	2	26	108	-119	-3
18	-6	-3	73	13	6	372	27	12
19	15	11	18	6	10	1199	57	45
20	60	4	-5	0	-2	-25	47	4
21	37	2	70	2	-16	-156	9	1
22	11	6	41	10	46	4123	2	1
23	11	1	62	3	9	166	17	2
24	40	5	68	4	-6	-123	-1	0
25	16	7	89	16	-1	-59	-4	-2
26	39	11	36	4	29	1237	-4	-1
27	11	3	81	9	3	142	5	1
28	94	25	2	0	0	-10	4	1
29	23	5	19	2	5	191	52	13
30	86	2	7	0	8	35	-2	0
31	51	55	26	12	-2	-261	25	29
32	4257	8	1632	1	-4764	-1333	-1025	-2
Total		100		100		100		100

Source: see Table 4.1

Table 4.15. Source of Output Deviation from Equiproportional Growth :1961-81 (syrquinTotal Method) (percent)

Sec.	DDE		EE		IS		TC	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	78	-432	0	0	3	5	19	-6
2	34	-31	70	-1	4	1	-7	0
3	31	-148	2	0	38	54	29	-8
4	140	-303	-6	0	22	14	-55	7
5	17	-20	-24	1	79	28	27	-2
6	555	-67	-165	0	35	1	-325	2
7	2766	28	4929	1	-23925	73	16331	10
8	27	-45	78	-3	4	2	-9	1
9	32	-21	66	-1	2	0	0	0
10	206	-368	-20	1	78	42	-164	18
11	-5	-40	107	17	11	-25	-12	-6
12	25	27	109	2	-24	8	-10	-1
13	1	2	47	2	-4	3	56	7
14	-1	-1	109	2	-6	2	-2	0
15	5	5	80	2	17	-5	-3	0
16	44	-29	11	0	21	4	24	-1
17	-23	-22	104	2	18	-5	1	0
18	-1	-6	69	11	5	-10	27	12
19	12	127	20	5	8	-26	60	40
20	67	55	-11	0	-3	1	47	2
21	40	38	75	2	-13	4	-3	0
22	13	115	45	8	38	-99	3	2
23	10	17	70	3	10	-5	11	1
24	40	97	60	3	-1	1	1	0
25	19	173	80	16	-1	4	2	1
26	40	187	34	3	23	-32	2	1
27	9	38	88	8	1	-1	2	1
28	90	368	0	0	0	1	10	3
29	21	70	26	2	4	-4	49	10
30	97	46	11	0	2	0	-10	0
31	16	143	67	13	-8	22	26	14
32	-103	96	-71	1	156	44	118	-7
Total		100		100		100		100

Source: see Table 4.1

While export expansion was the dominant source of structural change in Taiwan, domestic demand has also played an important role in many sectors. When the whole period from 1961-1981 is taken into account, domestic demand expansion was the dominant source of output deviation from equiproportional growth in the following sectors: miscellaneous food products (10), fertilizers (16), cement and cement products (20) and transport equipment (26).

In contrast, the nonproportional growth of import substitution had a negligible impact on the compositional changes in the manufacturing output. As can be learned from Tables 4.9-4.15 import substitution was only dominant in the first subperiods in machinery (24) and electrical machinery and equipment (25) industries.

The effect of technological change was, however, positive and relatively significant in some sectors. Technological change was a major source of structural change during the first subperiod in the following industries, paper and paper products(13), leather and leather products(14), chemical fertilizer(16), drugs miscellaneous chemicals(17) and petroleum products(19). Still, in the last subperiod, technological change was significant, but its significance was very much reduced when compared to the first subperiod. When the whole period from 1961 to 1981 is considered, only in the petroleum products

industry(19) was technological change's contribution to nonproportional growth of the sector's output dominant. In general, while technological change made a positive contribution to structural change, its role has been significantly reduced from 32.1 percent in the first subperiod to 22.2 percent in the last subperiod. Nevertheless, next to export expansion and domestic-demand expansion, technological change was the most important factor in explaining output deviations from equiproportional growth.

Thus, whether by the source-of-growth decomposition measure or by the deviation measure, the analysis indicates that export expansion was the single most important factor in explaining output growth of the manufacturing sector. Nevertheless, the results of the last subperiod seem to indicate that the role of export expansion was significantly reduced then compared to the last third subperiod. When the 1981-1984 period was included, the role of export expansion was further reduced(unfortunately it was too late to be incorporated fully in the analysis). Since, by contrast, domestic demand expansion has increased during the last period (by the first difference method), the reason for the decline in the relative importance of export expansion must be the widening of the domestic market due to the increase in per capital real income and population growth.

4.5. Sources of Import Growth and Import Dependence in an Export-Led Economy: The Case of Taiwan, 1964-1984

4.5.1 Introduction

One advantage of the export-led stategy followed by Taiwan and the rest of the export-led countries is that foreign exchange earnings from exports enables them to import intermediate and capital goods relatively easier than the inward-oriented countries. Indeed, over the past few decades, by providing free access to imported raw materials and intermediate goods for producers of exportables, and by discouraging the use of imported intermediates in domestic production, Taiwan increasingly diverted imported intermediates towards exporting activities (see de Melo, 1985, p. 22). In this section the apparent import deepening industrialization of the Taiwanese economy that accompanied the export-led growth over the past few decades is explained in terms of sources of import growth and import content analysis for the 1964-1984 period in current prices.

4.5.2. Sources of Import Growth, 1964-1984.

The purpose of this section is to estimate the sources of import growth in Taiwan in order to gain some insight into the process arising from the import-dependent export-led growth strategy followed by Taiwan. It is hoped that identification of these sources of import growth can provide a complementary perspective to that of the sectoral sources of output growth discussed

in the first part of this chapter. The method employed here is basically an extension of the method used to analyze the sources of gross output growth discussed in Chapter three.

Total imports M, comprise intermediate imports, M^W, and imports for final use, M^F

$$Mt = M^W + M^F = A_t^M X_t + M^F = A_t^M X_t + m^f D_t \qquad (4.1)$$

where $m^f_t = D_t^m / D_t$, and D^m and D are imported final demand and total final demand respectively.

From equation (4.1) we can derive the following source of import growth decomposition:

$$\begin{aligned}
\Delta M = {} & (m^f + A_1^M R_1^d + u_1^f)\Delta D && \text{Demand expansion} \\
& + A_1^M R_1^d \Delta E && \text{Export expansion} \\
& + [I - A_1^M R_1^d]\Delta m^f D_2 && \text{IS final} \\
& + [\{I - A_1^M R_1^d\}(\Delta m_{ij} a_{ij2})]X_2 && \text{IS intermediate} \\
& + [\{I - A_1^M R_1^d\}(m_{ij1} \Delta a_{ij})]X_2 && \text{Technological change}
\end{aligned} \qquad (4.2)$$

where $m_{ij} = a_{ij}^m / a_{ij}$.

Tables 4.16 to 4.20 present estimates of sources of import growth for Taiwan over the period 1964-1984 in aggregated and disaggregated first-difference formulation as proposed by Syrquin(1976). The aggregate direct measures listed in Table 4.16 indicates that intermediate demand expansion was the single most important source of import growth. For the entire period under review and

for the sub-periods the share of intermediate demand expansion was higher than any other source of import growth. Intermediate demand expansion measured by the direct method accounted for more than three-fourths of the import growth; while final domestic demand expansion and import substitution accounted for 28.1 percent and -3.4 percent respectively. As can be seen from Table 4.16 the share of final domestic demand expansion always remained below the level recorded in the first sub-period while that of intermediate demand expansion has more than doubled from 48.4 percent in the first sub-period to 102.7 percent in the last sub-period. Furthermore, as the chained result in Table 4.16 shows, the relative contribution of intermediate demand expansion to the source of import growth has increased from 48.4 percent in the 1964-69 chained period to 78.1 percent in the 1976-84 chained period. On the other hand, the relative share of import substitution declined from 17.1 percent in the first chained period (1964-1969) to -6.2 percent during the last chained sub-period (1976-1984). The negative values for impact of import substitution in the last two sub-periods indicate a falling import-to-domestic-supply ratio implying that some form of import substitution has taken place in these sub-periods.

In terms of the total method, the relative contributions of final domestic demand expansion, export expansion,

import substitution and technological change to the total source of import growth for the whole period were 74.4, 15.6, 10.1, and -0.1 percent respectively. It is clear from this table that domestic final demand expansion was the most important source of import growth; while technical change was the least important. Next to final domestic demand expansion, export expansion was the main source of import growth. As can be learned from Table 4.17, the relative contribution of this factor increased from 10.3 percent in the first chained period(1964-1969), to 16.3 percent in the last chained period(1976-1984). Table 4.18 also reveals that the role of import substitution was significant in almost all the sub-periods except the fourth sub-period (1976-1981). During the last sub-period, it made a substantial contribution to import growth mainly due to negative import substitution in the petroleum and petroleum product industry which accounted for more than a fifth of the import growth during this period.

The finding that intermediate demand expansion as a source of import growth is important in Taiwan seems to be in line with the observation that "...as countries industrialize, their productive structure becomes more 'roundabout' in the sense that a higher proportion of output is sold to other producers rather than to final use" (Chenery, et.al., 1986, p. 57).

Table 4.16. Sources of Import Growth, 1964-1984:
A Summary of Aggregated Results
(First Difference Syrquin Direct Share Method).

A. Direct Method

	DDE	IW	IS	TOT
	(percent)			
1964-1966	43.1	48.4	8.5	100
1966-1969	31.6	48.4	20.1	100
1969-1971	37.2	72.0	-9.2	100
1971-1976	25.8	71.7	2.5	100
1976-1981	29.4	72.9	-2.3	100
1981-1984	22.2	102.7	-24.9	100
1964-1969**	34.5	48.4	17.1	100
1969-1976**	27.2	71.7	1.1	100
1976-1984**	28.2	78.1	-6.2	100
1964-1984**	28.1	75.3	-3.4	100

B. Total Method

	DDE	EE	ISF	ISW	TC	TOT
1964-1966	84.8	12.1	-3.3	6.6	-0.2	100
1966-1969	84.6	9.8	2.1	3.3	0.2	100
1969-1971	91.7	16.1	-4.3	-3.8	0.3	100
1971-1976	84.2	14.5	1.0	-0.5	0.8	100
1976-1981	86.2	14.7	-0.6	-0.3	0.0	100
1981-1984	45.5	18.6	-0.9	37.6	-0.8	100
1964-1969**	84.6	10.3	1.0	3.9	0.1	100
1969-1976**	85.1	14.7	0.4	-0.8	0.8	100
1976-1984**	70.7	16.2	-0.7	14.2	-0.3	100
1964-1984**	74.4	15.6	-0.4	10.5	-0.1	100

Source: author's estimate

Notes: DDE= final domestic demand expansion,
EE = export expansion
IW = intermediate demand expansion
IS = import substitution
ISF= IS in final goods
ISW= IS in intermediate goods
TC = technological change.
** indicates that the estimates are chained results.

Indeed, as the discussion in the next section indicates the share of intermediate inputs in total production has increased markedly in Taiwan.

The sectoral breakdown of the sources of import growth Both for the direct and the total measures, over the longer (chained) periods are presented in Tables 4.17 to 4.20. According to the direct measure, the main source of import growth for the the agricultural, mining and the manufacturing sectors was intermediate demand expansion which accounted for 63.5, 90.5, and 80.8 percent respectively. By contrast, final domestic demand expansion was the main source of import growth in the service sector.

In the manufacturing sector we observe that import substitution was positive during the first chained period but turned to negative during the last two chained periods. The negative values during these last two periods indicates a falling import-to-domestic-supply ratio; which may suggest that some form of direct import substitution was taking place during this periods.

Coming to the individual sectors we observe that the main source of import growth in the food sector, as expected, was final domestic demand expansion followed by import substitution and intermediate demand expansion. Domestic final demand has also played a significant role in the growth of imports in the basic metal and machinery sectors.

The factors contributing to the growth of imports in basic metals and machinery changed between the first

Table 4.17. Sources of Import Growth, 1964-1976:
A Summary of Disaggregated Results
(First Difference Syrquin Direct Share Method).

percent

A. 1964-1966-1969

		DDE	IW	IS	TOT
1.	Agriculture	15.1	44.3	40.1	100
2.	Mining	13.6	81.6	4.8	100
3.	Food	12.1	94.5	-6.6	100
4.	Textile & Leather	15.3	59.7	25.0	100
5.	Light Intermediate	29.8	51.9	18.4	100
6.	Basic Intermediate	8.8	97.5	-6.3	100
7.	Basic Metals & Machinery	56.1	27.1	16.8	100
8.	Social Overhead	16.4	27.8	55.9	100
9.	Services	65.2	3.6	31.3	100
10.	Manufacturing	37.9	51.5	10.6	100

B. 1969-1971-1976

		DDE	IW	IS	TOT
1.	Agriculture	15.2	58.8	26.0	100
2.	Mining	4.3	89.9	5.8	100
3.	Food	54.0	37.9	8.1	100
4.	Textile & Leather	15.7	94.7	-10.4	100
5.	Light Intermediate	17.3	74.6	8.1	100
6.	Basic Intermediate	10.2	105.5	-15.7	100
7.	Basic Metals & Machinery	52.1	49.7	-1.8	100
8.	Social Overhead	52.9	41.4	5.7	100
9.	Services	46.4	23.0	30.6	100
10.	Manufacturing	33.4	73.3	-6.7	100

Notes: see Table 4.16.
Source: author's estimate.

and the last chained periods. During the first and second chained periods, domestic demand expansion was the main source of import growth in these sectors.

Table 4.18. Sources of Import Growth, 1964-1984:
A Summary of Disaggregated Results
(First Difference Syrquin Direct Share Method).

percent

A. 1976-1981-1984

	DDE	IW	IS	TOT
1. Agriculture	40.6	69.1	-9.7	100
2. Mining	-2.7	90.8	11.8	100
3. Food	38.1	26.0	35.9	100
4. Textile & Leather	23.7	79.3	-3.0	100
5. Light Intermediate	8.8	62.2	29.1	100
6. Basic Intermediate	10.9	138.5	-49.3	100
7. Basic Metals & Machinery	48.4	65.6	-14.0	100
8. Social Overhead	39.3	39.5	21.2	100
9. Services	90.6	45.5	-36.2	100
10. Manufacturing	33.1	85.9	-19.0	100

B. 1964-1984

	DDE	IW	IS	TOT
1. Agriculture	29.0	63.5	7.5	100
2. Mining	-0.9	90.5	10.4	100
3. Food	40.9	28.9	30.2	100
4. Textile & Leather	21.5	82.3	-3.8	100
5. Light Intermediate	11.0	63.9	25.1	100
6. Basic Intermediate	10.5	126.1	-36.6	100
7. Basic Metals & Machinery	49.9	59.0	-8.8	100
8. Social Overhead	40.7	39.4	19.9	100
9. Services	75.1	35.9	-11.0	100
10. Manufacturing	33.4	80.8	-14.2	100

Notes: see Table 4.16.
Source: author's estimate.

However, during the last chained period, intermediate demand expansion become the the dominant source of import growth(see Tables 4.17 and 4.18).

According to the total measure, except for the basic

intermediate sector the main source of import growth for the main sectors of the economy listed in Tables 5.19 and 5.20 was final domestic demand expansion followed by export expansion and import substitution. For the manufacturing alone, domestic final demand expansion contributed 63.1 percent of the growth of imports while export expansion, import substitution and technological change contributed 25.1, 11.3, and around 0.6 percent respectively. Data not reported here indicate, export expansion was the dominant source of import growth in the following industries: forestry, artificial fibre, petrochemical raw materials, miscellaneous chemicals, artificial fibre, plastic and plastic products, and non-ferrous metals. On the other hand, the main source of import growth in the miscellaneous sector, cement and cement products, and miscellaneous non-metalic minerals was import substitution. In all the remaining sectors, however, final domestic demand expansion was the main source of import growth.

The role of changes in input-output coefficients (or technical change) was insignificantly low for most sectors. Apart from the mining sector, changes in input-output coefficients did not make any substantial contribution to the source of import growth.

Table 4.19. Sources of Import Growth, 1964-1976: A Summary of Disaggregated Results (First Difference Syrquin Total Share Method).

percent

A. 1964-1966-1969

	DDE	EE	ISF	ISW	TC	TOT
1. Agriculture	48.8	20.3	9.8	21.0	0.2	100
2. Mining	62.5	25.3	0.3	10.8	0.9	100
3. Food	98.9	0.9	-1.2	1.4	0.1	100
4. Textile & Leather	47.9	28.5	21.0	2.7	0.1	100
5. Light Intermediate	83.5	13.9	-3.9	6.7	-0.3	100
6. Basic Intermediate	60.4	52.9	-7.4	-5.1	-0.8	100
7. Basic Metals & Machinery	79.5	11.0	1.6	6.7	1.2	100
8. Social Overhead	95.1	0.6	1.0	3.3	0.0	100
9. Services	97.0	0.7	0.6	1.8	0.0	100
10. Manufacturing	78.3	19.6	-0.2	2.1	0.3	100

B. 1969-1971-1976

	DDE	EE	ISF	ISW	TC	TOT
1. Agriculture	69.7	24.3	-1.1	6.8	0.2	100
2. Mining	59.6	36.3	-0.2	-0.4	4.7	100
3. Food	98.4	1.3	0.7	-0.1	-0.1	100
4. Textile & Leather	75.2	30.2	1.5	-7.0	0.0	100
5. Light Intermediate	78.2	19.8	3.4	-1.5	0.1	100
6. Basic Intermediate	61.2	42.0	3.3	-9.2	2.7	100
7. Basic Metals & Machinery	74.8	28.6	-2.4	-2.7	1.7	100
8. Social Overhead	99.1	0.6	0.9	-0.6	0.0	100
9. Services	96.1	1.2	0.2	2.3	0.0	100
10. Manufacturing	78.6	23.8	0.5	-4.1	1.3	100

Notes: see Table 4.16.
Source: author's estimate.

Table 4.20. Sources of Import Growth, 1964-1984:
A Summary of Disaggregated Results
(First Difference Syrquin Total Share Method).

percent

A. 1976-1981-1984

	DDE	EE	ISF	ISW	TC	TOT
1. Agriculture	83.4	23.4	-3.8	-3.3	0.4	100
2. Mining	109.8	96.3	5.0	-94.0	-17.0	100
3. Food	89.6	3.9	0.8	5.3	0.4	100
4. Textiles & Leather	76.4	21.9	3.3	-1.6	0.4	100
5. Light Intermediate	34.1	12.6	2.5	50.7	0.2	100
6. Basic Intermediate	36.5	31.2	0.4	31.6	0.2	100
7. Basic Metal & Machinery	67.4	36.5	-7.8	3.2	0.8	100
8. Social Overhead	72.7	1.6	0.4	25.3	0.1	100
9. Services	83.1	1.9	-0.2	15.2	0.1	100
10. Manufacturing	57.6	25.7	-1.5	17.7	0.4	100

B. 1964-1984

	DDE	EE	ISF	ISW	TC	TOT
1. Agriculture	77.4	23.6	-2.3	1.1	0.3	100
2. Mining	95.1	78.4	3.5	-66.2	-10.7	100
3. Food	92.8	2.9	0.7	3.4	0.2	100
4. Textile & Leather	75.6	24.1	2.9	-2.9	0.3	100
5. Light Intermediate	42.5	13.7	2.4	41.3	0.1	100
6. Basic Intermediate	41.7	33.4	0.8	23.1	0.7	100
7. Basic Metals & Machinery	69.6	33.6	0.8	23.1	0.7	100
8. Social Overhead	79.8	1.3	0.5	18.3	0.1	100
9. Services	86.0	1.8	-0.1	12.3	0.0	100
10. Manufacturing	63.1	25.1	-1.0	12.3	0.6	100

Notes: see Table 4.16.
Source: author's estimate.

The preceding pages have shown that by both the direct and the total measure the dominant source of import

growth was final domestic expansion. Nevertheless, it important to note that the contribution of export expansion was also significant. As will be shown in the next section, this development may indicate the growing import intensity of export-led growth in Taiwan.

It may be argued that the poor natural resource endowment of Taiwan may have acted as an impetus for its rapid economic growth through dependence on imported intermediate inputs. As de Melo (1985) remarks "... it is not necessary to have a strong natural resource base to become an important exporter of manufactured exports provided one is ready to allocate foreign exchange for imports to be used by exporting industries".

4.6 Import Content of Final Demand

In this section the import content of final demand and export are analysed. We use the usual Leontief input-output model discussed in Chapter 3:

Let S, the import content matrix, be defined as:

$$S_t = A^m_t R^d_t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (4.3)$$

where:

A^m = imported inter-industry input-output coefficients

R^d = Leontief inverse of domestically supplied inter-industry input-output coefficients, and

t= 1964,1966,1969,1971,1976,1981 and 1984.

A typical element of S, s_{ij}, gives the total imports of a ccommodity i needed to generate one unit of final product of sector j. The column sum of S gives the total import content of one unit of final product in each sector.

The input-output tables of Taiwan classify domestic final demand (F^d) into five components:

HD= household consumption

GD= government consumption

KD= fixed capital formation

E= exports

QD= inventory changes

Hence, imports generated by each component of final demand are calculated as follows:

$$Q_t = S_t f^d_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.4)$$

where $f^d_t = F^d_t / \Sigma F_t$ and F^d=final domestic demand and F is total final demand.

In this analysis we consider various measures of import coefficient:

1) the gross import coefficient:

$$m1 = (M/X)_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.5)$$

2) the share of intermediate imports in the supply of intermediate inputs:

$$m2 = [A^m X/AX]_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.6)$$

3) the share of imports in total supply :

$$m3 = [(A^m X)_i + F^m_i]/[(AX)_i + F_i] \quad .....(4.7)$$

4) the share of imports in purchase of intermediate inputs:

$$m4 = [\Sigma(A^m_{ij})_i / \Sigma A_{ij}] .....(4.8)$$

5) share of imports in the total input needs,

column sum of A^m_{ij}:

$$m5 = \Sigma A^m_{ij} = A^m_{.j} \quad .....(4.9)$$

6) export propensity of the ith industry:

$$m6 = (E/X)_i .....(4.10)$$

7) total import content of the jth industry,

column sum of S_{ij}:

$$m7 = \Sigma_i S_{ij} = S_{.j} .....(4.11)$$

8) the final demand coefficient:

$$m8 = F^m_i / F_i .....(4.12)$$

9) Total (direct-plus-indirect) imports of each component of domestic final demand are derived as follows:

$$m9 = [f^m_t + R^d_t f^d_t) \quad .....(4.13)$$

where $f^m_t = F^m_t / \Sigma f_t$ and F^m is imported final demand.

4.6.1. Analysis of Import Dependence.

In Table 4.21 we present some measure of import and trade dependence for the Taiwanese economy. As can be seen from this table, the structure of import dependence in Taiwan has undergone some significant changes. There was a substantial increase in the gross-import, intermediate-import and the final-import coefficients.

The gross import coefficient(m1 = M/X) increased more than two-fold from 9.9 percent in 1964 to 20.4 percent in 1981; but it slightly declined to 17.7 percent in 1984. Similarly, the intermediate-import coefficient increased from 13.5 percent in 1964 to 25.2 and 23.2 percent in 1981 and 1984 respectively. On the other hand, the final-import coefficient (m8 = F^m/F) increased from 5.6 percent in 1964 to 8.4 and 6.9 percent in 1981 and 1984 respectively.

For the primary sector, the gross import coefficient dramatically increased from 13.3 % in 1964 to 92.3 % in 1981 and to 77.6 % in 1984, which largely reflects the increasing dependence of primary raw materials used in the manufacturing sector. It also reflects the poor natural endowment of Taiwan and also the relatively poor growth performance of the primary sector. The average annual growth rate of the agricultural sector (at constant price) was 6.2% in 1962-1965, 2.4% in 1966-

Table 4.21. Summary of Measures of Trade Dependence

	1964	1966	1969	1971	1976	1981	1984
A. All Sectors							
1. M/X	0.099	0.120	0.151	0.164	0.189	0.204	0.177
2. M/Z	0.090	0.107	0.131	0.141	0.159	0.167	0.155
3. WM/X	0.065	0.078	0.098	0.111	0.138	0.150	0.132
4. WM/M	0.659	0.650	0.650	0.680	0.730	0.750	0.750
5. E/X	0.096	0.115	0.143	0.170	0.206	0.206	0.228
6. WM/W	0.135	0.155	0.198	0.214	0.244	0.252	0.232
7. FM/F	0.056	0.068	0.080	0.079	0.080	0.084	0.069
8. OP	0.177	0.210	0.255	0.287	0.333	0.339	0.344
B. Primary Sector							
1. M/X	0.133	0.142	0.215	0.270	0.523	0.923	0.776
2. M/Z	0.118	0.124	0.177	0.213	0.343	0.480	0.437
3. WM/X	0.131	0.129	0.196	0.252	0.495	0.892	0.773
4. WM/M	0.979	0.912	0.911	0.934	0.947	0.967	0.996
5. E/X	0.035	0.051	0.081	0.070	0.076	0.066	0.062
6. WM/W	0.143	0.143	0.208	0.262	0.415	0.579	0.545
7. FM/F	0.013	0.052	0.069	0.057	0.084	0.083	0.082
8. OP	0.148	0.169	0.243	0.268	0.394	0.514	0.472
C. Manufacturing Sector							
1. M/X	0.154	0.190	0.225	0.219	0.213	0.198	0.175
2. M/Z	0.132	0.160	0.184	0.179	0.174	0.165	0.149
3. WM/X	0.087	0.107	0.135	0.135	0.140	0.133	0.125
4. WM/M	0.569	0.563	0.599	0.620	0.656	0.671	0.719
5. E/X	0.152	0.170	0.225	0.249	0.304	0.296	0.330
6. WM/W	0.206	0.228	0.261	0.246	0.234	0.214	0.205
7. FM/F	0.090	0.116	0.127	0.124	0.117	0.112	0.087
8. OP	0.264	0.303	0.368	0.384	0.426	0.412	0.430
D. Service Sector							
1. M/X	0.019	0.020	0.034	0.026	0.042	0.036	0.037
2. M/Z	0.019	0.020	0.033	0.020	0.041	0.034	0.036
3. WM/X	0.003	0.011	0.013	0.010	0.020	0.019	0.020
4. WM/M	0.206	0.574	0.389	0.386	0.567	0.538	0.540
5. E/X	0.067	0.087	0.070	0.084	0.074	0.080	0.074
6. WM/W	0.012	0.039	0.048	0.039	0.082	0.058	0.057
7. FM/F	0.021	0.011	0.027	0.014	0.024	0.023	0.025
8. OP	0.084	0.104	0.100	0.108	0.111	0.111	0.107

Source: see Table 4.16.

Notes: X=output, M=imports, Z=total supply(=M+X), WM=imported intermediate inputs, W=total intermediate inputs, E=exports, FM and F are imported and total final demand, OP=(E+M)/(X+M), it measures the degree of openness of a sector.

1970, 0.8% in 1971-1975, 2.7% in 1976-1980, and 0.6% in 1981-1986; against GDP growth rate of 10.1%, 9.8%, 8.8%, 10.5%, and 6.8% for the same period (see DGBAS, 1987). Furthermore, the fall in the gross import dependence during the 1981-1984 period may also suggest that some form of import substitution has taken place during this sub-period.

The gross import coefficient of the manufacturing sector, unlike that of the primary sector, did not increase markedly. The coefficient for this sector rose from 15.4 in 1964 to 19.8 percent in 1981 and fell slightly to 17.5 percent in 1984. Results not reported here indicate that the import coefficient of many of the leading export industries declined markedly. The individual industries whose import coefficient declined include rubber and rubber products (from 28.8 percent in 1964 to 2.7 percent in 1984), artificial fibre(from 135.2 percent in 1964 to 5.4 percent in 1984), iron and steel(from 64.6 percent in 1964 to 19.7 percent in 1984), iron and steel products (from 40.6 in 1964 to 4.8 in 1984), machinery (from 131.1 percent in 1964 to 74.5 in 1984), electrical apparatus and equipment (from 36.1 percent in 1964 to 28.6 percent in 1984), transport equipment(from 43.6 percent in 1964 to 19.1 percent in 1984), and miscellaneous manufacturing (from 88.2 percent in 1964 to 20.8 percent in 1984).

For the textile sectors, however, the coefficient has remained almost stable throughout the period under review. For instance, the gross import coefficient of the cotton fabric industry declined from 7.0 percent in 1964 to 5.7 percent in 1984. Between 1964 and 1984 it remained within the range of 7.0 to 2.6 percent. By contrast, for the artificial fabric industry, the coefficient more than doubled between 1964 and 1971; but it fell continuously thereafter to 5.6 percent in 1984.

Intermediate-import-coefficients also depict a similar trend; but they were higher than the gross import coefficients. For the economy as a whole, intermediate import-coeffcients increased until 1981 from 13.5 percent in 1964 to 25.2 in 1981 but declined slightly to 23.2 percent in 1984.

Like the gross import-coefficient, the intermediate import coefficient of the primary sector increased appreciably from 14.3 percent in 1964 to 54.5 percent in 1984. The increase in the manufacturing sector was modest; with the coefficient continuously declining after it reached 26.1 percent in 1969. As can be learned from Table 4.21, the intermediate import coefficient remained within the range of 20.6 to 26.1 percent for the 1964-1969 period and declined continuously to 20.6 percent in 1984. This fall, as has been indicated elsewhere, may be a result of the second stage of import substitution taking place in Taiwan.

Data not reported here reveal that for many of the products in which Taiwan presumably did not have an initial comparative advantage, the intermediate-import-coefficient was relatively higher than the rest of the industries. This is particularly true for the chemical, iron and steel, machinery, electrical, and transport equipment industries. This may be because when a shift from import substitution to export promotion occurs, still these industries use imported technology and imported intermediate goods. Therefore, it is not surprising to find that the values of their intermediate import coefficient was the highest level when Taiwan was presumably embarking on its export-oriented industrial strategy. However, during the later stages, the intermediate-import-coefficient of these industries declined markedly which may be due to some form of local linkage effects that might taken place during this period.

Concerning the share of imports in the purchase of intermediate inputs and the share of imports in total inputs we observe that there was an upward shift in almost all branches of the primary sector; downward movement occurred only in the paddy rice and sugar cane sectors. However, regarding the total import content of the final product, all primary industries increased their import content substantially. In contrast, for many of the leading export sectors, the share of

imports in the purchase of inputs and in the the total input needs drastically declined. This was particularly true for the canned food industry, the textile industry, most of the chemical industries, iron, steel, and iron and steel products. However, for the total import content of the final product, only the artificial fabric, rubber and rubber products, iron and steel, iron and steel products, and non-ferrous metals and products, industries had coefficients that declined.

4.6.2. Import Content Analysis

Table 4.22 presents the level of import content of five components of final demand. As can be learned from this table, induced import content of all the final demand elements has increased substantially; with the rate of increase in government consumption and capital formation being the highest. The table further reveals that the import content of exports is much higher than the import content of final demand.

As is evident from Table 4.22, the low level of direct import content of household consumption and government consumption are not the cause of the high value of imports of these final demand components. The fact that the rate of increase in government import content(G) is the highest among the final demand elements, shows that the government sector is becoming increasingly dependent on imported goods. As Table

4.22 further reveals, the import content of investment(K) is very high relative to the other final demand components. Hence, the apparent import deepening of the past few decades was mainly caused by increasing dependence on foreign-made capital equipment and import-intensive productive technology in the capital

Table 4.22. Import Content of Final Demand: 1964-1984.

	1964	1966	1969	1971	1976	1981	1984
A. Direct							
H	N.A	0.052	0.043	0.048	0.056	0.083	0.075
G	N.A	0.011	0.028	0.034	0.041	0.126	0.129
K	N.A	0.264	0.291	0.278	0.232	0.211	0.203
Q	N.A	0.133	0.247	0.278	0.387	0.187	0.071
F	0.056	0.068	0.080	0.079	0.080	0.084	0.069
B. Induced							
H	N.A	0.106	0.123	0.141	0.176	0.197	0.267
G	N.A	0.065	0.054	0.075	0.106	0.136	0.223
K	N.A	0.125	0.132	0.165	0.191	0.222	0.424
Q	N.A	0.242	0.232	0.221	0.172	0.205	0.275
F	0.105	0.126	0.150	0.172	0.223	0.246	0.326
E	0.155	0.209	0.270	0.266	0.328	0.344	0.376
C. Total							
H	N.A	0.158	0.168	0.188	0.232	0.280	0.341
G	N.A	0.077	0.082	0.147	0.262	0.262	0.352
K	N.A	0.389	0.423	0.444	0.423	0.432	0.637
Q	N.A	0.375	0.479	0.500	0.560	0.392	0.346
F	0.161	0.194	0.230	0.251	0.303	0.330	0.395
E	-	-	-	-	-	-	-

Source: same as Table 4.16
notes: H=household consumption, G=government consumption, K=capital formation, Q=inventory changes, F=total final demand, and E=exports.

goods sector as well as by the fact that intermediate imports for export production were growing fast, which implies that exports were becoming increasingly users of

foreign materials in their production.

An estimate of the import content of Taiwan's exports (which is not reported here) indicates that it has increased substantially except for the following sectors: other crops, forestry, cotton fabrics, chemical fertilizer, and artificial fibre. Taiwan's exports are becoming increasingly import-intensive for two main reasons: First, there is an apparent import deepening due to shift in product composition shift; and second there is also import deepening due to I-O import coefficient changes. The input-output coefficient changes outweigh the compositional changes. This implies that the apparent import deepening changes is caused more by import deepening technological change reflected in the I-O coefficient changes than by the demand shift and final import changes. This phenomenon is also true for the import content of final demand.

The results of import content of exports presented above are consistent with the view that a rapid expansion of manufactured exports require increased imported intermediate inputs especially in countries such as Taiwan. As was pointed out earlier, the import content of exports grew at a faster rate because of high export expansion. No doubt this rapid expansion of exports was only possible because of

the rapid increase in imported intermediate goods. In other words, if the export-led policies had not made imports available, the economy would not have grown as it did. As Kuo(1983) rightly argues, "...the opportunity to export was crucial because exports broadened the market to provide more productive opportunities and at the same time earned foreign exchange necessary for the imports of materials and equipment needed for processing production". Thus, despite the big increases in the import content of exports, exports of manufactures are still the leading sectors of the Taiwanese economy and they are the ones that keep up the growth momentum .

Appendix 4.1

Input-output Sector Classifications

(Reclassified 32 Sectors)

01. Rice
02. Sugar Cane
03. Misce. Crops
04. Livestock
05. Forestry
06. Fisheries
07. Mining
08. Sugar
09. Canned Food
10. MIsce. Food
11. Textiles
12. Lumber & Plywood
13. Pulp, Paper & Products
14. Leather & Leather Products
15. Rubber & Rubber Products
16. Chemical Fertilizer
17. Drugs & Misce. Chemicals
18. Plastic & Plastic Products
19. Petroleum Products
20. Cement & Cement Products
21. Misce. Non-metalic Products
22. Steel & Iron
23. Aluminum & Misce. Metals
24. Machinery & Instruments
25. Electrical Machinery & Insruments
26. Transport Equipment
27. Misce. Manufactures
28. Construction
29. Electricity
30. Water & City Gas
31. Transport, Communication & other Services
32. Undistributed

CHAPTER 5

TRADE DIRECTION AND FACTOR INTENSITY: ANALYTICAL CONSIDERATIONS

5.1 The Factor Proportions Model of Trade

Until quite recently the factor-proportions model of trade was tested on the assumptions of two countries, two factors and two commodities. As will be clear later, however, such a formulation is not adequate for the purpose of evaluating the impact of trade strategy on employment. It is now widely recognized that developing countries differ greatly among themselves not only in their level of development but also in the economic policies they pursue. As Deardorff (1979) rightly argues, "... a trade model, to describe them, should therefore permit greater variety in their relative factor endowments than is possible in the standard two-by-two Hechscher-Ohlin (H-O) model of international trade." Furthermore, in many developing countries agriculture (or primary production) constitutes a large share of the economic activity of these countries. Consequently, the Hechscher-Ohlin-Samuelson (HOS) model on trade in manufactured goods can be inappropriate in most developing countries as trade in the primary sector cannot be explained by the countries' endowment of labour and capital. Furthermore, given the observed disparities in factor endowments between the developed and the developing world, Krueger (1983) believes that what is needed is not a model of factor equalization but

a model of complete specialization. An addition to the above reasons why the standard model should be modified is that it assumes perfect commodity and factor markets. As is well documented in numerous studies, developing countries trade experience indicates that factor and commodity market distortions are common and therefore any trade model that deals exclusively with the less developed countries must take these rampart distortions into consideration.

In this chapter the Krueger (1977) and Deardorff (1979) models that take the above considerations into account will be reviewed first and the testable hypotheses that emerge from these models will be enumerated. According to the Krueger and Deardorff models, countries will specialize in the production of commodities that have factor intensities appropriate to their relative factor endowment ranking. The models of Krueger and Deardorff suggest that it will be possible to rank countries on the basis of their factor endowments and commodities on the basis of their factor intensities and derive the pattern of production and trade from that ordering. The fundamental theorem that emerges from the above models is that production in the most labour-abundant country will be concentrated on the most labour-intensive commodities and production in the most capital-intensive country will include production of the most capital intensive goods, with countries between the two extremes or in the middle

of the factor-intensity ranking specializing in the production of commodities with factor intensities appropriate to their factor endowments.

When transport costs are included in the model, directionality of the pattern of trade emerges with a country at the middle of the factor-endowment ranking exporting labour-intensive commodities to the capital-abundant destination and capital-intensive commodities to the labour abundant destination.

The Krueger and Deardorff models have the additional advantage of projecting the pattern of production and trade for a rapidly growing economy such as those of the so-called newly industrializing countries of Asia and Latin America. In a fast growing economy, the model predicts that exports of the labour-intensive commodities will be replaced by exports of more capital- and skill intensive commodities as the changing relative factor endowment alters the country's comparative advantage. This changing process will affect the commodity composition of exports to existing destinations and produces a change in the desintations themselves.

Finally, Krueger and Deardorff analyze the effects of factor - and commodity-market distortions on the pattern of production and trade. The conclusions that emerge from their study is that the pattern of trade is not affected by the existence of the above distortions with the notable exception of (a) distortions in inter-

industry factor-price differentials and (b) taxes and subsidies.

5.1.1 The Assumptions of the Model

Krueger and Deardorff make the following assumptions:-

1. There are n commodities and m countries and two factors of production, labour and capital, fully employed and in fixed supply. The relative endowments of these factors vary from country to country, i.e. what distinguishes each country is its relative labour-capital endowment. Factors are qualitatively identical across countries.
2. Factors are mobile between industries in the same country, but are immobile between countries.
3. Perfect competition in the factor market exists with wages equal to the value of the marginal product of labour and rental on capital equals the value of the marginal product of capital for all industries. The domestic marginal rate of transformation between any pair of produced commodities is equal to their price ratio.
4. Corresponding to the n commodities there are n production functions available in the m countries involving the use of both factors of production. These production functions are characterized by constant returns to scale, and diminishing marginal product to each factor.
5. There is no factor-intensity reversal at any relevant factor price ratios. Commodities differ consistently in

their factor intensities.

6. There are no artificial impediments to trade such as tariffs and transportation costs. Prices are the same in all countries. That is, international prices are given and no country can influence international prices by its production and consumption behaviour. (The usual small-country assumption is made).

7. Consumer preferences are identical in all countries at all relevant price ratios.

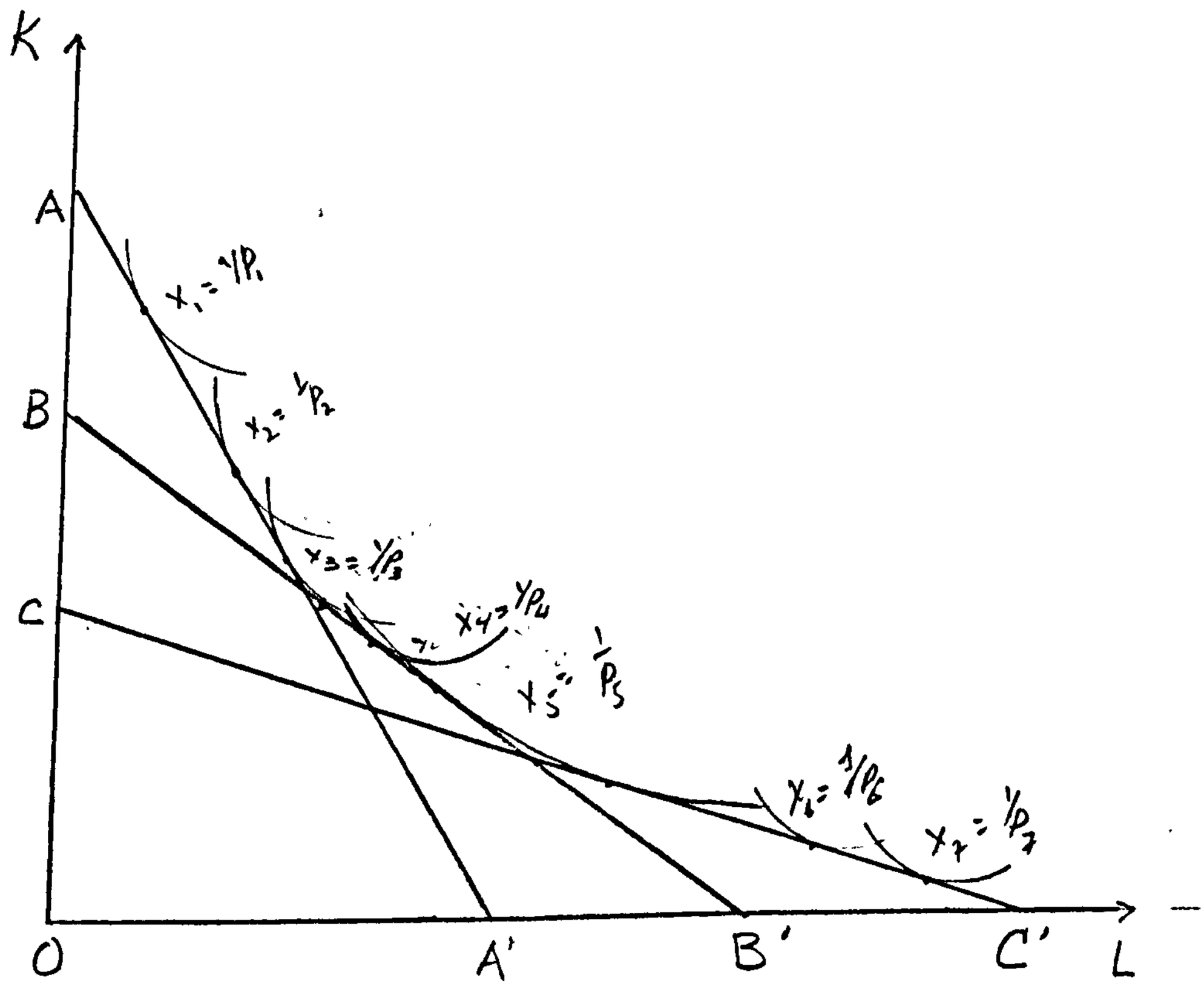
8. There is no factor-price equalization across countries, i.e. unequal factor prices prevail across countries.

5.1.2 The Deardorff Model

Given the above assumptions Deardorff (1979) has shown that the pattern of trade agrees with the ranking of the goods by factor intensities. He puts the proposition that for a capital-abundant country "... all of a country's exports must lie higher on this list than all its imports". To demonstrate the above, Deardorff uses the following diagram. In Figure 5.1 three isocost lines, AA', BB' and CC' are drawn for three countries (on the asumption of unequal factor prices prevailing in the three countries). These isocost lines represent combinations of capital (K) and labour (L) which could cost, say, one dollar (or international numerie) in each of the three countries, with country A having a higher

wage rental ratio than B, and country B having a higher wage-rental ratio than C. Unit value isoquants are drawn for goods X_1, X_2, ..., X_7, which are unambiguously ranked in terms of capital intensity with X_1 being the most capital intensive and X_7 the least capital intensive. The prices of the goods, p_1, p_2, p_3,...., p_7, are the same in the three countries and are set such that the unit value isoquants (defined as $X_i P_i = 1$) are exactly tangential to the outermost of the three unit isocost lines as shown in Figure 5.1.

Figure. 5.1



As can be learned from the figure, if a unit-value isoquant were to lie wholly outside the three isocost lines, the goods would not be produced in either country. However, if it were to lie anywhere inside either one of the three isocost lines, its production would yield a positive profit in the corresponding country. Furthermore, while it is possible for an isoquant to be tangent to two isocost lines (as in goods 3 and 5 in Figure 5.1), "this need not happen for any goods and, without factor-intensity reversals, cannot happen for more than one" (Deardorff, 1979, p. 201).

It is evident from Figure 5.1 that the pattern of trade must agree with the ranking of the goods by factor intensity, the most capital-intensive goods (1 and 2) can only be produced by country A, the high wage country, and must be exported by country A; while the most labour-intensive goods (6 and 7) must be produced and exported by C, the low wage country. Country B which is in the middle of the factor-endowment ranking, produces and exports one or more of the goods with isoquants tangent to its isocost line. As can be seen from Figure 5.1, isoquant X_3 is tangent to isocost lines AA' and BB' and isoquant line X_5 is also tangent to both BB' and CC'. The points of interaction of each country's isocost with adjacent isocost lines, according to Deardorff, are interpreted as being the upper and lower limits of the factor intensities of a country's exports. Borderline

goods such as 3 may be exported by either country A or B or both. Similarly, 5 must be exported by either B of C or both. Each country must export all goods which all appear only in its segment of the chain and must import all the goods which do not appear in its segment. The chain of goods ranked by capital intensity is broken into segments, one for each country, and the segments are ordered identically with the relative capital abundance of these countries. Each of a country's exports must be at least as capital-intensive as each of the exports of all less capital-abundant countries and at least as labour-intensive as each of the exports of all less labour-abundant countries (Deardorff, 1979, p. 206).

5.1.3 The Krueger Model

Like Deardorff, Krueger (1977) has also developed a model of international trade that is appropriate for developing countries. It is the contention of Krueger that from the pattern of production a pattern of specialization and trade can emerge. Krueger suggests that it is possible to rank countries according to their factor endowments and rank commodities on the basis of their factor intensity and derive a pattern of production and trade from that ordering. Countries will specialize in the production of commodities according to their factor endowments.

In Figure 5.2 commodities are listed in the columns and countries in the rows. Commodities are ordered in such

a way that commodity 1 has the highest labour/capital ratio (at that wage/rental ratio), commodity 2 the next highest, and so on down to commodity n, which has the lowest labour/capital ratio. Similarly, countries are so numbered that country 1 has the highest endowment of labour to capital, country 2 the next highest, and so on to country m, which has the lowest labour/capital endowment. Thus commodities are numbered so that the highest number implies a high capital/labour ratio in production and countries are numbered so that a high number is associated with greater abundance of capital relative to labour. In the figure an X in the ith row and j^{th} column indicates that production of commodity j is positive in the ith country, and a blank (O) means there is no production of the commodity in question.

The basic proposition of Krueger is that countries tend to specialize according to their relative positions in the factor-endowment ranking. Production in the labour-abundant country will be concentrated in the most labour-intensive commodities and production in the most capital-abundant country will include production of the most capital-intensive goods. Countries in the middle of the factor-endowment ranking specialize in the production of commodities with factor intensities appropriate to their factor endowments. Country 1, in other words is certain to produce commodity 1, and country m is certain to produce commodity n. For countries 2 to m-1, those with

high capital/labour endowment will produce higher numbered commodities than those with lower capital/labour endowment. Since factor-rental equalization is assumed away, it will never be the case that a relatively more

Figure 5.2.

		COMMODITIES								
		1	2	3	4	5	6	7	8	9
	1	X	X							
C	2		X	X	X					
O	3				X					
U	4				X					
N	5				X	X				
T	6				X	X				
R	7					X	X			
I	8					X	O	X		
E	9						X	X		
S	10							X		
	11								X	X
		1	2	3	4	5	6	7	8	9

capital-abundant country will produce a more labour-intensive goods than the less capital-abundant countries. More labour-abundant countries will produce more labour-intensive commodities than the more capital-abundant countries. The more labour-abundant of any pair of countries cannot produce any commodity more capital-

intensive than the least capital-using commodity in the other.

As can be seen from Figure 5.2, country 1 is producing commodities 1 and 2 and country 2 is producing commodities 2, 3 and 4, and commodity 2 is commonly produced by the two countries. However, since there is no factor-rental equalization between these two countries, country 1 may have a considerably lower-wage-rental ratio than country 2. Further, country 2 produces commodity 4 in common with countries 3, 4, 5 and 6. However, as can be depicted from Figure 5.2, the capital intensity of production of commodity 4 is greater in each higher-numbered country. Figure 5.2 further shows that country 2 produces one commodity in common with country 1 and one commodity in common with country 3. However, there is no factor-rental equalization because there are not two commodities produced in common. When two commodities are produced in common in two adjacent countries as in the case with countries 5 and 6 producing two commodities 4 and 5 in common, these countries must have equal wage rental ratios. Thus, according to Krueger (1983), "If two countries have overlapping production patterns and factor-rental equalization, they may be regarded as one country in a economic sense. Such may be the case, for example, for some of the European Common Market countries" (p. 59).

If a country produces more than one commodity, the

produced commodities will lie adjacent to each other in the factor-intensity ordering. Whether the additional commodities are exportables or importables will depend on the country's relative factor endowment (in the absence of transport cost) and (if variation in preferences is not assumed away) on demand conditions (see Krueger, 1983). At least one produced commodity will be exported and all commodities that are not produced will be imported. As can be depicted from Figure 5.2, except for the most and the least capital abundant countries, import competing industries can lie on either or both sides of the factor intensity of export industries. There will be no essential commodity characteristic that distinguishes import substitutes from exports. The key distinction is between produced and non-produced commodities (see Krueger, 1983, pp. 62-63).

As was pointed out earlier if two countries produce a commodity in common without factor-rental equalization between them, the more capital-abundant country will use more capital-intensive technique of production than the labour-abundant country and the wage-rental ratio will be higher in the labour abundant country. Furthermore, countries in the middle of the factor-endowment ranking will tend to specialize in producing commodities in the middle of the factor-intensity ranking. They will import capital-intensive commodities from capital-rich countries and labour-intensive commodities from countries with relatively lower capital-labour endowments.

5.4.1 The Pattern of Exports

As can be inferred from Figures 5.1 and 5.2, a country will export whatever commodities it produces to all non-producing countries, and perhaps to the only other country that produces the same commodity, i.e. there is no commodity characteristic of exports among destinations. However, if transport costs are incorporated into the model a pattern of exports by destination can emerge for all exporting countries except those at the two extremes of the factor-endowment ranking. A country's exports will be relatively capital-intensive to the more labour-abundant destinations, and relatively labour-intensive to the more capital-abundant destinations. This result can best be explained with the help of Figure 5.3.

In Figure 5.3 there are three countries, A, B and C and seven commodities produced and exported between these three countries. Country A is more labour-abundant than country B and B in turn is relatively more endowed with labour than country C. Similarly, commodities X_1 to X_7 are ranked in ascending order of capital intensity with commodity 1 the least, and commodity 7 the most, capital-intensive commodity. If transport costs are positive and international prices prevail, then country B exports X_4 and X_5 to A, its relatively capital intensive commodities to the more labour abundant country and X_3

and X_4 to C, its relatively labour-intensive commodities

Figure 5.3.

COMMODITIES

		1	2	3	4	5	6	7
	A	X	X	X				
COUNTRIES	B			X	X	X		
	C					X	X	X

to the more capital-abundant country. However, as Khanna (1982) has demonstrated, the above result may not hold if the example is extended to many countries and many commodities.

Figure 5.4 is drawn within the context of the Krueger model. Here, if country M's exports to A are compared with its exports to Z, there will be no distinction in commodity characteristics of the export bundles to the two destinations. For the earlier result to hold, therefore, the exporting country has to overlap its production and export bundles with at least one of the two destinations being compared. This is likely to occur if we are considering adjacent countries in the factor abundance ranking.

The incorporation of transport costs in the model provides greater overlapping of production patterns without factor-rental equalization than is suggested in Figures 5.1 to 5.3. The domestic price of a commodity can

be higher than the international price by the amount of the transportation cost: production of that commodity can become profitable domestically (but it would not be profitable to export that commodity). A country could produce new commodities contiguous in the factor

Figure 5.4.

COMMODITIES

COUNTRY	1	2	3	.	.	21	22	23	.	.	50	51	52
A	X	X	X										
B						X	X	X					
C											X	X	X

intensity ranking to those it was producing when transport costs were assumed away. For example, a country in the middle of the factor-abundance ranking would produce import substitutes on both sides of the factor intensity of its exports. To illustrate the above proposition, Figure 5.3 is reproduced below with country A also producing commodity 4, country B producing commodity 2 and 6 and country C producing commodity 4. This new pattern, as Figure 5.5 depicts, will have great overlapping of production patterns. However, the new overlapping does not alter the difference in the commodity characteristics of B's exports to A and C. Country B will export commodity 5 to A, its relatively-capital intensive product to the labour-abundant country,

and commodity 3 to country C, B's relative labour-intensive product to the capital-abundant country.

Figure 5.5.

		COMMODITIES						
		1	2	3	4	5	6	7
	A	X	X	X	X			
COUNTRIES	B		X	X	X	X	X	
	C				X	X	X	X

The hypothesis that emerges from the above discussion is that the factor intensity of domestic production of import-competing goods will still be similar to that of exportables:

1. for a country with the lowest manufacturing capital-labour ratio, import-substituting production will, generally be more capital intensive than export production, and conversely for the most capital-abundant country;

2. for countries in the centre of the factor-endowment ranking, however, import-substituting industries' factor proportions are likely to lie on each side of those of export industries (Krueger, 1983, pp. 63-70).

5.1.5 Relative Growth in One Country

Within the context of the general model, Krueger has

developed certain hypotheses concerning the evolution of comparative advantage of a labour-abundant rapidly growing economy. This sub-model allows a stage-by-stage verification of the factor-proportions theory of trade.

When a labour abundant country jumps up the ladder of factor endowments by accumulating capital more rapidly than the rate of growth of the labour force while international prices and other countries factor endowments are constant, three possibilities emerge:

1. the country is specialized in the production of one commodity;
2. the country produces two or more commodities but no more than one commodity in common with any single country, and
3. there is factor-rental equalization with another country and two or more commodities are produced in common.

Assume that this country specializes in the production of one commodity. As the country continues accumulating capital, the production process becomes more capital-intensive with an increase in the wage-rental ratio but continued specialization in the single commodity. With further capital accumulation the rental on capital continues declining until it is profitable to produce the next most high-numbered (capital-intensive) commodity. After the production of the above commodity has started, continued capital accumulation results in shifting the

composition of output towards the more capital-intensive commodity. At some point, production of the first commodity initially produced ceases. During the period of producing both goods, the wage rental ratio is constant, as international prices are given. When production becomes concentrated on the next-higher commodity, the wage/rental ratio starts rising again and continues until it is profitable to produce the next commodity (Krueger, 1983, p. 63).

As can be inferred from the above, there is what Krueger calls "a two-phase progression up the commodity chain". When only one commodity is produced, the wage/rental ratio increases with capital accumulation, but the pattern of production remains unchanged. In the second phase of producing two commodities, the wage/rental ratio remains constant, but the structure of production is shifting among commodities.

In case three, where there is factor-rental equalization, output of the capital-intensive commodity would increase relatively faster than capital accumulated until production of the labour-intensive commodity ceased and then what happened in cases 1 and 2 above would be repeated.

Needless to say, as the rapidly growing country continues accumulating more capital its production structure shifts to more capital-intensive goods thereby "meeting" and passing some other countries along the way.

The two-stage progression here has strong implications for the pattern of trade and its changes over time that would be observed for a rapidly growing country: exports of labour-intensive commodities would gradually be replaced by exports of more capital-intensive commodities as the changing factor endowment altered the country's comparative advantage". (Krueger, 1983, p. 64).

5.2 The Effects of Commodity and Factor Market Distortions Upon the Commodity Composition of Trade

The factor-proportions model presented above was formulated for a world of efficient resource allocation, where among other things, perfect factor and commodity markets are assumed. While such an assumption may be relatively realistic for the advanced countries and perhaps for some developing countries, it may not be realistic when we are dealing with the majority of the less developed countries. In countries where commodity - and factor-price distortions are rampant, the pattern of production and trade may significantly diverge from the prediction the model makes. Even for the most advanced country, the USA, Travis (1964, 1972) has claimed that protection can account for the Leontief paradox, presumably by altering the actual pattern of trade.

In this section the effects of commodity and factor-market distortions on the predictions of the Krueger and Deardorff model will be outlined. The predictions of the model in the presence of these distortions depend on whether the distortion affects the goods market or the factor market. Needless to say, distortions in the

goods market occur when domestic prices diverge from international prices and distortions in the factor market occur when domestic factor prices do not reflect the opportunity cost of employing these factors. First we shall discuss the effects of commodity market distortions assuming no distortion in the factor market. But as Krauss and Johnson (1974, p. 266) argue:

> The problem, however, often is more complex than presented, since a distortion that makes the market price of a good greater than its social opportunity cost may not originate in the commodity market, but may be a reflection of a distortion in domestic factor markets that makes the price of a factor of production greater than its social opportunity cost to the economy.

5.2.1 Goods-Market Distortions

In many developing countries it is often alleged that protection has provided some industries with the incentive not to exploit their comparative advantage. In countries where the import-substitution strategy is pushed far, it is possible that the production structure that would have resutled from efficient resource allocation can be altered by tariffs or subsidies. As a result, it is possible that industries that would have been unprofitable domestically under an undistorted regime have flourished instead. In other words, because of various protective measures, industries would be producing that would not have been producing under efficient allocation (Krueger, 1983, p. 74). Furthermore, the structure of protection prevalent in many developing

countries may result in the 'wrong' commodities being exported.

In this section the implications of commodity-market distortions on the pattern of production and trade as postulated by the Krueger and Deardorff models will be discussed. According to Krueger, despite the numerous distortive measures, the pattern of production and trade does not differ from the predictions of the model. Krueger contends that, assuming the absence of subsidies and the efficient functioning of the factor market, protection accorded to goods does not result in the reversal of trade patterns; and the prediction of the HOS model would still hold (Krueger, 1983, p. 74).

> Under tariff protection, some industries would be producing that would not produce under efficient allocation. It is not possible, however, to turn an industry that would be an exporter under an efficient allocation into a non-producing industry. Protection can cause some resources to be used in import substitution that would otherwise have been employed in producing the commodity for export. However, the most that production can be diverted is to the point of autarky: tariffs can raise the internal price of commodities and thereby render their production for the domestic market profitable, but they cannot induce exports of those commodities at the lower world price.

Thus according to Krueger, despite the various distortive measures the HOS model would still hold and one would expect that manufacturing sector of a labour-abundant country to produce the most labour-intensive commodities for export.

The assertion made by Krueger that tariffs do not result

in trade reversal does not seem to be shared by Deardorff (1979). Deardorff agress with Krueger in the two-country case but disagrees over the multi-country case where according to him, impediments to trade (such as tariffs) can alter the pattern of trade. Deardorff illustrates his case with the aid of Figure 5.7, which is a direct copy of Figure. 5.1, except that the number of commodities is reduced to 6. Before we move to the multi-commodity case however, we shall first see the effects of tariffs on the two-country case in Figure 5.6.

In Figure 5.6, we redraw Figure 5.1, with only two countries, A and B. Assume that some good X_i, is exported by country A. To be exported it must be produced and its price must be at least as high abroad as at home; and to be imported its price must be at least as low abroad as at home (so as to compensate exporters and importers for the additional cost of tariff and transport). Since X_i is produced by country A, its unit value isoquant must be tangential to AA'. Suppose that it were tangential at a point on AA' below the intersection M, like the dotted isoquant X's in Figure 5.6. For the goods to be exported from A, it must also fetch at least as high a price in B (to cover any transport cost or tariff) and this would place B's unit-value isoquant for the same goods i still closer to the origin than X's and certainly inside the line BB'. The goods would then yield a positive profit in B and this is

impossible under the assumption of perfect competition. Thus, the unit value isoquants of all A's exports must be tangential to AA' above the intersection with BB' exactly as was the case with free trade.

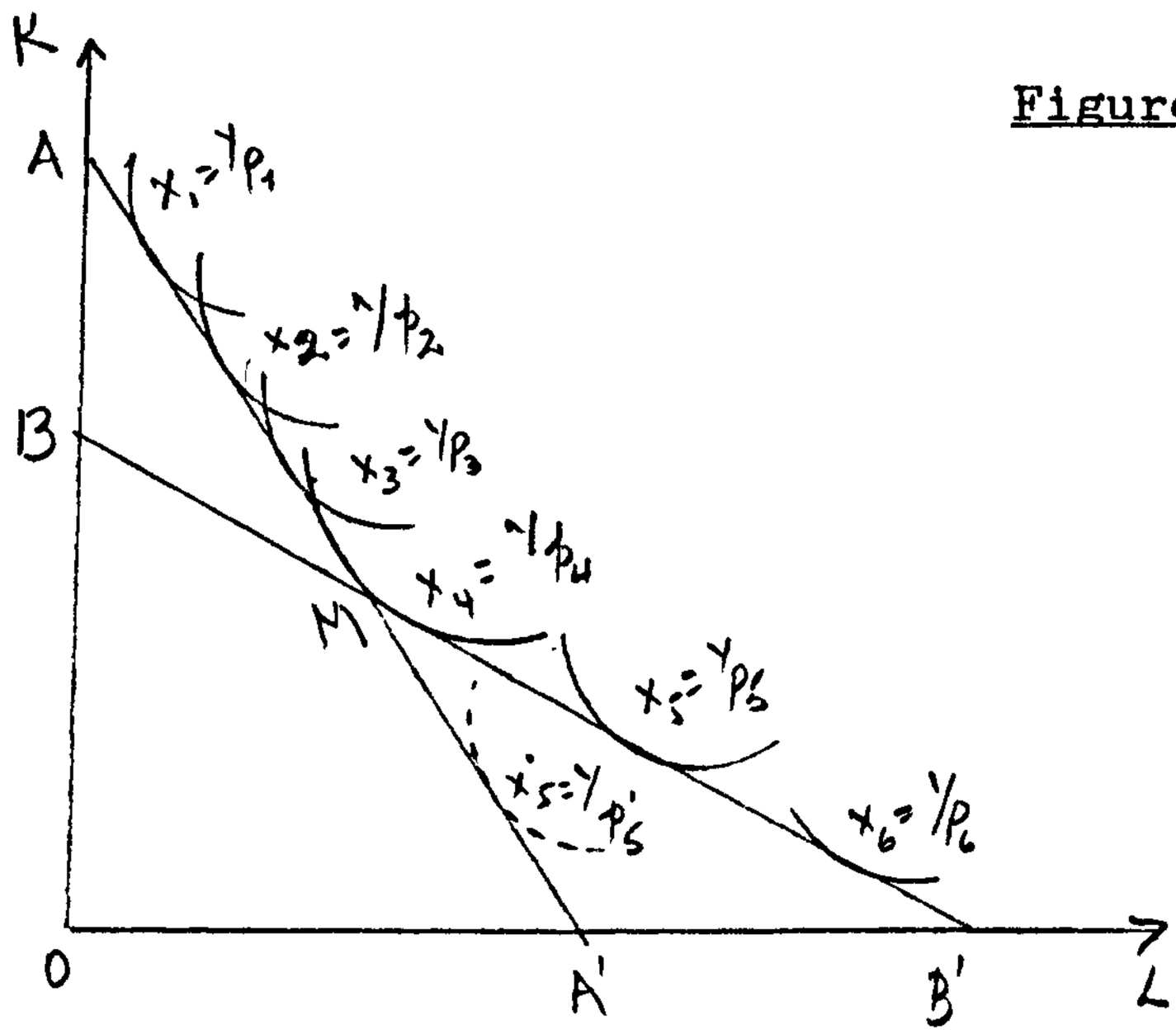


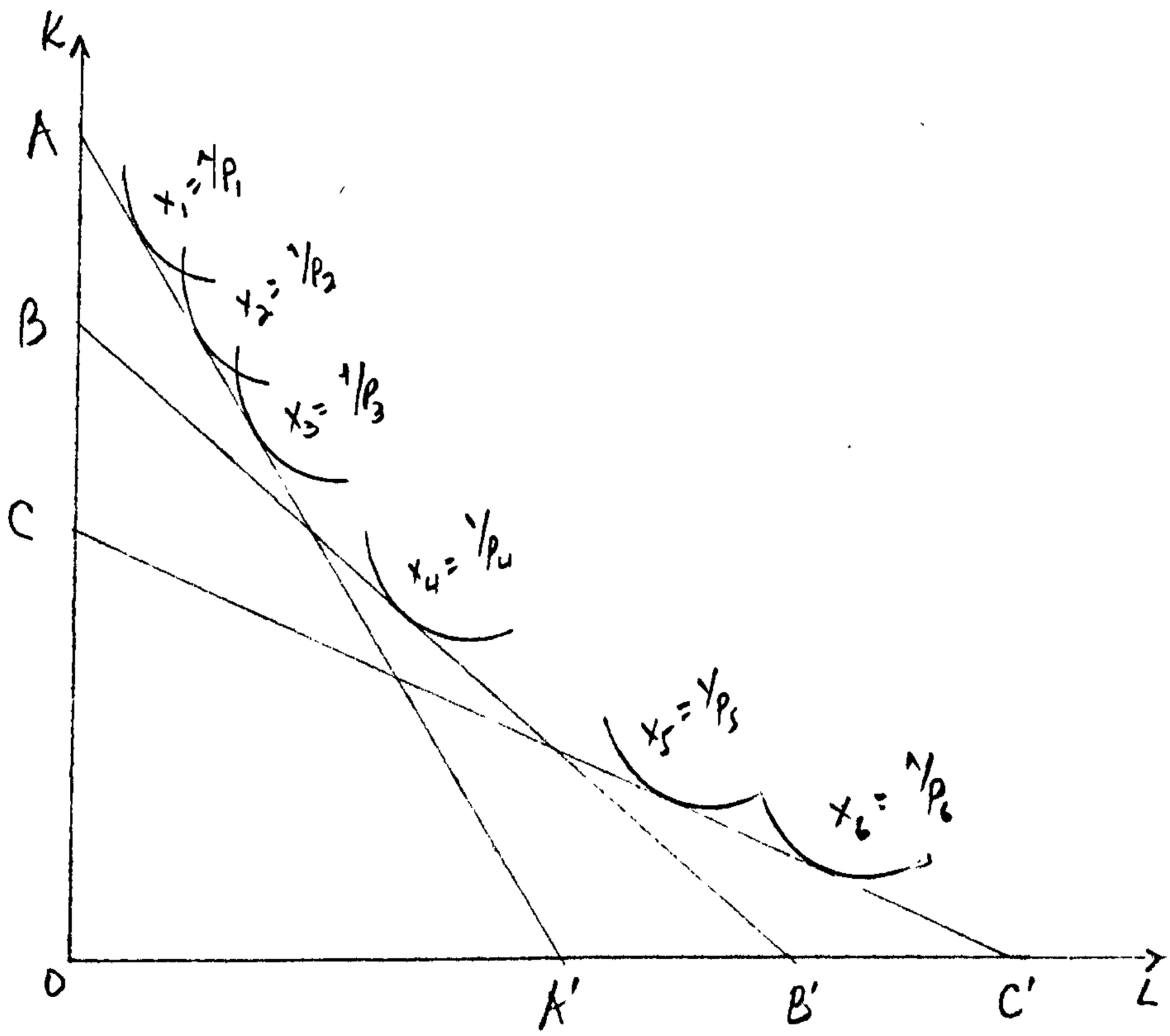
Figure. 5.6.

Hence, a capital abundant country (using the price definition of abundance) will export only goods which are more capital intensive than any of its imports, even if there are impediments to trade and unequal factor prices between the two countries. In a multi-commodity case, however, when a country whose factor abundance is intermediate between those of other countries, imposes a tariff on its imported goods, Deardorff argues that impediments to trade (such as tariffs) can drastically alter the pattern of trade.

In Figure 5.7 assume that a small country B, with factor-endowment ratio lying between the ratios that would be

employed by A and C in industry 4. With free trade such a country will specialize completely in production of good 4, exporting it in exchange for all other goods. Suppose that country B levies a large tariff on imports of the most capital-intensive good, 1. The tariff will raise the price of goods 1 in B, pulling its unit value isoquant in towards - and past - B's unit isocost line. Country B will begin production of goods 1 and the relative wage in B will fall. However, goods 1 is so capital intensive that much of it cannot be produced with the factors available in B and, if demand is fairly inelastic, imports of goods 1 will continue.

Figure. 5.7.



Thus, there is nothing to prevent a further increase in the tariff from raising its price still more, to bring its unit-value isoquant inside CC'. With this further increase in tariff, a new isocost line must appear in B, tangent only to isoquants of goods 1 and 6. As a result production of good 4 (B's original export goods) ceases entirely and production of good 6 begins instead. And good 6 must be exported, since good 1 cannot be, and imports of goods 2, 3, 4 and 5 must continue. Thus, country B, because of a tariff, has changed from being an exporter of goods of intermediate factor intensity to become an exporter of the most labour-intensive goods that there is. Deardorff, however, hastens to add that "the extreme response of the trade pattern to a tariff is only possible for a country whose factor abundance is intermediate between those of other countries. This explains why this result was not possible in the two-country case", p. 207. Thus, the apparent conflict between Deardorff's and Krueger's model in the presence of tariffs emanates from their difference in the asusmption of which country it is that imposes the tariff. In the case of Krueger it is the least capital abundant country while in that of Deardorff, as we have seen, it is a country in the middle of the factor-endowmwnt ranking (see Khanna, 1982). In a more recent article, however, Deardorff (1980 p. 266) seems to have changed his mind when he says:

It is true, as Travis (1964, 1972) has suggested, that such impediments can cause particular goods to be exported that would have been imported and vice-versa. But while this is possible for particular goods, my analysis shows it cannot be true of so many goods as to reverse the average relationship that must hold between comparative advantage and trade. Only by subsidies could this average relationship be made not to hold....".

5.2.2 Factor-Market Distortions

It is now widely recognized that the inability of many industries in most developing countries to generate adequate employment emanates from their excessive use of capital-intensive methods of production. The economic and social policies of these countries have, by and large, made the price of capital artificially low relative to the cost of employing labour. The major consequence of such distortive effects and the one relevant to this dissertation is the negative impact they create on employment generation.

In this section our main concern is to investigate the impact of factor-market distortions on employment in general and their impact on the pattern of trade and specialization in particular. The growth and welfare effects of such distortions are not discussed here.

Two types of factor-market distortions are briefly identified, namely, (a) exogenously specified minimum real wage and (b) wage differential within manufacturing. The first type of factor-market distortion can be

subdivided into two - (i) an exogenously imposed real minimum wage that applies over the entire economy (with open unemployment when the real minimum wage is binding) (Brecher, 1974); and (ii) the Harris-todaro (1970) case in which the urban real wage is set above the rural wage. (For an excellent summary of these models, see Hazari, 1978, pp. 107-37).

5.2.2.1 An Economywide Real Wage Floor: The Brecher Model

In this kind of economy an economywide real wage floor prevails and is taken to be specified exogenously. The real wage is assumed to be flexible in the upward direction. The problem of unemployment in the Brecher(1974) model arises only when market forces bid the level of real wages downward but the minimum real wage becomes a binding constraint at a level higher than is required for full employment.

The Brecher model is basically a two-commodity two-factor model of trade with the usual standard assumption, namely:-

(i) two commodities (X_1 and X_2) are produced by labour and capital under constant returns to scale and according to a given level of technology;

(ii) labour and capital are perfectly mobile nationally and immobile internationally so that each factor's reward is the same in both sectors of the economy;

(iii) the second commodity (X_2) is more labour intensive than the first (X_1) at every common factor-price ratio;

(iv) factor supplies are perfectly inelastic at fixed factor endowments.

Let w_2^* denote the exogenously specified minimun wage in terms of commodity 2. Given this, Brecher defines the minimum wage constraint as:

$$\frac{1}{p} w_1 = w_2 \geq w_2^* \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.1)$$

where w_i ($i = 1,2$) is the real wage in terms of commodity i and equals labour's marginal products in i because of profit maximization and p is the relative price of the second commodity in terms of the first. In the above, the real minimum wage is defined in terms of the second commodity at some particular level denoted by w_2^* .

The imposition of the minimum wage changes the shape of the supply curves of labour. In the absence of the real minimum wage constraint the supply of labour is perfectly inelastic, while in the case of the minimum wage economy the supply of labour is perfectly elastic at the minimum wage until full employment level I (in Figure 6.8a), where the curve assumes its transitional shape.

In Figure 5.8b equilibrium occurs at E_1 where the demand for labour intersects the supply of labour. Obviously, since the intersection lies to the left of the full

employment point, part of the labour force remains unempoyed, E_1Q in this case. (The market for capital is assumed by assumption. Therefore any variations to total employment will always refer to labour and never to capital).

Figure 5.8a

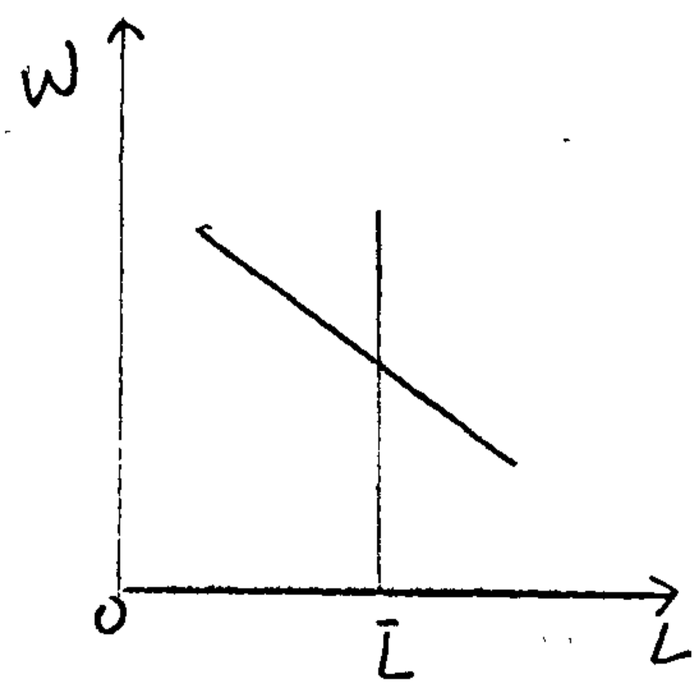
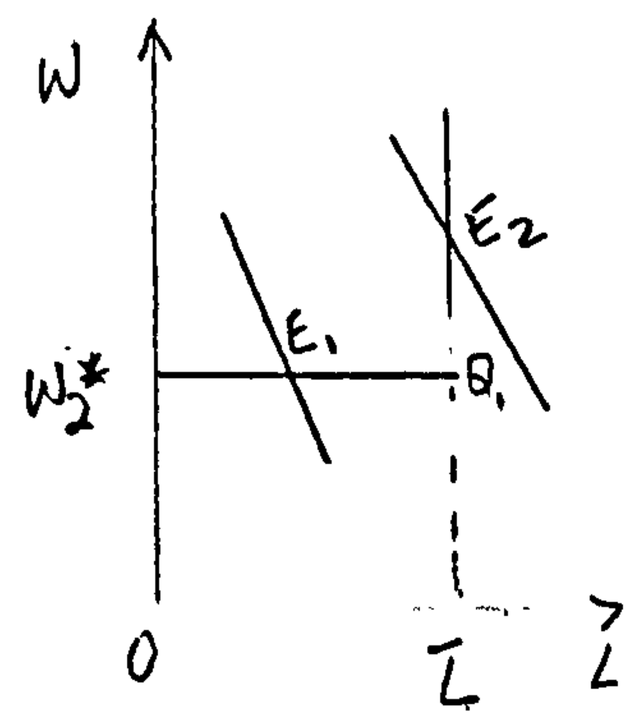


Figure 5.8b



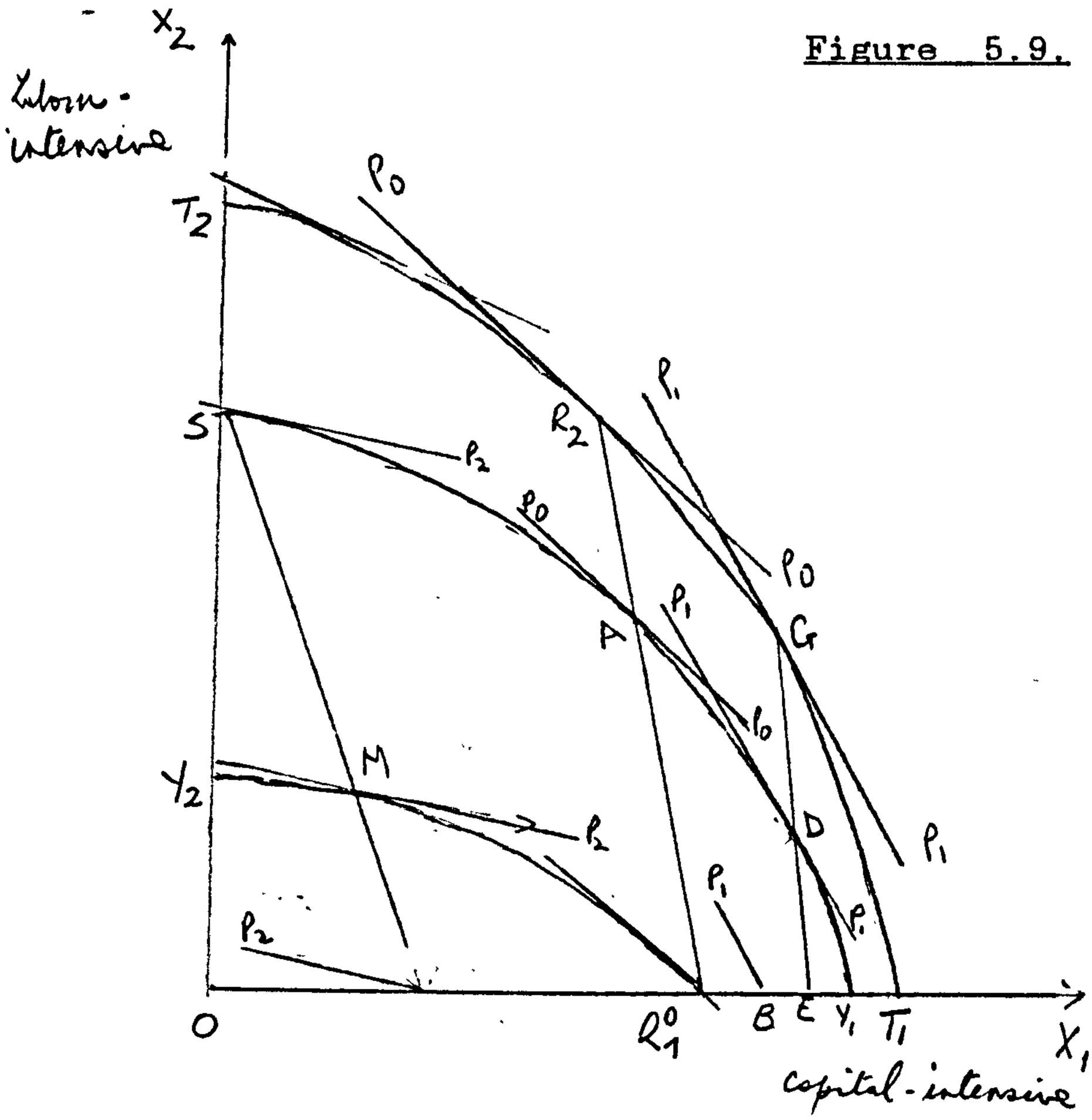
Now we derive the production possibilities curve of the minimum wage economy. In Figure 5.9 T_2T_1 is the conventional transformation (possibilities) curve. Suppose the relative price of commodity 1 is given by the slope P_oP_o. Assuming profit maximization prevails, production occurs at R_2. Associated with point R_2 is an implicit price ratio. Assume now that the minimum real wage in both sectors is imposed exogenously and corresponds with the price ratio given by the slope P_oP_o and production point R_2. As pointed out earlier, the real minimum wage does not allow market forces to bid the wage level below the floor set by the constraint and hence full employment does not necessarily prevail in such an

economy.

By assumption production at R_2 satisfies the (tangency) condition of profit maximization without violating the minimum-wage constraint. Hence point R_2 is a possible output equilibrium of the minimum wage economy. Consider now a point above R_2 such as C. Compared to R_2, at C the relative price of the labour-intensive commodity has risen. Since the relative price of the labour-intensive commodity (X_2) is higher at C that at R_2, it follows from the Stopler-Samuelson (1941) theorem that the reward of the factor used intensively, X_2, the labour-intensive commodity in our case, rises. Therefore, since the reward for labour is greater in C than at R_2, the minimum wage constraint is not binding at C or any point above R_2 including R_2 itself. Needless to say, since our concern here is unemployment and since along segment T_2R_2 the economy operates in the well-known full-employment manner with the minimum wage not great enough to be a binding constraint, we are not concerned with that portion of the transformation curve.

The rest of the transformation curve of the minimum-wage economy can be derived as follows. Consider a point on T_2T_1 such as G. At G the relative price of commodity two is lower than at point R_2. It follows again from the Stopler-Samuelson theorem (1941) that the real reward of capital will increase and that of labour will fall compared to the rewards they get at point R_2.

Figure 5.9.



Thus, since the wage constraint was set at the wage level associated with point R2, point G is not feasible. According to the Stopler-Samuelson theorem once again the real wage constrain is not satisfied at points below R2 (except T1), (why T1 is part of the constrained possibilities curve is explained later) on the normal production possibilities curve. Hence, we have established that, for an economywide mimimum wage economy, the conventional production-possibilities curve in no more applicable.

To find another possible output equilibrium for PoPo

consider an arbitrary decrease in the total quantity of labour employed (keeping the fixed amount of capital fully employed). The decrease in the labour force, according to the Rybczynski (1955) theorem, leads the production-possibilities curve inwards to a new position such as SY_1. With constant prices, production equilibrium on the new production possibilities curve occurs at a point such as A (where the price line tangent to R_2 is parallel to the line tangent to the new production-possibilities curve at A). (The shift of the equilibrium point from R_2 to A at the constant price ratio P_oP_o leaves the profit maximization (zero profits) wage unchanged at the minimum because the relationship between factor price and commodity prices is the same in both points by the application of factor price equalization theorem due to Samuelson (1949).) Point A is therefore admissible since as established above it satisfies the minimum wage constraint. At A capital is fully employed (by assumption) but part of the labour force remains unemployed.

By successive reduction of the labour force, points such as A can be constructed. One such point is R_1. The locus of such points is satisfied; because prices are constant hence the wage-rental ratio is constant by the Samuelson theorem (1949). Line R_2AR_1 in the Rybczynski line (Brecher, 1974, p. 103). Thus since the minimum-wage constraint is satisfied along the segments T_2R_2 and

R_2AR_1 then, $T_2R_2AR_1$ is part of the production-possibilities curve under the minimum-wage constraint. As can be inferred from the above discussion and figure 5.9, as the labour intensive (X_2) industry contracts in moving from R_2 to R_1 along R_2AR_1 the conventional production possibilities curve shifts inwards, and the level of total labour employment continues to decline. Therefore, along R_2AR_1 unemployment is increasing as the expansion of the capital-intensive industry X_1 does not absorb the larger proportion of labour released from the labour-intensive industry X_2. Consequently, part of the labour force remains unemployed.

Another Rybczynski line such as GDE may be derived. Suppose the relative price of X_1 rises to the level depicted by the slope of the line P_1P_1. As was explained previously point G does not satisfy the minimum-wage constraint, hence it is not feasbible. By applying the same reasoning given in deriving the Rybczynski line R_2AR_1, we can derive the GDE Rybczynski line, which is entirely feasible. Since along GDE the wage is lower than the minimum-wage implied at R_2 all points along GDE do not satisfy the minimum wage constraint and hence are inadmissible.

As can be depicted from Figure 5.9, output equilibrium for the price ratio implied by point G occurs at point E, which is the right of R_1. At R_1 the minimum wage constraint is satisfied. Recall that price ratio

($p=P_2/P_1$) at point R_2 is greater than at D. At point R_1 unemployed labour bids the wage down proportinally in terms of the first commodity (X_1) without violating the minimum wage constraint ($1/p\ w = w_2 \geq w_2^*$) in terms of the second commodity (X_2). By this process of bidding, emplooyment and output increase above R_1 levels (recalling that the given capital stock is always fully utilized) and equilibrium is reached at E. As is clearly implied by this reasoning, the further the price ratio falls below P_oP_o, the greater are the equilibrium levels of employment and output along R_1T_1. Sufficiently, small values of p are capable of achieving full employment at T_1" (as Krueger rightly remarks, curiously enough, as production of X_1 increased from R_2 to T_1, employment is increasing and the production technique employed in X_1 (the capital-intensive commodity) is increasingly labour intensive (Krueger, 1983, p. 79 and Brecher, 1974, p. 104). Thus, if we assume that the exogenously set minimum wage is initially associated with a price level denoted by the slope of P_oP_o, the distorted production curve for the minimum wage economy is therefore $T_2R_2AR_1BT_1$.

As we have seen before, when the relative price of the labour-intensive commodity rises above the level denoted by the slope of P_1P_1, the minimum wage is no more binding. By the application of the technique used for deriving the Rybczynski lines R_2AR_1 and GDE, we can discover that, as the minimum wage in terms of X_2 is raised further, the Rybczynski line shifts leftwards

towards SMN. With the real minimum wage associated with SMN, full employment could be attained only with specialization in the capital-intensive commodity, and as we have seen above that could only occur if there were a sufficiently high price for the capital intensive commodity (X_1) to maintain the real wage in terms of the labour-intensive goods (X_2).

The implication of the Brecher model for our purpose have been succinctly summarized by Krueger (1983, p. 79):

(1) within the model in its two-commodity form, it is possible that the wrong commodity will be produced and even that there will be specialization in it; (2) the higher the real wage the greater is the likelihood of wrong specialization; and (3) at a sufficiently high real wage, full employment is possible only if the price of the capital-intensive commodity is sufficiently high and the real wage is fixed in terms of the labour-intensive commodity.

The higher the real wage the more capital intensive the production and moreover the empirical evidence from a number of countries idicates that :

> it is not possible for the factor intensities of produced commodities to reverse; that is, it is not possible that an industry that would be labour-intensive under efficient allocation could become capital intensive with a higher minimum wage ... there is no possibility of industries reversing factor intensities. Therefore, if the most labour-abundant country was found to be exporting the most labour-intesnsive goods when it was subject to a minimum wage

> constraint, one could be confident that the same outcome would apply under an efficient allocation (Krueger, 1983, p. 80).

Krueger, however, hastens to add that "if that country was exporting manufactured commodities that were not the most labour-intensive, there would be a question whether the distortion changed the pattern of production or whether the HOS (Heckscher-Ohlin-Samuelson) model did not describe an efficient allocation" (Krueger, 1983, p. 80). In such a situation, therefore, "one would not ascertain whether the failure to hold of the factor proportions hypothesis called into question the validity of the model or was due to the real minimum wage ..." (Krueger, 1983). One way of solving the above dilemma, as suggested by Krueger, is to simulate the optimal allocation before the minimum wage was introduced.

5.2.2.2 The Sector-Specific Minimum Wage

Unlike the Brecher model where the minimum wage applies to the whole economy, the Harris-Todaro (1970) model to be discussed in this section applies to only one sector of the economy, namely, the modern (manufacturing) sector. In this model the wage in the remaining sector-the agricultural (rural) sector is not set equal to the urban minimum wage but is exogenous and is equated to equilibrium with the urban expected wage. According to Harris and Todaro, the expected urban wage is defined as "equal to the fixed minimum wage (expressed in terms of

the manufactured commodity) times the proportion of the urban labour force actually employed" (p. 128). It is weighted by the rate of unemployment in the manufacturing sector. In the Harris-Todaro model, therefore, a differential exists between the manufacturing and the agricultural sectors that depends on the expected wage rate. Thus the model combines specificity of wages in one sector with wage differential in the other sector. (For an excellent summary of the model see Hazari, 1978, W. M. Corden, 1974, Corden and Findlay, 1975, Bhagwati and Srinivasan, 1974).

According to the Harris-Todaro model, the minimum wage constraint is definded in terms of the manufacturing goods as:

$$w_m = f'_m \geq w_m^* \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.2)$$

where f'_m is the marginal product of labour in manufacturing w_m is the real wage in the manufacturing sector and w_m^* is the minimum real in the manufacturing sector wage.

The urban expected wage is defined as:

$$w_u^e = \frac{w_m^* \; N_m}{N_u}, \quad N_m/N_u \leq 1, \quad \ldots\ldots\ldots (5.3)$$

where the expected real wage in the urban sector, w_u^e, is equal to the real minimum wage w_m adjusted for the proportion of the total urban labour force actually employed, N_m/N_u, (where N_m is the urban labour force

actually employed and N_u denotes the total urban labour force that is employed and unemployed labour). As is clear from the above equation, in the case of full employment in the manufacturing sector, where $N_m = N_u$, the expected wage w_u^e equals the minimum wage, w_m^* .

In equilibrium, the real wage rate in the agricultural sector w_A equals the expected wage rate:

$$w_a = w^e u = w_m^* L_m/N_u \quad .....(5.4)$$

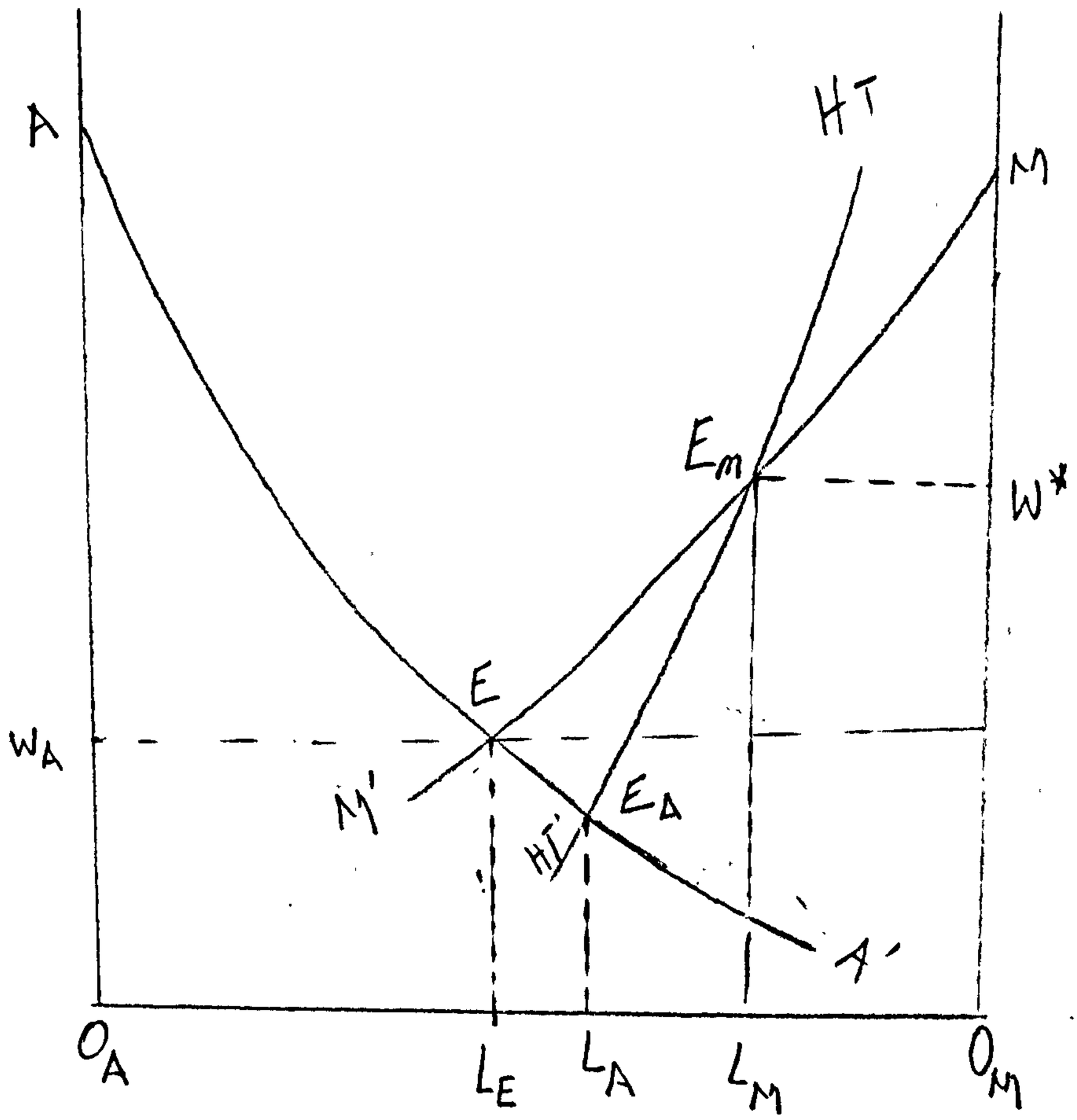
Given the above conditions, the existence of urban unemployment can be demonstrated with the aid of Figure 5.10. In this figure, the horizontal axis measures the fixed total endowment of the labour force. Points O_A and O_m represent the origins for labour employed in the agricultural (rural) sector and manufacturing (urban) sector respectively. Given the assumption that the country under consideration is small, it is possible tod draw the values of the marginal product curves for both sectors of the economy. Let MM' and AA' be the values-of-the-marginal-product curve for manufacturing and agricultural (measured at world prices) sectors respectively. In the standard competitive (non-distortinary) model the intersection of the two curves at E would determine employment levels in the two sectors and the uniform wage rate would be EL_E.

The wage rate is, however, fixed institutionally at a level of OmWm, which determines manufacturing employment

at Em, where the value of the marginal product equals the exogenously specified minimum wage. At this wage rate OmLm of labour is employed in the manufacturing sector.

In the orthodox wage-differential literature, which does not allow urban unemployment, the remainder of the labour force, O_ALM, would be employed in agriculture (see Corden and Findlay, 1975, p. 59). In the Harris-Todaro model, however, only part of this labour force finds employment in the agricultural sector because of the high urban wage set in the manufacturing sector. Therefore, part of the labour force O_ALM has to be unemployed. To determine the allocation of the labour force that is not employed in the agricultural sector draw a rectangular hyperbola HTHT' through the point E_m on MM' corresponding to the urban wage w_m. The curve HTH'T is the geometric representation of the equilibrium equation, which states that the agricultural real wage rate equals the expected wage rate ($w_A = w_m * N_m/N_u$). The HTHT' curve intersects the value of the marginal product curve of the agricultural sector at E_a. At E_a the rural wage rate equals not only the value of the marginal product in the agricultural sector but also the expected urban wage rate. With agricultural employment of O_ALA and manufacturing employment of O_MLM, L_ALM is urban unemployment. (Total urban labour force, N_u, consisting of those employed is manufacturing and the urban unemployed (L_ALM), is equal to O_ML_A).

Figure. 5.10.



From the equilibrium equation $w_A = w_m^* N_m/N_u$, we have:

$$w_A N_u = w_m^* N_m \quad \ldots\ldots\ldots\ldots\ldots\ldots(5.5)$$

As can be depicted from the diagram this condition and

the condition that the value of the marginal product in each sector equals the wage rate are met only by the points E_m and E_a (see Corden and Findlay, 1975, p. 62). Furthermore, the output of the manufacturing sector is reduced by the existence of a minimum wage above the competitive level of EL_E since the higher wage leads to less employment with a fixed capital stock. But output of the agricultural sector could be higher or lower. [In Figure 5.10, with the point E to the left of the point E_a, it is higher (see Corden, 1974, and Corden and Findlay, 1975)].

The conclusion that emerges from the Harris-Todaro model is that the higher the fixed urban wage, the more production structure would shift towards more capital-intensive commodities for given international prices. As with the uniform wage (economywide minimum wage of the Brecher type), however the belief that factor-intensity reversals are excluded implies that commodities that were capital-intensive under the real-minimum wage constraint would also be capital-intensive under free trade.

5.2.2.3 Factor Price Differential

In this sector we are concerned with distrortions in the factor market in which a qualitatively identical factor does not earn the same reward in all sectors of the economy. In a two-commodity two-factor world we assume that one sector pays higher price for labour than the

other sector.

The wage differential is introduced in the form:

$$\phi w_1 = w_2, \quad \phi > 0, \quad \phi \gtreqless 1 \qquad (5.6)$$

where w_i (i= 1, 2) ϕ is the wage in sectors 1 and 2 and ϕ is the differential factor between the two sectors.

Unlike the distortions discussed in the preceding pages, the results of distortions arising from wage differentials are not very clear. It has been demonstrated by a number of researchers that all kinds of perverse responses can arise (see Magee 1976; Batra, 1973; Hazari, 1978, Bhagwati and Srinivasan, 1971; and Johnson, 1966). These distortionary effects can be summarized as follows:

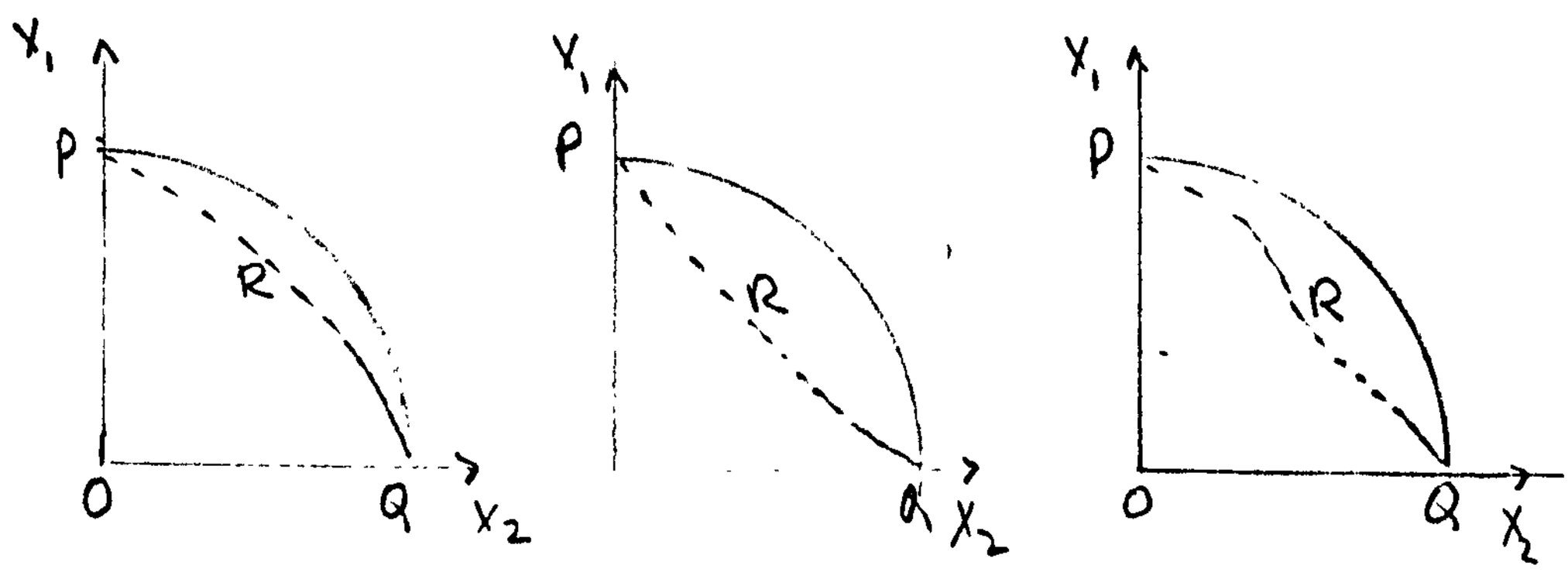
1. The one-to-one correspondence between factor prices and commodity prices breaks down. As demonstrated by Bhagwati and Srinivasan (1971) and Magee (1976), the correspondence between these two parameters is no longer monotonic. Instead of a single equilibrium of the usual type (the non-distortionary case) there can be multiple equilibria. As a result of this the Stopler-Samuelson theorem of factor price equalization breaks down completely.

2. The distorted production-possibilities curve lies inside the normal (non-distorted) possibilities-curve (except at end points) and can be of any shape. When

there are distortions in the factor market, the slopes of the isoquants are not equal. Given such distrortions the contract curve becomes the locus of points at which the two isoquant maps intersect each other. Since production takes place at these points, the distorted production-possibilities curve shrinks inward toward the origin. In the presence of such distortions therefore the shape of the production-possibilities curve can take one of the following shapes (a) concave to the origin, (b) convex to the origin and (c) partly concave and partly convex to the origin, as depicted in Figure 5.11a, 5.11b and 5.11c .

Needless to say, all the distorted production-possibilities curves (PRQ) lie inside the normal possibilities curve (PQ). In all three cases, therefore,

Figure 5.11a Figure 5.11b Figure 5.11c



the locus of competitive output is PRQ, which must everywhere, except the two complete specialization points, lie inside the non-distorted production possibility curve. (For the shape of the transformation curve with distortins, see Johnson (1966), Herberg and Kemp (1971), and Lloyd (1970).

In the non-distortionary case, an increase in the price of a commodity is accompanied by an increase in the output of that commodity, When there is a factor-price differential, however, this does not necessarily follow; an increase in the price of a commodity may result in a fall in the output of the commodity in question (see Hazari 1978, Magee, 1976, and Batra, 1973). Such a perverse result is caused by value-intensity reversal. Value intensity (VI) is defined in terms of the shares of the value of output going in each industry (X_1 and X_2) to each factor (labour, L and capital, K). It can be represented for commodity 1 in relation to commodity 2 as :

$$VI = [(r_1 K_1 / w_1 L_1) - (r_2 K_2 / w_2 L_2)]$$

where, r = rental for capital

w = wage rate

In the absence of factor-price differentials both sectors face the same wage-rental ratio, hence we have:

$$VI = r/w\ (k_1 - k_2), \qquad k_i = K_i / L_i .$$

$$r = r_1 = r_2$$

$$\text{and } w = w_1 = w_2$$

Physical intensity is defined as $PI = k_1 - k_2$. In the non-distortionary case if a sector is capital-intensive in the physical sense then it is also capital intensive in the value sense. In the presence of wage differentials, however, the signs of PI and VI need not be same (see Hazari, 1978 pp. 36-40 and Batra, 1973 pp. 251-254). In the presence of distrortion in the factor market the ranking of sectors in the physical sense may not be the same as the ranking of sectors in the value sense. Therefore, as Krueger (1983 p. 85) rightly remarks:

> The important lesson is that, in the presence of factor-market distortions that are thought to affect resource allocation significantly, one cannot draw any inference about the efficient commodity composition of production and trade and its factor proportions solely from observing the actual pattern of production and trade.

Nevertheless, in the presence of wage differentials within the manufacturing sector Krueger advances some propositions.

Suppose that the manufacturing sector is divided into two groups of industries according to the wage-rental ratio they face. Assume further that the first group of industries are labour-intensive relative to the second group, which have higher wage-rental ratios. If the country under consideration is at the top end of the factor endowment ranking (well endowed with labour), it

would under free trade and without factor-market distortions export the relatively labour intensive manufactured goods. In the distortionary situation discussed above however the outcome postulated under the free trade and non-distrortionary situation may or may not happen. In such distortionary situations, Krueger points out four possible situations:

A. Assume the differential is not sufficient to reverse factor intensities, then under this situation two possibilities can arise:

1. the right group of commodities will be produced with the right technique and will be exported, and

2. it is also possible that the country exports the 'wrong' commodities with the 'right' factor proportions. That is the capital-intensive commodity is exported instead of the labour-intensive commodity.

B. Assume that the differential is big enough to alter the distrortion free ordering of the commodities. Again there are two possibilities:

3. export industries become capital-intensive relative to import competing industries. In this case, the right commodity is exported with the wrong factor propositions.

4. the distortion can make the labour-intensive commodity capital intensive and reduce output sufficiently so that the capital-intensive commodity was exported instead of

labour intensive. Hence, the 'wrong' commodity (the capital intensive) is exported with the 'wrong' (labour-intensive) factor proportions.

5.3 Hypotheses to be Tested

The basic proposition of the Krueger-Deardorff model discussed in the preceding pages is that specialization and trade depend on the relative position of a country in the manufacturing capital-endowment ranking. For a country in the middle of the factor-endowment ranking the Krueger-Deardorff model postulates the following:

1. The factor-intensity characteristics of exportable industries should bear no specific relationship to that observed in import-competing (IC) industries. This is so because for countries in the middle of the factor-intensity ranking their import-competing industries might be competing not only with countries with higher capital endowments, but also with relatively lower capital endowments than themselves.

1. Thus, for a country in the middle of the factor-endowmwnts rankings, the model predicts that import competing industries whose products are competing with imports from developed countries will be more capital-intensive than export industries exporting to developed countries, while the converse is true if import competing industries compete with less develped countries (presumably less endowed with capital than any country in

the middle of the the factor endowment ranking). Hence, we have :

$$\left(\frac{K}{L}\right)_{DC}^{IC} > \left(\frac{K}{L}\right)_{DC}^{E} \qquad \text{.....(5.7)}$$

$$\left(\frac{K}{L}\right)_{LDC}^{IC} < \left(\frac{K}{L}\right)_{DC}^{E} \qquad \text{.....(5.8)}$$

Where (K/L) is capital-labour ratio, IC and E are import competing and exports respectively, and LDC, MFR and DC are less developed, countries in the middle of the factor endowment ranking and developed countries respectively. (The above postulate will also be true for the skill composition of trade, substitute S (some measure of skill) for K).

2. For a country relatively well endowed with labour, the model predicts that the capital intensity of import-competing industries whose products are competing with imports from both DCs and from countries in the middle factor-endowment ranking will be more than exports to these two groups of countries:

$$\left(\frac{K}{L}\right)_{LDC}^{IC} > \left(\frac{K}{L}\right)_{MFR+DC}^{E} \qquad \text{.....(5.9)}$$

This is also true for the skill composition.

3. The model predicts that a country in the middle of

the factor-endowments ordering will import capital (skill)-intensive commodities from capital (skill)-rich countries and labour-intensive commodities from countries with less endowment of both factors.

$$\left(\frac{K}{L}\right)_{DC}^{M} > \left(\frac{K}{L}\right)_{LDC}^{M} \qquad \text{.....(5.10)}$$

4. The model also predicts that the factor intensity of imports not competing with domestic production will diverge relatively more from the factor-intensity characterstics of exportables and import-competing goods with the divergence depending on the factor endowment of the country or origin of these non-competing imports (NCI).

5. The export basket of a country in the middle of the factor-endowment ranking will be more labour (less capital and skill)-intensive to developed countries and less labour- (more capital and skill) intensive to less-developed countries.

$$\left(\frac{K}{L}\right)_{DC}^{E} < \left(\frac{L}{K}\right)_{LDC}^{E} \qquad \text{.....(5.11)}$$

6. By contrast, for a country at the extreme top of the factor endowment ranking, its export basket both to advanced countries and to countries in the middle of the factor endowment ranking will be less capital- and less skill-intensive.

It is quite evident from the above hypotheses that for countries in the middle of the factor endowment ranking the overall pattern of trade cannot be predicted unless trade flows are weighted by origin and destination.

7. As the relative position of a country in the factor-endowment ranking changes over time, so will the factor content of its exports of manufactured goods to various destinations. Countries that have accumulated capital more rapidly than the country under consideration will receive relatively more labour content in their imports from this country. On the other hand, countries that have accumulated capital less rapidly than the above country will receive relatively more labour content in their imports from this country. This hypothesis tries to shed light into the way the pattern of comparative advantage of an economy changes with its changing factor endowment in relation to the rest of the world.

CHAPTER 6

MEASUREMENT OF VARIABLES

6.1 Introduction

In the previous chapter we put forward the hypothesis that alternative trade strategies imply different compositions of output. The discussion on the multi-commodity and multi-country dimensions of trade suggests that classification of commodities into importables and exportables only is not adequate for assessing the impact of trade strategies on employment. It is, therefore, important to make a proper identification of the commodities whose output increases or decreases according to the incentives they receive under the different trade and payment regimes.

6.2 Trade Categories

In Chapter 5 we theoretically identified four types of commodities when we were discussing the pattern of trade and specialization. These commodities are: (i) exportables, (ii) import-competing, (iii) non-competing imports and (iv) non-traded goods. In reality, however, such classification of commodities is not an easy task. In the first place, production and trade data are not published according to the above classification. Secondly, the census of industrial production and employment is undertaken on an industry rather than on a commodity case. Thus, we have neither the trade nor the

factor-coefficient data at the product level. Consequently, we have to rely on an indirect way of identifying the four groups of commodities mentioned above.

In the empirical literature of international trade, numerous classifications of industries have been tried. The most common of these has been the original Leontief (1954) method of considering any sector that has positive export in the year under consideration as exporting and any sector that has competing imports in that year under consideration as an import competing sector. Non-competing imports are left out.

A second approach that has been used by Finger (1969) is to classify an industry as an exporting industry when its export share in total exports exceeds its import share in total imports and conversely for an import-competing industry. The main difficulty with Finger's type of classification arises when there is disequilibrium in the overall commercial account. In the case of a trade deficit, an industry can have a high share of exports in the total value of exports but at the same time the absolute value of competing imports for the same industry could be higher than the total value of exports. It seems that such an industry should be called an exporting industry though will be so called by Finger, (Corbo and Meller, 1977).

A third approach is to classify industries according to their ratios of imports and exports to total domestic production. For instance, Balassa (1982), Liang and Liang (1976) and Kuo (1983) used the following types of classification:

Trade Category	Ratio of Exports to Domestic Production	Ratio of Imports to Domestic Production
Export competing	> 10%	< 10%
Export import-competing	> 10%	> 10%
Import competing	< 10%	> 10%
Non-competing imports	> 10%	< 10%

As Krueger (1983) rightly argues, however, such a scheme has several shortcomings. If the trade regime provides prohibitive protection to some industries, use of recorded figures completely omits an important component of import-competing activities - a serious problem if consideration is to be given to what might happen under a switch of trade policies. Secondly, since import substitution policies might have discouraged some industries from exploiting their comparative advantage, with such classification, industries of the above type may not surface very much.

A fourth measure (which will be used in this study) due to Krueger (1982) is to calculate a specialization statistic defined as the ratio of trade balance (imports minus exports) to the total domestic use (total supply less exports). Thus, for each industry we have:

$$T_{it} = (C_{it} - X_{it})/(C_{it}) = (M_{it} - E_{it})/C_{it} \qquad (6.1)$$

where $C_{it} = X_{it} + M_{it} - E_{it}$ = apparent consumption of commodities produced by industry i.

M = imports of industry i

E = exports of industryi

X = production of industry i

Each industry or sector was classified as:

$T_i < X_o$ producer of exportable goods

$X_o \leq T_i < X_1$ producer of import-competing goods

$X_1 \leq T_i < X_2$ producer of non-competing imports

The X's are the cutoff points which separate the above industries. Krueger (1981, 1983) suggests (for four-digit manufacturing industry) the following cutoff points:

$T_i < 0$ exportable industry

$0 \leq T_i < 0.5$ import competing

$0.5 \leq T_i < 0.99$ non-competing imports

The values of the cutoff points are arbitrarily fixed and cannot be determined a priori. The degree of aggregation and knowledge of the industries in question can change the appropriate cutoff points.

Effective rate of protection can also be used: classify those commodities with the lowest rate of protection as potential exporting industries. However, such a procedure is fraught with many imperfections. In the first place, there can be systematic discrimination

between domestic and foreign sales which need not be reflected in ERP. Secondly, effective rates of protection reflect excess of domestic value added over international value added; and besides costs they may also reflect elements of monopoly profits (See Bergsman, 1974, Krueger, 1983).

Krueger further believes that such a broad classificaiton is not adequate for evaluating the factor-proportions model of trade. As was pointed out in the preceding chapter, judgement of a country's factor endowment for trade purposes should be based on its manufacturing capital/labour ratio and not on its overall endowment. Further reclassification is therefore necessary. Krueger suggests the following: (1) Natural-resource-based industries, and (2) HOS (Heckscher-Ohlin-Samuelson) goods. Within the HOS classification there are some processing activities where the country's ability to process the goods economically hinged in large part on the domestic availability of the primary commodity. In such instances, a subcategory within the HOS classification called PCB (primary commodity based) HOS goods was formed. The rationale of reclassification activities in such categories is obvious. For NRB industries profitability basically depends upon the availability of some resources deriving rent, such as land or a mineral. For these activities the country's comparative advantage is primarily the result of the

presence of the natural resource whose exploitation is economic (see Krueger, 1981). Factor prices may not be a determining factor in the exploitation of the natural resource. By contrast, pure HOS activities are defined as those commodities whose production location is not determined by the location of the resource to which rent accrues. For HOS sectors, profitability (and hence location) is primarily a function of the relative prices of labour and capital goods and services (Krueger, 1981, p. 15).

6.3 Measurement of the Factor Content of Trade

In the following sections, therefore, we set forth the methodology to be used in subsequent chapters to determine the relative factor intensities of exportables, import-competing and non-competing imports industries. Three basic factor-requirement measures will be used:

1. direct factor requirements

2. direct-plus-home-goods-indirect factor requirement. (See next section for the meaning of direct- plus-home-goods - indirect factor requirement).

3. direct-plus-total-indirect factor requirement,

Three typres of inputs (factors) will be used, namely, physical capital, labour and skilled labour (or human capital).

6.3.1 Direct Plus Home-Goods-Indirect Labour Coefficient

Any expansion of a tradable producing sector requires

inputs from home-goods industries, and these industries in turn require home goods and primary factors to produce their output. Hence any expansion in such a sector will generate indirectly value added, labour employment, capital and skill requirements in the home goods industries which provide inputs. According to Krueger (1981), the direct-plus-indirect requirement of labour per unit of value added

> is perhaps more relevant for examining the effect of a change in trade stragegy: if trade policies were altered in a manner that increased value added in imports and exports by an equal amount, it seems clear that the expansion of exportable production would require not only factors of production directly, but home goods such as construction, electricity, finance and domestic transport. Home goods production itself requires factor inputs and purchased inputs, some of which are themselves home goods (Krueger, 1981, p. 22).

In order to develop a measure of the indirect factor requirements we shall use the following notations due to Corbo and Meller (1977).

EMP_j = direct labour requirement in sector j (tradables trading sector) dimension

$EMP_{j(D+IHG)}$ = direct-plus-home-goods-indirect labour requirements in sector j,

DVA_j = domestic value added in sector j,

$DVA_{j(D+IHG)}$ = direct-plus-home-goods-indirect value added in sector j,

X_j = gross output in sector j,

L' = (1, 2, 3... T) row vector of employment to output coefficients,

where $L_j = EMP_j/X_j$

v' = $(v_1, v_2, v_3, \ldots vT)$ row vector of direct value added to output coefficients, where $v_j = DVA_j/X_j$.

LV_j = direct labour requirements per unit of direct domestic value added in sector j, where $L_j = EMP_j/DVA_j$

$R^{(D+IHG)}$ = direct-plus-home-goods-indirect labour requirements per unit of direct-plus-home-goods-indirect value added [$R^{(D+IHG)} = EMP_j(D+IHG)/DVA_j(D+IHG)$ in sector j ,

e_j = column vector with one (1) in the jth row and zero otherwise,

A = matrix of total input-output coefficients,

A^d = domestic coefficient matrix,

A^H = Rectangular matrix of home-goods coefficients for the T input-output sectors, $(a_{ij}^H = X_{ij}^H/X_j)$,

A^{HH} = square matrix of direct intermediate input coefficients in the home-goods industries, $(a_{ij}^H = X_{ij}^H/X_j^H)$,

L'_H = row vector of direct employment to output coefficients in the home goods industry, $L'_H = (EMP_H/X_H)$

V'_H = row vector of direct value added to output coefficients in the home H goods

industries, $V'_H = (DVA_H / X_H)$

After defining the necessary elements we can derive some expressions to measure the direct-plus-indirect effects in the home goods. We proceed first to define the direct-plus-home-goods-indirect labour requirements, $EMP_{j(D+IHG)}$. The direct-plus-home-goods-indirect labour requirement ($EMP_{j(D+IHG)}$ is equal to the direct employment in industry $L_j X_j = L'e_j X_j$) plus the employment generated in the home-goods industries by the production of the inputs for the output X_j (gross output in sector j), that is, $L'_H A^H e_j X_j$, plus the employment generated in the home-goods industries by the production of the inputs for the output $A^H e_j X_j$, that is, $L'_H A^{HH} A^H e_j X_j$ and so on. We can measure the sum of these direct plus home-goods-indirect effects as follows:

$$EMP_{j(D+IHG)} = L'e_j X_j + L'_H A_H e_j X_j + L'_H A^{HH} A^H e_j X_j + \\ + L'_H (A^{HH})^2 e_j X_j + \ldots \qquad (6.2)$$

$$EMP_{j(D+IHG)} = L'e_j X_j + L'_H (I - A^{HH})^{-1} A^H e_j X_j \qquad (6.3)$$

By an argument analogous to the one in the previous section used to derive the direct-plus-home-goods-indirect labour requirements, the direct-plus-home-goods-indirect value added in each tradeable producing sector $DVA_{j(D+IHG)}$ is given by the following expression:

$$DVA_{j(D+IHG)} = v'e_j X_j + v'_H A^H e_j X_j + v'_H A^{HH} A^H e_j X_j + \\ + v'_H (A^{HH})^2 e_j X_j + \ldots \qquad (6.4)$$

$$DVA_{j(D+IHG)} = v'e_jX_j + v'_H(I-A^{HH})^{-1}A^He_jX_j \qquad (6.5)$$

6.3.2 Value Added and Factor Requirement Multipliers

The value added multiplier which measures the direct-plus-indirect value added in home-goods industries is defined as the ratio of direct-plus-indirect-home-goods value added per unit of output to direct value added per unit of output and is given as:

$$\begin{aligned} VM_j &= VA_{j(D+IHG)}/v'_j \\ &= [v'e_j + v'_H(I-A^{HH})^{-1}A^He_j]/v'e_j \qquad (6.6) \end{aligned}$$

Similarly, the direct-plus-indirect-home-goods employment multiplier is defined as:

$$\begin{aligned} EM_j &= EMP_{j(D+IHG)}/L'_j \\ &= [L'e_j + L'_H(I-A^{HH})^{-1}A^He_j]/L'e_j \qquad (6.7) \end{aligned}$$

Thus, the employment multiplier of direct-plus-indirect-home-goods requirement per unit of value added in sector j, is defined as the ratio of direct-plus-indirect value added per unit of direct-plus-indirect value added to direct labour per unit of value added and is given as:

$$TM_j = VM_j/EM_j = \frac{L'e_j + L'_H(I-A^{HH})^{-1}A^He_j}{v'e_j + v'_H(I-A^{HH})^{-1}AHe_j} \Big/ \frac{L'e_j}{v'e_j} \qquad (6.8)$$

The expressions for the multipliers for capital and skill requirements are of the same form with capital and skill

requirements per unit of production vectors being substituted for L' and L'H in the above expressions, in each respective formula.

Similar to the direct-plus-homegoods-indirect multipliers, the direct-plus-total-indirect multipliers can be derived:

Let us define:

$EMP_{j(D+T)}$ = direct-plus-total-indirect labour requirements in tradable sector j

$VA_{j(D+T)}$ = Direct-plus-total-indirect value added in tradable sector j.

Then the following multiplier can be derived:

1. Direct-plus-total indirect value added multipliers:

$$\frac{v'(I-A)^{-1}}{v'e_j} \qquad (6.9)$$

2. Direct-plus-total-indirect employment multipliers:

$$\frac{L'(I-A)^{-1}}{L'e_j} \qquad (6.10)$$

3. Direct-plus-total-indirect labour requirements per unit of direct-plus-total-indirect value added multipliers:

$$EM_j^T = \frac{L'(I-A)^{-1}}{v'(I-A)^{-1}} \Big/ \frac{L'e_j}{v'e_j} \qquad (6.11)$$

The formulae for the skill and capital requirements multipliers are of the same form with capital and skill requirements per unit of production vectors substituted for labour ' in each respective formula.

Having derived the formula for labour, capital and skill requirements per unit of domestic value added, we can now derive a formula for the factor requirements of the trade categories identified above. To arrive at the value added content of exports for the jth industry, the vector of direct value added to output is multiplied by the export value of that industry:

$$VE_j = (VA_j/X_j)*(E_j) \qquad (6.12)$$

Then the share or weight of each export industry is given by the following formula:

$$WE_j = VE_j/\sum VE_j \qquad (6.13)$$

To get the total value added generated by an increase in domestic production we multiply the value added multiplier by the value added content of exports:

$$VE_{j(D+IHG)} = (VM_j)*(VE_j) \qquad (6.14)$$

The weight for each export industry will be:

$$WE_{j(D+IHG)} = VE_{j(D+IHG)} / \sum VE_{j(D+IHG)} \qquad (6.15)$$

Analogous to the case of exports, a weighting system for import-competing industries can be derived. The first

weighting scheme uses as weights the DVA (domestic value added) content of a basket of local production of the set of industries classified as import-competing M^{IC}. (These are the industries classified by the T statistic. They are the subset of the total import competing).

$$VM^{IC}_j = (DVA_j/X_j)* M_j^{IC} \qquad (6.16)$$

Then the share of each import competing industry in total domestic value added content of import competing production is arrived as:

$$WM^{IC}_j = (VM^{IC}_j)/\Sigma(VM^{IC}_j) \qquad (6.17)$$

The second weighting system uses as weights the DVA content of a basket of competing imports (Mj)

$$VM^{C}_j = [\{(DVA_j)/X_j)\}*M_j]/\Sigma[\{(DVA_j)/X_j\}*M_j] \qquad (6.18)$$

6.3.3 Net Factor Content of Trade

The net factor (capital, labour and skill contents) content of trade being denoted by $(E-M)_j$, is the simple difference between the factor content of exports and the factor content of imports. To find the net factor content of trade we need to know the international-value-added content of a basket of exportables and a basket of import-competing goods. In measuring the IVA (international value added) content of exportables and import competing goods, we need to convert domestic value added (DVA) to IVA ones . This conversion is done using

the information on effective rates of protection. Thus, IVA per unit of production is given by:

$$IV_j = IVA_j/X_j = (DVA_j/X_j)*(1 + ERP_j) \qquad (6.19)$$

where ERP is the effective rate of protection.

To arrive at the net factor content of trade, we substitute IV_j/X_j for DVA_j/X_j in the relevant equations (6.1) to (6.15).

The HOS model predicts that the net labour content of trade for a country abundant with labour will be positive: that is, it is predicted that Taiwan will be a net exporter of labour and a net importer of both capital and skill.

6.3.5 Factor Content of Non-Import Competing Industries

In the preceding pages a methodology for measuring the factor contents of industries producing for the domestic and external market was set out, non-competing imports were not included.

Although some local production of non-competing imports is possible, the bulk of these goods consist of different commodities from the domestically produced ones. Consequently, we may not learn much about their technology from observing the domestic technology they use. To arrive at the factor content of these groups of industries, therefore, we shall make use of the

methodology suggested by Krueger (1981) and elaborated by Nogues (1983). Since the bulk of these goods are imported from advanced countries, the factor proportions of the industries used to produce these goods in the developed countries will be used. This method estimates the factor proportions of these imports in the country of origin and scales them down in order to reflect the factor-intensity differential caused by the wage-rental differential (Nogues, 1983, p. 1032).

Following Krueger (1981) and Nogues (1983) we define the labour requirement of non-competing imports per unit of their domestic value added in Taiwan by the following formula:

$$(EMP/DVA)_{NCI} = \beta\ [\{EMP/(DVA*k)\}^{F}*(IMP_j/\ IMP_j)] \qquad (6.20)$$

where EMP is total employment; IMP_j is the CIF value of non- competing imports (NCI) produced by industry j; k is the exchange rate used to convert foreign domestic value added (DVA) figures into domestic values and β is an adjustment factor that accounts for the differential in factor intensities caused by differences in the wage-rental ratio between countries producing these NCI (F = foreign) and Taiwan. The adjustment factor, β , can be estimated according to:

$$\beta = [(DVA_j/EMP_j)^{T}]\Big/[\{EMP_j/(DVA*k)_j\}]^{F} \qquad (6.21)$$

For a country such as Taiwan, whose manufacturing factor

endowment (capital/labour) lies in the middle of the factor-endowment ranking, the factor intensity of non-competing imports depends upon the origin of the imports themselves. If the bulk comes from countries relatively better endowed with capital than Taiwan, we would expect non-competing import goods to be more capital intensive than either competing imports or exports. The converse ought to be true if the bulk of non-competing import goods come from countries less endowed with capital than Taiwan.

CHAPTER 7

TRADE AND EMPLOYMENT IN TAIWAN

7.1 Introduction

The rapid economic growth and structural transformation achieved by Taiwan is the respect in which Taiwan is the envy of most developing countries. As was pointed out briefly in the second Chapter of this dissertation, the equitable distribution of personal income and the near-full employment of the labour force are also some of the most spectacular achievements of the Taiwanese miracle. It has been forcefully argued by many students of the Taiwanese economy that the strategy of economic development followed by this country was one of the fundamental reasons for this rapid growth and structural transformation. The early shift from the import-substitution strategy (followed up to the early sixties) to export-led growth since then is particularly singled out as the major contributing factor to rapid economic progress in general and employment generation in particular.

In Chapter 4 it was demonstrated that, from the early sixties to the early eighties, export expansion contributed more to output growth than the other components of final demand. In general, it has also been found that there is stronger and more positive association between exports and economic growth in Taiwan

than there is in the remaining members of the 'Gang of Four' (see Darrat, 1987, p. 279). Furthermore, the sources of employment expansion indicate that export-expansion contributed more to employment generation than domestic final demand expansion for most of the 1961-81 period . These findings do not, however, indicate whether the principles of comparative advantage were followed or not. It is the purpose of this chapter to test the hypothesis that Taiwan's success in generating near-full employment of its labour force was largely due to its adherence to the principles of comparative advantage.

The study will be carried out in three stages. In the first stage the contribution of exports to employment will be discussed for the period 1961-84. In the second stage the hypothesis set out in Chapter 1, namely that exportable industries generate more employment per unit of value added than import-competing industries, will be tested. In the third stage the Deardorff-Krueger versions of the Heckscher-Ohlin-Samuelson (HOS) model will be empirically tested.

7.2 The Contribution of Exports to Employment

As was pointed out in the introductory remarks of this chapter, one of the most interesting aspects of the effects of the strategy followed by Taiwan is the extent to which exports contribute to employment creation.

Table 7.1 shows the relative contribution of final-demand

components to labour absorption in Taiwan. As the table clearly shows, the contribution of exports to labour utilization has increased substantially over the past two and a half decades. In 1961 employment created by export business accounted for less than 12 percent, but it increased by more than three-fold to 35.8 percent in 1984. It can also be learned from this table that labour used by domestic final demand fell from 88 percent in 1961 to 64.2 percent in 1984. The table reveals, however, that the importance of domestic final demand in labour absorption has declined in the last period while that of exports has increased.

As the bulk of Taiwan's trade is with developed countries, it is not surprising to see that exports to developed countries absorb more labour in total than exports to developing countries. Table 7.1 indicates that the share of labour absorbed by exports to developed countries as a proportion of total employment increased from 7.1 percent in 1961 to 24.5 percent in 1976. Similarly, labour used by exports to less developed countries increased from 4.8 percent in 1961 to 9.5 percent in 1976. As column 6 of Table 7.1 indicates, labour used by exports to developed countries as a percentage of labour used in exports to developing countries has more than doubled from 148 percent in 1961 to 258 percent in 1976.

Table 7.1 . Labour[a] Utilization in Taiwan: 1961-1981.
(percent)

Year	Labour Used by: Total final demand	Domestic final demand	Total exports	Exports to DCs	Exports to LDCs	
	(1)	(2)	(3)	(4)	(5)	(4)/(5)
1961	100.0	88.1	11.9	7.1	4.8	1.48
1966	100.0	79.6	20.4	12.2	8.2	1.49
1971	100.0	74.2	25.8	17.6	8.2	2.15
1976	100.0	66.0	34.0	24.5	9.5	2.58
1981	100.0	67.8	32.2	NA	NA	NA
1984	100.0	64.2	35.8	NA	NA	NA

SOURCE 1. For 1961-1976 - Kuo (1983), pp.184-5
2. For years 1981 and 1984 - author's estimate
Notes : [a] refers to direct-plus-total-indirect

In Chapter 2 we have indicated that manufactured output in general and manufactured exports in particular have played an important role in the transformation of the economy. Manufacturing employment has risen significantly over the last three decades. In Table 7.2 we present a more disaggregated view of Table 7.1. Labour used by three broad sectors of the Taiwanese economy is presented. As this table clearly indicates, employment opportunities created by the manufacturing industry have significantly risen over the past two decades. In 1961 manufactured exports absorbed 3.6 percent of total employment by 1984, however, this share was increased to

Table 7.2. Allocation of Wage Employment[a] in Taiwan: 1961-1984. (Percent)

Year & Industry	Labour Used by: Total final demand	Domes-final demand	Total exports	Exports to DCs	Exports to LDCs
1961					
1. A.	47.3	42.4	4.9	3.4	1.5
2. M.	13.3	9.7	3.6	1.8	1.8
3. S.	39.4	36.0	3.4	1.9	1.5
1966					
1. A.	44.0	35.9	8.1	6.1	2.0
2. M.	15.7	9.3	6.4	2.9	3.5
3. S.	40.3	34.4	5.9	3.2	2.7
1971					
1. A.	35.7	29.3	6.4	4.7	1.7
2. M.	22.7	10.7	12.0	8.0	4.0
3. S.	41.6	34.2	7.4	4.9	2.5
1976					
1. A.	29.6	24.3	5.3	4.3	1.0
2. M.	28.1	9.9	18.2	12.7	5.5
3. S.	42.3	31.8	10.5	7.5	3.0
1981					
1. A.	23.6	18.8	4.8	na	na
2. M.	36.8	16.4	20.4	na	na
3. S.	39.5	32.6	6.9	na	na
1984					
1. A.	16.0	12.7	3.3	na	na
2. M.	39.6	12.6	27.0	na	na
3. S.	44.5	39.0	5.5	na	na

SOURCE: Same as Table 7.1.
notes: A= Agriculture, M= Manufacturing, S= Services
[a] refers to direct-plus-total-indirect

27.0 percent. By contrast, employment generated by agricultural exports remained almost stagnant throughout this period. This trend was also true of the service sector. Labour used by manufactured exports to developed countries has increased substantially over this period. As is evidenced from Table 7.2 the manufacturing sector has played a significant role in generating employment opportunities for the Taiwanese labour force. The large rise in employment associated with the near-full employment of the labour force was largely due to export expansion in general and manufacturing exports in particular.

7.3 Trade Strategy and Employment

The analysis presented above does not tell us whether resources, in particular labour, have been used according to the factor endowment of the country. What it attempts to show is that exports were a decisive factor in employment growth and in eliminating mass unemployment. Indeed, the unemployment rate in Taiwan has declined from 6.2 per cent in 1961 to 1.4 percent in 1981.

The purpose of this section is to test the hypothesis set in Chapter 1, namely that export expansion generates more employment (per unit of value added) than import substitution. Tests for the hypothesis are based on four input-output tables, 1966, 1971, 1976 and 1981 which are

reclassified into 69 comparable sectors.

In the first part of this section direct labour per unit of domestic value added will be estimated. Then, direct-plus-home-goods-indirect employment per unit of direct-plus-home-goods indirect value added and direct-plus total-indirect labour requirement per unit of direct-plus-total indirect domestic value added will be calculated. All the estimates are at current prices.

7.3.1 Direct Employment

As was discussed in Chapter 6, for the purpose of testing our hypothesis set in the first chapter of this dissertation, we have classified industries according to the formulae discussed in that chapter.

$$T_i = (M_i - E_i)/(X_i + M_i - E_i)$$

For the purpose of our study in this section, industries were categorized as follows:

(a) as exportables if $T_i < 0$;

(b) as import-competing industries if T_i fell between 0 and 0.50; and

(c) as non-import-competing activities if T_i was greater than 0.50.

The average direct employment generated per million NT$ of direct value added for the first set of industries is presented in Table 7.3. On a Leontief (1954) type of test, we should expect that Taiwan's exports would be

more labour-intensive than import-competing industries. As can be seen from Table 7.3 direct labour per unit of direct domestic value added in exports is greater than in import-competing industries for the period covering 1966-1981. Furthermore, as will be discussed in Chapter 8,

Table 7.3. Direct Labour Requirements per Million of NT$ Direct Domestic Value Added 1966-1981

Year (1)	Exportables (2)	Import Competing (3)	(4) = (2)/(3)
1966	50.69	25.62	1.98
1971	19.56	14.28	1.37
1976	9.04	8.31	1.09
1981	4.01	3.69	1.09

Source: Author's estimate

the pattern of direct labour requirements per unit of direct domestic value added in both exportables and import competing industries is consistent with the hypothesis that as Taiwan accumulates more capital relative to labour, labour requirements in both sorts of industries will decline. That is, as the country approaches the stage of neoclassical full employment, capital accumulation and the associated labour migration to the manufacturing sector will start raising wages, thereby leading to capital deepening.

Table 7.3 also presents the ratio of labour requirements in exports to that in import-competing industries. In terms of the employment implications of alternative trade strategies these ratios have very important implications.

As can be seen from the table, the ratios are always greater than unity indicating that export industries generate more employment per unit of direct domestic value added than import-computing industries. This implies that there is potentially a positive effect of trade strategy on employment. In other words, these results indicate that Taiwan, a relatively labour-abundant country, is exporting the abundant factor embodied in its exports. These results also provide a strong indication that export industries are more labour-intensive and therefore provide more employment than do import-competing industries.

7.3.2 Indirect Employment

In this section we shall attempt to estimate labour requirements by taking into account the indirect employment and indirect value added generated in the non-tradeables (home goods) industries by the expansion of tradeable sectors. As Krueger (1983) argues, the effects of a shift in trade policy or strategy should be assessed by taking into account the indirect employment, capital, skill and value added generated as a result of this shift. This is so because the expansion of exportable production would require not only factors of production directly used in tradeables but also home-good intermediate inputs such as construction, electricity, financial services and transport and communication. This is particularly important to note in the light of the

experience of Korea in which service-related industries had the highest rate of employment expansion of any macro sector (Engelbrechet, 1987).

In the computation of direct-plus-indirect labour requirements (home-goods-indirect effects in one case and total indirect effects in the other), we start by finding the direct and indirect domestic value-added content of a basket of radeables (exportables and import-competing goods). For these computations we use the value-added multipliers derived in Chapter 6 . The direct and indirect labour-requirements coefficients for each tradeable sector are derived through use of the multipliers by the formula as developed in Chapter 6. Multipliers are derived for home-goods-indirect and total-indirect effects for each tradeable sector.

To derive the indirect employment requirements, the following sectors were assumed to be home goods: construction, electricity, gas, city water, transportation, communication, warehousing, wholesale and retail trade, finance and insurance, and other miscellaneous services:

In Table 7.4 we present the direct-plus-home-goods-indirect labour requirements per NT$ one million of direct domestic value added on the one hand and direct-plus-home-goods-indirect labour requirements per NT$ one million of direct-plus-home-goods-indirect domestic value

added. As can be learned from this table (column 2 and 3) , these individual employment effects conform with the direct employment coefficients. Exportables created more indirect employment than import-competing industries. As the table further reveals, the ratio of direct-plus-home-goods-indirect labour requirements per NT$ one million of direct value added and per NT$ one million of direct-plus-home-goods-indirect domestic value added in exportables is greater than the same labour requirements in import-competing industries. The ratio for all the years was greater than unity, indicating that exportable industries generated more indirect employment per unit of domestic value added than import-computing industries.

In comparing the results of the direct employment requirements per NT$ one million of direct DVA with the direct-plus-home-goods-indirect labour requirements per NT$ one million of direct-plus-homegoods-indirect domestic value added, we observe that labour requirements in both tradeables did not charge very much. Labour requirements in exportables increased by 19, 8, 9 and 10 percent and in import-competing-industries by 5, 33, 12 and 10 percent for 1966, 1971, 1976 and 1981 respectively. These modest increases in labour requirements may indicate that Taiwan's home-goods industries are not labour-intensive.

In the previous section indirect labour requirements were

estimated for the home-goods industries. In the following we shall attempt to determine the direct-plus-

Table 7.4. Direct-plus-homegoods-indirect and Direct-plus-total-indirect Labour Requirements in Exportables & Import-Competing Manufactured Products: 1966-1981 (at Current Prices)[a].

	Direct-plus-home goods-indirect		Direct-plus-total-indirect	
(1)	(2)	(3)	(4)	(5)
I. EXPORTS				
(a) 1966	58.39	42.45	140.09	38.82
(b) 1971	23.93	18.05	59.71	19.43
(c) 1976	9.93	8.30	18.85	9.12
(d) 1981	4.55	3.63	7.90	3.60
II. IMPORTS				
(e) 1966	37.63	24.33	63.69	25.94
(f) 1971	17.90	13.89	31.36	14.81
(g) 1976	9.25	7.42	17.85	7.23
(h) 1981	4.47	3.31	6.74	3.13
III. EXPORTS TO IMPORTS				
(i) (a):(e)	1.55	1.74	2.20	1.50
(j) (b):(f)	1.34	1.30	1.90	1.31
(k) (c):(g)	1.07	1.12	1.06	1.26
(l) (d):(h)	1.07	1.10	1.17	1.15

SOURCE: Author's estimate

[a] Notes : 1. column (2) refers to direct-plus-homegoods-indirect number of people per NT$ one million of direct DVA;

2. column (3) refers to direct-plus-homegoods-indirect number of people per NT$ one million of direct- plus-homegoods-indircet DVA;

3. column (4) refers to direct-plus-total-indirect number of people per NT$ one million of direct DVA;

4. column (5) refers to direct-plus-total-indirect number of people per NT$ one million of direct- plus-total-indircet DVA;

total indirect labour requirements by including both tradeables and non-tradeables (home goods). As in the previous section direct-plus-total-indirect labour requirements will be estimated per NT$ one million of direct-plus-total-indirect domestic value added and per NT$ one million of direct domestic value added. The estimates are presented in columns 4 and 5 of Table 7.4. They also conform that expotable industries generate more employment per unit of value added than impotables.

Having studied the direct and the indirect labour requirements, we maintain our basic conclusion that despite the fact that Taiwanese exportables are becoming less labour-intensive, their labour requirements as measured by the different methods indicate that they have higher labour requirements than import-competing goods. Therefore, in terms of employment creation, the evidence from the above analyses shows that exportable industries are superior to import-competing industries.

7.5 Factor Content of the Trade Categories

7.5.1 Introduction

The purpose of this section is to see whether Taiwan is trading in accordance with the static principles of comparative advantage. This analysis will have two interrelated objectives. The first is to test whether Taiwan, in trading with countries whose stages of

development differ from its own uses its scarce factors (capital and skill) and its abundant factor (unskilled labour) in line with the conventional view of the principles of comparative advantage. The second is to test in a more detailed manner whether different trade strategies imply different compositions of employment. This latter objective will be pursued by disaggregating the trade-data flows by destination (exports) and by origin (imports). Of course, the two objectives are interrelated; for, if the HOS (Heckscher-Ohlin-Samuelson) model is correct, then the regime that departs from the pattern of international-trade specialization according to the principles of comparative advantage in endowment of unskilled labour as against other factors, will have negative effects on employment creation in a labour-abundant country such as Taiwan.

The analysis will be carried out in two stages. In the first stage, the factor proportions of Taiwanese trade in manufacturers will be examined. The analysis is done for the manufacturing sector in order to avoid problems with the comparative advantage that may come from the availability of natural resources. The hypothesis that Taiwan's exports of manufacturers should be more labour-intensive but less capital- and skill-intensive than her manufactures which compete with imports will be tested for the period 1966-1981. In the second stage of the analysis, a bilateral test of the HOS model will be made by disaggregating the 1971 trade data into trade with

developed and trade with developing countries. For this purpose we shall use four digit industry census data. Our plan in this section is as follows: we shall first present the analysis for the 41 three-digit manufacturing industries aggregated from the 1966, 1971, 1976 and 1981 input-out tables. After that we shall present the results of the test of the multi-commodity and multi-country trade model discussed in Chapter 5.

7.5.2 Factor Intensity of Taiwanese Trade in Manufactures

In this section the hypothesis that Taiwan exports more labour-intensive products and imports more capital- and skill-intensive products will be tested for the industries classified as exportables and import-competing according to the T statistics we derive previously . As was discussed in Chapter 6 , we hare five kinds of measurement for our three factors of production:

(i) direct labour (capital, skill) per unit of direct DVA;

(ii) direct-plus-home-goods-indirect labour (capital, skill) per unit of direct DVA;

(iii) direct-plus-home-goods-indirect labour (capital, skill) per unit of direct-plus-home-goods-indirect DVA;

(iv) direct-plus-total-indirect labour (capital, skill) requirements per unit of direct DVA ; and

(v) direct-plus-total-indirect labour (capital,

skill) requirements per direct-plus-total-indirect DVA.

Tables 7.5, 7.6 and Table 7.7 set out the result of our investigation on the factor-endowment structure of Taiwanese trade in manufacture. As is evident from these tables, Taiwan, as the theory predicts, is

Table 7.5. Direct Factor Requirements and Factor Proportions in Exportables and Import-Competing Manufactured Products, 1966-1981 (in Current Prices).

	LABOUR (L)	Physical Capital (K)	Human Capital (H)	(K)/(L)	(H/L)
I. EXPORTS					
(a) 1966	50.69	2,135,596	1,621,410	42,158	31,981
(b) 1971	19,56	1,426,044	2,270,734	72,906	116,091
(c) 1976	9.04	1,775,811	2,963,029	196,439	327,769
(d) 1981	3.69	1,568,471	3,459,052	391,140	862,606
II. IMPORTS					
(e) 1966	25.62	1.594,760	3,211,305	62,247	125,344
(f) 1971	14.28	2,311,408	3,311,636	161,863	219,302
(g) 1976	8.31	4,907,070	2,627,496	590,052	316,185
(h) 1981	3.69	3,032,911	4,168,118	821,927	1,129,577
III. EXPORTS & IMPORTS					
(i) (a):(e)	1.98	1.34	0.51	0.68	0.26
(j) (b):(f)	1.37	0.62	0.73	0.45	0.53
(k) (c):(g)	1.09	0.36	1.13	0.33	1.34
(l) (d):(h)	1.09	0.52	0.83	0.48	0.76

SOURCE: Author's estimate.
Notes: factor inputs are per NT$ one million of direct DVA

exporting labour-intensive and importing capital intensive products for the period under study. The ratio of labour requirements in exportables to those in import-

competing products has always been greater than unity. Similarly, the ratio of capital requirements in

Table 7.6. Direct-plus-homegoods-indirecrt Factor Requirements and Factor Proportions Per NT$ one million of direct-plus-homegoods-indirect DVA in Exportable and Import-Competing Manufactured Products, 1966-1981 (in Current Prices)

	L	K	H	K/L	H/L
	(1)	(2)	(3)	(4)	(5)
I. EXPORT					
(a) 1966	42.45	2,177,938	3,224,848	51,306	75,992
(b) 1971	18.05	1,485,798	3,848,140	82,316	213,193
(c) 1976	8.30	3,274,890	4,233,526	394,565	508,859
(d) 1981	3.63	3,309,841	4,665,252	911,802	1,285,193
II. IMPORT					
(e) 1966	24.33	1,930,243	3,922,138	79,366	161,582
(f) 1971	13.89	2,392,838	4,239,654	172,270	305,231
(g) 1976	7.42	6,990,958	3,858,150	942,178	519,966
(h) 1981	3.31	5,561,892	5,166,096	1,680,330	1,560,754
III. EXPORTS & IMPORTS					
i) (a):(e)	1.74	1.13	0.82	0.65	0.47
j) (b):(f)	1.30	0.47	0.91	0.48	0.70
k) (c):(g)	1.12	0.63	1.10	0.42	0.98
l) (d):(h)	1.10	0.60	0.90	0.54	0.82

SOURCE: Author's estimate.notes:

exportables to those of import-competing products is less than unity (except for the 1966 period). In the case of the skill intensity of these sets of industries also Taiwan seems to export less skill-intensive products except for the 1976 period, where, Taiwan seems to export rather than import skill-intensive manufactured products.

Moreover, as these tables show, the evolving comparative advantage in Taiwan seems to be tilted more towards skill-intensive manufactured products than towards capital-intensive products (for more detailed examination see Chapter 7).

Table 7.7. Direct-plus-total-indirect Factor Requirements and Factor Proportions per NT$ one million of direct-plus-total-indirecct DVA in Exportables and Import-Competing Manufactured Products, 1966- 1981 (in Current Prices)

	L	K	H	K/L	H/L
	(1)	(2)	(3)	(4)	(5)
I. EXPORTS					
(a) 1966	38.82	1,585,967	2,534,834	40,854	65,297
(b) 1971	19.43	1,840,546	3,600,385	94,727	185,300
(c) 1976	7.95	3,616,624	3,958,871	454,021	497,971
(d) 1981	3.45	3,938,861	4,412,018	1,141,699	1,278,846
II. IMPORTS					
(e) 1966	25.94	1,893,353	3,926,672	72,990	151,375
(f) 1971	14.81	2,400,575	4,117,671	162,089	278,033
(g) 1976	7.23	5,895,173	3,738,220	815,377	517,043
(h) 1981	3.13	5,761,308	4,808,637	1,840,673	1,536,306
III. EXPORTS & IMPORTS					
i) (a):(e)	1.50	0.84	0.65	0.56	0.43
j) (b):(f)	1.31	0.77	0.87	0.60	0.67
k) (c):(g)	1.10	0.61	1.06	0.56	0.96
l) (d):(h)	1.10	0.68	0.92	0.62	0.84

SOURCE: Author's estimate

7.6 Trade Regime and Commodity Composition of Trade in a Multi-Commodity and Multi-Country Case: Testing the Krueger and Deardorff Models.

In testing the HOS theory for a multi-product and multi-country case, we disaggregate the 1971 trade data of Taiwan into trade with developed and trade with developing countries. Then, considering that Taiwan's capital/labour and skill/labour ratios of manufacturing are somewhere between the ones for developed and developing countries, we proceed to test the following hypotheses at the four-digit level of industrial disaggregation:

(i) Capital and skill requirements per unit of labour in exports are smaller than those factor requirements in import-competing products ;

(ii) Capital and skill requirements per unit of labour in exports to developed countries are smaller than those factor requirements in exports to developing countries;

(iii) Capital and skill requirements per unit of labour in exports to developed countries are smaller than those factor requirements in import-substitute industries whose products are competing with goods from developed countries.

(iv) Capital and skill requirements per unit of labour in exports to developing countries are

greater than the capital and skill requirements per unit of labour in import-substitute industries whose products are competing with imports from developing countries.

These four propositions shall be tested for direct factor requirements, direct-plus-homegoods-indirect factor requiremements and direct-plus-total-indirect requirements. In addition to the above, we shall also attempt to test the relationship between factor proportions of non-import competing industries against the factor requirements of export industries and import-competing industries. However, the analysis of the latter case will be confined to direct factor content requirements only. As was explained in Chapter 5, for a country in the middle of the factor endowment ranking, non-import-competing products should be more labour-intensive if they originate from a labour-abundant country than if they originate from countries relatively less endowed with labour with labour. In the case of Taiwan, since the bulk of its non-import-competing imports come from more advanced countries, we should expect the capita/labour ratio of these industries to be higher than either that of exportables or than that of import-competing industries.

7.6.1 Factor Intensity in Trade : Direct Requirements

In this section the hypotheses enunciated above are tested with the use of direct factor requirements. Three inputs are used in this study. Labour is measured by the number of people engaged, capital by the book value of fixed assets, and skill by the number of managerial, technical and skilled labour employed. Direct factor requirements are computed for a unit of domestic value added (DVA) for the sets of industries classified as exportables, import-competing and non-import competing. The study uses the four-digit manufacturing census data for 1971, the 1971 input-output table and the 1971 trade data of Taiwan.

7.6.1.1 Factor Intensity of Exporting Industries

As was indicated previously, in a bilateral test of the HOS theory of international trade, we would expect Taiwan's exports to developed countries to be more (less) labour (capital- and skill-) intensive than exports to developing countries. In Table 7.8 we present the direct factor requirements for a million of NT$ domestic value added in export and import-competing industries (for 1971). As can be observed from the table, direct labour requirements per million of NT$ of domestic value added are higher for exports to developed countries than for exports to developing countries. The labour requirements per unit of DVA for exports to developed

countries are about 27 percent higher than labour per unit of DVA in exports to less developed countries. Direct capital and direct skill requirements per million of NT$ DVA are lower for exports to developed countries than those for exports to developing countries. However, the differences for these two requirements between the two destinations are not so big as that for labour requirements.

Table 7.8 reveals that capital and skill requirements per million of NT$ DVA in exports to developed countries were about 88 and 96 percent respectively of the capital and

Table 7.8. Direct Factor Requirements and Factor Proportions per NT$ one million of direct DVA in Exportables and Import-Competing Manufactured Products by destination and Origin of Trade Flows, 1971.

	LABOUR (L)	CAPITAL (K)	SKILL (S)	(K)/(L)	(S/L)
I. EXPORTS					
(a) DC	29.54	2,804,044	9.84	94,924	0.33
(b) LDC	23.32	3,168,486	10.24	135,870	0.44
(c) W	27.68	2,913,092	9.96	105,242	0.36
(d)(a):(b)	1.27	0.88	0.96	0.70	0.75
II. IMPORTS					
(e) DC	27.70	3,121,295	15.56	112,683	0.56
(f) W	24.44	3,022,871	13.65	123,685	0.56
III. EXPORTS & IMPORTS					
(a):(e)	1.07	0.90	0.63	0.84	0.59
(c):(f)	1.13	0.96	0.73	0.85	0.64

SOURCE: Author's estimate

skill requirements in exports to developing countries. Thus, regarding the direct factor requirements of exports to various destinations, the above findings provide strong support for the HOS theory of international trade in the Taiwanese case.

7.6.1.2 Factor Intensity of Import-Competing Industries

In testing the factor proportions concerning import-competing industries, we have first to classify these industries as competing with either developed or developing countries. Analogously to the case of exports, the origin of import-competing products was classified by the following market share:

$$h_i = M_i \text{ developed} / M_i \text{ total}$$

where M_i is imports.

Industries were classified with cut-off values of 0.25 and 0.75.

(i) industry i is competing with developed countries if $h_i \geq 0.75$

(ii) industry is competing with less developed countries if $h_i \leq 0.25$; and

(iii) industry i is non-classified if $0.25 < h_i < 0.75$.

According to the above criterion, none of the import-competing manufacturing industries in Taiwan werre classified as competing with less developed countries. Consequently, it was not possible to test the hypothesis

concerning the factor proportions of import-competing industries whose products are competing with imports from developing countries. The bilateral test of the HOS theory will be carried out only between total import-competing industries and those import-competing industries whose products are competing with goods from developed countries.

Table 7.8 reveals that in 1971 labour per unit of value added in exports to developed countries is higher (by about 7 percent) than in import-competing industries whose products are competing with goods from the same group of counttries. Capital per unit of value added in import-substitutes competing with goods from developed countries was 10 percent higher than in exports to the same group of countries. Skill per unit of value added in import-substitute goods competing with imports from developed countries was 58 percent higher than skill per unit of value added in exports to the same group of countries.

Thus, as predicted by the HOS theory, Taiwan's exports to developed countries had in 1971 lower capital/labour and skill/labour ratios than its imports from developed countries. The capital/labour and skill/labour ratios in exports to developed countries were about 84 and 59 percent of the capital/labour and skill/labour ratios of import-competing industries whose products were competing with goods from developed countries. These findings

seem to indicate that Taiwan, in line with its comparative advantage, is exporting relatively less skill-intensive products to, and importing relatively more skill-intensive products from developed countries.

7.6.2 Factor Intensity of Non-Competing Imports

The purpose of this section is to estimate labour per unit of DVA that could be employed if imports without domestic competition had to be produced domestically with the same techniques as are actually used for them. By definition labour requirements for non-competing imports cannot be estimated from Taiwan's observed data, and must be inferred from some countries that trade heavily with Taiwan. Since the United States is Taiwan's main trading partner, we used estimates of labour requirements based on the United States Survey of Manufactures. The method used is discussed in Chapter 6.

Labour per one million NT$ direct DVA in non-competing imports is estimated at 17 persons for 1971. Thus total exports are about 1.63 times more labour intensive than non-competing imports, while import-competing goods are 1.44 times more labour intensive than non-competing imports.

7.7 Factor Intensity in Trade: Direct-Plus-Indirect Factor Requirements

7.7.1 Introduction

In the previous sections we tested some propositions concerning the HOS theory using only direct factor requirements. However, as was pointed out in the previous chapter, any expansion of the tradeable producing sector will require inputs from other sectors and from home goods (non-tradeables) industries. Therefore, any expansion in a tradeable sector will generate indirectly value added, labour, capital and skill requirements in home goods industries which provide inputs to the tradeable sectors. If the composition and quantity of home goods used by the tradeable sectors (exportables and import-competing industries) differ between the two types of industries and if the factor requirements differ among home-goods industries, then, even if the HOS theory is supported by evidence from the direct factor requirements, it can still be rejected when direct-plus-home-goods-indirect factor requirements are taken into consideration (see Krueger, 1983).

The direct factor requirements presented in the previous sections were based on 106 four-digit manufacturing-census data. However, the 1971 input-output table for Taiwan includes only 47 manufacturing sectors. Therefore, in implementing the value-added and factor-input

multipliers, we face the problem of working at the four-digit ISIC level while the 1971 input-output table has a degree of disaggregation that is approximately equal to that of a three-digit ISIC classification. We have thus two options. The first is to aggregate the four-digit data to the level of aggregation in the 1971 input-output table. The second is to compute value-added and factor-input multipliers at the 1971 I-O level of aggregation and then to use the same multipliers for all four-digit industries belonging to the corresponding three-digit manufacturing industries in the input-output table. Applying either of these methods has certain disadvantages. If we apply the first procedure, we lose through aggregation the information on direct factor requirements. If we follow the second procedure, we are assuming that the indirect cost structure for each of the four-digit industries is the same as that of the three-digit industries within which they are included. This means that the technical coefficients of the 47 manufacturing industries in the input-output table are to be assigned to the 106 manufacturing sectors derived from the 1971 census of industrial and commercial data. In this study we have followed the second procedure. Thus, the indirect effects estimated are less reliable in this respect than the direct factor requirements estimated in the previous sections.

7.7.2 Factor Intensity in Trade: Direct-Plus-Home-Goods-Indirect Effects

In estimating the direct-plus-indirect factor requirements (home-goods-indirect effects in one case and total-indirect effects in the other), we start by finding the direct and indirect domestic value added content of a basket of tradeables (exportables and import-competing goods). For this purpose, we use the value-added multipliers derived in Chapter 6. Then direct- and indirect-factor-requirement coefficients for each tradeable producing sector are derived by means of the multipliers derived by the formula developed in Chapter 6. Multipliers are derived for home-goods-indirect and total-indirect effects for each tradeable sector and for each factor (labour, capital and skill). Then, we find the direct and indirect factor requirements for each category of tradeables and with destination breakdown for exports and import-competing goods.

In Table 7.9 we present the direct-plus-home-goods-indirect factor requirements and factor proportions per NT$ one million of direct-plus-homegoods-indirect DVA in exportables by destination and imports by origin. Again, as with the case of the direct factor requirements, we find that capital/labour ratio of exports to developed countries is lower than the capital/labour ratio of exports to developing countries. This is also true for the skill/labour ratio. Moreover, we also observe that

these ratios for exports are lower than for import-competing goods. As Table 7.9 indicates, direct-plus-home-goods-indirect indirect labour requirements per unit of direct-plus-home-goods-indirect domestic value added in exports to developed countries are higher by about 20 percent than the same factor requirements in exports to developing countries. Furthermore, direct-plus-homegoods-indirect labour requirements per unit of direct-plus-home-goods-indirect domestic value added in exports to

Table 7.9. Direct-plus-homegoods-indirect Factor Requirements per NT$ one million of direct-plus-homegoods-indirect DVA in Exportables and Import-Competing Manufacturing Products by Destination and Origin of Trade Flows, 1971

	LABOUR (L)	CAPITAL (K)	SKILL (S)	(K)/(L)	(S)/(L)
	(1)	(2)	(3)	(4)	(5)
I. EXPORTS					
(a) DCs	25.26	2,503,329	10.01	99,102	0.40
(b) LDCs	21.12	2,902,065	10.12	137,408	0.48
(c) World	24.08	2,615,930	10.04	108,635	0.42
(d) (a):(b)	1.20	0.86	0.99	0.73	0.83
II. IMPORTS					
(e) DCs	24.07	2,878,569	14.11	119,608	0.59
(f) World	21.82	2,821,514	12.73	129,309	0.58
III. EXPORTS & IMPORTS					
(g) (a):(e)	1.05	0.87	0.71	0.83	0.68
(h) (c):(f)	1.10	0.93	0.79	0.84	0.83

SOURCE: Author's estimate.

developed countries are about 1.05 times higher than the same factor requirements in import-competing industries whose products are competing with imports from developed countries. Table 7.9 also reveals that direct-plus-home-goods-indirect capital requirements per unit of direct-plus-home-goods-indirect domestic value added in exports to developed countries is lower than the same factor requirements in exports to developing countries. This is also true for the skill requirements.

As is evident from Table 7.9, direct-plus-home-goods-indirect capital (skill) requirement per unit of direct-plus-home-goods-indirect domestic value added in exportables is smaller than the same factor requirements in import-competing industries whose products are competing with imports from developed countries.

In Table 7.10 we present the direct-plus-home-goods-indirect factor requirements and factor proportions per unit direct domestic value added. As is evident from this table, there is again strong support for the hypotheses set in the introductory part of this chapter. Direct-plus-home-goods-indirect labour requirements in total exports are greater than the same factor requirements in import-competing products. Similarly, direct-plus-home-goods-indirect labour requirements per NT$ one million of direct domestic value added in exports to developed countries are greater than the same factor requirements in import-competing industries whose

products are competing with imports from developed countries. Furthermore, direct-plus-home-goods-indirect labour requirements per NT$ one million of direct value added in exports to developed countries are more than 1.13 times as high than the same factor requirements in exports to developing countries.

Table 7.10. Direct-plus-homegoods-indirect Factor Requirements per NT$ one million of direct DVA in Exportables and Import-Competing Manufacturing Products by Destination and Origin of Trade Flows, 1971

	LABOUR (L)	CAPITAL (K)	SKILL (S)	(K)/(L)	(S)/(L)
I. EXPORTS					
(a) DCs	36.10	3,498,361	13.17	96,908	0.36
(b) LDCs	28.30	3,739,509	13.97	132,138	0.49
(c) World	33.88	3,566,893	13.75	105,280	0.41
(d) (a):(b)	1.28	0.94	0.94	0.73	0.73
II. IMPORTS					
(e) DCs	32.07	3,910,630	18.77	121,940	0.59
(f) World	29.01	3,751,385	16.87	129,314	0.58
III. EXPORTS & IMPORTS					
(g) (a):(e)	1.13	0.89	0.70	0.79	0.61
(h) (c):(f)	1.17	0.95	0.82	0.81	0.71

SOURCE: Author's estimate.

Concerning capital and skill requirements we also observe that both direct-plus-home-goods-indirect capital and direct-plus-home-goods-indirect skill requirements per NT$ one million of direct domestic value added in exports

are lower than the same factor requirements in import-competing products. As is evident from Table 7.10, direct-plus-home-goods-indirect capital and direct-plus-home-goods-indirect skill requirements per NT$ one million of domestic value added in exports to developed countries are lower than the direct-plus-home-goods-indirect capital and the direct-plus-home-goods-indirect skill requirements in exports to developing countries.

Moreover, both direct-plus-home-goods-indirect capital and direct-plus-home-goods-indirect skill requirements in exports to developed countries are lower than the same factor requirements in import-competing industies whose products are competing with imports from developed countries.

7.7.3 Factor Intensity in Trade: Direct-Plus-Total-Indirect Factor Requirements

In the preceding pages the indirect effects of the expansion of non-tradeable sectors on employment, capital, skill and value added were considered. In the following pages, however, the indirect effects of the expansion of tradeables and non-tradeables on labour, capital, skill and value added will be discussed. Direct-plus-total-indirect labour, capital, skill and value-added multipliers for all sectors in the 1971 input-output tables and the 1971 census of manufacturers are considered. As in the previous section direct-plus-

total-indirect labour, capital and skill per NT$ one million of direct-plus-total-domestic value added and direct-plus-total-indirect labour, capital and skill per NT$ one million of direct value added are estimated.

Table 7.11 presents the direct-plus-total-indirect factor requirements and factor proportions per NT$ one million of direct-plus-total indirect domestic value added in exportables and import-competing products. As can be

Table 7.11. Direct-plus-total-indirect Factor Requirements and Factor Proportions per NT$ one million of direct-plus-total-indirect DVA in Exportables and Import-Competing Manufacturing Products by Destination and Origin of Trade Flows for 1971

	LABOUR (L)	CAPITAL (K)	SKILL (S)	(K)/(L)	(S)/(L)
I. EXPORTS					
(a) DCs	25.78	2,327,170	8.49	90,763	0.33
(b) LDCs	25.64	2,562,482	8.65	99,941	0.34
(c) World	24.71	2,393,857	8.53	96,878	0.34
(d) (a):(b)	1.01	0.91	0.98	0.91	0.97
II. IMPORTS					
(e) DCs	22.05	2,927,350	11.67	132,760	0.53
(f) World	20.04	2,868,106	10.88	143,219	0.54
III. EXPORTS & IMPORTS					
(g) (a):(e)	1.17	0.79	0.73	0.68	0.62
(h) (c):(f)	1.23	0.83	0.78	0.68	0.63

SOURCE: Author's estimate.

seen from the table, direct-plus-total indirect labour requirements per NT$ one million of direct-plus-total indirect domestic value added in total exportables and in exportables to developed countries are higher than in (i) total import competing products, (ii) in exports to developing countries and (iii) in import competing products whose products are competing with imports from developed countries. Similarly, direct-plus-total-indirect capital and skill per NT$ one million of direct-plus-total-indirect domestic value added in total exportables and in exports to developed countries are lower than the same factor requirements (a) in total import-competing products, (b) in import-competing industries whose products compete with imports from developed countries, and (c) in exports to developing countries.

When direct-plus-total-indirect factor requirements per NT$ one million of direct domestic value added are considered we also observe a similar pattern, but with of course a substantial increase in all the factor requirements (see Table 7.12).

Table 7.12. Direct-plus-total-indirect Factor Requirements and Factor Proportions per NT$ one million of direct DVA in Exportables and Import Competing Manufacturing Products by Destination and Origin of Trade Flows, 1971

	LABOUR (L)	CAPITAL (K)	SKILL (S)	(K)/(L)	(S)/(L)
I. EXPORTS					
(a) DCs	112.75	9,446,564	33.90	83,783	0.30
(b) LDCs	111.11	9,642,158	32.66	86,780	0.29
(c) World	112.30	9,504,194	33.55	84,632	0.30
(d) (a):(b)	1.01	0.98	1.04	0.97	0.97
II. IMPORTS					
(e) DCs	82.51	11,046,406	42.04	113,880	0.51
(f) World	75.95	10,390,618	38.58	136,801	0.51
III. EXPORTS & IMPORTS					
(g) (a):(e)	1.37	0.86	0.81	0.63	0.59
(h) (e):(f)	1.48	0.91	0.87	0.62	0.59

SOURCE: Author's estimate.

7.8 Net Factor Content of Taiwanese Trade

The HOS model predicts that a labour-abundant country should be a net exporter of labour and a net importer of capital and skill. A method that can be used to test this hypothesis is the net factor content of trade which is defined as the net increase (decrease) in employment resulting from an increase in exports of one million unit of international value added (IVA) and an increase in imports of one million units of IVA, which between them would leave the trade balance unchanged (see Nabli,

1978).

To find the net factor content of trade, we need to know the international-value-added content of a basket of exportables and import-competing goods. International value added is arrived at by deflating domestic value added (DVA) by one plus the effective rate of protection (ERP):

$$IVA = DVA/(1 + ERP)$$

Of course at free and balanced trade, the industry-specific coefficients are identical whether domestic or international value added are used, and the relationship between labour per unit of domestic value added and labour per unit of IVA is one to one. However, when tariffs and other protective devices lead to differentials in the domestic/foreign price ratios for different commodities or industries, the one-to-one correspondence between IVA and DVA breaks down (see Krueger, 1983). If ERPs for all exportables were zero, factor requirements per unit of DVA and IVA would be identical for exporting industires. However, if the regime is biased in favour of import-competing industries or commodities so that ERPs for import-competing goods are positive, factor requirements per unit of DVA will be greater than factor requirements per unit of IVA. As Krueger (1983) rightly argues, this can lead into trade reversals especially when there is a negative effective rate of protection for exportables (so that factor

requirements per IVA are less than factor requirements per unit of DVA) and positive ERP for import-computing industries (so that factor requirements per unit of DVA are more than factor requirements per unit of IVA).

Effective rates of protection are available for 1969 and cover 61 tradeable sectors of which 47 are manufacturers. For our purpose we used the 1969 ERP estimate for 1971 under the following assumptions. First, we assumed that the ERP for 1969 could equally be applied for 1971, that is if actual estimates of ERP were made for 1971, we assumed that the difference between them and the actual 1969 estimate mode would not be big. Secondly, we have allocated effective rates of protection from each three-digit sector of 1969 to the corresponding four-digit sectors of 1971.

The estimates of direct factor requirements per NT$ one million of direct international value added for exportables and import-competing goods are presented in Table 7.13 . As is evident from the table total exportables are slightly less labour-intensive than total import-competing products contrary to the implications of results based on DVA. However, as expected, exports to developing countries are less labour-intensive than import-competing industries whose products are competing with imports from developed countries. Also, exports to developed countries are more labour intensive than exports to developing countries. Regarding the capital

and skill content of total exportables, we observe that they are less capital- and less skill-intensive than total import-competing products. Furthermore, exports to developed countries are less capital and less skill intensive than import-competing industries whose products are competing with imports from developed countries.

Table 7.13. Direct Factor Requirements and Factor Proportions per NT$ one million of International value added in Exportables and Import-Competing Manufacturing Products at International Prices by Destination and Origin, 1971

	LABOUR (L)	CAPITAL (K)	SKILL (S)	(K)/(L)	(S)/(L)
I. EXPORTS					
(a) DCs	37.56	3,564,707	12.51	94,907	0.33
(b) LDCs	29.12	3,956,754	12.78	135,876	0.44
(c) World	35.00	3,683,486	12.59	105,242	0.36
(d) (a):(b)	1.29	0.90	0.98	0.70	0.75
II. IMPORTS					
(e) DCs	38.40	4,323,356	21.56	112,587	0.56
(f) World	36.42	4,502,598	20.35	123,630	0.56
III. EXPORTS & IMPORTS					
(g) (a):(e)	0.98	0.82	0.58	0.84	0.59
(h) (c):(f)	0.96	0.82	0.62	0.85	0.79

SOURCE: Author's estimate.

When direct-plus-indirect factor content (Table 7.14) is considered, however, a slightly different pattern emerges. Direct-plus-home-goods-indirect labour requirements per NT$ one million of direct-plus-home-

goods-indirect international value added in exports to developed countries are slightly more labour-intensive than import-competing industries whose products are competing with imports from developed countries (see column 4 of Table 7.14) . This also seems to be true for total exports and total import-competing products. As in

Table 7.14[a]. Direct-plus-homegoods-indirect and direct-plus-total-indirect Factor requirements and Factor Proportions in Exportables and Import-Competing Manufactured Products at International Prices by Destination and Origin of Trade Flow, 1971

	Labour (1)	Capital (2)	Skill (3)	Labour (4)	Capital (5)	Skill (6)
I. EXPORTS						
(a) DCs	29.68	2,914,135	11.64	13.63	1,737,515	10.15
(b) LDCs	24.56	3,339,661	11.59	12.58	1,981,356	9.31
(c) World	28.22	3,035,841	11.63	13.33	1,807,095	9.91
(d) (a):(b)	1.21	0.87	1.00	1.08	0.88	1.09
II. IMPORTS						
(e) DCs	29.38	3,388,650	17.29	13.44	1,939,915	9.91
(f) World	28.29	3,563,446	16.56	13.16	1,967,526	9.68
III. EXPORTS & IMPORTS						
(g) (a):(e)	1.01	0.86	0.67	1.01	0.90	1.02
(h) (c):(f)	1.00	0.85	0.70	1.01	0.92	1.02

SOURCE: Author's estimate

[a]Notes : column (1)-(3) are direct-plus-homegoods per NT$ one million of direct international value added. column (4)-(6) are direct-plus-homegoods-indirect per NT$ one million of direct-plus-homegoods-indirect international value added.

the case with the direct factor requirements, direct-plus-home-goods-indirect capital and direct-plus-home-goods-indirect skill per NT$ one million of direct international value added and per NT$ one million of direct-plus-home-goods-indirect international value added in total exportables to developed countries are smaller than the same factor requirements in total import-competing products and import-competing industries whose products compete with imports from developed countries.

In Table 7.15 we present the direct-plus-total indirect factor requirements and factor proportions of exportables and import-competing products at international prices. As is evident from column 2 of this table, direct-plus-total-indirect labour per NT$ one million of direct-plus-total-indirect international value-added in exports to developed countries is slightly lower than in exports to developing countries contrary to expectations. Concerning capital and skill requirements, however, exports to developing countries, as the theory predicts, are higher than the same factor requirements in exports to developed countries. Furthermore, when the direct-plus-total-indirect labour, capital and skill requirements per NT$ one million of direct international value added in exports to developed countries are compared with the same factor requirements in import-competing industries whose products are competing with imports from developed countries, we observe that exports are more labour

intensive less capital and less skill intensive.

In Table 7.15 we also present direct-plus-total indirect factor requirements per NT$ one million direct international value added from this table we observe that exports to developed countries are more (less) labour (capital, skill) intensive than import-competing industries whose products are competing with imports from developed countries. However, direct-plus-total

Table 7.15 Direct-plus-total-indirect Factor Requirements and Factor Proportions in Exportables and Competing Products by Destination and Origin of Trade Flow at International Prices, 1971

	Labour (1)	Capital (2)	Skill (3)	Labour (4)	Capital (5)	Skill (6)
I. EXPORTS						
(a) DCs	27.83	2,486,991	9.03	135.60	11,634,503	42.01
(b) LDCs	28.44	2,768,119	9.16	134.49	11,774,289	40.01
(c) World	28.01	2,567,608	9.06	134.31	11,676,620	42.06
(d) (a):(b)	0.98	0.90	0.99	1.00	0.99	1.05
II. IMPORTS						
(e) DCs	25.71	3,204,554	13.67	112.08	16,164,092	60.52
(f) World	24.41	3,190,357	13.00	107.13	15,901,302	57.81
III. EXPORTS & IMPORTS						
(g) (a):(e)	1.08	0.78	0.66	1.21	0.72	0.69
(h) (c):(f)	1.15	0.80	0.70	1.25	0.73	0.73

SOURCE: Author's estimate

Notes : column (1)-(3) are direct-plus-homegoods-indirect factor inputs per NT$ one million of direct international value added.

column (4)-(6) are direct-plus-homegoods-indirect per NT$ one million of direct-plus-homegoods-indirect international value added.

indirect skill requirementss in exports to developed countries are smaller than in exports to developed countries. In terms of labour and capital, however, we observe that exports to developed countries are more labour and less capital intensive than the same factor requirments in exports to developing countries.

7.9. The Effect of Commodity Market Distortions on Employment

7.9.1 Introduction

In Chapter 5 we put the hypothesis that the height of the effective protection rate(ERP) would be positively correlated with the capital-labour ratio of the protected industries. In this section an attempt will be made to test the above hypothesis and also to see whether there is any systematic relationship between ERP and the labour coefficient of the protected industries. The implication of the relationship between ERP and factor intensity is perhaps best explained by Krueger(1983, p. 157). She says:

> Insofar as labor coefficients vary systematically with the level of protection and there existed opportunities within trade strategy to alter the mix of industries toward those with less protection, there presumably existed opportunities to increase international value added, employment, and real incomes for given levels of investment within the manufacturing sector by switching within a category to less-protected activities.

Protection can affect the labour coefficient by creating, a bias towards industries that are more capital-

intensive and hence detrimental to employment creation (see Krueger, 1983). As was pointed out in chapter one, if labour requirements per unit of output or value-added are greater under one strategy than under the other, then the strategy that allows the labour-intensive industries to grow fast will, other things remaining equal, generate more employment than the other.

7.9.2 Protection, Factor Requirements and Factor Proportions: A Descriptive Analysis

In this part of the study we examine how distortions in the product markets, brought about by the structure of effective rates of protection affects the factor requirements of exportables and import-competing products in the Taiwanese manufacturing industries for 1971. Our analysis is carried out in two steps. First, we present a descriptive analysis of the effects of distortions on factor requirements and factor proportions by grouping industries according the levels of protection. Industries are classified into two categories: one above the average protection rate and the other below it. The factor requirements and factor proportions are compared for these two sets of industries. In the second stage an econometric analysis will be carried out to determine whether distortions in the commodity market have an influence on the factor

intensity of Taiwnese manufacturing industries.

In this section we shall attempt to estimate the factor requirements and factor proportions of protected exportables and import-competing products with effective rates of protection above and below the average rate. In Table 7.16 we present the direct factor requirements and factor proportions of exportables. As is evident from the table, for exportable industries, the industries with lower protection levels are the ones with higher requirements for the three sets of factor inputs. However, for the factor proportions, the capital/labour ratio and the skill/labour ratio for exportables below the average rate of protection is lower than the respective ratios of exportables with above the average rate of protection. As Table 7.16 further reveals, when the direction of trade is taken into account, the hypothesis that the more protected industries should be relatively less efficient users of factors of production does seem to be supported by the above evidence.

The capital/labour and the skill/labour ratios of exportables with levels of effective protection above the average rate are higher than the same factor proportions of exportables whose effective rate of rate of protection is below the average.

For importables again (Table 7.16) the capital/labour ratio of the high-protected industries are much higher

Table 7.16. Direct Factor Requirements and Factor Proportions and Protection Levels in Exportables and Import-Competing Products by Trade Flow Destination and Origin for Taiwan Manufacturing Industries, 1971.

	LABOUR (L)	CAPITAL (K)	SKILL (S)		
	Number of persons employed per NT$ one million of DVA	Book value of fixed assets per NT$ one million of DVA	Number of skilled persons employed per NT$ one million DVA	K/L ratio	S/L ratio
(1)	(2)	(3)	(4)	(5)= (3):(2)	(6)= (4):(2)
i) below average rate of protection					
A. EXPORTABLES					
1. DC	19.48	1,620,383	5.80	83,182	0.30
	(13.17)	(1,298,562)	(3.94)	96,600	0.30
2. LDC	12.44	1,525,425	4.63	122,623	0.37
	(9.76)	(1,389,117)	(3.84)	142,328	0.39
3. W	17.38	1,592,907	5.46	91,652	0.31
	(12.16)	(1,326,627)	3.91	109,097	0.32
B. IMPORT-COMPETING					
4. DC	18.91	1,893,724	11.04	100,144	0.58
5. W	16.13	1,628,998	9.27	100,992	0.57
ii) above average rate of protection					
C. EXPORTABLES					
6. DC	10.07	1,183,661	4.04	117,543	0.40
7. LDC	10.87	1,614,219	5.60	148,502	0.52
8. W	10.30	1,320,185	4.50	128,173	0.44
D. IMPORT-COMPETING					
9. DC	8.79	1,227,571	4.52	139,665	0.51
10. W	8.31	1,393,874	4.38	167,735	0.53

notes: W= world, and figures in brackets exclude miscellaneous industries.

than those the low-protection industries, but here the skill-labour ratios for the former are slightly lower than for the latter. Both sets of ratios are higher than the corresponding ratios for exportables.

In Table 7.17 we present results for direct-plus home goods indirect factor requirements and factor proportions of exportables and import-competing industries by levels of protection rates. As can be learned from Table 7.17 the capital/labour and the skill/labour ratios of the the protection group are again substantially more than those of the low-protection group. This is also true for exports to developed and exports to developing countries taken separately.

In Table 7.17 we also present the direct-plus-home goods-indirect factor requirements and factor proportions of import-competing industries by levels of protection rates. Again, as with the case of direct factor proportions (table 7.16), import-competing industries with effective rates of protection above the average have higher capital/labour but lower skill/labour ratios than import-competing industries with levels of protection below the average. Furthermore, we observe (as for the direct requirement) that the capital/labour ratios of this set of industries are higher than the same ratios of exportables, regardless of the protection category.

Table 7.17. Direct-Plus-Home-Goods Indirect Factor Requirements and Factor Proportions in Exportables and Import-Competing Products by Trade Flow Destination and Origin and Protection Levels for Taiwan Manufacturing Industries, 1971.

	Number of persons employed per NT$ one million of DVA	Book value of fixed assets per NT$ one million of DVA	Number of skilled persons employed per NT$ one million of DVA	K/L ratio	S/L ratio
(1)	(2)	(3)	(4)	(5)= (3):(2)	(6)= (4):(2)
		i) below average rate of protection			
A. EXPORTABLES					
1. DC	25.22	2,240,257	9.18	88,829	0.36
	(17.97)	(1,788,936)	(6.64)	99,551	0.37
2. LDC	16.14	2,009,257	6.82	124,489	0.42
	(12.84)	(1,804,385)	(5.56)	84,857	0.43
3. W	22.64	2,175,852	8.51	79,553	0.38
	(16.52	(1,794,415)	(6.36)	80,243	0.38
B. IMPORT-COMPETING					
1. DC	21.10	2,306,312	12.64	109,304	0.60
2. W	18.55	2,037,124	10.95	109,818	0.59
		ii) above average rate of protection			
C. EXPORTABLES					
4. DC	10.88	1,258,105	4.80	115,635	0.44
5. LDC	12.15	1,727,327	6.35	142,167	0.43
6. W	10.30	1,391,041	5.24	135,053	0.51
C. IMPORT-COMPETING					
3. DC	10.97	1,604,319	6.13	142,246	0.56
4. W	10.46	1,714,262	5.92	163,887	0.57

Notes: see Table 7.16

Finally, direct-and-total-indirect factor requirements and factor proportions of exportables and import-

Table 7.18. Direct-Plus-Total-Indirect Factor Requirements and Factor Proportions in Exportables and Import-Competing Products by Trade Flow Destination and Origin and Protection Levels for Taiwan Manufacturing Industries, 1971.

	LABOUR (L)	CAPITAL (K)	SKILL (S)		
	Number of persons employed per NT$ one million of DVA	Book value of fixed assets per NT$ one million of DVA	Number of skilled persons employed per NT$ one million of DVA	K/L ratio	S/L ratio
(1)	(2)	(3)	(4)	(5)= (3):(2)	(6)= (4):(2)
i) below average rate of protection					
A. EXPORTABLES					
1. DC	95.54	7,439,222	25.71	77,865	0.27
	(83.69)	(6,564,013)	(21.46)	78,432	0.26
2. LDC	88.08	7,414,907	24.69	84,184	0.28
	(82.65)	(7,013,411)	(22.74)	84,857	0.27
3. W	93.49	7,437,365	25.43	79,553	0.27
	(83.45)	(6,696,290)	(21.83)	80,243	0.26
B. IMPORT-COMPETING					
4. DC	79.43	9,782,007	41.28	123,152	0.52
5. W	70.84	8,639,025	36.40	121,951	0.51
ii) above average rate of protection					
C. EXPORTABLES					
6. DC	48.11	4,980,937	17.80	103,532	0.37
7. LDC	49.45	5,582,967	18.50	112,901	0.37
8. W	48.47	5,149,265	17.99	106,236	0.37
A. IMPORT-COMPETING					
9. DC	31.18	4,636,129	16.40	146,689	0.53
10. W	31.09	5,284,878	16.56	169,986	0.53

notes: see Table 7.16

competing industries are presented in Tables 7.18. Again for exportables (Table 7.18) the high-protection groups for each destination have higher capital/labour and skill/labour ratios than low-protection groups. For import-competing industries (Table 7.18), the picture is similar to those given for direct-plus-home-goods-indirect requirement (Table 7.17). Capital/labour ratios are higher, but skill/labour ratios slightly lower, in the high-protection than in the low-protection group, and again, as for the direct and direct-plus-home-goods-indirect, that these ratios are markedly higher for importables than the corresponding ratios for exportables (Table 7.18).

The analysis presented above supports the view that the system of protection in Taiwan has created a bias in terms of employment creation, in spite of inevitable doubts about the figures and inconsistencies in some of the results. As we have seen above, both exportables and import-competing industries with levels of protection above the average show much higher capital/labour ratios than han exportables and import-competing industries respectively whose levels of protection are below the the average. Skill/labour ratios were higher for the more protected industries in the case of exportables but apparently slightly lower in the case of importables.

7.10. Commodity Market Distortions and Capital Intensity

In the context of the Krueger and Deardorff models, Taiwan, a relatively labour-abundant country to protect industries that use its scarce resource, physical and human capital. As was pointed out in the introductory remarks of this section, there is expected to be a positive relationship between the physical-capital intensity of a industry and the protection given to it.

To test the above hypothesis the following regression equation will be used:

$$(K/L)_i = \alpha_0 + \alpha_1 (ERP)_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7.1)$$

where:

K = physical capital intensity of industry i; and

L = employed persons in industry i

ERP = effective rate of protection for industry i

Equation (7.1) is estimated for a cross-section of 46 Taiwanese manufacturing industries for the year 1966 and 1969 for which actual estimates of effective protection are available. For the two periods there seems to be no relationship between the height of effective rate of protection and the direct capital-intensity of industries. However, for the 1969 period, there was a significant relationship between the nominal rate of protection and the direct-plus-indirect capital-intensity

of an industry. This may be due to the fact that ffective rates of protection measure the change in the value-added per unit of output that results from protection; while nominal protection, on the other hand, pertains to the final value of an activity's output rather than the value added at the last fabrication stage. Total (direct-plus-indirect) factor requirement are according to Travis (1968, p. 454) applicable for nominal protection (see also Clark 1980).

Table 7.19. Protection and Capital intensity, 1969.

Dependent variable	Constant	Independent varible		
Capital/Labour		Nominal Rate	R^2	F
	52.934	1.840	0.24	14.21
	(4.642)***	(3.770)***		

notes: *** significant at 1 % level.

7.8. Concluding Remarks

This chapter has aimed at evaluating the implications of alternative trade strategy on employment. Various hypotheses pertaining to the factor-proportions explanations of international trade in manufactures in the context of a three-factor (labour, capital and skill) and a multi-country model were tested. As was explained fully in the text, the results are broadily consitent with the HOS explanation of international trade.

Exports of manufactured goods have significantly contributed to employment creation in the Taiwanese economy. And when exportables were compared with import-competing and non-competing-imports at domestic prices, it was found that Taiwan was exporting more labour-intensive commodities to developed countries than to developing countries, while exporting more skill- and more capital-intensive products to developed countries. Furthermore, as predicted by the HOS model, Taiwan was net exporter of labour and net importer of skill and physical capital in the course of its rapid economic development.

These findings have a major gearing on the employment implications of alternative trade strategies, for, as was indicated, trade policy can have significant effects on employment creation. The results are consistent with the view that the higher labour absorption performance of the Taiwanese economy was mainly due to the export-led strategy pursued according to the principles of comparative advantage, and as such, these findings have asobering lesson for countries that are still struggling to solve their 'employment' problem. Of course, it must not be forgotten that employment creation may not be a matter of choosing between exports and import substitutes (see Bruno, 1988).

CHAPTER 8

FACTOR ACCUMULATION AND CHANGES IN THE FACTOR INTENSITY OF TAIWAN FOREIGN TRADE, 1961-1984

8.1 Introduction

In Chapter 5 it was hypothesized that, as the relative position of a country in the factor endowment ranking changes over time, so will the factor content of her trade. Countries that have accumulated physical and human capital more rapidly than Taiwan will receive a higher proportion than before of labour-intensive commodities in their imports from Taiwan while countries that have accumulated physical capital and human capital less rapidly than before will receive a higher proportion of physical capital-and human capital-intensive commodities in their imports from Taiwan.

Under the conjecture that the price of physical capital as compared to that of raw labour and human capital is declining as a result of increases in physical accumulation, this chapter shall attempt to examine the changing pattern of Taiwan's commodity trade in manufactures so as to test the empirical validity of the HOS theorem in a multi-period framework.

The plan of this chapter is as follows: In section 8.2 we present some evidence of the changing pattern of wage employment in Taiwan to be followed by discussion on physical and human capital accumulation. In section 8.3

we present empirical evidence on the evolving comparative advantage in Taiwan.

Two different approaches are often used to explain the structure of foreign trade. The first, developed by Leontief (1953), and which is the subject of section 8.3, is to compare the relative total (direct and indirect) factor intensities of exports and competitive imports. In the second part of this chapter we shall use the second approach, which is to regress the interindustry variations in net exports (imports), imports and exports on sectoral factor usage.

8.2 Changes in Resource Endowment in Taiwan

In this section, as part of testing the hypotheses set in this chapter, we shall first attempt to establish whether Taiwan has been accumulating physical and human capital faster than labour in the course of its rapid economic development.

The population of Taiwan grew from 8.1 million in 1952 to 19.0 million in 1984. For the same period, the economically active population, which is an indication of the potential labour force, increased from 4.6 million to 12.5 million of which 2.9 million and 7.3 million were wage employment for the years 1952 and 1984 respectively.

Concerning the composition of employment of the labour force, we have seen in Chapter 2 , that the structure of employment has undergone profound changes. The

proportional share of manufacturing employment in total employment was growing faster than any of the other sectors. For ease of reference, we have reproduced some employment figures relevant to this Chapter in Table 8.1.

Table 8.1. Employed Persons by Industry in Taiwan: 1966 - 81 ('000 of persons)

Year	Primary	Mining	Manufacturing	Const. + Services	Total
1961	1.747	83	525	1,150	3,505
1966	1,735	83	633	1,405	3,856
1971	1,665	65	1,053	1,955	4,738
1976	1,641	65	1,628	2,335	5,669
1981	1,257	54	2,146	3,215	6,672

Source: DGBAS Yearbook of Labour Statistics, 1984.

The human capital endowment has also been changing rapidly. As can be seen from Table 8.2, the share of illiterate employed persons as a percentage of total employment has declined from 18.9 % in 1967 to 10.8 % in 1976 and to 6.5 percent in 1983, while the share of employed persons with vocational, college and graduate education increased from 9.4 to 16.8 and 26.9% respectively for the years mentioned above (see Table 8.2). Furthermore, educational attainment of the labour force was also impressive. For the population aged 15 and over, the number of years of schooling increased from 4.84 in 1965 to 6.90 in 1977, an increase of 43 percent. For the labour force as a whole, the average number of schooling increased from 5.57 in 1968 to 7.37 percent in 1977, or an increase of 32 percent. For 1980, the average number of years of schooling for all persons aged 15

and over was 7.74 according to the Labour Force Survey and 7.35 according to the Household Registration

Table 8.2 Employed Persons by Educational Attainment in Taiwan 1967-1983 (percent)

Year	Illiterate	Primary & Self Education	Junior & Senior High Sch.	Voc.,Coll. & Graduate	Total
1967	18.9	57.0	14.7	9.4	100
1971	16.3	57.4	15.6	10.8	100
1976	10.8	51.2	20.9	16.8	100
1981	6.5	43.0	26.3	24.1	100
1983	6.5	40.3	26.3	26.9	100

Source: Yearbook of Labour Statistics, ROC, 1984.

(Hou and Chang, 1981, pp. 487-488). According to the Household Registration data, the average number of years of schooling for all persons aged 15 and over was 2.81 in 1946-1950 and then went up to 6.88 in 1972-1976. The average annual growth rate was 3.87 percent in 1947-1976 (Hou and Chang, 1981). A recent study made by the Financial Times (June 30, 1988) also reveals that almost every individual worker will have had twelve years of education in the coming few years.

Table 8.3 provides an indication of the shift in the level of stock of physical capital for the period 1952-1980. Between these years, the capital stock of the non-primary sector grew at an annual rate of 8.2 percent with the most rapid expansion of 13 percent annual growth taking place between 1965-1980. As is evident from this table, the physical capital per worker in the non-primary

sector in Taiwan more than doubled between 1952 and 1980.

Table 8.3. Changes in Relative Factor Endowment in Taiwan, 1952-1980(non-primary sectors)

Period	Output (Y)	Physical Capital Stock (K)	Labour (L)	(K/Y)	(K/L)
	(NT$ billion)		('000)		(in NT$ '000)
1952	35	131	1,375	3.8	95.6
1955	47	141	1,471	3.0	95.5
1960	66	162	1,749	2.5	92.8
1965	111	203	2,069	1.8	98.0
1970	196	326	2,895	1.7	112.7
1975	309	605	3,869	2.0	156.3
1980	533	1066	5,270	2.0	202.4

Source: Duller, 1985, p. 15.

Despite the impressive increases in the physical and human capital stock however, Taiwan is still a physical and human capital poor country when compared to its major trading partners. Table 8.4 shows that for the 1970s and 1980s the per employed labour stock of physical capital was lower in Taiwan than the United States, Japan, West Germany and the United Kingdom. The situation is also similar with regard to human capital. As is evident from Table 8.4 the average years of schooling for the Taiwanese population is lower than the major trading partners (who constitute for 74.3 percent of total Taiwan exports and for 71.9 percent of Taiwan imports for 1986). Thus, from the brief sketch presented above, it is evident that factor endowments (physical capital and human capital) have been fast increasing in the course of Taiwan's economic development. Indeed, Taiwan is among a

group of newly industrializing countries (NICs) that

Table 8.4. Some Indicators of Relative Factor Endowment of Taiwan and It's Major Trading Partners, 1970 and 1980

	Physical Capital per Employed Person in (US$'000)[a]		Percent of Taiwan's Trade		Average[a] Years of Schooling
			Exports	Imports	
	1970	1980	1986	1986	1970[b]
USA	17.2	52.2	47.7	22.4	11.1
Japan	17.6	43.4	11.4	34.2	10.0
W. Germany	18.7	63.6	3.2	4.7	9.2
UK	12.1	75.1	2.4	1.5	10.2
Taiwan	2.7	9.7			7.7[c]

Source: [a] Baruh (1986, Tables 1 and 2)
[b] population aged 25-64, circa, 1970
[c] employed persons aged 15 and over

accumulated physical and human capital at a more rapid rate than the rest of the world between 1965 and 1980 (Noland, 1987, p. 685). Evidence gathered by Noland (1987) seems to indicate that Taiwan's ranking of human capital seems to be higher than physical capital when compared with a group of NICs. The purpose of the next section is therefore to test whether the trade of Taiwan conforms with the rapidly changing resource endowment of the country.

8.3 Factor Proportions in Taiwan's Manufacturing Trade, 1961-1981

The hypothesis set in the introductory section of this chapter postulates that, as Taiwan accumulates more physical and human capital relative to raw labour, the factor intensities of its trade change with its exports

becoming more physical capital and skill intensive relative to its imports. To test this hypothesis we will first present the results obtained from the aggregated matrices of 32 sectors covering the period 1961-1981. Then from the domestic input-output-coefficient matrix, which is available for 1966, 1971, 1976, and 1981 (and which also coincides with the census of manufacturing and commerce periods) we will present results at the 69-sector level. Relative factor intensity is estimated by the following formula:

$$\phi = \frac{k[I-A^d]^{-1}\ e}{l[I-A^d]^{-1}\ e} \div \frac{k[I-A^d]^{-1}\ m}{l[I-A^d]^{-1}\ m} \qquad \text{.....(8.1)}$$

where $k = K/X$, capital-output ratio
$l = L/X$, labour-output ratio
$e = e_i / \Sigma e$
$m = m_i / \Sigma m$

Table 8.5 shows the relative factor-intensity of the 32 commodity groups (direct and indirect) for the period covering 1961-1981. Concerning the relative factor-intensity of Taiwan's trade, we observe, as the theory predicts, that the factor intensity (capital-labour ratio) of exports relative to imports has increased.

As is evident from Table 8.5, for the years 1976 and 1981, the capital intensity of exports was greater than the capital intensity of imports. Considering the fact that Taiwan is still a labour-abundant country when compared to the advanced countries, this result provides

prima facie evidence of a Leontief type paradox (see

Table 8.5. Relative Factor Intensity of Exports and Imports of Taiwan's Trade

Year	Relative Factor Intensity
1961	0.815
1966	0.868
1971	0.950
1976	1.045
1981	1.035

Source: Author's estimate.

Leontief, 1954). However, as was postulated in Chapter 5, the relevance of the test used to the validity of the factor-proportions theory depends a great deal on what commodities are being traded. The model should, therefore, be tested with commodities whose production is not determined by the availability of natural resources. As Krueger rightly remarks, the existence or absence of an industry producing these commodities (natural resource-based) and hence the industry's comparative advantage is primarily the result of the presence of the natural resource itself. Hence, the natural-resource based commodities may not conform to the predictions of the factor-proportions model of international trade when the theory is interpreted with regard to only two factors, capital and labour (see Kim, 1983).

In order to determine the extent to which trade in natural-resource-intensive commodities and trade in services 'bias' the predictions of the HOS model of international trade, a separate test excluding these

sectors was carried out and, as Table 8.6 depicts, the predictions of the factor proportions theory applies consistently until 1976 to the pattern of comparative advantage in trade changes over time in Taiwan.

As is evident from Tables 8.5 and 8.6, the capital intensity of exports relative to that of imports has fallen by 1981 from its 1976 level. However, when the

Table 8.6. Relative Factor Intensity of Manufactured Export and Imports in Taiwan's Trade

Year	Relative Factor Intensity
1961	0.493
1966	0.687
1971	0.808
1976	0.971
1981	0.962

Source: Author's estimate.

domestic inverted Leontief matrix at the 69 sector level is used, we note that the physical capital intensity of exports relative to that of imports has increased in the last period (see Table 8.7).

Table 8.7 presents the relative physical- and human-capital intensities in manufactured imports and exports calculated on the basis of the total (direct-plus-indirect) of the inputs of physical and human capital embodied in them. In all the years under consideration the human capital intensity ratio was lower for exports than for imports. As is evident from Table 8.7, both

the physical and human capital intensity ratios are consistent with the dynamic interpretation of the HOS model.

Table 8.7. Physical and Human Capital Intensities in Taiwanese Manufacturing Trade, 1966-1981

Year	Physical Capital-Labour Ratio of Exports to that of Imports	Skill-Labour Ratio of Exports to that Imports[a]
1966	0.66	0.73
1971	0.81	0.82
1976	0.86	0.81
1981	0.93	0.85

Source: Same as Table 8.3

[a] Skilled labour is defined as managerial, tech-technical, supervisory and other skilled labour

This section also attempts to test one aspect of the HOS model postulated in Chapter 5, namely that Taiwan's exports to developing countries will be more capital intensive than its exports to developed countries.

As can be learned from Table 8.8, the capital labour ratio of exports to developing countries was always higher than of exports to developed countries. The fact that capital-labour ratio of exports to LDC's was higher than the capital-labour ratio of exports to developed countries means that Taiwan was exporting more labour-intensive commodities to the latter than to the former.

Furthermore, as Table 8.9 reveals, the value added per worker, which can be taken as a proxy for capital intensity (see Lary, 1968), was also higher for exports

to developing countries than for exports to developed countries.

Table 8.8 Total Factor Intensity of Exports and Competitive Imports: 1961-1971 (Nt $ 1000 per worker)[1]

Year	Competitive Imports (1)	Exports (2)	Exports to DC's (3)	Exports to LDC's (4)	(5) (4)/(3)
1961	88.3	84.8	82.8	87.8	1.06
1966	98.9	88.5	80.2	100.7	1.26
1971	113.6	98.3	92.8	110.1	1.19

Source: Kuo (1983), p. 169.
1. Capital/labour ratio including direct and indirect effects.

We also note that over the 1961-1976 period, the value added per worker more than doubled in total exports, with value added per worker of exports to developing countries increasing faster than exports to developed countries.

Table 8.9. Indices of Value Added per Worker in Exports by Destination (Base Year 1961 = 100)

Year	Exports to Developed Countries	Exports to Less Developed Countries
1961	100.0	100.0
1966	124.7	151.4
1971	177.2	197.6
1976	206.6	232.9

Source: Same as Table 8.8

Thus, these findings coupled with the author's findings in both this chapter and Chapter 7, should be regarded as an empirical confirmation of the factor-proportions model of trade as applied to the case of Taiwan.

8.4. Determinants of The Structure of Taiwan's Manufactured Trade: 1966-1981.

8.4.1 Introduction

In this section the second approach of testing the Heckscer-Ohlin trade model shall be attempted. This involves regressing inter-industry variations in net exports(or net imports), exports and competitive imports on sectoral factor use.

The aim of is to investigate the sources of comparative advantage in international trade of Taiwan's manufacturing industries for four points in time (1966, 1971, 1976, and 1981) and to explain the changes in the foreign trade pattern of Taiwan in terms of changes in the factor endowment of the country. Four questions are addressed in this section:

1. which are the major determinants of the static pattern of Taiwan's foreign trade in manufactures,
2. how could the changes in the factor endowment of Taiwan affect the determinants of its comparative advantage ? That is, we shall try to test whether the determinants of comparative advantage of Taiwan's manufacturing trade have undergone any structural changes in the period under review.
3. whether there is a difference in the determinants of comparative advantage between trade with

developed and trade with developing countries.

Since the pattern of specialization is believed to evolve in a systematic manner over time, reflecting factor endowment, it is hypothesised here that the determinants of comparative advantage of Taiwan's trade in manufactured goods will change with changes in the factor endowments of the country. Since the Leontief type of test for Taiwan has indicated that the country is progressively exporting relatively more physical capital and skill intensive goods than its imports of competitive goods, we would expect this to be reflected in the regression results.

To this end, in section 8.4.2 we shall outline the main features of a number of paradigms that (in a attempt to explain the trade patterns of other countries) have been advanced as an extension of the Heckscher-Ohlin model of international trade. In section 8.4.3 to 8.4.6 we shall present the results, and finally, in section 8.7, we touch on the issue of policy and make some suggestions for future research.

8.4.2 The Model

The traditional two-factor model states that a country tends to export the commodities that intensively use its relatively abundant factor ofproduction and to import those commodities that use its scarce factor intensively.

It is now widely recognized that this two-factor model is not an adequate one. The major consensus of most theoretical and empirical studies is that an adequate model of determinants of comparative advantage will be, of necessity a multifactor one (see Gray, 1980). For instance, the neo-factor proportions model recognizes the importance of differences in the composition of the labour force in explaining trade patterns. The neo-technology model, on the other hand, emphasises inter-country and inter-industry difference in the ability to innovate, so that the comparative advantage of a country depends to a large extent on new technologies used and discovered.

Unlike the Heckscher-Ohlin and the neo-factor proportions models, the technology model does not assume that knowledge is freely and universally available, and hence recognizes that countries many differ not only in the range of techniques by which they can produce any product but also in the ability to create new products (see Roque, 1984). Despite these criticisms, however these multifactor models are regarded as extensions rather than as substitutes for the basic tenets of the determinants of comparative advantage. Relative factor endowments are still the major determinants of comparative advantage. The departure from the basic model is that these new theories of comparative advantage redefine the

traditional inputs of labour and capital. For instance, physical capital is redefined to take into consideration not only the material means of production but also natural resources, human skills and the stock of productive knowledge (Johnson, 1968). Johnson(1970, p. 14) further suggests that a full solution to the Leontief paradox would be made "... by extending the concept of capital to include the capitalized value of productive knowledge created by research and development expenditure". Furthermore, labour is not taken as a homogeneous factor of production; consequently it is classified into various categories that are expected to reflect its human capital aspect.

The Heckscher-Ohlin (OH) hypothesis is of a relationship among three separately observable phenomena: trade, factor input requirements, and factor endowments. A proper test of the hypothesis therefore, requires measurement of all three of the variables. In addition, it is now widely recognized that the proper test of the Heckscher-Ohlin-Samuelson model requires not only information about absolute factor endowments and distribution of resources across industries in the country whose pattern of trade is under investigation, but also information about the relative factor endowments of its trading partners (see Deardorff, 1984; Bowen, Leamer and Skveikausas, 1987; Noland,

1987; and Tomara, 1987). Unfortunately, the test to be attempted here does not take into account the relative factor endowments of Taiwan's trading partners. This shortcoming should be borne in mind in the empirical analysis that follows.

In this section we begin, as Stern and Maskus (1981) call it, with 'a stylized version' of the Heckscher-Ohlin model. Two basic models are adopted for the analyses. The first is a three-direct-input version of the Heckscher-Ohlin model where an industry's position as a net exporter (or importer), exporter and importer is related to the factor services derived from physical capital, skilled labour, and unskilled labour. Thus, we have the following model:

$$EX_i = f(K_i, S_i, U_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8.2)$$

where EXi is alternatively i) net imports, ii) exports, and iii) imports of industry i, and K, S, and U refer to the industry stock of physical capital, skilled and unskilled labour respectively.

The second model incorporates a proxy for technological inputs and the human capital variable:

$$EX_i = f(K_i, H_i, T_i, U_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (8.3)$$

where H is the stock of human capital and T is the ratio of technicians to the labour force employed.

Normally, this latter variable should represent the number of scientists and engineers engaged in research and development (RD). However, since such data is not available for Taiwanese manufacturing industries we have taken the ratio of number of technicians to total employment as a proxy for RD expenditure.

Data for all the variables are available at different levels of aggregation from the various issues of the input-output tables for 1966, 1971, 1976, and 1981, and the Industrial and Commercial Censuses. Physical capital is measured by total value of fixed assets. In addition, to the stock measure, we have also the flow measure of physical capital as represented by the non-wage component of value added or the operating surplus.

The stock of human capital was estimated by the following formula:

$$H_i = ((W_i - \theta)/0.10) * L_i \quad \ldots\ldots\ldots\ldots\ldots\ldots (8.4)$$

where W_i is the average annual wages and salary paid for each industry, θ is the lowest average wages and salary paid to labour, and 10 is the rate of discount.

For reasons outlined in various studies (see, for instance, Branson and Monoyois(1977) and Crafts and Thomas(1986), we may expect heteroscedasticity from the basic models. In other words, we would expect that the residuals from the estimated regression

equations to have variance increasing with industry size. Consequently, estimates made by ordinary least squares will result in inefficient, albeit, unbiased, parameter estimates. To overcome this problem a number of suggestions have been made. Some scale both the dependent and the independent variables by a variable to which the standard deviation of the error term is believed to be proportional to the variances of the disturbance term. Unfortunately, as Crafts and Thomas(1986) note, the structure of heteroscedasticity is generally unknown. For this purpose the White(1980) test is thought to be more relevant because it does not require knowledge of heteroscedasticity; rather it provides a heteroscedastic consistent covariance matrix which enables correct confidence intervals to be obtained. Others have used total trade (exports+imports) as a weight (see Balassa, 1987; Noland, 1987; and Balance, Forstner, and Murry, 1987).

8.4.3 Empirical Results

In this section the major empirical findings on the determinants of comparative advantage of Taiwan's manufacturing industries are presented. The first part is concerned with evaluating the significance of each variable individually and with simultaneous inputs of variety of factors on the

external trade of Taiwan. The second part deals with the determinants of comparative advantage through intertemporal comparisons; i.e. changes in Taiwanese industrial trade from 1971 to 1981. A logit analysis based upon the commodity version of the Heckscher-Ohlin model will also be attempted.

To recapitulate, the hypotheses can be stated as follows: the comparative advantage of Taiwan will be negatively correlated i) with the capital intensity; ii) with the skill or the human capital intensity; and iii) but will be positively correlated with unskilled labour intensity.

The simple correlation coefficient between the 3-digit manufacturing industries for the period 1966-1981 is presented in Tables 8.10 to 8.12. From tables A8.1 to A8.4 (appended to this chapter) it is apparent that many of the input variables are highly correlated. This may not be surprising in the empirical research of this nature. The theoretical models may be implicit in the definition of their input variables, but in empirical research some of the variables are proxied and this may give rise to the problem of multicollinearity. Among the four input variables there is a high correlation between unskilled labour and human capital. This is especially true for the years 1971, 1976, and 1981.

From tables 8.10 to 8.12, we find that the coefficient of

determination (R^2) between net imports and unskilled labour is as expected very high. It increased from 0.19

Table 8.10 Correlation Matrix Net Export with Some Factor Inputs, 1966-1981.

	1966	1971	1976	1981
K	-0.221*	-0.054	-0.178	-0.095
T	0.195	0.157	0.439	0.409
H	0.270**	0.166	-0.575	-0.538
S	0.486***	0.472***	0.477***	0.478***
U	-0.440***	-0.623	-0.716	-0.717

Notes: *** significant at 1% level, ** significant at the 5% level, * significant at 10% level.

Table 8.11 Correlation Matrix Import with Some Factor Inputs, 1966-1981.

K	-0.033	0.221*	0.399**	0.562***
T	0.082	0.062	0.310**	0.266**
H	0.365***	0.539***	0.429***	0.548***
S	0.319	0.150	0.217*	0.145
U	-0.016	0.185	0.292**	0.378***

Notes: see Table 8.10

Table 8.12 Correlation Matrix Export with Some Factor Inputs, 1966-1981.

K	0.355***	0.283**	0.471***	0.491***
T	-0.235	-0.124	-0.219	-0.184
H	0.057	0.724***	0.890***	0.886***
S	-0.409***	-0.412***	-0.325**	-0.334**
U	0.782***	0.923***	0.937***	0.929***

Notes: see Table 8.10

$[(-0.444)^2]$ in 1966 to 0.51 $[(-0.717)]^2$ in 1981. This implies that the unskilled labour variable alone explains between one-fifth to one-half of of the

variations in net imports. The coefficient of determination for human capital has also increased from 0.07 in 1966 to 0.33 1981. However, the coefficient of determinations of skilled labour has remained constant throughout the period.

The coefficient of determination of unskilled labour and the export variable is also very high. The coefficient increased from .61 in 1966 to .86 in 1981; which implies that unskilled labour explains between 61 to 86 percent in variations of export performance. The coefficient of determination between exports and human capital and exports and physical capital has also increased appreciably from 0.003 in 1966 to 0.78 in 1981 and from 0.13 in 1966 to 0.24 in 1981 respectively.

Results of the regression equations presented above are are shown in Table 8.13 and Table 8.14. As expected, the coefficients of unskilled labour are not only negatively and significantly related with the net imports but they are decreasing over time. The coefficients for skilled labour are positive and statistically significant for 1966, 1976 and 1981. The coefficient of the physical capital variable was negatively related to net imports for 1966 and 1976 and positively correlated for 1971 and 1981; but it was statistically significant only for 1966; but, in general, physical capital does not help explain

inter-industry differences in net imports. In contrast, the skill variable was positively and significantly related to the net imports throughout the period. Thus, Taiwan seem to be importing relatively more skill-intensive products than capital-intensive products.Table 8.13 further reveals that the skill coefficient is increasing over time.

When imports are taken as dependent variable, we observe that the physical capital variable is negative up to 1976; but was positive and significantly related to the import variable in the last period. As can be learned from Table 8.13 both the skilled and unskilled labour variables are positively related to imports. Skilled labour is positively and significantly related to imports for the periods 1966, 1976 and 1981. On the other hand, unskilled labour is positively and significantly related to imports for the last two periods. Furthermore, as is evident from the table, there is a marked increase in the coefficients of both the skilled and the unskilled labour variables.

The source of this apparent contradiction could possibly be eliminated if the trade of Taiwan was weighted by trade with the various destinations. According to our model, Taiwan, being in the middle of the factor endowment ranking, should export labour-intensive products to countries above its factor endowment ranking and import relatively more skill-intensive

products from these countries. In contrast, Taiwan should export more skill-and capital-intensive products to countries below its factor endowment ranking.

Table 8.13. Scaled regression on direct factor inputs, 1966-1981.

	1966	1971	1976	1981
1. Net Imports				
C	-522.000	-2020.000	-4239.000	-55522.000
	(-0.809)	(-0.781)	(-0.433	(-2.371)**
K	-0.439	0.015	-0.07	0.226
	(-2.078)**	(0.101)	(-0.84)	(1.574)
S	31.586	107.160	335.70000	1231.4
	(3.486)***	(2.466)**	(1.900)**	(3.010)***
U	-0.020	-0.105	-0.206	-0.424
	(-0.966)	(-4.498)**	(-4.052)***	(-5.375)***
R^2	0.47	0.60	0.68	0.73
F	10.037***	17.713***	24.243***	31.853***
DW	1.956	2.204	1.995	1.996
2. Imports(M)				
C	-118.000	204.000	-9703.000	-63377.000
	(-0.198)	(0.066)	(-0.977)	(-2.551)**
K	-0.446	-0.025	-0.151	0.344
	(-2.306)**	(-0.146)	(-0.728)	(2.263)**
S	25.697	68.466	409.410	1318.800
	(3.104)***	(1.325)	(2.283)**	(3.088)***
U	0.023	0.024	0.122	0.220
	(1.179)	(0.867)	(2.368)**	(2.628)**
R^2	0.28	0.05	0.16	0.39
F	4.435***	0.623	2.296**	7.511***
DW	2.046	2.095	2.296	2.174
3. Exports (E)				
C	404.000	2225.000	-5464.000	-7855.000
	(2.329)**	(1.854)	(-1.523)	(-0.715)
K	-0.061	-0.040	0.019	0.119
	(-0.110)	(-0.590)	(0.260)	(1.762)
S	-5.889	-38.689	73.442	87.403
	(2.454)**	(-1.920)**	(1.134)	(0.455)
U	0.43	0.130	0.329	0.644
	(7.664)***	(11.921)***	(17.619)***	(17.393)***
R^2	0.79	0.87	0.95	0.95
F	42.751***	78.628****	230.408***	213.847***
DW	1.742	1.988	1.875	2.238

Notes: *** significant at 1% level, ** significant at the 5% level, * significant at 10% level.

The relationship between the variables gains clarity when we look at the regressions with exports as dependent variable. This may be due to the fact that even in Taiwan certain imports are still controlled directly or indirectly through the trade and payment regimes. Therefore, exports, not the net imports, seems the more appropriate indicator of international competitiveness. Consequently, this dependent variable might less distort the outcome of the regression results. As is evident from Table 8.13, it clear that the unskilled labour coefficient is positive and statistically highly significant throughout the period under review. Second, there is a marked increase in the coefficient of this variable. It is also clear that the skilled labour variable was negatively correlated to exports for the first two periods, but statistically significant only for the first period. The physical capital variable also shows a similar trend with negative coefficient for the fist two periods and positive coefficient for the last two period. However, it was positively and significantly related only to the 1981 figure.

As Table 8.13 indicates, there is a marked increase in the explanatory powers of of the equations over time. For instance, R2 for net imports increased from 0.47 in 1966 to 0.73 in 1981; for imports it increased from 0.28 to 0.39; and for exports from 0.79 to 0.95 for

the same period.

We introduced two variables: one designed to capture the influence of technical skills and the other to capture the accumulated stock of human capital in the determinants of comparative advantage. As Baldwin (1971), Stern(1976) and Stern and Maskus(1981) note, the share of technicians in the labour force may also be an indication of technological inputs, notably research and development (RD). The introduction of this variable may help to detect whether it reflects technological influences that cannot be distinguished from, or that may exist apart from, the industry stocks of human capital. The results of the analysis are presented in Table 8.14.

Comparing these results with the three-input regression presented above, it is clear that technological influences and human capital on Taiwan's manufacturing trade, in addition to the effects of physical capital, skilled labour, and unskilled labour, are important. The coefficient of the technological variable is, except for 1971, positively related to net imports, but statistically significant only for the years 1976 and 1981. This is also true when imports only are considered. Like the technological variable the human capital variable also seems to play an important role in the determinants of comparative advantage of Taiwan's trade in manufactures. This

variable was significantly related to inter-industry differences in net imports for the periods 1966 to 1971. However, for the remaining periods the coefficient was negative but not statistically significant. Furthermore, as the Table 8.14 indicates, the coefficient changed signs from positive in the first two periods to negative in the last two periods. As can be seen from this table, the coefficient of human capital use loses its importance when related to the inter-industry difference in the net imports. On the other hand, when it is related to exports, it gains in importance during the last two periods. This is evidenced from the increase in the coefficient of the variable over the period under review.

Furthermore, as Table 8.14 shows this coefficient was significantly and positively related for the last periods under review. However, when exports are taken as the dependent variable, technological factors do not seem to be important determinants of Taiwan's trade in manufactures. As the table indicates, even though technological variable are positively related with exports for the 1971-1981 period,they are not statistically significant. On the other hand, the human capital variable was negatively and significantly related to exports for the first period and positively and significantly for the remaining periods. Furthermore, it is clear that the coefficient of this variable has increased during the

last period under review.

Table 8.14 Scaled regression on direct factor inputs of physical capital, human capital,unskilled labour , and technological variable 1966-1981.

	1966	1971	1976	1981
1. Net Imports (M-E)				
C	-302.000	3159.000	-11277.000	-60975.000
	(0.498)	(2.300)	(-1.338)	(-3.850)**
K	-0.412	-0.036	-0.160	0.156
	(-2.119)**	(-0.309)	(-0.881)	(1.261)
T	37.216	-219.970	3381.400	9141.000
	(0.571)	(1.194)	(3.257)***	(5.050)***
H	0.513	0.600	-0.062	-0.016
	(4.593)***	(5.225)***	(-0.401)	(-0.208)
U	-0.089	-0.347	-0.159	-0.428
	(-4.631)***	(-7.905)***	(-1.234)	(-2.897)***
R^2	0.57	0.75	0.73	0.81
F	10.726***	25.600***	22.720***	36.253***
2. Imports (M)				
C	567.000	1871.000	-18177.000	-77246.000
	(0.990	1.400)	(-2.202)	(-5.136)
K	-0.423	-0.055	-0.116	0.265
	(-2.304)	(-0.487)	(-0.654)	(2.254)
T	27.000	-96.000	3855.000	9760.000
	(0.436)	(-0.534)	(3.792)***	5.677)***
H	0.424	0.726	0.052	0.128
	(4.023)**	(6.501)***	(0.342)	(1.717)
U	-0.034	-0.252	0.079	-0.027
	(-1.893)	(-5.909)***	(0.636)	(-0.190)
R^2	0.390	0.600	0.350	0.650
F-t	5.259***	12.825***	4.529***	16.103***
3. Exports (E)				
C	264.000	-1288.000	-6900.000	16270.000
	(1.513)	(-1.748)	(-2.206)	(-2.323)
K	-0.111	-0.019	0.044	0.109
	(-0.119)	(-0.307)	(0.649)	(1.990)
T	-10.000	124.000	474.000	619.000
	(-0.553)	(1.258)	(1.230)	(0.773)
H	-0.089	0.126	0.114	0.145
	(2.764)**	(2.048)**	(1.985)*	(4.159)***
U	0.055	0.095	0.237	0.401
	(9.874)***	(4.020)***	(4.978)***	(6.142)***
R^2	0.800	0.890	0.960	0.970
F	33.549***	69.841***	196.729***	252.684***

Notes: see table 8.13

Thus, as can be seen from Table 8.13, the period 1966-1981 can be divided into two sub-periods as regards to skilledlabour content of manufactured exports in Taiwan. Exports were negatively correlated with skilled labour for the 1966-1971 period but positively correlated for the 1976-1981 period. As is evident from the tables appended to this Chapter, inter-industry export performance is related more strongly with human capital than either physical capital or the technological variable. Scanty evidence available so far seem to supports this finding. Noland(1987) has shown that Taiwan's ranking in human capital endowment is higher than its physical capital endowment when ranked with a group of developing and newly-industrializing countries. Needless to say, this may be due to the excellent educational system that Taiwan experienced during its course of rapid economic development.

8.4.4. Determinant of Taiwan's Regional Trade, 1966-1971.

In Chapter 5 we hypothesised that a country in the middle of the factor endowment ranking will export labour-intensive products to countries above its ranking and import physical- and human-capital-intensive products from these countries. By contrast, it will export physical- and human-capital-intensive products to countries below its factor endowment ranking and will import commodities that are unskilled labour-intensive from these countries. Thus,

the relative explanatory power of the trade theories may vary with particular regional trade flows. It is argued here that trade in manufactured goods between developed and developing countries is more likely to be explained in terms of factor proportions theory than is such trade among developed countries themselves. From the viewpoint of a developing country like Taiwan, one might expect an inconclusive answer for the determinants of comparative advantage in trade between Taiwan and the rest of the developing countries. Theoretically it seems that the difference in relative factor prices may not be sufficiently large to suggest the factor proportion hypothesis as a prominent explanation of trade between Taiwan and the rest of the developing countries especially as early as 1966 and 1971. This may be less true during the latter stages of the massive capital and human accumulation of Taiwan and the other members of the 'Gang of Four' countries. As was indicated in Chapter Seven, Taiwan was exporting its abundant resource to developed countries and exporting relatively more capital-intensive and skill-intensive products to developing countries. The purpose of this section is, therefore to augment the above findings by means of regression analysis. We shall attempt to assess the major determinants of regional comparative advantage for the year 1966 and 1971.

The results pertaining to the 1966 and 1971 regional trade are presented in Table 8.15 and Table 8.16. As can be seen from Table 8.15, for 1966, exports to developing countries are more physical and human-capital intensive than exports to developing countries. Physical capital is negatively and significantly related with exports to developed countries ; while positively and significantly related with exports to developing countries. We also observe a similar trend when the human capital variable is taken into consideration.

Human capital was negatively and significantly related with exports to developed countries; but positively and significantly correlated with exports to developing countries. The unskilled labour variable

Table 8.15. Regression Results of the Determinants of Regional Exports, 1966.

	Total Exports	Exports to DCs	Exports to LDCs
Constant	132.000	103.000	19.000
	(1.072)	(0.769)	(0.265)
K	-0.07	-0.149	0.142
	(-0.143)	(-2.661)**	(4.698)***
T	8.65	18.852	-9.044
	(0.331)	(0.661)	(-0.585)
H	-0.117	-0.187	0.070
	(-3.167)***	(-4.640)	(3.214)
U	0.051	0.049	0.003
	(11.336)***	(9.880)***	(0.972)
R^2	0.81	0.77	0.56
F-t	40.269***	32.080***	11.900***

Notes: see Table 8.13

was positively correlated with exports to developed and developing countries; but was highly significant only when related with exports to developed countries.

Table 8.15 further reveals that the physical capital variable was negatively correlated with exports to developed countries but positively and significantly related with exports to developing countries.

For the 1971 regional regression analysis, there is no fundamental difference in the determinants of the net imports for the various groups. The only difference is in the coefficient of the human capital. In the case of the net imports between Taiwan and the other developing countries, the human capital variable is negatively and significantly related to this dependent

Table 8.16 Regression Results of the Determinants of Regional net imports, 1971.

	Net Imports	Net Imports DC	Net Imports (LDCs)
Constant	-234.000	-253.000	18.000
	(-0.234)	(0.244)	(0.139)
K	0.731	0.619	0.120
	(3.277)***	(2.678)***	(4.231)***
T	4.249	3.664	0.613
	(0.310)	(0.049)***	(0.065)
H	0.103	0.322	-0.219
	(0.310)	(0.946)	(-5.156)***
U	-0.253	-0.246	-0.067
	(-5.516)***	(-5.251)***	(-1.149)
R^2	0.34	0.29	0.38
F-t	11.410***	9.095***	13.986***
No	101	101	101

Notes: see Table 8.13.

variable; while it is positively (but not statistically significant) related to the trade balance between Taiwan and the developed world.

The determinants of the regional exports Table 8.16 between Taiwan and the developed world had the expected signs in the cases of physical capital and unskilled labour (but nothuman capital) and the coefficients were highly significant.

Table 8.17. Regression Results of the Determinants of Regional Exports, 1971.

	Total Exports	Exports(DCs)	Exports(LDCs)
Constant	775.000	711.000	65.000
	(1.124)	(1.028)	(0.585
K	0.582	-0.699	0.116
	(3.854)***	(-4.613)***	(4.803)***
T	-14.075	-10.802	-3.301
	(-0.282)	(-0.216)	(-0.412)
H	0.592	0.513	0.079
	(2.626)**	(2.268)**	(2.193)**
U	0.189	0.192	-0.031
	(6.080)***	(6.165)***	(-0.638)***
R^2	0.54	0.52	0.47
F-t	26.638***	24.106***	19.886***
No.	101	101	101

Notes: see Table 8.13

The empirical results of trade with developing countries, however, are much different than those for the trade with developed countries. We note that the individual performance of some of the independent variables differs significantly from that of those in trade with developed countries. For instance, the physical capital variable is positively and significantly

related while the unskilled labour variable is negatively related to exports to developing countries. However, both groups of destinations, human capital is positively and significantly related and the technological variable is negatively related but negligibly.

8.4.5. Determinants of Changing Pattern of Taiwan's Trade

The regression analysis presented above was concerned with the structural determinants of Taiwan's comparative advantage at a specific point in time. However, as Stern(1975) notes, this kind of analysis affords only limited insight into the initial determinants of comparative advantage and the process of changing through time.

As has been pointed out elsewhere in this dissertation, Taiwan's growth and structural change in terms of both output and factor inputs was phenomenal. Physical capital accumulation relative to human capital accumulation was relatively high. This change coupled with the big structural change that has taken place over the last three and half decades may provide a good opportunity for examining the direction of change of the country's comparative advantage during this period of rapid transformation.

The analysis that follows is basically the same as the

previous one. The procedure used to assess the changing pattern of comparative advantage is to regress changes in the relationship of the pattern of trade to the intensity of some factor inputs. The regression model to be used can be written as follows:

$$CX_i = q(K_i, U_i, S_i) \qquad (8.4)$$

where CX_i is alternatively the change in net imports, exports and imports; the other variables are defined as before. Table 8.18 presents the results of the regression model.

The result supports the view that the structural determinants of trade of Taiwan are expected to change with the changes in the factor endowment of the country. As Taiwan progresses, she may embark upon the export relatively more capital and more skill-intensive products.

Our results indicate that human capital is gaining in importance as a major determinant of the changing pattern of comparative advantage in Taiwan. As is evident from Table 8.18, the 1971-1981 changes in exports were positively correlated with the 1971 levels of the four independent variables; with human capital and unskilled labour highly statistically significant. Inter-industry changes in exports were also positively and significantly correlated with the changes of the independent variables of 1971 and 1981.

Despite the fast growth in physical and human capital, however, the major determinant of Taiwan's comparative advantage is still is abundant factor, namely, unskilled labour.

Table 8.18. Regression Estimates (changes in variables), 1971-1981.

	Dependent Variables		
	Net Imports	Change in Imports	Exports
C	322995.0000	7705.0000	-24589.000
	(2.435)	(0.811)	(-2.519)
K71	-1.358	-0.751	0.608
	(-1.031)	(-0.795)	(0.627)
T71	-1573.000	-74.617	1499.000
	(-0.912)	(-0.060)	(1.108)
H71	2.013	6.620	4.608
	(1.706)	(7.830)***	(5.305)***
U71	-1.600	-0.889	0.712
	(-6.657)***	(-5.159)***	(4.021)***
R^2	0.73	0.71	0.88
F-t	23.083***	21.049***	60.257***
	Change in the Independent Variables		
C	5578.000	-1841.000	-7420.000
	(0.538)	(-0.191)	(-2.185)
CK	0.289	0.313	0.024
	(1.813)	(2.109)**	(0.456)
CT	5684.000	4082.000	-1602.000
	(2.551)	(1.969)	(-2.193)**
CH	-0.303	0.024	0.327
	(-3.335)***	(0.287)	(10.992)***
CU	-0.188	0.223	0.411
	(-1.211)	(1.543)	(8.075)***
R^2	0.65	0.37	0.97
F-t	15.884***	5.027***	259.360***

Notes: 1. see Table 8.13
2. CK, CT, CH, CU, represent changes in a) fixed assets, b) the number of technicians in total employment, c) human capital, and d) unskilled labur respectively.

8.4.6 A Logit Analysis of Factor Content of Taiwan's Foreign Trade: 1966-1984.

The model specification presented above to reflect the sources of comparative advantage has been criticised by Harkness and Kyle(1977). According to Harkness and Kyle regressing the net imports on some determinants of comparative advantage is not supported by the hypothesis set in the Heckscher-Ohlin trade model. The Heckscher-Ohlin model predicts that, for a labour-abundant country, industries with relatively lower capital/labour ratio will tend to be exporters while those with relatively higher capital/labour ratios tend to be importers. However, the model does not say that, across industries,either the relative or the absolute share of net exports will be monotonically decreasing with the capital/labour ratio ceteris paribus (see Harkness and Kyle, 1977). In short, there is nothing in the theory to say that industries with lower capital/labour ratio will have higher net export surpluses; at best those with lower capital/labour ratio will simply tend to be exporters. In general, in a multi-factor proportions model with more goods than factors, and incomplete factor-price equalization,only the direction and not the value (or share) of trade can be predicted (see Bhagwati, 1971).

Given the above criticisms, Harkness and Kyle suggest

that the consistent way of reconciling the theory with the empirical work is to consider only whether an industry is a net exporter or net importer and ignore either the absolute or the relative size of its net net imports. For this reason they (Harkness and Kyle) suggest that the dependent variable in in the regression models presented above should take a binary variable where it takes the value of 1 (one) if the industry is a net exporter and 0 (zero) if it is a net importer. In such a case, the ordinary least square model is inappropriate; instead they suggest a logit or a probit model.

In contrast to the intrinsically linear models to which ordinary regression is applied,the logit or the probit models have a nonlinear probabilistic interpretation, in which predicted values can be considered an estimate of the conditional probability of the event's occurring, given the independent variables (Goldberger, 1964, p. 249; and Baum and Coe, 1977). Formally, the model for a single independent variable may be specified as:

$$Y_i = a + BX_i + e_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8.6)$$

$$Y_i = \begin{bmatrix} 1 \text{ with} & Pro(\phi_i) \\ 0 \text{ with} & Prob(1-\phi_i) \end{bmatrix} \quad \ldots\ldots\ldots\ldots\ldots\ldots (8.7)$$

The model postulates that the logarithm of the odds of an industry's being a net exporter is a linear in the explanatory variable. That is, the logit model expresses probabilities as log-linear functions of the independent variables):

$$\ln[(\phi/(1-\phi)]=a+BX_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8.8)$$

solving for ϕ

$$\phi_i=1/[1+\exp(-a+BX_i))] \quad \ldots\ldots\ldots\ldots\ldots\ldots (8.9)$$

With continuous independent variables, a maximum likelihood estimation procedure is used to yield estimates of the parameters; which for our data requires the use of an iterative solution method (Pindyck and Rubinfeld, 1981, p. 287 sqq.).

In Table 8.19 and 8.20 regression results for the total

Table 8.19. Logit Analysis of Taiwan's Net Exports, 1966-1981

	1966	1971	1976	1981
C	-1.3155	0.189	1.0598	0.341
	(-1.845)	(0.242)	(1.365)	(0.530)
K	0.449	-0.279	-0.061	-0.012.
	(0.952)	(-1.393)	(-1.005)	(-0.786)
S	-0.142	-0.541	-0.300	-0.264
	(-1.017)	(-2.072)**	(-2.386)**	(-2.402)**
U	0.148	0.663	0.277	0.293
	(1.742)*	(2.300)**	(2.530)**	(2.445)**
R^2	0.16	0.48	0.51	0.48

Notes: see Table 8.13

net exports for the years 1966, 1971, 1976 and 1981

are presented. It is evident from Table 8.19 and Table 8.20 except for 1966, physical capital is throughout negative and statistically insignificant. The coefficient of the skilled labour variable is also negative throughout the whole period; and statistically significant for the last three periods. The technological variable (see Table 8.20) is also negative throughout, but statistically signigicant for the years 1976 and 1981. The human capital variable has the expected negative sign for the first two years, but becomes positive for the remaining years, however, it is not statistically significant. The changes in the signs of the coefficients may be an indication that Taiwan is embarking more upon human-skill

Table 8.20. Logit Analysis of Taiwan's's Net Exports using four input variables, 1966-1981

	1966	1971	1976	1981
Constant	-1.222	0.170	1.215	0.393
	(-1.679)	(0.241)	(1.415)	(0.567)
K	0.541	-0.358	-0.0404	-0.021
	(1.072)	(-1.008)	(-0.683)	(-1.134)
T	-0.261	-0.665	-3.288	-1.856
	(-0.290)	(-1.013)	(-2.667)**	(-2.264)**
H	-0.555	-0.236	0.040	0.013
	(-1.281)	(-0.974)	(0.674)	(0.816)
U	0.131	0.291	0.326	0.277
	(1.486)	(2.403)**	(2.859)**	(2.264)**
R^2	0.21	0.37	0.55	0.41

Notes: see Table 8.13

intensive manufacturing exports. In contrast, the unskilled labour variable is always positive and statistically significant in all but the first period (see Table 8.20).

8.5. Concluding Remarks

By and large, our hypotheses concerning the determinants of comparative advantage of Taiwan's manufacturing trade are borne out by the regression results. The analysis presented above supports the view that Taiwan is exploiting its comparative advantage in unskilled labour. The regression estimates also seem to suggest that Taiwan's export structure is changing with the changes in human and capital accumulation. The empirical findings also suggest that the determinants of comparative advantage of Taiwan's trade with developed and developing countries are also fundamentally different and much as expected on the HOS reasoning.

The empirical evidence presented above, as we have indicated already, has certain limitations. The study undoubtedly would have been more complete if Taiwan's comparative advantage were assessed with respect to the relative factor endowments of Taiwan's competitors. Secondly, it would have been better if more variables, such as scale economy and product differentiation were added to the list of the independent variables. Furthermore, to gauge the impact of the rapid physical and human capital accumulation on regional trade, the empirical studies should incorporate the determinants of regional comparative advantage during the 1980s.

Appendix A8.1 Correlation Matrix 1966

	MN66	M66	E66	K66	H66	T66	S66	U66
MN66	1.000							
M66	0.838	1.000						
E66	-0.568	-0.027	1.00					
K66	-0.221	-0.033	0.355	1.00				
H66	0.270	0.365	0.057	0.238	1.00			
T66	0.195	0.082	-0.235	0.141	0.004	1.00		
S66	0.486	0.319	-0.409	0.183	0.268	0.411	1.00	
U66	-0.440	-0.016	0.782	0.314	0.211	-0.319	-0.389	1.00

Appendix A8.2 Correlation Matrix 1971

	MN71	M71	E71	K71	H71	T71	S71	U71
MN71	1.000							
M71	0.590	1.00						
E71	-0.602	0.290	1.00					
K71	-0.054	0.221	0.283	1.00				
H71	-0.166	0.533	0.724	0.301	1.00			
T71	0.157	0.062	-0.124	-0.094	0.072	1.000		
S71	0.472	0.150	-0.412	-0.096	-0.023	0.429	1.000	
U71	-0.623	0.185	0.922	0.310	0.689	-0.218	-0.426	1.00

Appendix A8.3 Correlation Matrix 1976

	MN76	M76	E76	K76	H76	T76	S76	U76
MN76	1.000							
M76	0.376	1.000						
E76	-0.738	0.347	1.00					
K76	-0.178	0.399	0.471	1.000				
H76	-0.575	0.424	0.890	0.404	1.00			
T76	0.439	0.310	-0.219	0.134	-0.135	1.000		
S76	0.477	0.217	-0.325	0.137	-0.228	0.674	1.00	
U76	-0.716	0.292	0.937	0.473	0.839	-0.301	-0.401	1.00

Appendix A8.4 Correlation Matrix 1981

	MN81	M81	E81	K81	H81	T81	S81	U81
MN81	1.000							
M81	0.271	1.000						
E81	-0.722	0.470	1.00					
K81	-0.095	0.562	0.491	1.000				
H81	-0.537	0.548	0.886	0.497	1.00			
T81	0.409	0.266	-0.184	0.048	-0.084	1.000		
S81	0.478	0.145	-0.334	0.011	-0.169	0.576	1.00	
U81	-0.717	0.378	0.929	0.461	0.780	-0.246	-0.361	1.00

CHAPTER 9
SUMMARY AND CONCLUSIONS

If the wealth of a nation has multiplied miraculously, that nation must be Taiwan.

Robert Wade

One nation can and should learn from another.

Karl Marx

9.1. Summary of Major Findings

In this dissertation the Taiwanese development experience in terms of output growth and labour absorption has been examined. We have observed that at a time when many other developing countries are economically stagnant and some are debt-laden, Taiwan enjoys: (i) a rate of economic growth almost unheard of in modern times, (ii) a relatively equal distribution of income, (iii) a near full employment of its labour force, and (iv) an external reserve balance of US $ 46.3 billon(1986). As was indicated also in Chapter Two, this exceptionally high growth rate in terms of output, employment and per capita income was accompanied by a structural transformation of the economy in which there was a substantial decline in the importance of agriculture, a rise in manufacturing, and a growing importance of trade. Above all, this spectacular growth and transformation was achieved without the worsening of distribution of income that often accompanied growth in other developing countries.

The primary objective of this summary is, therefore, to assess some of the important lessons that can be learned from the Taiwanese experience and evaluate the transferability of this miracle to other developing countries that are still struggling to overcome abject poverty and mass inequality. The aim is, to borrow words from Ranis and Fei (1987), 'to shed some light on some issues rather than provide definitive and incontrovertible answers' to the question of relevance and transferability of the Taiwanese model.

There is no doubt that the fast growth of manufactured exports has been the most important reason for Taiwan's prosperity and structural transformation. As the analysis of comparative statics in Chapter Four shows, export expansion has been a very important source of output growth and structural transformation for the period covering 1961-1981, especially in the manufacturing sector, were export expansion was the dominant source of growth and structural transformation. Furthermore, even though the Granger-Sims causality test failed to confirm that exports cause economic growth (Jude and Marshall, 1985; and Darrat, 1987), our regression results show that there was a high and positive correlation between exports and economic growth in Taiwan.

Our study also indicates that the role of exports in

generating employment was also significant. The proportion of direct and indirect employment generated by exports in total employment increased from 11.9 percent in 1961 to 35.8 percent in 1984.

To test the central hypothesis of the dissertation, namely, that exportables generate more employment per unit of valued-added than import competing commodities, several methods were used. The direct, the direct-plus-home-goods-indirect, and the direct-plus-indirect employment-generating capacity of exportables were compared against similar measures of the employment generation-capacity of import-competing industries. By all the three measures presented above, it was found that exportable industries generated more employment per unit of domestic value-added than import-competing industries. These findings have a major bearing on the employment implications of alternative trade strategies. They clearly indicate that trade policy can have a significant impact on employment creation and they thus have a sobering lesson for other developing countries who are still struggling to solve their employment problem. These findings have clearly demonstrated that in employment creation as in output growth, export expansion was superior to import substitution.

Apart from the above exercise, a separate test was carried out to see whether the determinants of trade in Taiwan changed with the changes in factor

accumulation and also to see whether Taiwan was utilizing its resources in line with its factor endowment. This dynamic interpretation of comparative advantage has also been examined specifically to see whether in the long-run equilibrium Taiwan's export commodities remained less capital- and less skill-intensive than import-competing commodities during the period of Taiwan's rapid physical-capital and human-capital accumulation. Our empirical results indicate that, as the theory predicts, Taiwan was exporting progressively more physical capital-intensive and more skill-intensive manufactured commodities. However, in none of the periods under consideration was the capital-intensity or the skill-intensity of exportables higher than that of import-competing commodities. Furthermore, in a bilateral test of Taiwan's trade in manufactures it was found that Taiwan, in line with its factor endowment, was exporting labour-intensive commodities to developed countries and importing skill- and capital-intensive commodities from these countries. In addition, Taiwan, being a country in the middle of the factor endowment ranking, was exporting more skill- and capital-intensive commodities to countries below its factor-endowment ranking in these factors than to countries above its factor endowment ranking. As the theory predicts also, we find that Taiwan was exporting more labour-intensive but less skill- and capital-intensive commodities to developed countries than to

developing countries. Thus, according to the Leontief type of test, Taiwan was exploiting its comparative advantage.

Apart from the Leontief type of test, the Taiwanese trade structure in manufactured goods was analysed by cross-section regression analysis across industry groups for various dates in the period 1966-1981. Intensity in unskilled labour, physical capital, skilled labour and human capital were regressed against Taiwan's net imports, imports and exports. By and large, most of the regression results support the previous findings. Net imports were negatively and significantly related to unskilled labour-intensity and positively and significantly to skilled labour-intensity. Regarding physical-capital coefficient, however, there was no discernible pattern. As expected also, exports were positively and significantly related to unskilled-labour intensity throughout the period under review. However, although they were negatively correlated with physical-capital and skilled-labour in the first two periods they were positively related to the two variables in the last two. That the regression coefficients for physical- and human-capital changed signs from negative to positive may be an indication that the sources of comparative advantage in Taiwan are changing towards human capital and physical capital.

Concerning the determinants of bilateral trade (for

1971), we observe that Taiwan's exports to developing countries were positively and significantly related to human-capital intensity and physical-capital intensity while exports to developed countries were negatively correlated to physical-capital intensity but positively related to human-capital intensity. Therefore, consistently with the dynamic interpretation of comparative advantage and consistently with the hypotheses set up in Chapter 5, it was shown that, on the whole, the factor proportion theory within a multi-period and multi-country framework is consistent with the way the pattern of comparative advantage has changed in the course of Taiwan's rapid economic development.

Finally, a test was made to see whether distortions in the commodity market affect the employment-generating capacity of Taiwan's manufacturing industries. It was found that the more protected industries generate less employment that the less protected industries.

9.2. Causes of Taiwan's Economic Miracle: A Summary

From the empirical evidence presented in this dissertation and from other studies as well, it seems clear that Taiwan provides an example of an economy which, following its comparative advantage in international trade in manufactures, has reaped the gains in terms of output growth, employment and egalitarian

distribution of income. The rapid expansion of labour intensive exports and the accompanying employment are credited with the prosperity Taiwan enjoys. Indeed, by the year 2000 the per capita income of Taiwan is expected to be about 57 percent of the per capita income of the United states and slightly less than that of Italy (Klein, 1987). For a small economy completely bereft of natural resources this is indeed remarkable.

In the second part of this chapter we shall attempt to draw some of the important lessons that can be learned from the Taiwanese experience.

Many students of Taiwan's success story ascribe this phenomenon to the early shift in strategy from import substitution to export promotion. It is argued that, rather than pushing inefficient import-substitution industries for the small domestic market, Taiwan opted for an export-oriented strategy and carried out policies that made it possible for the country to exploit its comparative advantage and develop labour-intensive manufacturing industries directed towards the world market (Myers, 1986). Once it was recognized that the domestic market was a limiting factor on the achievement of a sustained growth and structural transformation, Taiwan took several policy measures. The first step taken was to rationalize the economy in order to redress some of the past mistakes of the import substitution era.

Among the outstanding policy moves taken during this transition period were the abolition of the anti-export bias and the vigorous campaigns to promote exports. Of these, the latter, incidentally, received little attention in the literature. Towards this end, the first step taken was to devalue the currency and to simplify the complicated foreign exchange system. Furthermore, defying the conventional wisdom of the day, Taiwan raised interest rates paid to savers and charged to borrowers to levels unheard of. This policy is believed to have set interest rates close to a market-clearing rate and yielded positive real returns to savings-depositors which in turn helped to boost the rise in the saving rate to a very high even by international standards.

Finally, the government of Taiwan gradually liberalized and eventually abolished the commodity quota system. Foreign exchange was no more allocated by quota according to import category but was automatically made available to a large number of imports. Exports were further encouraged by an increase and generalization of tax and import duty rebates for industrial exports (Liang and Liang, 1981). In general, Taiwan adopted a policy in which broadly similar incentives for exports and domestic production were accorded and which gave producers neutral incentives as between domestic and imported inputs (Wade, 1988).

It is generally believed that these were the key policy measures that have played the crucial role in transforming Taiwan from a poor agrarian society to a small thriving industrial society. The policy measures that were taken during the transitional period were aimed at 'getting prices right' and lessening the role of the state in the direct running of the economy. Economists of the neoclassical tradition argue that after this policy shift it was the "unbridled free market mechanism with its concomitant of unrestrained export-orientation which did the trick of the spectacular growth in Taiwan and the rest of the 'gang of four'" (see Datta, 1987).

9.3. Factors in Taiwan's Economic Miracle: A Summary

The claim that the success of Taiwan and the rest of the 'gang of four' represents "the embodiment of the neoclassical parable" (Bienfeld, 1982) has been challenged by many critics of the 'Asian Model'. As Kirkpatrick (1987) rightly argues:

> There are two main grounds on which the neoclassical interpretation of the NICs (of Asia) phenomenon can be questioned. First, it is argued that to explain the NICs' success simply in terms of 'getting the prices right' is to ignore the role of government regulation and intervention in ensuring that this condition was met. The second is to point to the specificity of the NICs' experience which limits the prospects of replicating the NIC model.

Neoclassical economists argue that the initial strategy of import substitution followed in Taiwan was a mistake

(Myint, 1982, p. 126) and that the policy measures taken to promote exports were to redress these past mistakes. For them import substitution and export promotion are mutually exclusive and there is no 'half-import substitution and half-export promotion' (see Krueger, 1985). To many critics, however, the initial import substitution followed in Taiwan though inefficient, was, in part, a stage in the development process that might have laid the foundation for future export growth and also for the subsequent upgrading Taiwan's export pattern into product lines where economies of scale and quality are of paramount concern (Kirkpartick, 1987; Wade, 1988; and Woronoff, 1987). Indeed some of the leading sectors of the Taiwanese economy were established during this period. Even at a later stage most of these industries were perhaps deliberately promoted by the state without due consideration to the country's short-run static comparative advantage. This is in line with the view that future-oriented developmental states such as Japan and Taiwan have sacrificed short-term static comparative advantage for a long-term benefit in investment of indispensable capital- and skill-intensive manufacturing industries (Blumenthal and Lee, 1985).

Contrary to the view held by many neoclassical economists, recent case studies of Taiwan indicate that the state has extensively intervened to develop and shape industrial strategy including the

realization of comparative advantage, thereby establishing and maintaining an internationally competitive position in a number of industries (see Bradford,Jr., 1988; Wade, 1988; and White and Wade, 1988). Import controls and export incentives have been used to pursue a strategy based on selective import substitution and export promotion, with IS being used to develop local manufacturing capacity as a basis for subsequent export activities (Kirkpartick, 1987, p. 78). Furthermore, Taiwan has used tariff and licensing to create a sustained market for the development of infant industries; and when these industries developed Taiwan turned them towards the world market by subsidies, credit and exchange rate policies (Myers, 1986). The credit system has channelled financial resources at subsidized rates to preferred activities. The tax system has provided an exemption from import duties for export content (Myers, 1986). There is no doubt that pervasive protection of infant-industry went hand in hand with favourable treatment of the export sector through taxes and credit. Taiwan is not therefore a pure case of export orientation as opposed to import substitution: it has combined the two strategies both sequentially and concurrently (Wade, 1988). As Wade further argues, even during the export-oriented strategy era, Taiwan has pressed ahead with a guided programme of import-substitution, at the same time as the economy has been 'outward-looking'.

However, while Taiwan and South Korea have protected and carried out import-substitution policies, their protection was not indiscriminate and comprehensive, and they also avoided the pitfalls of protection so apparent in many other developing countries where import substitution often comes at a price of exports and hence leads sooner or later to balance of payments problem. Above all, their import substitution policy, unlike those of other developing counties, prepared industries for export promotion (see Dornbusch and Park, 1987); and, despite the fact that Taiwan has actively intervened in the economy and the state has been ubiquitous, such interventionist policies were designed to nurture private enterprise and not to impede its activities (Myers, 1986).

What the experience of Taiwan and South Korea teaches us is that the nature of state intervention is crucial to the development process. The issue is not one of state intervention in the economy. Apart from Hong Kong there is no country that has developed without protecting its industry (Sen, 1981 and 1983). The question is how the government intervenes and for what purposes. Success can be achieved despite state intervention.

In Taiwan, as in Japan before it, the state itself led the industrialization drive, that is, it took over the developmental functions (Johnson, 1982). Taiwan, to use Johnson's terminology, is a 'plan-rational' state:

> In the plan-rational state, the government will give greatest precedence to industrial policy, that is, to concern with the structure of domestic industry and with promoting the structure that enhances the nation's international competitiveness (Johnson, 1982, p. 19).

What makes the Taiwanese experience peculiar in the history of the role of the state in economic development is that its intervention was directive; that is, the state aims at predetermined results through conscious interference with market forces and selective application of incentives and/or controls (see Luedden-Neurath, 1988). Thus, as Bradford Jr. (1988) argues, the state has had a highly specific strategic design internally and externally and has marshalled policy instruments and engaged the private sector to achieve it. In its strategy for economic development, Taiwan has:

> "... identified certain key sectors which are of special importance for the economy's future growth-either to reduce the economy's vulnerability to foreign (especially Japanese) suppliers, or to generate a high value-added, more income elastic, more closely interlinked set of productive activities" (Wade, 1988, pp. 57-8).

The case of Taiwan clearly demonstrates that the government played a crucial role in the initial stages of the economic miracle. During the early stages, exports were singled out with subsidies, credit, and an attractive real exchange rate. When the situation called for more capital-intensive and technology-intensive industrialization, import restrictions were provided to generate profitability for infant

industries (Myers, 1986). It is therefore important to recognize that Taiwan's economic policies were not concerned alone to 'get prices right'; they were also intended to shape and direct the pace and direction of the country's future growth. The government was fully aware how to change the comparative advantage of the country in anticipation of changing world demand. In particular the state was aware that: (i) the country's dependence on labour-intensive manufactured exports would face problems from external competition and also from labour shortage in the country itself; (ii) dependence on traditional manufactured exports might not be a feasible strategy in the long-run, and hence export strategy was geared towards commodities whose income-elasticity of demand was higher, for instance, from textiles to electrical and electronic products. The government also attempted to reduce the dependence on imported inputs for its leading sectors (Wade, 1988) which is evidenced from the decline in the import coefficients of its leading export sectors (see Chapter 4). As was explained in the chapter that deals with the sources of industrial growth and structural change, Taiwan's leading industrial sectors have changed dramatically over the last three decades. Light industries were progressively overtaken in importance by heavy industries such as chemicals, machinery and electrical and electronics. This rapid structural transformation has led Fajnzylber (1981, p. 121) to make

the following remarks:

> It would be difficult, if not impossible, to try to explain this diversification towards capital-intensive sectors (petrochemicals) and sectors making intensive use of skilled labour and technology (such as shipbuilding) as a mere automatic reflection of the system of static comparative advantages and pressures by advanced countries, which in actual fact will themselves be affected by this industrial diversification of Taiwan. What it is wished to stress is that the industrial strategy of Taiwan, as in other cases, is due to a significant extent to the political decision of domestic economic and social agents which come together in the definition of the strategy formulated by the State.

It is therefore safe to assume that the strategy Taiwan followed was not wholly guided by profitability based on current comparative advantage alone but by a strategy that could "...create a flexible and integrated production structure within Taiwan, so that the economy can respond quickly to changes in world market conditions and be less vulnerable to interruptions in input supplies" (Wade, 1988, p. 54). It may be for this reason that after the oil crisis Balassa(1985) found that developing countries including Taiwan that followed the export-oriented strategy did better in terms of growth and structural adjustment and were able to weather the recession much better than countries that followed the import-substitution strategy. Furthermore, if it were not for this strategy and the maturity that accompanied it, it would have been difficult for Taiwan to adjust quickly to the voluntary export restrictions demanded by the advanced countries (Ranis and Orrock,

1985).

As was pointed out earlier, the second basis on which the neoclassical argument has been challenged is that it fails to appreciate the distinctive features of the international economy and/or the particular characteristics the individual 'gang of four' countries had at the time of their take-off.

Taiwan's take-off was assisted by favourable world economic growth with unprecedented expansion of world trade throughout the 1960s, in contrast with the later slowdown in economic growth and heightening protectionism in the advanced countries (Cline, 1984; Kaplinsky,1984). In fact Adelman (1985, p. 935) predicts that "... most LDCs which are not already newly industrialized countries (NICs) with established export markets are unlikely to break into international markets for non-traditional exports in the next decade". Furthermore, Cline(1982) is of the opinion that the assumption that NICs' export success can be replicated by other countries is subject to a fallacy of composition. According to him, if the other LDCs had the same intensity of export production as the the 'gang of four', the share of all LDCs in the manufactured imports of DCs would increase to 60 percent, and according to him it may not be possible for the developed countries to absorb these increases. However, Cline's view is static. As the

Asian NICs' comparative advantage moves from unskilled-labour-intensive to capital- and skill-intensive, their export composition will change and they have to move to a second stage of export expansion in human-skill and capital-intensive products and their place in unskilled labour-intensive export products will eventually be taken by second generation exporters which are relatively well endowed with abundant labour relative to the 'gang of four'.

Furthermore, the fact that foreign exchange earnings of these countries ('gang of four') is substantial, may stimulate import growth in the developed countries (Ranis, 1985). Furthermore, as Bhagwati (1987) remarks, "... in aggregate the share of manufactured exports from developing countries in the consumption of manufactures in developed countries runs even today at a little over 2 percent". In addition, Cline and other pessimists also seem to forget the role of intra-industry specialization among developing countries themselves and between them and the developed countries. As Cline himself acknowledges, however, the pursuit of export-oriented strategy simply amounts to adoption of a structure of incentives which do not discriminate against exports. Therefore, irrespective of the vagaries of world demand, countries that are still discriminating against exports in favour of import substitutes should aim at reducing or eliminating this

bias.

The economic take-off was also assisted by an easy access to international finance in the late 1960s which led to massive increase in the NICs' borrowing, and enabled them to maintain high growth rates through 'debt-led growth' (Griffin-Jones and Rodriguez, 1984). Had the international situation been less propitious, growth rates may well have been lower (Amsden, 1985). In a recent article Singer and Gray (1988) found that economic growth was very much affected by world economic growth. They are of the opinion that:

> High growth rates of export earning occur only when external demand is strong. The world demand factor is generally larger than the trade policy factor ...[thus] outward orientation cannot be considered as a universal recommendation for all conditions and for all types of countries.

To some observers the starting point of the Taiwanese economic miracle was the favourable colonial heritage from Japan. Apart from laying some basis for industrial take-off by providing infrastructural facilities, the Japanese colonial system developed the agricultural sector in Taiwan which later became the cornerstone of the Taiwanese miracle. Unlike other colonial powers, Japan regarded Taiwan an "agricultural appendage to be developed as a complement to Japan" (Amsden, 1985) and make Taiwan the 'breadbasket' for Japan to provide food necessary to feed it's (Japan's) growing industrial labour force.

Therefore, instead of destroying the indigenous social and economic structure of Taiwan, the Japanese sought to promote its development in particular its rice and sugar production for which Taiwan had a comparative advantage (Grabowskl, 1988). This was in sharp contrast to the colonial experience of many African countries where the social and economic fabric of the peasantry was destroyed to give room for the production of of cash crop for exports. Thus, the agricultural sector was developed as an enclave for a cash crop with no apparent linkages with the rest of the economy. While in some colonies, for instance, India under the British rule the agricultural sector stagnated and food production actually fell, the agricultural sector in Taiwan under Japanese rule flourished through the provision of modern agricultural facilities such as fertilizers, irrigation and land reform (see Datta, 1987). Furthermore, Taiwan was fortunate because Japan was itself a development oriented state (see Amsden, 1985; Datta, 1987; Grabowski, 1988; Koo,1987). Indeed, as a result of Japan's development-oriented strategy and the various measures taken to modernize agriculture, it is reported that the welfare of Taiwanese peasants in the first half of the twentieth century may have exceeded that of Japanese peasants (Ouchi, 1967 in Amsden, 1985, p. 81). Even after the change in policy from import substitution to export promotion, Taiwan, unlike most developing

countries, was fortunate to have close links with two of the leading economies of the world (Wade, 1988): Japan, a developmental state, and the United States dedicated to making Taiwan a success story.

The economic aid provided during the 1950s and 1960s also played an important role in that it provided a sound basis in the critical stages of the gestation of the export-led growth.

> The United States' assistance played an important role in the task of controlling inflation at the beginning of the 1950s. Moreover, if it had not been for United States aid, the trade deficit of Taiwan would have been a factor capable of seriously limiting the country's economic development during the take-off. United States aid overcame this bottleneck by increasing the foreign exchange resources and providing support for the importation of indispensable inputs served as a complement to the domestic labour force and other components of investment" (Fajnzylber, 1981, p. 128).

And according to Woronoff(1986), it was only thanks to American military and economic assistance that the country could pull of the tailspin. Military aid took some of the pressure off the government which could finally turn itself to economic issues.

Despite the fact that some countries have received more aid (per capita) than Taiwan; their economic progress was dismal compared to that of Taiwan. Unlike these countries, the purpose of economic assistance given to Taiwan seemed to have a clear and definite purpose: to make the country an export-oriented capitalist success

story that would be an envy of countries in the communists world and a model for the rest of the developing countries. American AID (Agency for International Development) officials as early as 1959 wanted Taiwan to become an export-oriented country. Accordingly, they advised and convinced the Taiwanese government to relax or cease some of the policy measures that were alleged to have made the economy distorted. It was during this period that the policy measures that laid the foundation of the export-led growth strategy was taken (Woronoff, 1986). Despite this massive economic assistance, however, it is argued that Taiwan could have grown just as fast and have consolidated her economic infrastructure for further growth as well as it did if the country had had less aid but a smaller military budget (Myers, 1986).

It can not be denied that the above factors have helped Taiwan to take-off faster than most developing countries; however, as Myers (1986) rightly argues:

> they are not sufficient to explain the remarkable economic performance so far achieved. If certain government policies had not been initiated when they were, even these favourable conditions would not have sufficed for Taiwan to have achieved the transformation that it did.

Hence, while there are strong grounds for believing that much of the economic success can be explained by historically specific factors, nevertheless, at the same time there is even stronger evidence to show that

the policies that have been pursued to eliminate the anti-export-bias was the major factor in stimulating higher economic, employment and equitable distribution of income.

9.4. Lessons from the Taiwan's Experience

Despite some of the divergent and even conflicting views expressed about the Taiwanese economic miracle, it is possible and equally important to draw some very important lessons from the Taiwanese experience.

First and foremost, as Myers (1986, p. 64) rightly remarks, the spectacular economic growth and structural transformation achieved in Taiwan was not a result of a single policy but of different policies applied at different times. Various kinds of policies were initiated, refined, tried and even abandoned as conditions dictate.

Second, economic development in Taiwan was not the result of setting prices right alone. Taiwan's development strategists were fully aware that prices are important but markets cannot in general be trusted and hence left alone. To borrow Dornbusch and Park's (1987) words: "The recipe therefore was definitely not simple 'hands-off,give free reign to market force', government interference was intensive and decisive (see also Scitovsky, 1985). Taiwan was not a laissez-faire

economy: considerable state intervention was involved in guiding the economy towards a deliberate structural transformation. The Taiwanese state, as Japan before it followed state-induced strategy which emphasized private sector in implementing strategies with the broad economic framework that the state establishes to pursue its chosen development objectives (Johnson, 1982). State intervention in Taiwan was 'market-conforming'. In implementing its economic development plans, Taiwan was able to preserve the presence of competition without, perhaps, sacrificing its development objectives. However, the Taiwan experience does show the creation of appropriate price and income incentive is critical for the allocation of resources".

Thus, contrary to the popular view,

> "The Taiwanese development experience, then, is very difficult to stereotype either as market-oriented success story or as an illustration of the triumph of dirigisme and policy intervention. Instead, its success is due to a mixture of both elements in effective and powerful interaction-and to a mixture, rather than sequencing, of import substitution and export promotion" (Bradford, 1986, p. 121).

Third, the history of Taiwan's economic development since the early 1950s consistently indicates that the state's priority was economic development. "A coherent development strategy was not only formulated but was followed by both the government and the private sector in providing an unusual degree of common direction to national energies in these cases" (Bradford, 1986,

p. 123). Furthermore, unlike many developing countries, the government of Taiwan since its inception had always:

> ... clear and urgent ideology of industrialization, and has seen industrialization issues in a comprehensive rather than piecemeal perspective, in a military rather than a bargaining or 'muddling through' mode (Wade, 1988).

Fourth, the Taiwanese experience seems to suggest that economic development requires a strong developmental state with a highly capable bureaucracy imbued with a sense of national purpose. As Findlay(1988) rightly remarks, Myrdal's characterization of India as a 'soft' state would certainly not apply here. The state's commitment to economic expansion and, more important, to implementing well-chosen development strategies, differentiates Taiwan from other developing countries. Taiwan's authoritarian state has clearly demonstrated that it is dedicated to economic development and can mobilize its people by investing its economic surplus in highly productive activities that are vividly visible to the ordinary citizen. What motivated the Taiwanese people to participate in the development process is perhaps the mode of utilization of the economic surplus. The greatest challenge and lesson that can be learned from the Taiwanese experience may lie in the ability of the state to mobilize its people towards a common objective. The different classes in Taiwan do not seem to have fought to undermined one another nor did the state seem to have favoured heavily

one class over the other. As a result of this, unlike the experience of other countries, especially that of Latin America, "no class posed a serious obstacle to export-oriented industrialization; rather the dominant class responded constructively when the state tried to propel the economy into the new pattern of dependency" (Koo, 1987, p. 175-6). As long as development proceeds to the benefit of the society as a whole, and as long as a solid foundation for future development is laid, the authoritarian nature of the state can be tolerated.

Lastly, the ingredients that made it possible are not likely to be easily transferred to other developing countries to help them initiate their own transformation. Economic development is a complex process that cannot be solved by economic principles alone. However, the experience of Taiwan's economic development teaches us that if private enterprise is nurtured and directed to exploiting a country's comparative advantage; then at least in some circumstances if is possible to remove widespread poverty and overcome the obstacles to take-off into sustained growth.

Apendix 3.2

Decomposition of Sources of Industrial Growth

Using the same notations as in the text, we have the following balance equation in domestic terms:

$$X_t = A_t^d X_t + U_t^B B_t + U_t^C C_t + E_t \qquad (A3.1)$$

solving for X we have,

$$X_t = R_t^d (U_t^C C_t + U_t^B B_t + E_t) \qquad (A3.2)$$

Based on the above the balance equation the increment in output between two periods in time we be derived as as follows:

$$\Delta X = X_2 - X_1$$

$$= R_2^d (U_2^C C_2 + U_2^B B_2 + E_2) - [R_1^d (U_1^C C_1 + U_1^B B_1 + E_1) \qquad (A3.3)$$

Output (X_1) in the first period can be decomposed as follows:

$$\begin{aligned}
R_1^d (U_1^C C_1 + U_1^B B_1 + E_1) &= R_1^d [(U_2^C - \Delta U^C)(C_2 - \Delta C)] \\
&+ R_1^d [(U_2^B - \Delta U^B)(B_2 - \Delta B)] \\
&+ R_1^d (E_2 - \Delta E_1) \\
&= R_1^d (U_2^C C_2 - U_2^C \Delta C) \\
&- R_1^d (U^C C_2 + U^C \Delta C) \\
&+ R_1^d (U_2^B B_2 + U_2^B \Delta B) \\
&- R_1^d (U^B B_2 + U^B \Delta B) \\
&+ R_1^d (E_2 - \Delta E) \\
&= R_1^d [U_2^C C_2] - R_1^d [U^C C_2]
\end{aligned}$$

$$- R_1^d [U_2^C C - U^C \Delta C]$$

$$+ R_1^d [U_2^B B_2] - R_1^d [U^B B_2]$$

$$- R_1^d u_2^B B - U^B \Delta B]$$

$$+ R_1^d [E_2 - \Delta E]$$

(A3.4)

Equation (A3.4) can be written as:

$$R_1^d [U_2^C C_2 + U_2^B B_2 + E_2]$$

$$- R_1^d [U_1^C \Delta C + U^C C_2]$$

$$- R_1^d [U_1^B \Delta B + U^B B_2]$$

$$- R_1^d \Delta E$$

(A3.5)

Then $\Delta X = X_2 - X_1$ can be decomposed as:

$$\Delta X = R_2^d (U_2^C C_2 + U_2^B B_2 + E_2) - R_1^d [U_2^C C_2 + U_2^B B_2 + E_2]$$

$$+ R_1^d [U_1^C \Delta C + U^C C_2]$$

$$+ R_1^d [U_1^B \Delta B + U^B B_2]$$

$$+ R_1^d \Delta E$$

(A3.6)

which can be written as:

$$\Delta X = [R_2^d - R_1^d] [U_2^C C_2 + U_2^B B_2 + E_2]$$

$$+ R_1^d [U_1^C \Delta C + U^C C_2]$$

$$+ R_1^d [U_1^B \Delta B + U^B B_2]$$

$$+ R_1^d \Delta E$$

(A3.7)

The first term on the RHS of the above can be written as:

$$[R_2^d - R_1^d] [X_2 - A_2^d X_2] = [R_2^d - R_1^d] [I - A_2^d] X2$$

$$= [R_2^d - R_1^d] [I - A_2^d] X_2$$

$$= [R_2^d - R_1^d]\,[Q_2]\,X_2 \qquad (A3.8)$$

where $Q_2 = [I - A_2^d]$

Thus, we have:

$$\begin{aligned}
[R_2^d - R_1^d]\,[Q_2]\,X_2 &= R_2^d Q_2 X_2 - R_1^d Q_2 X_2 \\
&= [X_2 - R_1^d Q_2 X_2] \\
&= [I - R_1^d Q_2] X_2 \\
&= R_1^d [(I - A_1^d) - (I - A_2^d)] X_2 \\
&= R_1^d [I - A_1^d - I + A_2^d] X_2 \\
&= R_1^d [A_2^d - A_1^d] X_2 \\
&= R_1^d \Delta A^d X_2
\end{aligned} \qquad (A3.9)$$

Change in output between two periods can now be written as:

$$\begin{aligned}
X = \; & R_1^d \; U_1^C \Delta C \\
& + R_1^d \; U_1^C \Delta B \\
& + R_1 d \; E \\
& + R_1^d \Delta U^C C_2 \\
& + R_1^d \Delta U^B B_2 \\
& + R_1^d \Delta A^d X_2
\end{aligned} \qquad (A3.10)$$

The last term measures the total impact of variation in the domestic input-output coefficent. These can be further subdivided into those originating in changes in the technology matrix and imort substitution of intermediate goods. An element of the domestic IO

coeffcient matrix A^d can be written as:

$$a_{ij}^d = a_{ij} - a_{ij}^m$$

The first term on RHS represents changes in the technology matrix. The second term mixes overall changes in technology (a_{ij}^d and a_{ij}^m) and substitution between

a_{ij}^d and a_{ij}^m with given techology a_{ij}. To separate these two Syrquin defines an auxilliary matrix $\hat{a}_{ij2}$ which tells us what the import matrix in period 2 would have been if all changes had been due to import substitution only, with no overll change in a_{ij}. A typical element of the auxilliary marix can be defined as:

$$\hat{a}_{ij2} = a_{ij2}^m \, (a_{ij1}/a_{ij2}) \qquad \text{(A3.11)}$$

$$a_{ij}^m = (a_{ij2}^m - \hat{a}_{ij2}) + (\hat{a}_{ij2} - a_{ij}^m) \qquad \text{(A3.12)}$$

define:

$$m_{ij2} = \frac{a_{ij2}^m}{a_{ii2}} \qquad \text{(A3.13)}$$

then,

$$a_{ij}^m = a_{ij} * m_{ij} \qquad \text{(A3.14)}$$

(A3.12) can now be written as:

$$a_{ij}^m = [\{(a_{ij2}^m * a_{ij2}) - (m_{ij2} * a_{ij1})\} + \{(m_{ij2} * a_{ij1}) - (m_{ij1} * a_{ij})\}]$$

$$= [(m_{ij2} * a_{ij}) + (m_{ij} * a_{ij1})] \qquad \text{(A3.15)}$$

hence,

$$\Delta a_{ij}^{d} = \Delta a_{ij} - [\, m_{ij2} * \Delta a_{ij}) + (\Delta m_{ij} * a_{ij1})]$$

$$= [\, a_{ij} - (m_{ij2} * \Delta a_{ij}) - (\Delta m_{ij} * a_{ij1})]$$

$$= [\, \{(1 - m_{ij2})\Delta a_{ij}\} - (\Delta m_{ij1} * a_{ij1})$$

(A3.16)

Since $m_{ij} = a_{ij}^{m}/a_{ij}$, and $u_{ij}^{W} = a_{ij}^{d}/a_{ij}$, then,

$m_{ij} + u_{ij}^{W} = 1$ or $1 - m_{ij} = u_{ij}^{W}$; and $m_{ij} = - u_{ij}^{W}$.

Then, (A3.16) can be written as:

$$a_{ij}^{d} = [\, (u_{ij2}^{W}\Delta a_{ij}) - (\Delta u_{ij}^{W} a_{ij1})] \qquad \text{(A3.17)}$$

Therefore R_1^{d} A^{d} X_2 (its elememts) can be written as:

$$R_1^{d}\ [\Delta u_{ij}^{W}\ a_{ij1}]X_2 + R_1^{d}[u_{ij}^{W}\Delta a_{ij}]X_2$$

Thus equation (A3.10) can be written as :

$$\begin{aligned} X = {} & R_1^{d}\ U_1^{C}\Delta C \\ & + R_1^{d}\ U_1^{B}\Delta B \\ & + R_1^{d}\Delta E \\ & + R_1^{d}\Delta U^{C} C_2 \\ & + R_1^{d}\Delta U^{B} B_2 \\ & + R_1^{d}\ [\Delta u_{ij}^{W}\ a_{ij1}]X_2 \\ & + R_1^{d}[u_{ij}^{W}\Delta a_{ij}]X_2 \end{aligned}$$

BIBLIOGRAPHY

Ahmad, J., "Import Substitution and the Growth of Exports: An Econometric Test", Revue Economique 1976, no, 2, pp. 286-96.

Ahmad, J., Import Substitution, Trade and Development, JAI Press, 1978.

Amsdem, A.H., "The State and Taiwan's Economic Development", in P. Evans et. al. (eds.), Bringing The State-in Back, 1985.

Ballance, R.H., H.F. Forstner and T. Murry, "Consistency Tests of Alternative Measures of Comparative Advantage", Review of Economics and Statistics vol. 69, 1986, pp. 157-61.

Balassa, B., and Associates, The Structure of Protection in Developing Countries, The Johns Hopkins University Press, 1971.

Balassa, B., "Exports and Economic Growth: Further Evidence", Journal of Development Economics, vol.5, 1978, pp. 181-9.

Balassa, B., "Accounting for Economic Growth: The Case of Norway", Oxford Economic Papers, vol. 31, 1979 pp. 415-36.

Balassa, B., "The Process of Industrial Development and Alternative Development Strategies", Princeton Essays in International Finance, vol. 141, 1981.

Balassa, B., (ed.), Development Strategies in Semi-Industrialized Economies, Baltimore, The Johns Hopkins University Press, 1982.

Balassa, B., "Comparative Advantage in Manufactured

Goods:
A Reappraisal", Review of Economics and Statistics, vol. 68, 1986, pp. 315-19.

Balassa, B.,"The Role of Foreign Trade in Economic Development of Korea", in W. Galenson(ed.), Foreign Trade and Investment: Economic Development in Newly Industrializing Asian Countries, The University of Wisconsin Press, 1985.

Balassa, B., "The Lessons of East Asian Development: An Overview", Economic Development and Cultural Change, Special Issue, vol. 36 no.3, 1988, pp.

s273-s290.

Baldwin, R.E., "Determinants of the Commodity Structure of US Trade", American Economic Review, vol. 61, 1971, pp. 126-46.

Baneriji, R., and Riedel, J., "Industrial Employment Expansion under Alternative Trade Strategies: The Case of India and Taiwan, Journal of Development Economics, vol. 7, 1980, pp. 567-77.

Baran, P. A., The Political Economy of Growth New York: Monthly Press Review, 1957.

Baruh, J., "Factor Proportions in Israel's Manufacturing Trade, 1965-1982", Journal of Development Economics, vol. 24, 1986, pp. 131-39.

Batra, R.N.,Studies in the Pure Theory of International Trade, London: Macmillan, 1973.

Baum, C.f., and D.T. Coe, "A Logit Analysis of the Factor Content of West German Foreign Trade", Weltwirtshafliches Archiv, vol. 120, 1978, pp. 328-37.

Bergsman, J., "Commercial Policy, Allocative Efficiency and X-Efficiency", Quarterly Journal of Economics, vol 88, 1974, pp. 409-33.

Bhagwati, J.N., and Srinivasan, T.N., "The Theory of Wage Differentials: Production Response and Factor Price Equalization", International Journal of Economics vol. 3, 1971.

Bhagwati, J.N., "The Heckscher-Ohlin Theorem in the Multi-Commodity Case", Journal of Political Economy vol. 80, 1971, pp. 1052-55.

Bhagwati, J.N., and Srinivasan, T.N., "On Realizing the Harris-Todaro Model: Policy Ranking in the Case of Sector-Specific Sticky Wages", American Economic Review, vol. 64 1974, pp. 502-8.

Bhagwati, J., Foreign Trade Regimes and Economic Development : Anatomy and Consequences of Exchange Control Regimes, NBER, 1978.

Bhagwati, J., "Rethinking Trade Strategies", in J. P. Lewis and V. Kallab (eds.), Development Strategies Reconsidered, Transaction Books, 1986.

Bhagwati, J., "Outward Versus Inward Policies: Trade Issues", in Corbo, V., M. Goldstein and M. Khan (eds.), Growth Oriented Adjustment Programmes, IMF and the World Bank, 1986.

Bhagwati, J., "Comment On", Transitional Growth and World Industrialization, By H.B. Chenery, in B. Ohlin, P. Hesselborn, and P. Wijkman (eds.), The International Allocation of Economic Activity, London: Macillan, 1977.

Bienefeld, M., "The International Context for National Development Strategies: Constraints and Opportunities in a Changing World", Bienefeld M. and Godfrey, M., (eds.), The Struggle for Development: National Strategies In International Context, John Wily and Sons, 1982.

Blumental, T., and C.H. Lee, "Development Strategies of Japan and the Republic of Korea, The Developing Economies, vol. no. 1985, pp. 235- .

Bowen, H.P., E.E. Leamer and L. Sveikausakas, "Multicountry Multifactor Tests of the Factor Abundance Theory", American Economic Review, vol. 77, 1987, pp. 791-809.

Bradford, Colin,I.,Jr., "Changing The Structure of Trade and New Forms of Adjustment Policies", in Guerrieri P. and P.C. Padoan (eds), The Political Economy of International Co-operation, Croom Helm, 1986.

Bradford, C.I. Jr., "East Asian 'Models': Myth and Lessons", in J. P. Lewis and V. Kallab (eds.), op.cit.

Brecher, R. A., "Minimum Wage Rates and the Pure Theory of International Trade", Quarterly Journal of Economics, vol. 88, 1974, pp. 98-116.

Branson, W.H., and N. Monoyios, "Factor Inputs in US Trade", Journal of International Economics, vol. 7, 1977 pp. 111-31.

Bruno, M., "Domestic Resources Costs and Effective Protection: Clarification and Synthesis", Journal of Political Economy, vol. 80, 1972, pp. 16-33.

Bulmel-Thomas, V., Input-Output Analysis in Developing Countries: Sources, Methods and Applications, John Wiley and Sons, 1982.

Celasun, M., Sources of Industrial Growth and Structural Change: The Case of Turkey, World Bank Staff Working Paper 614, Washigton D.C., 1983.

Chenery, H.B., "Pattern of Industrial Growth", American Economic Review. vol. 50, 1960, pp. 679-733.

Chenery, H.B., Shishido, S., and Watanabe, T., "The Pattern of Japanese Growth, 1914-1954", Econometrica, vol. 30, 1962, pp. 98-139.

Chenery, H.B., and L. Taylor, "Development Patterns Among Countries and over Time", Review of Economics and Statistics, vol. 50, 1968, pp. 391-416.

Chenery, H.B., and Syrquin, M., Pattern of Development 1950-1970, Oxford University Press, 1975.

Chenery, H.B.,"Transitional Growth and World Indsutrialization, in B. Ohlin, P. Hesselborn, and P. Wijkman (eds.), op.cit.

Chenery, H.B., and Syrquin, M., "A Comparative Analysis of Industrial Growth", in R. C. O Mathews (ed.) Measurement, History and Factors of Economic

Chenery, H.B., Structural Change and Development Policy Oxford University Press, 1979.

Chenery, H.B., "Interaction Between Industrialization and Exports"., American Economic Review Papers and Proceeding, vol. 70, 1980, pp. 281-7. Growth, New York: Macmillan, 1980.

Chenery, H.B., and Syrquin, M., "The Semi-Industrial Countries", in H. B. Chenery, S. Robinson, and M. Syrquin (eds.), Industrialization and Growth, New York: OUP, 1986.

Chow, G.C., "Discussion On", Sun C., and M. Liang, "Savings in Taiwan: 1953-1980", Conference on Experiences and Lessons of Economic Development in Taiwan, Taipei, Institute of Economics, Academia Sinica, December 18-20, 1981.

Chou, T.C., "The Pattern of Strategy of Industrialization in Taiwan: Specialization and Offsetting Policy", The Developing Economies, vol. XXXIII, no.2, June 1985.

Clark, C., The Condition of Economic Progress, 1957.

Clark, D.P., "The Protection of Unskilled -Labour in The United States: Further Evidence", Journal of Political Economy, vol. 88, 1980, pp. 1249-54.

Cline, W.R, "Can The East Asian Model of Development Be Generalized?" World Development, vol. 10, no. 2, 1982, pp. 81-90.

Cline, W.R., Exports of Manufactures from Developing

Countries: Performance and Prospects for Market Access, Washington D.C. 1984.

Cline, W.R, "Reply", World Development, vol. 13, no. 4 1985, pp. 547-8.

Corbo, V., and Meller, P., "Alternative Trade Strategies and Employment Implications: Chile", mimeo, 1976.

Corbo, V., and Meller, P., "Alternative Trade Strategies and Employment Implications: Chile", in Krueger, A.O., et. al., (eds.), Trade and Employment: in Developing Countries Individual Studies, NBER, 1981.

Corden, W.M., and R. Findlay, "Urban Unemployment, Inter-Sectoral Capital Mobility and Development Policy", Economica, vol. 42, 1975, pp. 59-78.

Corden, W.M., Trade Policy and Economic Welfare, Oxford: Clarendon, 1974.

Council for Economic Planning, Government of Taiwan, Statistical Data Book, 1985.

Council for Economic Planning, Government of Taiwan, Input-Output Tables, 1961, 1964, 1966, 1969, 1971, 1974, 1976, 1979, 1981 and 1984.

Courakis, A.S., and F.M., Roque, "An Enquiry into the Determinants of net Exports Pattern of Portugal's Trade in Manufactures", Economia, vol. 11, 1984 pp. 299-331.

Craft, N.F.R, and M. Thomas, "Comparative Advantage in UK Manufacturing Trade, 1910-1935", Economic Journal vol. 96 1986, pp. 629-45.

Darrat, A.F., "Are Exports an Engine of Growth? Another Look at the Evidence," Applied Economics, vol. 19 February, 1987 pp. 695-700.

Datta, A., "Understanding East Asian Economic Development", Economic and Political Weekly, vol. 22,

April 14, 1987, pp. 602-606.

Deardorff, A.V., "Weak Links in the Chain of Comparative Advantage", Journal of International Economic Review, vol.9, no. 2, May, 1979, pp. 197-208.

Deardorff, A.V., "The General Validity of the Hecksher-Ohlin Theorem", American Economic Review vol. 72 1982, pp. 683-694.

Deardorff, A.V., "The General Validity of the Law of

Comparative Advantage", Journal of Political Economy, vol. 88, no. 5, 1980, pp. 941-957.

Deardorff, A.V,. "Testing Trade Theories and Predicting Trade Flows", in R.W. Jones and P.B. Kenen (ed.), Handbook of International Economics, North Holland, 1982.

Deardorff, A.V., "Trade Policy and Factor Prices in Krueger's Model of Developing Countries Trade", Institute of Public Policy Studies, Discussion Paper no. 188, Michigan University, 1983.

Dervis, K., J. de Melo and S. Robinson, General Equilibrium Models for Development Policy, Cambridge England University Press, 1982.

Deyo, F. C., "Coalitions, Institutions, and Linkage Sequencing: Toward a Strategic Capacity Model of East Asian Development", in F. C. Deyo (ed.), The Political Economy of New Asian Industrialization Ithaca: Cornell University Press, 1987.

Directorate-General of Budget, Accounting and Statistics, Executive Yuan, National Income of the Republic of China, various years.

Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Census of Industry and Commerce, The Republic of China, various years.

Donges, J.B., "A Comparative Survey of Industrialization Policies in 15 Semi-industrial Countries", Welwirtschaftliches Archiv, Band 112, Heft 4, 1976, pp. 626-59.

Duller, H.J., "Techniques in Taiwan: The Role of Technology in Taiwan's Past and Present Development" mimeo, Institute of the Three Principles of the People, Academia Sinica, Monograph Series No. 4, 1983.

Engelbrecht, H.J., "An Informal Sector Perspective of Employment Expansion in the Republic of Korea, 1975-1980, The Developing Economies, vol. 25 1987, pp. 19-29.

Fajnzylber, F., "Some Reflections on South-East Asia Export Industrialization", CEPAL Review, no. 15, 1981, pp. 111-32.

Fane, G., "Consistent Measures of Import Substitution" Oxford Economic Papers, vol. 25, 1973, pp. 251-61.

Fei, J. C. H., G. Ranis, and S. W. Y. Kuo, Growth with

Equity: The Taiwan Case, London: OUP, 1979.

Fei, J., "Ideology Of Economic Development in Taiwan", Conference on Experiences and Lessons of Economic Development in Taiwan Taipei, Institute of Economics, Academia Sinica, December, 18-20, 1981.

Fields, G., "Employment, Income Distribution and Economic Growth", Economic Journal, vol. 24, 1984.

Findlay, F., "Trade, Development, and State", in Ranis, G., and T. P. Schultz (eds.), The State of Development Economics: Progress and Prospectives, Basisl Blackwell, 1988..

Finger, J. M., "Factor Intensity and Leontief Type Tests of the Factor Proportions Theory, Economia Internationale, vol. 22, Aug, 1969.

Gaveli, L., "Determinants of the Structure of Swedish Foreign Trade in Manufactures, 1968-1979", Scandinavian Journal of Economics, vol. 85, 1983, pp. 485-98.

Galesson, W., (ed.), Economic Growth and Structural Change in Taiwan, Cornell University Press, 1979.

Galenson, W., "Labor Force, Wages, and Living Standard", in W. Galenson (ed.), op.cit.

Galenson, W., "How to Develop Successfully: The Taiwan Model", Proceeding Conference on Experiences and Lessons of Economic Development in Taiwan Institute of Economics, Academia Sinica, Taipei December 18-20, 1981.

Goldberg, A. S., Econometric Theory, New York: Wiley 1964.

Grabowski, R., "Taiwanese Economic Development: An Alternative Interpretation", Development and Change, vol. 19, 1988, pp. 53-67.

Graham, P., and E. Thorbecke, Planning Techniques for a Better Future, Geneva, 1976.

Gray, P.H., "The Theory of International Trade Among Developed Countries", Weltwirtschaftliches Arhiv, vol. 116 1980, pp. 447-70.

Griffin-Jones, S. and Rodriguez, E., "Private International Finance and Industrialization of LDCs", Journal of Development Economics, vol.5, 1978, pp. 47-74.

Guillaumont, P., "More on Consistent Measures of Import Substitution", Oxford Economic Papers, vol. 31, 1979, pp.

Harkness, J., and J.F. Kyle, "Factors Influencing United States Comparative Advantage", Journal of International Economics, vol. 5, 1975, pp. 153-65.

Harris, J.R., and Todaro, M.P., "Migration, Unemployment and Development: A Two Sector Analysis, American Economic Review, vol. 60, 1970, pp. 126-42.

Hazari,B.R.,The Pure Theory of International Trade and Distortions, London: Grom Helm, 1978.

Heller, P, S., "Factor Endowment Changes and Comparative Advantage: The Case of Japan, 1956-1969, Review of Economics and Statistics, vol. 58, 1976,

pp. 283-291.

Herberg, H., and Kemp, M.C., "Factor Market Distortions, the Shape of the Locus of Competetive Outputs and the Relation Between Product Prices and Equilibrium Outputs", in J.N. Bhagwati et. al (eds.), Trade, Balance of Payments and Growth. Papers in International Economics in Honor of C.P. Kinderberger, Amesterdam, North Holland, 1971.

Ho, S.P., Economic Development of Taiwan, 1860-1970 New Haven: Yale University Press, 1978.

Hou C., and C. Liang, "Education and Economic Growth in Taiwan: Mechanism of Adjustment", Conference on Experiences and Lessons of Economic Development in Taiwan Taipei, Institute of Economics, Academia Sinica, December 18-20, 1981.

Hsieh, S.C. and T.H. Lee, Agricultural Development and its Contribution to Economic Growth to Taiwan, Joint Commission for Rural Reconstruction 1969.

Hsing , M. , J. H. Power and G. P. Sicat, Taiwan and Philippines: Industrialization and Trade Policies OECD, 1971.

Institute of Economics, Academia Sinica, Conference on Experiences and Lessons of Economic Development in Taiwan Taipei, December 18-20, 1981.

Hsu, J.C., "Trade Policies and Resources Allocation in a Small Economy: The Case of Taiwan", The Developing Economies, vol. 19, 1983, pp. 229-41.

Jacoby, N. H., U.S. Aid to Taiwan: A Study of Foreign Aid, Self-help and Development, New York: 1966.

Johnson, B. F., and P., Kilby, Agriculture and Structural Transformation, Economic Strategies in Late-Developing Countries, New York, 1975.

Johnson, C., MITI and The Japanese Miracle, California: 1982.

Johnson, H. G., "Optimal Trade Intervention in the Presence of Domestic Distortions", in R. Baldwin et. al (eds.),Trade, Growth and the Balance of Payments, Chicago, 1965.

Johnson, H. G., "The State of Theory in Relation to the Empirical Analysis", in R. Vernon (ed.), The Technological Factor in International Trade, NBER, 1970.

Johnson, H.G., Technology and Economic Interindependence, London: Macmillan, 1975.

Jung, W.S. and J. Marshall, "Exports, Growth and Causality in Developing Countries", Journal of Development Economics, vol. 18, 1985, pp. 1-12.

Khanna, A., "Testing for Directinality of Trade: India's Exports of Manufacturers in the 1970's", unpublished Ph. D. Dissertation Stanford University, 1982.

Kim, C., Evolution of Comparative Advantage: The Factor Proportion Theory in Dynamic Perspectives Kiel Studies no. 177, Tunbergen 1983.

Kim, K.S., Source of Industrial Growth and Structural Change in Korea, KDI, Working Paper 77-03, 1977.

Kim, K. S., "Lessons from South Korea's Experience With Industrialization" in V. Corbo, A. O. Krueger and F. Ossa (eds.), Export Oriented Development Strategies: The Success of Five Newly Industrializing Countries, Westview Press, Boulder, Col., 1985.

Kirkpartick, Colin, "Trade Policy and Industrialization in LDCs", in N. Gemmell (ed.), Surveys in Development Economics Basil Blackwell, 1987.

Klein, Lawrence,R., "Foreword", in Lau,L.J.,Models of Development: A Comparative Study of Economic Growth in South Korea and Taiwan, ICS Press, 1986.

Koo, H., "The Interplay of State, Social Class, and World System in East Asian Development: The Cases of South Korea and Taiwan", in F. C. Deyo (ed.), The Political Economy of New Asian Industrialization, Ithaca: Cornell University Press, 1987.

Krauss M.B. and H.G. Johnson, General Equilibrium Analysis, Chicago, 1975.

Krueger, A. O., "The Experience and Lessons of Asia's Supper Exporters" in V. Corbo, A. O. Krueger and F. Ossa (eds.), op. cit.

Krueger, A. O., Growth, Factor Market Distortions and Pattern of Trade among Many Countries Princeton Studies In International Finance, no. 40 Princeton: Princeton University Press, 1977.

Krueger, A.O., "The Framework of the Country Studies" in Krueger, et. al., Alternative Trade Strategies andEmployment, NBER, 1981.

Krueger, A. O., Alternative Trade Strategies and Employment: Synthesis and Conclusions National Bureau of Economic Research, 1983.

Krueger, A. O., Alternative Trade Strategies and Employment: Synthesis and Conclusions National Bureau of Economic Research, 1983.

Kubo, Y., "A Note on the Balassa Decomposition of the Sources of Industrial Growth", mimeo. World Bank, 1976.

Kubo, Y., "Syrquin's Decomposition Decomposition Equations of Direct Method and the Interaction Terms", mimeo. World Bank, 1976.

Kubo, Y., and S. Robinson, "Sources of Industrial Growth and Structural Change: A Comparative Analysis of Eight Economies", in UNIDO Proceeding of the Seventh International Conference on Input-Output Techniques, New York, 1984.

Kuo, S. H., and C. H. Fei, "Causes and Roles of Export Expansion in the Republic of China", in W. Galenson (ed.), Foreign Trade and Investment: Economic Development in Newly Industrializing Asian Countr -ies, The University of Wisconsin Press, 1985.

Kuo, S. W. Y., The Taiwan Economy in Transition, Boulder, Col.: Westview, 1983.

Kuznets, S., "Growth and Structural Shifts", in W. Galenson (ed.), Economic Growth and Structural Change in Taiwan, Ithaca: Cornell University Press, 1979.

Kuznets, S., "Notes on the Income Distribution in Taiwan, in Klein, L., et. al. (eds.), Quantitative Economics Development, New York, 1980.

Kuznets, S., Economic Growth of Nations: Total Output and Production Structure, Harvard University Press, 1971.

Lary, H. B., Imports of Manufactures from Less Developed Countries, NBER, New York, 1968.

Lau, Lawrence J., "Introduction", in Lau, L.J., op.cit.

Lee, T. H., and K. S. Liang,"Taiwan", in Balassa et. al (eds.), op. cit.

Leff, N., "Dependency Rates and Savings Rates", American Economic Review, December, 1969, pp. 886-96.

Leontief, W. W., "Domestic Production and Foreign Trade: The American Position Re-Examined," Proceedings of the American Philosophical Society, vol. 97, Sep., 1953.

Leontief, W. W., "Factor Proportions and the Structure American Trade: Further Theoretical and Empirical Analysis", Review of Economics and Statistics, vol. 38, Nov., 1956.

Liang, K.S. and C.H. Liang, "Exports and Employment in Taiwan", Institute of Economics, Academia Sinica, Conference on Population and Economic Development in Taiwan Taipei, Taiwan, 1976.

Liang, K. S., and C. H. Liang, "Trade Strategy and Exchange Rate Policies in Taiwan", in W. Hong and L. B. Krause (eds.), Trade and Growth of Advanced Developing Countries, Soul: KDI, 1981.

Liang, K.S., "Savings in Taiwan: An Empirical Investigation", Journal of Economic Development, vol. 8, 1983, pp. 109-29.

Lin, C.Y., Industrialization in Taiwan, 1946-1972: Trade and Import Substitution Policies for Developing Countries , New York, Prager, 1973.

Little, I.M.D, Scitovsky, T., and Scott, M., Industry

and Trade in Some Developing Countries, Oxford University Press, 1970.

Little, I.M.D., "An Economic Reconnaissance", in Galenson, op. cit.,1979.

Luede-Neurath, R., "State Intervention in Export-Oriented Development in South Korea", in G. White (ed), Developmental States in East Asia, London: Macmillan Press, 1988.

Lundberg, E., "Financial and Monetary Policies", in W. Galenson (ed.), Economic Growth and Structural Change in Taiwan, Ithaca: Cornell University Press 1979.

Magee, S. P., International Trade and Distortions in Factor Markets, New York: Marcel Dekker, 1976.

Manson, T., "Trade Strategies and Employment in Ivory Coast", in Krueger, el. at., 1981.

Martin, J. P. and J. M. Evans, "Displacement Effects of Trade by the Accounting Procedure", Oxford Economic Papares, vol. 33,1981, pp.154-64.

Maskus, K.E., "Evidence of Shifts in the Determinants of the Structure of U.S. Manufacturing Foreign Trade", Review of Economics and Statistics, vol. 65, 1983, pp.515-22.

de Melo, J., "Source of Growth and Structural Change in the Republic of Korea and Taiwan: Some Comparisons" in V. Corbo, A. O. Krueger and F. Ossa (eds.), op. cit.

Morley, S.H. and G.W Smith, "On the Measurement of Import Substitution", American Economic Review, vol. 60, 1970, pp. 728-35.

Myers, Ramon, H., "The Economic Development of The Republic of China on Taiwan, 1965-1981", in Lau, op. cit.

Myint, H., "Comparative Analysis of Taiwan's Development with Other Countries", Conference on Experiences and Lessons of Economic Development in Taiwan Taipei, Institute of Economics, Academia Sinica, December 18-20, 1981.

Nabli, M. K., "Alternative Trade Policies and Employment in Tunisia", in Krueger, et. al., 1981.

Nishat, S., "Labour Content and Structure of Pakistan Manufactured Exports", Pakistan Development Review,

vol,. 16, 1977, pp. 383-404.

Nogues, J. J., "Trade Distortions,and Employment in the Argentine Manufacturing Sector", unpublished Ph.D Dissertation University of Minnesota, 1980.

Noland, M., "Newly Industrial Countries' Comparative Advantage in Manufactured Goods", Weltwirschaftliches Archiv vol. 123, 1987, pp. 679-96.

Noland, M., "The Changing Pattern of Korean Comparative Advantage, 1965-1980", Journal of International Economic Integration, vol. 2, 1986, pp. 209-21.

Ouchi, T., "Agricultural Depression and Japanese Village" The Developing Economies, vol. 5, no. 4, 1967.

Pindyck, R.S., and D.L. Rubinfeld, Econometric Models and Economic Forecasts, New York, 1976.

Pitt, M. M., "Alternative Trade Strategies and Employment in Indonesia", in Krueger, et. al., 1981. China, 1969.

Ranis, G., "Industrial Development", in W. Galenson (ed.), Economic Growth and Structural Change in Taiwan, Ithaca: Cornell University Press, 1979.

Ranis, G., "Prospects of Taiwan's Economic Development", Conference on Experiences and Lessons of Economic Development in Taiwan Taipei, Institute of Economics, Academia Sinica, December 18-20, 1981.

Ranis, G., and Orrock, L., "Latin America and East Asian NICs: Development Strategies Compared", in E. Duran (ed.), Latin America and the World Recession, Cambridge University Press, 1985.

Ranis, G., "Employment Income Distribution, and Growth in the East Asia Context: A Comparative Analysis" in V. Corbo, A. O. Krueger and F. Ossa (eds.), Export Oriented Development Strategies: The Success of Five Newly Industrializing Countries, Westview Press, Boulder, Col., 1985.

Ranis, G., and T. P. Schultz, The State of Development Economics: Progress and Prospectives, Basil Blackwell, 1988.

Ranis, G., and T.P. Schultz,"Development Economics: What Next?", in, Ranis, G., and T. P. Schultz, The State of Development Economics: Progress and Prospectives, Basil Blackwell, 1988.

Riedel, J., "Intermediate Products and the Theory of International Trade: A Generalization of the Pure Theory of Intermediate Goods", American Economic Review, June 1976, pp. 441-47.

Rybczynski, T.M., "Factor Endowment and Relative Factor Prices", Economica, vol. 22, 1955, pp. 336-41.

Roque, F.M., "Trade Theory and the Portuguese Pattern of Trade", Economia, vol. 7, 1983, pp. 455-69.

Scitovsky, T., "Economic Development in Taiwan and South Korea: 1965-81", Food research Institute Studies, vol. XIX, no. 3, 1985, pp. 215-264.

Scott, M., "Foreign Trade", in W. Galenson (ed.), op.cit.

Sen, A. K., "Public Action and the Quality of Life in Developing Countries', Bulletin of the Oxford University Institute of EconomicsandStatistics vol. 93, 1981, pp. 287-319.

Sen, A. K., "Development Which Way Now?", Economic Journal, vol. 93, 1983, pp. 745-62.

Singer, W. H., and P. Gray, "Trade Policy of Developing Countries: Some New Data", World Development vol. 15, no, 3, 1988, pp. 395-403.

Singh, S.K., Development Economics: Some Findings, Lexington Books, 1975.

Stern, R.M., "Testing Trade Theories", in P. Kenen (ed.), International Trade and Finance: Frontiers of Research, Cambridge University Press, 1975.

Stern, R.M., "Some Evidence on the Factor Content of West Germany's Foreign Trade", Journal of Political Economy, vol. 84, 1976, pp. 131-41.

Stern, R.M., and K.E. Maskus, "Determinants of the Structure of US Foreign Trade, 1958-1976", Journal of International Economics Review, vol. 11, 1981, pp. 207-24.

Stopler, W.F. and P.A. Samuelson, "Protection and Real Wages", Review of Economic Studies, vol. 9, 1941 pp. 58.73.

Sun C., and M. Liang, "Savings in Taiwan: 1953-1980", Conference on Experiences and Lessons of Economic Development in Taiwan Taipei, Institute of Economics, Academia Sinica, December 18-20, 1981.

Sung, Y.W., "Factor Proportions ans Comparative Advant-

age in a Trade Dependent Economy: The Case of Hong Kong", unpublished Ph.D Dissertation University of Minnesota, 1979.

Syrquin, M., "Sources of Industrial Growth and Change: An Alternative Measure", Paper read at the European Meeting of Econometric Society, 1976.

Tamor, K.L., "An Empirical Examination of the Factor Endowments Hypothesis", Canadian Journal of Economics, vol. 20, 1987, pp. 387-98.

Tao, Y.C., Customs Tariff Systems of the Republic of China, 1969.

Thorbecke, E., and G. Dambe, Agricultural Development and Employment Performance and Planning: A Comparative Analysis, FAO, Rome, 1974.

Thorbecke, E., "Agricultural Development", in W. Galenson (ed.), Economic Growth and Structural Change in Taiwan, Ithaca: Cornell University Press, 1979.

Travis, W.P., The Theory of Effective Protection Harvard U.P. 1964.

Travis, W.P., "The Effective Rate of Protection and the Question of Labor Protection in the US", Journal of Political Economy, vol. 76, 1968, pp. 443-61.

Tsao, J.T.H., "Factor Endowment and Trade of the United States and Taiwan: The Leontief Paradox Re-Examined" Empirical Economics, vol. 5, 1980, pp. 245-253.

Tsiang, S. C., "Exchange Rate, Interest Rate, and Economic Development: The Taiwan Experience, in Klein, L., et. al. (eds.), op.cit.

Tsiang, S.C., et. al., "Progress in Trade Liberalization: Taiwan, Republic of China", Industry of Free China, vol. LXIII, no. 6, 1985, pp. 1-15.

Tsiang, S. C., "Monetary Policy in Taiwan", Conference on Experiences and Lessons of Economic Development in Taiwan Taipei, Institute of Economics, Academia Sinica, December 18-20, 1981.

Tsiang, S.C., "Taiwan's Economic Miracle: Lessons in Economic Development", in Harberge, A. C.,(ed.), World Economic Growth: Case Studies$of Develop ed and Developing Nations, ICS Press, 1984.

Tsiang, S. C., "Reasons for the Successful Economic Take -off of Taiwan", Industry of Free China, vol. 64, no. 3, 1985, pp. 5-27.

Tsiang, S.C., "Foreign Trade and Investment Boosters For Take-off: The Experience of Taiwan", in V. Corbo, A.O. Krueger and F. Ossa (eds.), op. cit.

Tsiang, S.C., and R. Wu,"Foreign Trade and Investment as Boosters for Take-off: The Experiences of the Four Asian Newly Industrializing Countries" in W. Galenson(ed.), Foreign Trade and Investment: Economic Development in Newly Industrializing Asian Countries, The University of Wisconsin Press, 1985.

Tyler, W.G., Manucacturing Export Expansion and Industrialization in Bzazil, 1976.

Tyler, W.G., "Growth and Exports Expansion in Developing Countries", Journal of Development Economics, vol. 9, no. 1, 1981, pp. 121-30.

Urata, S., "Factor Inputs and Japanese Manufacturing Trade Structure", Review of Economics and Statistics vol. 68, 1983, pp. 678-84.

United Nations, Input-Output Tables and Analysis, Series F. no. 14, Rev. 1, New York, 1970.

Wade, R., "State Intervention in 'Outward-Looking' Development: Neoclassical Theory and Taiwanese Practice", in G. White (ed), Developmental States in East Asia, London: Macmillan Press, 1988.

Westphal, L. and K.S. Kim, Industrial Policy and Development in Korea, World Bank Staff Working Paper no. 263 Washington D.C. 1977.

Westphal, L., "Industrial Incentives in the Republic of China", mimeo. , World Bank, 1978.

White, G., "The Evidence of Appropriate Factor Proportions for Manufacturing in Less Developed Countries" Economic Development and Cultural Change vol. 27, no. 1, 1978, pp. 27-59.

White, G., and R. Wade, "Developmental States and Markets in East Asia: an Introduction", in G. White (ed), Developmental States in East Asia, London: Macmillan Press, 1988.

White, H., "A Heteroskedasticity-consistent Covariance Matrix Estimator and Direct Test for Heteroskedasticity", Econometrica, vol. 48, 1980, pp. 817-38.

Woronoff, J., Asia's 'Miracle' Economies, New York: 1986.