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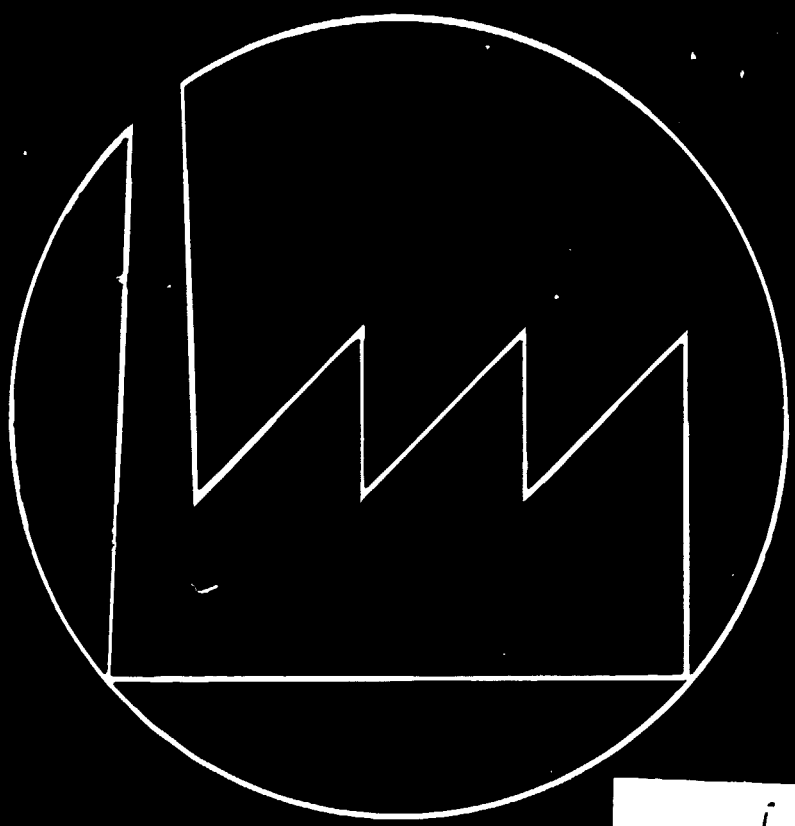
INDUSTRY IN THE 1980s
STRUCTURAL CHANGE AND INTERDEPENDENCE



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INDUSTRY IN THE 1980s: STRUCTURAL CHANGE AND INTERDEPENDENCE

Regular issue
of the biennal
Industrial Development Survey

ABSTRACT

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INDUSTRY IN THE 1980s: STRUCTURAL CHANGE AND INTERDEPENDENCE

Regular issue of the biennial Industrial Development Survey

L'INDUSTRIE DANS LES ANNEES 80 : CHANGEMENT STRUCTUREL ET INTERDEPENDANCE

Numéro bisannuel de l'Etude du développement industriel

LA INDUSTRIA MUNDIAL EN EL DECENIO DE 1980 : CAMBIO E INTERDEPENDENCIA ESTRUCTURALES

Volumen ordinario del Estudio del desarrollo Industrial bienal

ABSTRACT / SOMMAIRE / EXTRACTO

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ABSTRACT

Industry in the 1980s: Structural Change and Interdependence is the tenth edition of the *Industrial Development Survey*, which is published biennially by UNIDO. It is intended to provide an overview of major trends in world industry relating to industrial production, trade and employment as well as an analysis of selected issues.

Economic events have a vigorous momentum of their own, especially in the case of industrialization. Although the recent growth of world industry has been slow in comparison with performance in previous decades, changes are occurring at an unprecedented rate.

The industrial issues and forces confronting individual countries and the international community are often complex, and their clarification is a precondition for co-operation. Hence the approach of the *Survey* is largely in the tradition of positive economics—that is, a description of conditions as they are—rather than of normative economics—which is an exposition of conditions as they ought to be. Given the range of subjects covered and the purposes of the publication, the discussion is to some extent empirical and narrative in nature.

Structural change and interdependence are major themes of the *Survey*. In the first instance, a country's structure can be usefully described in terms of the underlying composition of different economic aggregates. An economy-wide picture could focus on the sectoral breakdown of GDP into manufacturing, agriculture, services, construction, exports, imports and so on. In a similar fashion, analysts who are concerned with the manufacturing sector will be interested in examining the composition of activities which comprise that sector. These two levels of structural analysis are used throughout the *Survey*. For certain topics, an economy-wide perspective (derived from national accounts data) is appropriate but, frequently, the scope of discussion is narrower and lends itself to an analysis of manufacturing in terms of its various industrial branches.

If the notion of structure merely referred to the composition of economic aggregates, however, it would add nothing to the analysis. The term carries other implications. Some degree of constancy in the economic structure is presumed; changes in structure are seldom abrupt, and they are permanent alterations rather than temporary or cyclical fluctuations. Moreover, structural changes are the consequence of fundamental, but obscure, economic determinants such as the pattern of resource allocation, the nature of technological advancement or lasting (not transient) shifts in market demand. Thus, the pace and direction of structural change can provide useful clues about these underlying economic determinants and their relationship to industrial policies.

With regard to interdependence, the term is not meant to be a euphemism for maintaining the *status quo*. The data and analysis in the *Survey* attest to the current or potential importance of interdependence. The concept is found to be applicable both at the international level, involving developing and developed countries or countries within the same economic grouping, as well as within the domestic economy—for example, as it relates to developments in the agricultural and manufacturing sectors or the links between small and large-scale enterprises. A number of such aspects are discussed in the *Survey*.

SOMMAIRE

L'inaustrie dans les années 80 : changement structurel et interdépendance est le dixième numéro de l'*Etude du développement industriel*, qui est publiée tous les deux ans par l'ONUDI. L'objet de l'étude est de donner un aperçu des grandes tendances de l'industrie mondiale en ce qui concerne la production industrielle, le commerce et l'emploi tout en analysant certaines questions particulières.

Les faits économiques ont leur propre dynamique, en particulier dans le cas de l'industrialisation. La croissance de l'industrie mondiale a été lente au cours des dernières années si on la compare à celle des décennies précédentes, mais des changements surviennent à un rythme sans précédent.

Les problèmes et les forces auxquels doit faire face l'industrie aux niveaux national et international sont souvent complexes, et leur clarification est une des conditions de la coopération. C'est pourquoi l'*Etude* s'inspire largement de la tradition de l'économie positive — c'est-à-dire la description de la situation telle qu'elle est — plutôt que de l'économie normative — qui est l'exposition de la situation telle qu'elle devrait être. Etant donné l'ampleur des sujets traités et l'objet de cette publication, l'analyse est dans une certaine mesure empirique et narrative.

Le changement structurel et l'interdépendance sont les grands thèmes de l'*Etude*. En premier lieu, la structure d'un pays peut être utilement décrite à partir des différents agrégats économiques qui la composent. Un tableau d'ensemble de l'économie pourrait être fondé sur la répartition sectorielle du PIB en industries manufacturières, agriculture, services, construction, exportations, importations et ainsi de suite. Les analystes du secteur manufacturier pourront examiner de la même façon les diverses activités de ce secteur. Ces deux aspects de l'analyse des structures sont présents d'un bout à l'autre de l'*Etude*. Certaines questions doivent être abordées dans une perspective d'ensemble de l'économie (à partir des données de la comptabilité nationale) mais le champ de la discussion est souvent plus restreint et se prête à une analyse de l'industrie manufacturière du point de vue de ses diverses branches.

Si la notion de structure se limitait à la composition des agrégats économiques, elle n'ajouterait rien à l'analyse. Ce mot suppose bien d'autres choses. Il évoque une certaine stabilité de la structure économique; les changements de structure se produisent rarement de façon brutale, et il s'agit plutôt de retouches permanentes que de fluctuations temporaires ou cycliques. En outre, les changements structurels sont la conséquence de facteurs économiques fondamentaux, mais obscurs, tels que le mode de répartition des ressources et la nature du progrès technique ou l'évolution durable (non passagère) de la demande. C'est ainsi que le rythme et l'orientation du changement structurel peuvent fournir d'utiles indices pour l'étude de ces facteurs économiques sous-jacents et pour leur relation avec les politiques industrielles.

En ce qui concerne l'interdépendance, le mot n'est pas considéré comme un euphémisme visant à perpétuer le *statu quo*. Les données et l'analyse figurant dans l'*Etude* attestent l'importance actuelle ou potentielle de l'interdépendance. Cette notion peut s'appliquer aussi bien à l'échelon international,

c'est-à-dire à des pays en développement et à des pays développés ou à des pays appartenant à un même groupe économique, qu'à l'économie intérieure d'un pays, dans la mesure où i'on s'intéresse, par exemple, à l'évolution des secteurs agricoles et manufacturiers ou aux relations entre petites et grandes entreprises. Un certain nombre de ces questions sont examinées dans l'*Etude*.

EXTRACTO

La Industria mundial en el decenio de 1980: cambio e interdependencia estructurales es el décimo volumen del *Estudio del Desarrollo Industrial*, que la ONUDI publica cada bienio. Su objeto es brindar un panorama de las principales tendencias de la industria mundial relativas a la producción industrial, el comercio y el empleo, así como un análisis de temas escogidos.

Los acontecimientos económicos responden a su propio y enérgico impulso, sobre todo en el caso de la industrialización. Aunque el crecimiento reciente de la industria mundial ha sido lento frente a la evolución de los decenios anteriores, los cambios tienen lugar a un ritmo sin precedentes.

Los problemas y fuerzas industriales que enfrentan los distintos países y la comunidad internacional suelen ser complejos, y su esclarecimiento es un requisito previo para la cooperación. Por ello, el criterio del *Estudio* sigue siendo principalmente la tradición de la economía positiva —esto es, una descripción de las condiciones tal como son— y no la de la economía normativa —que expone las condiciones como deben ser. Dada la variedad de temas comprendidos en esta publicación y los objetivos que persigue, el examen tiene hasta cierto punto un carácter empírico y descriptivo.

El cambio y la interdependencia estructurales son los principales temas del *Estudio*. En primer lugar, una descripción útil de la estructura de un país puede referirse a la composición fundamental de los distintos agregados económicos. Un panorama global de la economía podría concentrarse en la distribución por sectores del PIB en manufacturas, agricultura, servicios, construcción, exportaciones, importaciones, etc. De manera análoga, los analistas que se ocupan del sector manufacturero se interesarán en examinar la composición de las actividades que abarca. Estos dos niveles de análisis estructural son los que se aplican en todo el *Estudio*. Con respecto a determinados temas, si bien una perspectiva global de la economía (basada en los datos de la contabilidad nacional) es adecuada, con frecuencia, el ámbito de examen resulta más limitado y se presta a un análisis del sector manufacturero en función de sus diversas ramas industriales.

No obstante, si el concepto de estructura simplemente se refiriera a la composición de los agregados económicos no aportaría nada al análisis. El término entraña otros significados. Se presume cierto grado de constancia en la estructura económica; pocas veces los cambios en la estructura son abruptos, y se trata de alteraciones permanentes más que de fluctuaciones temporales o cíclicas. Además, los cambios estructurales son consecuencia de determinantes económicos fundamentales, pero oscuros, tales como el régimen de asignación de recursos, el carácter del adelanto tecnológico o desplazamientos duraderos (no momentáneos) de la demanda del mercado. En consecuencia, el ritmo y la orientación del cambio estructural pueden ofrecer indicios útiles acerca de estos determinantes económicos subyacentes y su relación con las políticas industriales.

Con respecto a la interdependencia, no se pretende que este término sea un eufemismo para mantener el *status quo*. Los datos y análisis contenidos en el *Estudio* confirman la importancia actual o potencial de la interdependencia. El concepto resulta aplicable en el plano internacional, que comprende países en

desarrollo y países desarrollados o países pertenecientes a una misma agrupación económica, así como en la economía interna, por ejemplo, al referirse a los adelantos en los sectores agrícola y manufacturero o a los vínculos entre empresas pequeñas y medianas. En el *Estudio* se examinan varios de estos aspectos.

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INDUSTRY IN THE 1980s

STRUCTURAL CHANGE AND INTERDEPENDENCE

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EXPLANATORY NOTES

The following classification of economic groupings is used in the text, and in most tables, in conformity with that used by the Statistical Office of the United Nations Secretariat: "Developing countries" includes all countries, territories, cities and areas in Africa (except South Africa), Latin America, East Asia (except Japan) and South Asia (except Israel). "Developed market economies" includes Northern America (Canada and the United States of America), Europe (other than Eastern Europe), Australia, Israel, Japan, New Zealand and South Africa. "Centrally planned economies" includes Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland, Romania and the Union of Soviet Socialist Republics. (For purely statistical reasons, Yugoslavia is listed in several tables as a domestic market economy.) Unless otherwise specified, "world" excludes Albania, China, the Democratic People's Republic of Korea, Mongolia and Viet Nam. In some tables, the classification may differ slightly from the above, depending on the source cited.

Unless arranged otherwise for statistical reasons, countries are generally listed in alphabetical order. In listings and tables, inclusion or exclusion of a particular country may have been dictated by considerations of the availability of comparable data; it does not necessarily express a judgement concerning the stage reached by the country in the development process.

The Federal Republic of Germany, which is cited very frequently in the present publication, is referred to as "Germany, Federal Republic of" in listings and tables (United Nations usage). To avoid unnecessary awkwardness, however, this form is used only when five or more countries are listed together.

Unless otherwise indicated, "manufacturing" includes the industry groups listed under Major Division 3 in *Indexes to the International Standard Industrial Classification of All Economic Activities* (United Nations publication, Sales No. E.71.XVII.8).

Mention of commercial enterprises does not imply endorsement of those enterprises by the United Nations.

International Standard Industrial Classification of all Economic Activities (ISIC) code numbers are accompanied by a descriptive title (for example, ISIC 323: "Manufacture of leather and products of leather, leather substitutes and fur, except footwear and wearing apparel"). For considerations of space, however, the description is sometimes shortened (e.g. ISIC 323 may be described simply as "Leather and leather products").

Dates divided by a slash (1970/71) indicate a crop year or a financial year.

Dates divided by a hyphen (1970-1975) indicate the full period involved, including the beginning and end years.

References to dollars ($) are to United States dollars, unless otherwise stated.

References to tons are to metric tons, unless otherwise specified.

Annual rates of growth or change are based on data for each year throughout the period indicated and are calculated using a semi-logarithmic regression over time, unless otherwise specified.

In tables:

Apparent arithmetical discrepancies, such as percentages that do not add precisely to totals, result from rounding of basic data or from differences in rounding of figures known to different degrees of precision;

Three dots (. . .) indicate that data are not available or are not separately reported;

A dash (—) indicates that the amount is nil or negligible;

A blank indicates that the item is not applicable;

A minus sign (-) before a figure denotes a deficit or decrease, unless otherwise indicated.

The following abbreviations are used:

United Nations Secretariat

UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization

Specialized agencies and other organizations in the United Nations system

FAO	Food and Agriculture Organization of the United Nations
GATT	General Agreement on Tariffs and Trade
IMF	International Monetary Fund

Other organizations

ASEAN	Association of South-East Asian Nations
CMEA	Council for Mutual Economic Assistance
EEC	European Economic Community
OECD	Organisation for Economic Co-operation and Development

Economic and technical abbreviations

CA	comparative advantage
CD	comparative disadvantage
GDP	gross domestic product
GNP	gross national product
RCA	revealed comparative advantage
ISIC	International Standard Industrial Classification of All Economic Activities
MVA	manufacturing value added
n.e.c.	not elsewhere classified
n.e.s.	not elsewhere specified
NMP	net material product
R and D	research and development
RNX	Donges-Riedel index
SITC	Standard International Trade Classification
TNC	transnational corporation

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I

Introduction

THE present issue of the *Industrial Development Survey* has two main purposes: *(a)* to review, as in previous *Surveys*, recent trends in fields of industry that have particular relevance for global developments, and *(b)* to analyse various aspects of industrial interdependence in the context of that pattern. Chapters II and III cover both of these purposes in broad terms, while subsequent chapters treat, in more detailed fashion, a narrow range of related topics.

Most observers agree that the foundation for today's interdependence was laid during the relatively recent era of rapid world economic growth: 1950 to the early 1970s. While the origins of this still-growing interdependence are clear, international economic relations have now assumed dimensions that could not have been anticipated at that time. The significance of interdependence has been brought more sharply into focus by the pervasive consequences of the slowdown in world industrial growth and in particular the effects of that slowdown as reflected in deteriorating terms of trade, soaring unemployment, rising protectionism and real interest rates, and sinking commodity prices.

Interdependence, however, despite the growing recognition of its importance, is an ambiguous term, the result of its having been employed in various contexts. As noted in a recent study by the Organisation for Economic Co-operation and Development (OECD), interdependence is most commonly used in an international context to refer to "North-South" relations.[1] Certainly, this usage covers the most striking cases of interdependent relationships involving, on a macro-economic level, issues concerning debt, trade, finance and energy. North-South interrelationships are equally evident when specific fields of manufacturing, or industrial branches, are the subject of analysis.[2]

The OECD study goes on to point out, however, that viewing interdependence in the light of North-South issues only may not provide a complete picture of interdependence.[3] Specifically, it suggests that while analyses of the international dimensions of the concept are useful, they may not always provide a frame of reference sufficient for treatment of the modern-day phenomenon. In line with this view, the present *Survey* has adopted a broad interpretation of interdependence. In many countries, economic conditions

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[1]Organisation for Economic Co-operation and Development, *World Economic Interdependence and the Evolving North-South Relationship* (Paris, 1983), p. 7.

[2]Previous issues of the *Survey* have examined these interrelationships against a background of a variety of industries. For a worldwide analysis of the agro-food, steel, machine-tools, consumer electronics and petrochemicals industries, see *Industry in a Changing World* (United Nations publication, Sales No. E.83.II.B.6), chapters IX, X and XI. Industrial chemicals, engineering products and food processing are treated in *World Industry in 1980* (United Nations publication, Sales No. E.81.II.B.3), chapter III.

[3]Organisation for Economic Co-operation and Development, *op. cit.*

have become increasingly dominated by problems of rising unemployment, inflation, lagging export performance and generally slow rates of growth. As one researcher has observed, "We confuse stagnant growth with 'no change' scenarios, when in fact the level of interdependence between countries may never have increased faster and the underlying structure of power changed more deeply . . .".[4] Whatever the present extent of interdependence, no country has recently enjoyed an economic performance so robust that it can afford to ignore those elements of interdependence which act as channels to transmit the benefits of growth from one field of economic endeavour to another.

Examined in these terms, the "growth-inducing" aspects of interdependence are seen to be numerous. The need to co-ordinate the monetary and fiscal policies of the major economies is widely accepted at the international level. It is also recognized that policies which boost aggregate demand in one or more countries are helpful in reviving growth elsewhere. Other examples might be regarded as "domestic" in scope, but given the widening application of interdependence, they, too, are assuming international relevance. One obvious such example is provided by the inter-industry linkages that form between rapidly growing industries and other parts of the manufacturing sector.

Inter-sectoral linkages also provide opportunities to bolster growth. Backed by a sound set of industrial policies, for instance, growth in manufacturing can provide an expansionary stimulus for growth in other sectors—and particularly for activities in the agricultural sector that are closely related to manufacturing.

"Spillover effects", whether gauged in terms of improved efficiency, greater economies of scale (either external or internal) or gains in labour productivity, may also serve as effective channels for transmitting the benefits of economic growth from one part of the economy to another.

The interdependence concept is also a useful tool for analysing wider-ranging issues, such as markets for labour or capital. Previous issues of the *Survey* have stressed the importance of small-scale industry and its contribution to total output and employment.[5] Because so little information is available regarding this sector, however, the firms involved are frequently overlooked when policies are being formulated, and their prospects suffer as a result. The analysis presented in the present *Survey* (chapter VII), suggests that the value of small-scale industry goes beyond mere employment generation. This sector can provide a vital link between rural and urban markets. In terms of efficiency, its performance can at times be favourably compared with that of large-scale industry. Policy makers must therefore recognize the impact that their decisions will have on all levels of industry and carefully weigh the implications of those decisions for employment in manufacturing as well as for the growth of productivity, trade and output.

These and other aspects of interdependence are equally applicable to both developing and developed countries. Given the extension of economic relationships between the two economic groupings, they may be more relevant than ever before. Ironically, when the concept of interdependence is cast in broader terms, many policies—both domestic and international—are seen to

[4] A. Bressand, "Mastering the 'world economy'", *Foreign Affairs*, Spring 1983, p. 745.

[5] See, for example, *Industry in a Changing World . . .*, chapter V.

have been formulated without reference to either inter-industry or inter-sectoral relationships. Some m. v even have negative consequences for growth.

Many policy makers in industry and government have changed their approach as the slowdown in the world economy has persisted. The decline or contraction[6] of certain industries has aroused the concern of Governments and the general public, as well as the industries themselves.[7] Concomitant with this concern, however, a new interest in fostering "high-growth" industries has emerged. Together, these two lines of thought have led to fears of "de-industrialization" and appeals for "re-industrialization" and a "new industrial policy". Often, new policy approaches are justified on the basis of an assessment of the conditions pertaining in selected industries, studied in isolation, ignoring trends in other industries and in the manufacturing sector as a whole.

The dangers of a myopic approach are perhaps best illustrated by reference to the law of comparative advantage. According to this law, the degree of international competitiveness is determined by relative rather than by absolute costs. In a world economy where countries trade extensively with each other, no single country can expect to be internationally competitive in every product and industry. International competitiveness is determined by a country's efficiency in a particular industry relative to its trading partners' efficiency in the same industry. Even if one country were more efficient than its trading partners in all fields of manufacturing, it would still end up exporting only those products in which its degree of efficiency was greatest, i.e. in which it held a comparative advantage. Furthermore, that country would import products in which it was (relatively) less efficient.

The law of comparative advantage is particularly useful to bear in mind when evaluating conditions in individual industries. Preoccupation with prospects in an individual industry has often led to evaluations with apocalyptic overtones. The consequences of industrial contraction—cutbacks in capacity, layoffs etc.—are extremely painful to those affected. However, it would not be logical to assign the blame for these contractions to competitors in other countries with different relative levels of efficiency. In a world of comparative criteria, a country's domestic priorities and policies may be paramount.

In the developed countries, the industries that enjoy government support usually include the computer, automated machine-tool, aerospace, chemical and telecommunications industries. This support usually goes beyond financial assistance: it may include technical and scientific assistance, and even the assurance of markets (through government purchases). Efficiency in these industries has increased dramatically in the developed countries since the early 1970s. It follows that competitive strides made by less favoured industries have

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[6]The contraction is sometimes a relative one, in the sense that output or employment in the industry concerned has failed to expand at its former pace, or, alternatively, that it has expanded at a slower pace than the rest of the manufacturing sector. Contraction could also entail an absolute fall in the industry's output or employment. Finally, a contracting industry may sometimes be described as one that has lost a portion of the domestic market to imports (although this would not necessarily mean a contraction in the earlier sense).

[7]While the situation varies from country to country, industries that may be said to be contracting in the developed countries include the steel, automobile, textile, clothing, footwear and shipbuilding industries.

been slow in comparison. As a result, patterns of comparative advantage in the developed countries have shifted. The considerable progress made by other countries (including developing ones) in industries such as textiles, clothing, leather or steel is then partly a consequence of the priorities adopted by the developed countries.

Some analysts have suggested that the extent of interdependence in today's world is so great that many policies designed with specific objectives in mind may have only a limited, or marginal, impact. National policy makers are depicted "as sailors on an open sea, taking the utmost care to adhere to the course of their choosing when in fact the currents, winds and swirls are often carrying them in the opposite direction".[8] Certainly, the extent of interdependence in the present-day world has altered the basic nature of industrial policies, whether the objectives of those policies relate to specific industries or to broad aspects of manufacturing, such as employment, technology, investment or trade. Obviously, only a few of these topics can be addressed in these pages. Readers will undoubtedly identify others equally deserving of attention.

Some of the topics chosen reflect aspects of interdependence which were traditionally regarded as purely domestic in scope, but which now, in view of the expanding range of economic interrelationships between countries, have also assumed an international character. In a number of instances, this international character predominates, but domestic issues continue to play a vital role. The trends in industrial production and trade analysed in chapters II and III, for example, have a variety of obvious international implications. They have also altered the landscape of domestic policy in many countries. Their international consequences are to be seen in the growth of interdependence among developed countries and between the economic groupings.

In chapter IV, the analysis of consumption patterns touches on one of the most important objectives of industrialization: increasing the availability of basic manufactures. The analysis illustrates the close interrelationship between *(a)* the conditions governing the sources of supply (domestic production and imports) and *(b)* the use of manufactures in terms of domestic consumption or export. These themes are echoed in chapter V, where production and trade relationships in specific industries are examined. The technological links between countries at different levels of development are considered in chapter VI, together with their consequences for trade between economic groupings. Chapters VII and VIII examine other aspects of interdependence. Chapter VII presents an analysis of employment and labour productivity, and chapter VIII a study of changing skill requirements in the manufacturing sector.

For some countries, especially the least developed ones, many of these aspects of interdependence are less applicable, as their situation can more accurately be described as one of dependence. Accordingly, chapter IX focuses on the industrial situation in some of these countries, looking at both their role in the international community and the circumstances which predominate in their domestic economies. The *Survey* concludes with an examination of one of the most important industries in terms of industrial interdependence: the agro-food industry. Some salient aspects of interdependence which emerged from the analysis are summarized below.

[8] Bressand, *loc. cit.*, p. 746.

The changing map of world industry

Chapter II reviews global trends in manufacturing value added (MVA), particular attention being given to changes in the composition of gross domestic product (GDP) and the share of the manufacturing sector in total income. The implications to be drawn from the review in respect of industrial interdependence are significant.

In the most general terms, the involvement of the developing countries in world industry has always been limited, and the data presented in chapter II point to no apparent improvement in the situation. The developing countries' share of world MVA was about 11.6 per cent in 1984: an increase of only 2 per cent since 1975. Analysis of growth rates in the manufacturing sector reveals, moreover, that:

(a) Manufacturing growth rates in the "low-income" developing countries[9] have remained consistently low, measured by global standards. This was the case even during the period of rapid world growth (1963-1973). Not surprisingly, the trend has persisted in recent years as the growth of the world economy has slowed. This has important implications for the global distribution of MVA, as more than half the entire population of the developing world is located in the low-income developing countries;

(b) The deceleration in world MVA growth rates in the mid 1970s and early 1980s was felt most by the "intermediate-income" developing countries.[10] These countries, which had previously made the most encouraging strides in their industrial development, were among the hardest hit by the slowdown.

These and other features highlighted in chapter II show that the degree to which individual developing countries participate in world industry varies widely. Even for countries that have achieved some measure of industrial success, the prospects of further progress are tenuous. Industrial interdependence, sketched in broad terms from the perspective of the developing countries, is characterized by fragmentation and fragility. Significantly, the analysis shows that the traditional relationships between industrial growth and structural change do not seem to apply to the patterns observed in many countries since the early 1970s. Manufacturing has long been regarded as the sector providing the major impetus for economic growth, and the share of MVA in GDP has tended to increase consistently, over time. This tendency, indeed, was most apparent in the structural changes that took place in the developing countries during the period 1950-1973. To a lesser extent, it was also apparent in many developed countries. However, data for 1973-1982 show that in many countries the share of MVA in GDP has declined. Moreover, changes in this share have often taken a direction opposite to movements in per capita income. While these trends are most noticeable in the case of the developed market economies, the share of MVA in GDP is also seen to decline in 43 of 95 developing countries surveyed. In many cases, manufacturing lost ground to services, but it lost to other sectors as well.

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[9]Statistically defined as countries having a per capita GNP of less than $295 in 1978.

[10]Statistically defined as countries having a per capita GNP of $600-$1,300 in 1978.

Patterns of growth in the manufacturing sector are obviously determined by the composition of output in that sector. Chapter II analyses the effects on these growth patterns of variables such as the size of the domestic market and endowments of natural resources. Broad areas of manufacturing such as the engineering, chemical, mineral transforming and consumer non-durable industries are examined in the same light. The results provide additional insights into the changes that are taking place in the patterns of growth.

International trade in manufactures

International trade, which provides one of the most obvious and easily observable measures of interdependence, is surveyed in chapter III. Trade performance is closely related to trends in world production. Not surprisingly, the slowdown in world industry has been accompanied by a decline in the value of global trade in manufactures. This decline is an unusual departure from previous trends. Although the value of world trade in manufactures increased in every year during the period 1969-1980, figures for 1981 and 1982 showed a fall. Moreover, in 1983 world trade was still below the level attained in 1980.

While the similarity between recent patterns in manufacturing production and trade is indicative of the close links between growth performance in the two fields, the prevailing pattern of trade between countries and economic groupings reveals a more problematic dimension of interdependence. The bulk of trade in manufactures continues to be confined to exchanges between countries in the same economic grouping. Between 60 and 70 per cent of the exports of manufactures by both the centrally planned economies and the developed market economies go to trading partners within the same grouping. The corresponding figure for the developing countries is far lower: between 34 and 38 per cent.

Judged by this (admittedly partial) criterion, interdependence would appear to be applicable mainly to the developed countries. Analysts and policy makers everywhere have pinned a great deal of hope for a global recovery on the resumption of growth in one or more of the developed countries. However, although such a resumption could have positive effects for the developing countries [illegible], the prevailing pattern of world trade would necessarily limit those c[illegible]s' impetus for growth. To counter the effects of mounting protectionism [illegible] to boost their exports in order to meet their financial commitments, the developing countries must identify new export markets. Trade among the developing countries themselves, however, has shown no tendency to increase since the mid-1970s.

The positive benefits of interdependence are seen to be even more limited when the global distribution of trade in manufactures is examined. The bulk of world trade is accounted for by a small number of exporters. During the 1970s, only 12 developing countries accounted for more than half the manufactures exported by that economic grouping. During the early 1980s, that proportion increased. A similar concentration is observed in the exports of the developed market economies. In this case, however, the countries involved are relatively large ones, whether measured in terms of GDP or population. In the developing countries, the leading exporters are often comparatively small. Many of the larger countries account for only a marginal share of the grouping's total exports of manufactures.

Other aspects of interdependence are considered in chapter III. An analysis is made of recent trade performance in developing countries which are major international borrowers. As the analysis is restricted to trade in manufactures, it is obviously not intended to provide a complete picture of the ability of those countries to earn foreign exchange through exports. For this, a wider-ranging examination of export performance would be needed, covering raw materials, oil and semi-processed commodities. Nevertheless, manufacturing is generally regarded as the sector having the most dynamic growth prospects. And exports of manufactures have expanded more rapidly than exports of other goods in recent years. On the basis of these two trade features, the growth of industrial exports can be compared against trends in debt servicing, thereby providing a useful benchmark for evaluating the ability of debtor countries to cope with their commitments. During the period 1975-1981, the growth of debt servicing commitments in most cases outstripped the value of total exports (i.e. including exports of non-manufactures). By the early 1980s, debt servicing in several countries was equivalent to over 90 per cent of the value of those countries' industrial exports. This trend is an ominous one and underlines the need for remedial policy action, at international as well as national levels, to reduce the cost of international borrowing and to help boost the export performance of the developing countries.

The final section of chapter III looks at the interrelationship between export performance and the growth of manufacturing output, focusing on export performance in recent years, when world growth has been particularly slow. It is seen that in many countries the proportion of manufacturing output destined for export has not declined. Nevertheless, the effects of the slowdown are evident when rates of growth for exports and output are compared. During the present growth cycle, the slowdown in exports has been more abrupt in most countries than the corresponding slowdown in output. This is true of both developed and developing countries. Aside from this, however, the data for the two economic groupings show markedly different patterns.

Traditionally, exports of manufactures have tended to expand at rates exceeding the growth rates of output. This relationship has generally been maintained in the developed countries in the years since 1974, although in some the two growth rates have converged. The data also suggest that a country's demand for imports varies according to its level of development and that, therefore, exporters in developing countries may be hardest hit by a slump in world demand. These tentative findings point to the need for further analysis of the interrelationship between export performance and growth in manufacturing output. They point, moreover, to the need for urgent remedial policies to be adopted, at international as well as national levels, if the developing countries' exports are to be boosted, and particularly now, when those countries' foreign exchange requirements are so crucial.

Patterns of consumption of manufactures

One of the primary justifications for industrialization is that it serves as a means of satisfying human needs, and a strong case can be made for this line of reasoning. On the other hand, some economists argue that this justification holds true only when some "ideal" form of industrialization has been achieved,

a form which in practice is seldom realized.[11] Chapter IV examines this area of concern through an analysis of patterns of consumption of basic manufactures (including consumer and essential industrial goods as well as inputs for agriculture and construction). Carried out in terms of commodity balances, the analysis not only shows consumption levels for each country surveyed, but also the role of various commodities in respect of domestic production, imports and exports. In this manner, aspects of industrial interdependence are also considered, from both domestic and international viewpoints.

Per capita consumption of almost all basic manufactures increased in the developing countries during the period 1972-1981. When the relevant figures are compared with those for the developed countries, however, two significant differences appear. First, in 1979-1981, in the case of food products and basic consumer goods, the average level of per capita consumption in the developed countries was almost six times greater than that of the developing countries. And for most of the other product categories examined, the ratio was even larger. Second, when self-sufficiency is measured by the extent to which consumption needs are met through domestic production, the developing countries are seen to have achieved this goal only in very few instances (mainly through production of primary products of basic metals). The opposite is the case where most developed countries are concerned.

Another key aspect of interdependence dealt with in this chapter is the relationship between the goals of raising domestic consumption levels and boosting exports. Commodity balances are examined in terms of the extent of "trade exposure" (exports and imports) and the relationship between this and the level of development. In many developing countries, a disproportionate share of domestic consumption is met through imports, and significant trade imbalances are common for most basic manufactures. The cumulative effects of these imbalances can restrict growth. Alternative ways of dealing with the problem are sketched in chapter IV. One frequently suggested approach would involve curbing consumption in order to boost exports.[12] While that holds most promise of immediate effect, current levels of per capita consumption in most developing countries are so low that opportunities for improving trade performance in this way are virtually non-existent.

International patterns of comparative advantage

International trade involves much more than the processing of indigenous raw materials into final goods for domestic consumption and export. It is a highly interdependent process whereby some countries produce raw materials and export them to others which, in turn, transform them into intermediate products for export to yet other countries for further processing. The degree of this interdependence, the number of processing stages involved, and the international dispersal of the stages differs from industry to industry.

Efficient production, in this context, requires the integration of processing activities throughout the world. Ideally, each processing stage should be located

[11] See, for example, R. Sutcliffe, "Industry and underdevelopment re-examined", *Journal of Development Studies*, vol. 21, October 1984, p. 123.

[12] This assumes, of course, that some portion of consumption is already being satisfied through domestic production and that the commodities involved have export potential.

where the cause of economic efficiency can best be served. This does not mean that jobs would have to be "exported", though it might mean a restructuring of employment patterns in some countries. Jobs would be lost at those stages of processing that could be accomplished more efficiently in other countries, but jobs would be gained at those stages where the "home" country had a comparative advantage. In chapter V, this dimension of interdependence is examined as it applies to four industries: textiles and apparel; iron and steel; wood and wood products; and consumer electronics. An exploratory exercise rather than a definitive test of interdependence, the examination is an extension of the analysis of international comparative advantage in industrial sectors that has appeared in the last three issues of the *Survey*.

The examination is conducted using two sets of data, on domestic consumption and trade. Two alternative patterns emerge. Countries having a comparative advantage in some industries are found to have developed those industries on the basis of export markets. Those with a comparative disadvantage still meet much of their needs through domestic production, but satisfy the remainder through imports. Countries having a comparative advantage in other industries exploit this feature only as an extension of their domestic markets.

The four industries are studied in greater detail by arranging their products according to successive stages of processing. Generally, those countries that are well endowed with raw materials gain a comparative advantage by extracting these materials and transforming them into intermediate or semi-finished products. Other countries, which lack the raw materials, import the semi-finished products and gain a comparative advantage in trade in more highly processed goods. Countries that are well endowed with raw materials rarely enjoy a comparative advantage in the final product also. On the other hand, countries that do have a comparative advantage at the final products stage are not mere importers of raw materials and exporters of finished products: they are efficient processors of imported, intermediate-stage materials that have successfully rationalized their industrial structure in accordance with the concept of international interdependence.

Technology and trade in manufactures

Chapter VI deals with one of the more complex elements of international interdependence: the influence of technological development on patterns of trade in manufactures. Trade between developing and developed countries is a special form of interdependence and particular attention is focused on this aspect. The first section of the chapter provides an empirical assessment of the relationship between technological capability and international competitive abilities in 90 selected industries. These break down into three groups: industries where competitive ability appears to be closely related to expenditure on research and development (R and D); industries where no such relationship is observed; and industries where R and D does not appear to be a crucial factor. The composition of these three groups is of interest in itself. The general impression that emerges from the assessment is that a country's level of technological sophistication and the volume of its technological inputs can be particularly important determinants of trade performance.

The second section focuses on trade performance trends in various countries with a view to evaluating, loosely, each country's performance in terms of its technological capabilities. Several developed countries are found to rely on exports to an unexpectedly high degree, given their technological capabilities. The reverse situation obtains in some developing countries which have failed to upgrade their export structure to match their level of technological sophistication. Given the need for these countries to diversify, as well as to raise the total level of their exports, domestic and international action may be needed to ensure that their technological capabilities are fully realized.

The concluding section carries the analysis one step further by providing a fairly detailed picture of North-South trade flows. R and D expenditures are seen to be most highly concentrated on the engineering (including electrical, electronic, aerospace and transport) and chemical industries. Other industries (including basic metals, food, textiles and leather) account for only a very small portion. In some instances, the "technology gap" in North-South trade closed somewhat between 1970 and 1980, but the trend was not widespread. In general, the technology gap is uneven and volatile in nature and there is an urgent need to close it in certain industries and regions.

Employment and productivity within the manufacturing sector

Most countries, in recent years, have experienced a slowdown in growth of labour productivity, coupled with a rise in unemployment. The analysis contained in chapter VII, however, shows that behind this broad, common trend several features distinguish between the developing and the developed countries. In the former countries, growth in manufacturing output is the result, primarily, of expansion in employment; gains in labour productivity play a moderate to negligible role. In the developed countries, this relationship is reversed. These countries, whether they be centrally planned or developed market economies, rely primarily on improvements in labour productivity to spur growth, however slowly, in manufacturing.

At the industrial branch level, the contrasts between the economic groupings are even more distinct. An examination of productivity trends in industries whose output expanded most rapidly in 1970-1981 shows that for the developing countries the benefits of rapid growth in output and productivity were limited as the industries concerned were almost always very small in terms of their shares in MVA and total employment. Because of the small size of these industries, and the frequent absence of close links between them and other industries, the diffusion of productivity gains was also limited. In the developed countries, the chemical, machinery and transport equipment industries generally accounted for the most rapid growth in output. Those industries all have strong links with other industries and economic sectors. Although their productivity performance in recent years has slackened, it continues to be an important impetus to growth on an economy-wide basis.

The productivity performance in those industries accounting for the largest proportion of MVA in each country was also studied. Food products or resource-based industries are typically the largest industries in the developing countries. Moreover, the dominant industries in those countries often account for a disproportionately large share of MVA. Improvements in labour

productivity, therefore, are closely tied to conditions in agriculture or mining. In the developed market economies, the dominant industries generally account for a small proportion of MVA and the range of industries is varied—facts which indicate the more diversified structure of MVA in those economies. Improvements in labour productivity in the dominant industries are likely to have positive repercussions on other industries, as well as on other economic sectors.

The second section of chapter VII looks at labour productivity and output among small-scale manufacturers. Although these manufacturers' labour productivity levels are generally below the national average, this is not always the case. Analysis of the share of value added in the gross output of both small and large firms shows that, quite often, the former have a greater proportion of value added in their gross output than do the large firms. One reason for this is that small firms frequently carry out more intensive processing of raw materials. Several characteristics of small-scale firms—their concentration in rural areas, their emphasis on the production of consumer goods for the low-income buyer, and their role as a supplier of capital goods to other small-scale operations in the agricultural, construction and transport sectors—confirm that these firms can constitute a vibrant source of employment and growth.

Skill intensities in manufacturing

The emergence of new technologies can mean significantly increased requirements of skilled labour. While development of a skilled labour force is essential if a country is to keep pace with international advances in technology, it is also a costly and long-term process. Moreover, the issues arising in connection with it are varied and often complex. For example, if advances in technology are rapid, and cut across a wide range of manufactures, the competitive advantage of producers in developing countries will be eroded as these producers depend heavily on a labour force that is largely unskilled. Similarly, technological innovations originate almost exclusively in the developed countries, where labour is comparatively expensive and not as abundant as in the developing countries. Thus, while most technological advances make use of additional inputs of skilled labour, they are also intended to reduce the total work force. For this reason, they may not always be appropriate for the developing countries. This is particularly true in the case of the least developed countries, where levels of unemployment are exceptionally high and labour skills are often minimal.

International comparisons of the type presented in chapter VIII are subject to certain statistical limitations and are contingent upon the validity of various assumptions; some of them must therefore be regarded as tentative. Nevertheless, there is evidence to suggest the emergence of trends that have important consequences for developed and developing countries alike. In the former group, for example, the most rapidly expanding industries are using increasingly greater amounts of skilled labour and physical capital. In the latter, the opposite relationship is to be observed.

Industries found to have relatively high skill intensities were analysed in an attempt to identify other common characteristics. In the developed countries, increases in skilled labour requirements often tended to be associated with the

initial skill requirements of the industry concerned. In other words, the use of skilled labour increased most rapidly in those industries which already employed a relatively skilled labour force. Moreover, skill intensity tended to increase most rapidly in those industries which employed the most physical capital. Similar generalizations concerning the developing countries proved to be difficult to make, owing to the heterogeneity of the activities carried out in each branch of industry in those countries. In several instances, however, it was observed that the level of skill in low-wage industries tended to rise rapidly during the period studied.

In an effort to bring these issues more clearly into focus, the chapter concludes with a detailed analysis of data for nine specific industrial groups. Wide variations between the economic groupings were noted in the use of physical capital in all nine groups throughout the period studied. The use of skilled labour was relatively constant, although this constancy was more evident in the developed countries than in the developing ones.

In conclusion, the interrelationships between capital usage and skill requirements are obviously crucial determinants of change in the manufacturing sector. Divergent trends can be observed in the developing and developed countries and these underline the need for further study of these interrelationships at the specific industrial activity level.

Industrial conditions in the least developed countries

The predominant economic characteristic of the least developed countries is their inability to achieve sustained increases in real standards of living. Chapter IX shows that per capita MVA in these countries, which in 1965 was $10, had risen to only $13 by 1981. These simple facts attest to the failure to integrate the least developed countries into the world economic community. They remain dependent on foreign technical assistance as well as food and financial aid. The forms of interdependence described in the present *Survey* are equally absent when the links between the various economic sectors are inspected. Per capita value added in agriculture (at constant prices) is seen to have declined by 15 per cent in the period 1965-1981. Although many factors contributed to this decline, the tenuousness of the links between agriculture and manufacturing is certainly one of them. The provision of industrial inputs for agriculture constitutes one important aspect of the inter-sectoral relationship that should be strengthened. Chapter IX also shows that very few of the least developed countries produce any major types of fertilizer. And even among these few, output declined in many instances between 1972 and 1981.

The picture of industrial development that emerges from analysis of industry in the least developed countries is essentially a microeconomic one. Structural changes, trade performance, employment generation and other issues of concern to all developing countries are often the consequence of events in only a handful of industrial plants, or even a single plant, in the case of the least developed countries. This microeconomic perspective is merely a consequence of the very limited and fragmented nature of the manufacturing sector in almost all these countries. With few exceptions, linkages between industries in the manufacturing sector are non-existent. Almost all manufacturing activities are geared to providing simple consumer goods while the

bulk of industrial inputs used by the firms are supplied through imports. Figures showing the distribution of output between light and heavy industry provide some indirect evidence of this characteristic: 80 to 100 per cent of MVA was accounted for by light industry as recently as 1980. In 1982, some 86 per cent of total imports (including non-manufactures) consisted of industrially processed goods.

The microeconomic character of industrial issues in the least developed countries is a confirmation of the way that the concept of interdependence —whether domestic or international—fails to touch those countries. Thus, efforts to address many problems may first have to be examined in light of this situation. The growing attention to the microeconomic framework within which firms operate provides some evidence of such thinking at the policy-making level. Increasingly, Governments have begun to concern themselves with the determination of relative prices (prices for final output as well as wages and interest rates) and have begun to search for ways to simplify existing systems of subsidies and taxes. In other policy-related areas, one promising avenue may be an aggressive search for opportunities to establish, through subcontracting, a wider range of international ties for existing domestic industrial plants. Here, the focus could be on the development of closer economic ties with plants in more advanced developing countries.

The evolution of agro-food systems in developed market economies and developing countries

The interrelationship between the agricultural and manufacturing sectors is one of the most crucial aspects of interdependence. It is in this context that chapter X begins with an analysis of the development of new, industrially processed food products. This development has been rapid and continuous, but has been concentrated in the agro-food industries of the developed market economies. It has, however, had significant international consequences: a diffusion of standardized patterns of food production and consumption has occurred through trade, foreign investment and imitative national investment.

The widening range of innovations and technological changes that have marked the past two decades has gradually increased the share of MVA in total food consumption. In the developed market economies, this trend has had significant implications for the market structure and organization of the industry. Links between different branches of the industry have been strengthened as agro-food systems have become more interdependent with regard to the supply and demand of essential components and ingredients.

From product development and technological advances, the chapter turns to the growing standardization in patterns of food consumption and production. While this is most pronounced in the developed market economies, large sections of the population in some developing countries (particularly those at higher levels of per capita income) have adopted similar consumption patterns. In a number of developing countries, these trends have increased the pressure on traditional food producers to adjust to the new patterns of demand and, in the process, have accentuated the dualistic structure of the agro-food complex.

The international diffusion of the developed countries' food patterns places a heavy strain on the traditional agro-food systems of the developing

countries. As consumers shift their preferences to new staples, and as producers in developing countries adopt new technologies, traditional food processing activities tend to be crowded out. This phenomenon is examined in the context of the gradual internationalization of an animal-protein food chain.

The diffusion of this chain in the developing countries is seen to have had three effects. First, it has increased the capital intensity and the productivity of agro-food operations. The initial processing of new staples, which is always more capital-intensive than that of traditional staples, is soon followed by entry into more advanced processing phases which again tend to be more capital-intensive than the average for the food industry. Some developing countries have succeeded in progressing to the final stage (occasionally for export) at which the processing units involved use the most advanced technological equipment and are as capital-intensive as similar units anywhere else in the world. Second, the output mix of the agro-food complex has changed, being marked by an increase of livestock products relative to agricultural products. Finally, expansion of the animal-protein food chain has at times led to growing divergence between the agrarian structure and the food industry. The latter, being geared to swiftly rising demand for food in the industrial and urban sectors, has become more autonomous *vis-à-vis* the agricultural sector and more dependent on imported staples, technology and know-how.

The successful integration of the animal-protein chain with staples processing and peasant agriculture is one of the most urgent tasks confronting policy makers—particularly those in low- and middle-income countries that have high rates of industrial growth and large populations. The chapter concludes by stressing the important role that must be played by the peasant economy in this integration process.

II

The changing map of world industry

THE present chapter begins with a brief account of recent changes in the global distribution of industrial activity. These changes are noteworthy for several reasons. First, observations on their direction and intensity are of help in gauging the consequences of the widely varying rates of industrial progress that apply in different parts of the world. Second, though they may open up new industrial opportunities, they can also introduce new sources of competition and lead to adjustment-related problems. Finally, they are bound to alter the direction and composition of international trade, investment and technology transfer.

The chapter continues with a study of the relative degree of industrialization in countries, as measured by the share of MVA in total income. The sluggish growth that has predominated throughout the world economy since the early 1970s has led to several unexpected shifts in basic relationships between growth and structural change. In particular, the contention that rapid expansion in manufacturing equals rapid economic growth may be less defensible today than it was earlier when economic growth rates were generally much higher.

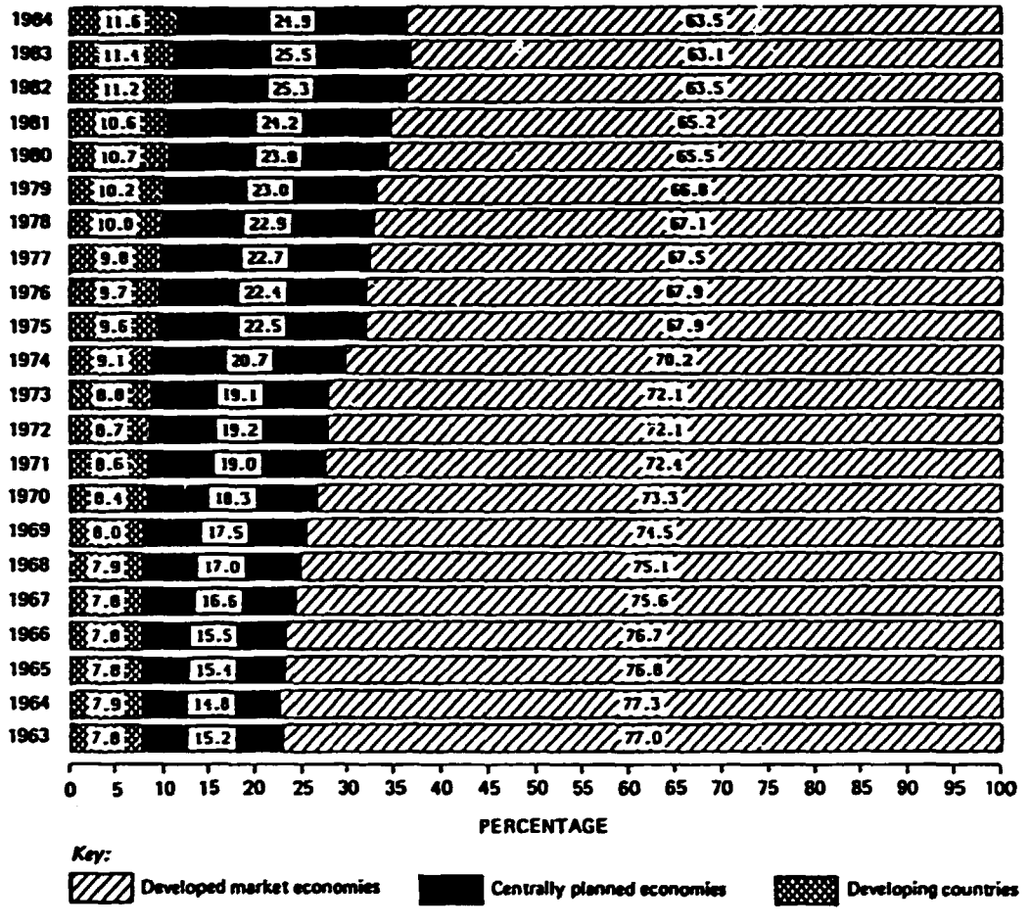
As growth performance in the manufacturing sector is governed by underlying shifts in the composition of manufacturing, the chapter concludes with a study of long-term trends in selected branches of industry. The results provide an indication of the extent to which general economic characteristics such as market size, resource endowment and level of development can alter patterns of structural change within the manufacturing sector. They also support the view that patterns of structural change are not uniform, but differ widely between economic groupings and even among countries within an economic grouping.

The global distribution of manufacturing activity

Figures I and II summarize global trends with regard to MVA distribution and growth in manufacturing. The developing countries' share in world MVA rose from 7.8 per cent in 1963 to approximately 11.6 per cent in 1984.[1] In the same period, the developed market economies' share dropped from 77 to 63.5 per cent. This fall was the result, primarily, of rapid growth in the centrally

[1]For want of comparable data, China has not been included in these compilations. Tentative estimates of that country's share in world MVA are given in appendix I to the present chapter.

Figure I. Share of economic groupings in world MVA, at constant (1975) prices, 1963-1984



Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

Note: The distribution shown above does not include China. Figures for 1982 and 1983 are preliminary. Figures for 1984 are estimates.

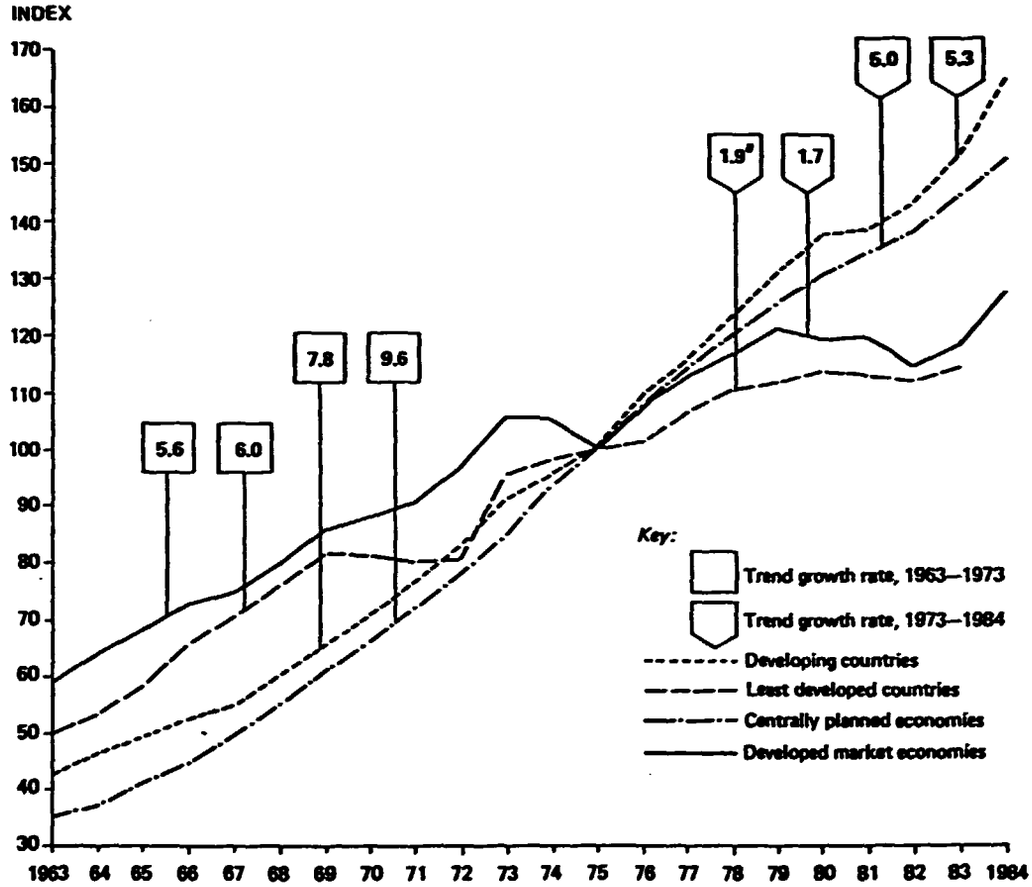
planned economies whose share rose from 15.2 to 24.9 per cent.[2] These shifts are reflected in the growth rates for MVA. In the years prior to 1973, for example, growth in the centrally planned economies and, to a lesser extent, in the developing countries, generally exceeded that reported for either the developed market economies or the least developed countries (figure II). After 1973, however, the pace of growth decelerated everywhere, although the slowdown was most marked in the developed market economies and the least developed countries.

MVA growth rates for five income groups of developing countries, over roughly the same period, are given in table II.1. The rate in the low-income

[2]Owing to conceptual differences in the national accounting practices of the developed market economies and the centrally planned economies, original data for the two economic groupings were not comparable. A statistical exercise was undertaken by the secretariat of UNIDO, therefore, to derive a set of data that would permit reliable conclusions to be drawn from a comparison of the share of the three economic groupings in world MVA. The figures for the centrally planned economies should nevertheless be regarded only as estimates needed to permit consideration of the share of manufacturing by the centrally planned economies of the world.

Figure II. Indices of industrial production in manufacturing by economic groupings, 1963-1984

(1975 = 100)



Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Covering the period 1973-1983.

Table II.1. Average annual MVA growth rates in 95 developing countries, by income group, 1963-1973 and 1973-1981

Income group	*GNP per capita, 1978 (current dollars)*	*MVA growth rate for income group (percentage)*		*Group share in population of the developing countries, 1980 (percentage)*	*Number of countries in group*
		1963-1973	*1973-1981*		
Low	295	4.6	4.7	50.7	28
Lower-middle	295-600	7.1	8.1	18.2	21
Intermediate	600-1 320	8.8	6.8	15.7	24
Upper-middle	1 320-2 415	9.1	6.1	12.3	11
High	2 415	7.5	3.7	3.1	11

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

group, which was already modest in 1973, has remained almost unaltered. It is, in fact, considerably less than the growth recorded for most developing countries since 1963. The implications of this poor performance are significant since roughly half the total population of the developing countries is involved. The table further shows that the post-1973 deceleration in MVA growth was most pronounced among countries at the $600-plus income level,[3] Thus, countries that had reached at least intermediate levels of development were more exposed to the consequences of the recession that began in the early 1970s.

Broad shifts in the economic groupings conceal many of the more subtle changes that occurred in the global map, as may be seen from table II.2, which details the role of the major industrial economies and the geographical distribution of manufacturing activity. Among the centrally planned economies, the USSR made significant gains. In 1963, that country accounted for 9.2 per cent of world MVA; by 1981 the figure had risen to 16.6 per cent. The proportion of world MVA attributed to the developed market economies as a whole declined. But, as the table shows, this decline was due mainly to trends in some of the more advanced of those economies (particularly the United States); in fact, several developed market economies, including Greece, Israel, Japan and Portugal, increased their share in world MVA, albeit at a decelerating rate in recent years.

With regard to the developing countries, the largest among them[4] increased their share of world MVA from 5.6 per cent in 1963 to 8.0 per cent in 1981. The corresponding figures for small developing countries with modest natural resources were 1.1 and 1.5 per cent, and those for small developing countries with ample natural resources were 1.0 and 1.1 per cent.[5]

In regional terms, developing countries in West Asia and in South and East Asia have had a significant increase in their share in world MVA whereas those in Africa and Latin America have had only a modest one. The situation in the least developed countries is particularly discouraging. Not only is their share in world MVA very small, but it has remained unchanged throughout the period under consideration here. In the past decade, growth in those countries has slowed considerably. It amounted to only 2.4 per cent per annum in 1973-1983, compared to 5.8 per cent per annum in 1963-1973 (figure II). This pronounced slow-down distinguishes the least developed from the other developing countries with low incomes and implies a deterioration in their performance relative to that of all developing countries. In 1981, the least developed countries accounted for only 1.52 per cent of the MVA of all developing countries, compared to 2.41 per cent in 1967.

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[3]Income groups are defined in terms of 1978 levels of GDP per capita. A definition in terms of 1960 levels was also tried, to test the sensitivity of the figures given in table II.1. The differences in the values of growth rates and in the proportions between the growth rates were found to be minimal.

[4]Developing countries with population of more than 20 million towards the mid-1970s. See list in appendix II to the present chapter.

[5]Small developing countries are divided into those with ample natural resources and those with modest natural resources, in accordance with the findings of a cluster analysis described in *World Industry since 1960: Progress and Prospects* (United Nations publication, Sales No. E.79.II.B.3). See list in appendix II to the present chapter.

Table II.2. Share of selected countries and country groups in world MVA (at constant 1975 prices), 1963-1981

(Percentage)

Year	USSR	Canada and United States	Japan	Recently industrialized developed market economies[a]	Other industrially mature developed market economies[b]	Large developing countries[c]	Small developing countries[c]		Developing countries, by region				Least developed countries
							With modest natural resources	With ample natural resources	Africa	West Asia	South and East Asia	Latin America	
1963	9.2	31.9	6.4	2.6	36.1	5.6	1.1	1.0	0.8	0.5	2.1	4.7	0.2
1973	...	26.7	9.4	3.4	32.6	6.5	1.3	1.0	0.8	0.6	2.6	5.5	0.2
1975	15.0	24.1	9.0	3.6	31.3	7.2	1.3	1.0	0.9	0.7	2.8	5.9	0.2
1977	...	24.5	9.6	3.4	30.0	7.4	1.4	1.0	0.8	0.7	3.0	5.6	0.2
1979	...	24.7	10.2	3.4	29.0	7.7	1.4	1.1	0.9	0.9	3.1	5.7	0.2
1981	16.6	23.9	10.5	3.5	27.3	8.0	1.5	1.1	1.0	1.0	3.2	5.9	0.2

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis of the United Nations Secretariat.

[a] Greece, Ireland, Israel, Malta, Portugal, South Africa, Spain.

[b] Australia, Austria, Belgium, Denmark, Finland, France, Germany, Federal Republic of, Italy, Luxembourg, Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom.

[c] For country composition, see appendix II to the present chapter.

Table II.3 shows the distribution of manufacturing activity among developing countries and areas, highlighting the 10 which made the largest contribution to the total MVA of that economic grouping at various times. The predominant feature of the table is the relative deterioration in the contribution of manufacturing in Latin America and its growth in South and East Asia. In 1981, Brazil and Mexico together accounted for 37 per cent of the developing countries' total MVA. Data for 1963 show that in that year six of the largest contributors were Latin American countries: together they accounted for over 48 per cent of the developing countries' total MVA. By 1981, however, only four Latin American countries were still among the ten largest contributors, and their combined share was less than 44 per cent. This deterioration can be attributed to the recession which struck Latin America during the late 1970s and early 1980s, the worst experienced since the 1930s. The result was a shift in the impetus for industrial growth: by 1981, Hong Kong, Indonesia and the Republic of Korea had emerged among the grouping's leading suppliers of manufactures.

To look at the contributions made to global MVA at selected times, however, is to see only a portion of the industrial map. To obtain a more complete picture, it is necessary to consider changes in the contribution of each economic grouping. Table II.4 shows incremental additions to world MVA, expressed as percentages of the total increase (at 1975 prices). A clear distinction can be made between trends in the developed market economies and those in the rest of the world. By comparing figures for 1963-1973 and 1973-1981, it will be seen that the developed market economies' incremental contribution to world MVA fell from 66.8 to 37.6 per cent. Much of this decline can be attributed to two downturns in growth, one of which occurred in 1974-1975, the other in 1980-1981. Even during the interim period (1975-1979), a clear distinction between the activities of the three economic groupings is apparent. Because growth in the centrally planned economies has remained comparatively steady, its relative significance is greatest in years of slow world growth. Finally, the figures show that the developing countries have consistently provided an input to world growth in manufacturing that has far exceeded their corresponding share in world MVA.

Table II.5 provides similar data in respect of individual developing countries. Two different groups can be noted. Five countries or areas—Brazil, Hong Kong, India, Mexico and the Republic of Korea—have consistently provided a strong growth impetus to world industry. Others, however, have made only sporadic contributions to growth. In periods of slow world growth, countries whose economic output stagnates or declines are numerous. Countries which can provide strong impetus to growth during these periods assume added significance. This fact is illustrated in the last column of table II.5 where it can be seen that the 10 countries or areas which contributed most to growth accounted for 105 per cent of incremental output, meaning that the cumulative addition to MVA provided by all other developing countries was negative. This points to the limited participation of many developing countries in the industrialization process. Industrial progress in the developing countries is dominated by the performance of a few countries and, to a lesser extent, by sporadic bursts of growth in a limited number of other countries. While such a pattern can provide instances of encouraging industrial performance, these

Table II.3. The 10 developing countries or areas with the largest share in the MVA (at constant 1975 prices) of their economic grouping, 1963, 1973 and 1981[a]

(Percentage)

1963		1973		1981	
Country or area	*Share of MVA*	*Country or area*	*Share of MVA*	*Country or area*	*Share of MVA*
Brazil	19.64	Brazil	22.74	Brazil	22.71
India	13.48	Mexico	12.36	Mexico	13.88
Mexico	10.71	India	9.06	India	8.61
Argentina	9.02	Argentina	8.40	Republic of Korea	4.86
Venezuela	3.81	Turkey	4.21	Argentina	4.85
Turkey	3.43	Venezuela	3.08	Turkey	3.69
Philippines	2.82	Republic of Korea	2.85	Indonesia	2.77
Peru	2.76	Philippines	2.48	Philippines	2.62
Chile	2.40	Peru	2.30	Venezuela	2.46
Egypt	2.10	Iran (Islamic Republic of)	2.06	Hong Kong	2.27
Total	70.17	Total	69.54	Total	68.72

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Data were available for 97 developing countries.

Table II.4. Contribution of economic groupings to increase in world MVA (at constant 1975 prices)

(Percentage)

Economic grouping	*1963-1973*	*1973-1981*	*1973-1975*	*1975-1977*	*1977-1979*	*1979-1981*
Developed market economies	66.8	37.6	−2 080.6	64.5	58.5	−54.1
Centrally planned economies	23.4	44.4	1 750.9	24.5	25.9	113.5
Developing countries	9.8	18.0	429.7	11.0	15.6	40.6

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

Table II.5. Contribution of selected developing countries and areas to the increase in MVA of their economic grouping (at constant 1975 prices)[a]

(Percentage)

1963-1973		*1973-1975*		*1975-1977*		*1977-1979*		*1979-1981*	
Brazil	25.4	Brazil	27.8	Brazil	25.2	Brazil	25.7	Mexico	35.0
Mexico	13.8	Mexico	15.4	Republic of Korea	8.7	Mexico	19.1	Indonesia	14.6
Argentina	7.9	Iran (Islamic Republic of)	9.7	India	8.5	Republic of Korea	10.0	India	13.5
India	5.2	Republic of Korea	9.0	Mexico	7.0	India	6.3	Hong Kong	8.7
Turkey	4.9	Turkey	5.9	Turkey	4.8	Indonesia	4.5	Pakistan	6.9
Republic of Korea	4.5	Indonesia	4.7	Thailand	4.1	Hong Kong	3.7	Republic of Korea	5.9
Iran (Islamic Republic of)	2.6	India	4.1	Hong Kong	3.7	Iraq	3.6	Egypt	5.5
Venezuela	2.4	Peru	3.4	Iran (Islamic Republic of)	3.4	Nigeria	3.2	Singapore	5.0
Philippines	2.2	Thailand	2.9	Philippines	3.2	Thailand	2.7	Philippines	5.0
Hong Kong	1.9	Egypt	2.5	Argentina	3.0	Saudi Arabia	2.2	Nigeria	4.9
Total	70.8	Total	85.4	Total	71.6	Total	81.0	Total	105.0

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Data were available for 97 developing countries.

instances are often isolated. They have little impact on the bulk of the population in the developing countries and, perhaps, only limited applicability to industrial conditions in those countries. Such a wide disparity in industrial capabilities is a poor substitute for the more broadly based effort that is required to alleviate poverty and better integrate the industrial efforts of individual developing countries.

Up to now, the global spread of industrial activity has been described in terms of MVA generated in selected country groupings. But it should also be gauged in relation to the distribution of world population. Table II.6 shows levels of MVA per capita in selected years. A striking diversity is observed among the developing countries. For example, in the least developed countries, MVA per capita was only $13 in 1981; indeed, between 1963 and 1981 it rose by only $4. Per capita MVA in both Africa and South and East Asia was also low in 1981—less than 3 per cent of the average for the developed market economies. Figures for West Asia and Latin America were considerably higher. Although the former region accounted for only 1 per cent of world MVA, its per capita level was 10 per cent of that attained in the developed market economies. The corresponding figure for Latin America was 19.2 per cent. Despite the advantages which large countries in general are thought to enjoy through economies of scale, per capita MVA in large developing countries is only equal to, or even less than, that in smaller developing countries. With regard to the growth of per capita MVA, the achievements of the centrally planned economies were unmatched by any other grouping. MVA per capita in that grouping trebled between 1963 and 1981 and by the latter year was 77 per cent of the level reported for the developed market economies (up from 48 per cent in 1963).

Again, the broad trends in the three economic groupings conceal wide variations in the performance of individual countries. Between 1973 and 1981, per capita MVA in the developing countries increased by 25 per cent, although in about one third of those countries it actually declined. With certain qualifications,[6] MVA per capita provides some measure of the contribution of manufacturing to the standard of living. The fact that manufacturing levels have fallen in recent years in many developing countries is a matter of concern, therefore. In the following section, these aspects are considered in greater detail, especially those aspects concerned with patterns of structural change subsequent to 1973.

The degree of industrialization

A prominent feature of the development process is that, relative to other sectors, manufacturing generally assumes added importance as per capita income rises.[7] The degree of industrialization achieved by a given country can

[6]The MVA per capita ratio does not fully measure the contribution of manufacturing to the standard of living, for two reasons. First, manufacturing activities generate external economies whose impact on the standard of living is, by definition, not recorded using the usual accounting methods. Second, the real contribution of value added to the standard of living can be assessed only if the prices of outputs, factors and inputs are correct guides to their values—a condition, as is well known, that more often than not is not fulfilled in the real world economy.

[7]See *World Industry since 1960 . . .*, annex I.

Table II.6. MVA (at constant prices) per capita in selected country groupings, 1963, 1973 and 1981

(Dollars)

Year	Centrally planned economies	Developed market economies	Developing countries	Developing countries in:				Large developing countries	Small developing countries with modest natural resources	Small developing countries with ample natural resources	Least developed countries
				Africa	West Asia	South and East Asia	Latin America				
1963	407	996	48	24	83	22	172	44	48	79	9
1973	897	1 623	81	38	153	34	289	75	78	104	14
1981	1 333	1 729	101	46	175	51	332	97	94	131	13

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

be measured by the share of MVA in total income (i.e. GDP) in that country. For countries at the early stages of development, the share of MVA is low, but it rises rapidly as per capita income increases. Thus, in low-income developing countries roughly 16 per cent of GDP, on average, originates in the manufacturing sector. Comparable figures for middle-income and high-income developing countries are 18 and 21 per cent, respectively. The average is around 28 per cent in the developed market economies.[8]

Of course, the relative importance of a specific sector is not entirely dependent on the level of per capita income. Because the composition of GDP is also influenced by the particular circumstances of individual countries, the average share of MVA in GDP will vary widely. For example, in 51 low-income developing countries surveyed, the degree of industrialization was found to be less than 10 per cent in 25 cases, but between 16 and 27 per cent in another 10. Similarly, in 24 middle-income developing countries surveyed, 8 had a degree of industrialization of between 18 and 34 per cent, but 4 had one of less than 10 per cent. Finally, in 23 high-income developing countries, the degree of industrialization in 8 cases was less than 10 per cent.

Even among developed market economies regarded as having reached a relatively mature stage of industrial development, the share of MVA in GDP varies from 11 to 37 per cent. In spite of these sometimes significant variations, most economists are satisfied that the share of MVA rises with growth in per capita income and that the relationship between income levels and economic structure is applicable to most countries. The following analysis of recent trends, however, suggests that this interpretation might well be reviewed.

In the period 1973-1982, the degree of industrialization declined in many countries and the direction of structural change was often contrary to that of per capita income (see table II.7). The decline was particularly noteworthy for three reasons. First, it affected all categories of countries. While it was particularly acute in the developed market economies (where manufacturing lost ground relative to other sectors in 21 of 26 countries surveyed), it also affected the developing countries. The degree of industrialization, calculated at current prices, declined in 25 out of 48 low-income developing countries, in 10 out of 24 middle-income countries, and in 14 out of 23 high-income countries.

Second, the decline was apparent no matter whether data were based on constant or current prices. Although the share of MVA declined less frequently when measured at constant prices, such decline was by no means uncommon. A relative decline in manufacturing was observed in more than half of the developed market economies and low-income developing countries surveyed.[9] It was observed in a smaller, though significant, proportion of middle-income and high-income developing countries. In the case of the developed market economies and the high-income developing countries, the decline in several instances could be attributed to the fact that oil and mineral extraction and/or processing accounted for a large part of GDP. As the prices of minerals and oil had risen in comparison with those of manufactures, the relative size of the manufacturing sector declined.

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[8]Because of problems of definition, as well as lack of data in current prices, the centrally planned economies are not covered in the analysis. Figures, which refer to 1981, are from the UNIDO data base.

[9]Country data are more plentiful in constant than in current prices.

Table II.7. Direction of change in the degree of industrialization between 1973 and 1982, selected country groupings[a]

Country groupings	*Number of countries in grouping*		*Number of countries showing*					
			A decline in the share of MVA in GDP		*A decline in the share of MVA in GDP, less services*		*A divergence in the direction of change in the degree of industrialization and growth of GDP*	
Centrally planned economies	...	(8)	...	(...)	...	(0)	...	(...)
Developed market economies	26	(27)	21	(16)	13	(7)	21	(16)
Developing countries of which	95	(98)	49	(41)	43	(32)	37	(34)
Low income	48	(51)	25	(25)	21	(22)	16	(15)
Middle income	24	(24)	10	(9)	10	(6)	9	(10)
High income	23	(23)	14	(7)	12	(4)	12	(9)
Total, developed market economies and developing countries	121	(125)	70	(57)	56	(39)	58	(50)

Source: UNIDO data base; information supplied by the Office Of Development Research and Policy Analysis.

[a]Figures in parentheses are based on constant prices, others on current prices.

Third, a reduction in the degree of industrialization frequently reflects deterioration of the dynamic role of manufacturing. A levelling off, or even a decline, in the degree of industrialization is not an unexpected feature of growth, particularly in the developed market economies. Most interpretations of structural change anticipate that the industrially mature countries will reach a point when the dynamism of the manufacturing sector will be overtaken by services. Trends in the last decade, however, do not entirely confirm these interpretations. In many countries other than the industrially mature ones the manufacturing sector lost ground not only to services but to other sectors of economic activity. These trends are not confined to those expressed in current prices; nor, for that matter, are they observable only in countries where oil and mineral production figure prominently. In 39 countries surveyed (including 22 low-income developing countries), real manufacturing output lost ground relative to GDP less services. This suggests an abrupt deterioration in the dynamism of growth that is normally associated with the manufacturing sector.

A fall in the degree of industrialization in developing countries, while it may be unexpected, does not necessarily contradict the hypothesis that changes in the share of manufactures in GDP correlate positively with growth in per capita GDP. In 50 of 125 countries considered, however, the direction of income growth (measured at constant prices) was opposite to that taken by shifts in the degree of industrialization. In other words, countries with increasing (decreasing) per capita income frequently registered a decrease (increase) in the degree of industrialization. When indicators were constructed on the basis of current price data, the frequency of such instances was found to be even higher (58 out of 121 countries).

A systematic and comprehensive view of these was obtained by fitting the available data to a model of structural change. It has been shown in previous

studies[10] that patterns of structural change can be represented by a simple logarithmic regression of MVA on GDP per capita and population.[11] To offset doubts that a single pattern structural change would be applicable to all countries, the countries covered were divided into groups likely to fit into a common pattern.[12] These groups, indicated in table II.8 by roman numerals, are: developed market economies (I); large developing countries (II);[13] small developing countries with modest natural resources (III); and small developing countries with ample natural resources (IV).[14] Regression coefficients were calculated from data for two periods, 1966-1972 and 1975-1981.[15]

The income coefficients in table II.8 relate the growth of MVA to changes in per capita income. In the case of the developed market economies, values are near unity, meaning that MVA tends to increase at approximately the same pace as income per capita. The largest coefficients apply to small developing countries having modest endowments of natural resources (group III) and to large developing countries (group II). In these countries, MVA tends to increase more than proportionately to growth in per capita income. Conversely, the lowest values are associated with developing countries that are amply endowed with natural resources (group IV), which may suggest a relatively high propensity in these countries to spend more on imports.

Table II.8. Early (1966-1972) and late (1975-1981) growth patterns in selected country groups

	Country group			
Coefficient	*I*	*II*	*III*	*IV*
Income coefficient				
1966-1972	1.085	1.356	1.503	0.622
1975-1981	0.954	1.318	1.343	0.780
Population coefficient				
1966-1972	1.018	1.074	1.268	1.069
1975-1981	1.020	1.070	1.223	0.987
R^2				
1966-1972	0.988	0.857	0.925	0.712
1975-1981	0.988	0.910	0.924	0.819

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis of the United Nations Secretariat.

[10]See, for example, *World Industry since 1960 . . .*, annex I.

[11]The explicit functional form is $\ln MVA = a + b \ln y + c \ln P$ where y is GDP per capita (at constant prices) and P is population. Another form, $\ln MVA = a + b \ln y + c \ln P + d (\ln y)^2$, was tested, but did not fit the data any better. As its non-linear component made it somewhat complicated to handle, it was not retained.

[12]The countries included in the various groups are listed in appendix II to the present chapter.

[13]Developing countries with populations of more than 20 million towards the mid-1970s.

[14]Small developing countries were divided into those with ample natural resources and those with modest natural resources, in accordance with the findings of a cluster analysis described in *World Industry since 1960 . . .*, annex I.

[15]Based on a pooled time series cross section analysis. Following statistical tests, the hypothesis that the growth patterns of each group are similar to one another or to the average pattern observed for all developing countries was rejected.

Population parameters are close to unity in groups I, II and IV, indicating that the size of the domestic market is not a particularly significant factor in large countries, nor in countries where industry is based on natural resources.[16] This is not the case in group III, where population size makes a clear difference in industries' ability to exploit the opportunities for expansion afforded by economies of scale. In this group, for example, in a country having a per capita income at the arithmetic mean of the group, a 50 per cent increase in population is likely to bring about at least a 60 per cent increase in MVA. In other words, the per capita MVA in a country with a 6 million population and a per capita GDP of $600 would be 9 per cent higher than that in a country having the same per capita GDP, but a population of only 4 million. This clearly suggests the benefits that countries in this group could derive from greater market integration.

A comparison of figures for the period 1966-1972 and 1975-1981 suggests that significant changes in structural relationships in world industry occurred during the transition from the fast, steady growth which distinguished the early period to the slow, erratic growth which distinguished the later one. Indeed, statistical tests confirm that the parameters estimated for three of the country groups (I, III and IV) for the early period may be regarded, with little risk of error, as being distinctly different from those for the later period. As can be seen from table II.8, the difference mainly concerns income, which declined in groups I, II and III, but rose in group IV.

In order to better depict the consequences of the changing pattern of industrialization, table II.9 shows predicted levels of per capita MVA corresponding to various levels of GDP per capita in both periods. Differences between the two periods are most obvious in the case of group III. A small developing country with modest endowments of natural resources and a per capita GDP of $600 (approximately the mean for group III) would be expected to have a per capita MVA of $87 in the period 1975-1981 compared with one of $99 in the period 1966-1972. Thus, the pattern which had emerged by the late 1970s was one in which economic growth was less closely associated with advances in the manufacturing sector. A similar situation can be noted in the case of the developed market economies, at least the more industrially mature among them. In those whose per capita GDP was less than $5,000, per capita MVA tended to increase as income rose; in those whose per capita GDP was above $5,000 the opposite was the case. In sum, the potential for industrial progress in the developed market economies waned, and at the same time shifted in favour of the less industrialized members of the group. In later years, trends were more favourable to the industrialization of small developing countries with ample resources. In this group, a country with a per capita GDP of $2,000 (approximately the mean value for the group) would likely have attained a per capita MVA of $195 in the period 1975-1981, compared with one of $153 in the early period, i.e. the equivalent of an increase of 27 per cent. To some extent, such a gain would reflect the success of deliberate, post-1973 policies aimed at building a manufacturing sector on the basis of domestic natural resources.

The changing relationship between income level and industrial structure obviously affects the degree of industrialization in a country. The last two

[16] Average population in group II: 90 million.

Table II.9. Per capita MVA and degree of industrialization predicted according to early (1966-1972) and late (1975-1981) growth patterns in selected country groups (at constant 1975 prices)

Country group	Per capita GDP (dollars)	Per capita MVA[a] (dollars)		Degree of industrialization[a] (percentage)	
		1966-1972	1975-1981	1966-1972	1975-1981
Developed market economies (I)	4 000	1 085	1 112	27.1	27.8
	4 500	1 233	1 244	27.4	27.6
	5 000	1 382	1 376	27.6	27.5
	5 500	1 533	1 507	27.9	27.4
	6 000	1 685	1 637	28.1	27.3
	6 500	1 838	1 767	28.3	27.2
	7 000	1 991	1 896	28.4	27.1
Large developing countries (II)	400	60	63	15.0	15.1
	600	104	107	17.4	17.2
	800	154	156	19.2	28.9
	1 000	208	210	20.8	20.2
	1 200	267	267	22.2	21.5
	1 400	329	327	23.5	22.5
	1 600	394	390	24.6	23.5
Small developing countries with modest natural resources (III)	200	19	20	9.5	9.9
	400	54	50	13.4	12.6
	600	99	87	16.5	14.5
	800	152	128	19.0	16.0
	1 000	213	173	21.3	17.3
	1 200	280	221	23.3	18.4
	1 400	353	273	25.2	19.5
Small developing countries with ample natural resources (IV)	1 400	122	148	8.7	10.6
	1 600	133	164	8.3	10.3
	1 800	143	180	7.9	10.0
	2 000	153	195	7.6	9.8
	2 200	162	210	7.4	9.6
	2 400	171	225	7.1	9.4
	2 600	180	240	6.9	9.2

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis of the United Nations Secretariat.

[a]Calculated by giving to the auxiliary variable population values corresponding approximately to the mean of the country group in the later period. Group I: 30 million; group II: 100 million; group III: 6 million; group IV: 6 million.

columns in table II.9 show some of the major features of this changing relationship. In the developed market economies, the share of manufacturing fell as GDP per capita increased—reflecting a negative relationship between the two variables after 1975. A negative relationship can also be observed in respect of small developing countries with ample natural resources. Nevertheless, the expected degree of industrialization in 1975-1981 was higher at identical income levels than was that at the corresponding levels for 1966-1972. Moreover, the tendency for the share of MVA to decline was less pronounced at higher levels of income. In small developing countries with modest natural resources, the predicted degree of industrialization in the period 1975-1981 rose for countries with a per capita GDP of up to $200, but fell for those with higher GDP levels.

The statistics quoted here would not be sufficient to refute the proposition that growth in income is associated with an increase in the degree of industrialization. They do, however, raise doubts as to the proposition's general applicability, especially during periods of slow growth in world income. Caution must be exercised with regard to the changing economic conditions in the world and the vast differences in the structural characteristics of countries.

The composition of MVA

Broad patterns of structural change, as represented by the share of MVA in GDP, are sensitive to shifts in the composition of manufacturing activity. Here again, however, generalizations concerning large numbers of countries with diverse economic structures are seldom justified. The relative economic significance of different industries depends, to some extent, on the level of development of the countries in which they are located. Nevertheless, shifts in the relative strength of specific industries (as measured, for example, by their share in total MVA) are caused by a variety of determinants. These considerations suggest the need for a detailed study of growth and structural change in the manufacturing sector of specific industrial branches and countries. Because such a detailed exercise was beyond the scope of the present *Survey*, a simple, analytical framework was adopted in order to facilitate review of the relevant data. Thus, the remainder of this chapter focuses on four industrial branches and on patterns of structural change within each of the economic groupings as well as in selected groups of countries.

The four industrial branches chosen include those which mainly produce non-durable consumer goods and industrial chemicals, as well as those mainly involved in engineering and transforming minerals into intermediate goods. The salient feature of table II.10, which illustrates the branches' contribution to manufacturing in the three main economic groupings, is the comparatively larger share of MVA devoted to the production of non-durable consumer goods in the developing countries and the prominence of the engineering industries in the developed countries. Activities associated with the transformation of minerals are of only moderate significance everywhere. Chemicals account for a smaller share of total MVA in the centrally planned economies than in the other two groupings. A comparison of data for different years shows a tendency for the size of the consumption industries to fall relative to that of the chemical or engineering industries. In the centrally planned economies and the developed market economies, a slight tendency to switch away from mineral-processing activities can also be noted.

To a certain extent, these shifts can be related to the effects of income and population distribution. This relationship is demonstrated in table II.11 which shows a hypothetical composition of MVA corresponding to different levels of income and population.[17] In the developed market economies, growth in income is seen to result in a relative increase in the share of engineering industries and a decrease in those producing consumer non-durables. The share of chemicals and mineral transformation, by contrast, is little affected by

[17]Calculated by estimating, for each industrial branch, the same regression equation for successive groups of countries.

Table II.10. The composition of manufacturing[a] in three economic groupings, 1963, 1973 and 1980 (at constant 1975 prices)

(Percentage)

	Centrally planned economies			*Developed market economies*			*Developing countries*		
	1963	*1973*	*1980*	*1963*	*1973*	*1980*	*1963*	*1973*	*1980*
Non-durables	36.5	28.4	23.5	26.3	20.8	20.2	52.8	39.3	33.9
Chemicals	6.2	8.8	9.3	11.0	14.7	16.0	11.5	15.8	17.2
Mineral transformation	19.2	16.7	13.8	15.5	15.1	13.2	13.3	14.6	16.5
Engineering	38.1[b]	46.0[b]	53.4[b]	47.2	49.4	50.3	22.4	30.3	32.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Non-durables include food products (ISIC 311/2), textiles (ISIC 321) and wearing apparel (ISIC 322). Chemicals consist of industrial chemicals (351), other chemicals (352) and plastic products (356). Mineral transformation is composed of non-metallic mineral products other than glass (ISIC 369), iron and steel (ISIC 371) and non-ferrous metals (ISIC 372). Engineering goods are metal products (ISIC 381), non-electrical machinery (ISIC 382), electrical machinery (ISIC 383) and transport equipment (ISIC 384).

[b]Includes professional and scientific equipment (ISIC 385).

growth in income. When columns B and C are compared, the influence of the level of population is also seen to be minimal.[18]

Growth in population or income affects the composition of MVA in a similar fashion in large developing countries, although the magnitude of the structural changes involved is greater than in the case of the developed market economies. Growth in income would lead to a considerable increase in the engineering industries' share in MVA. Growth in population would also imply an increase, but a less pronounced one. Together, these increases would mean that the most significant shifts in the composition of manufacturing could be expected in large developing countries. A simultaneous increase of 67 per cent in both per capita income and population, for instance, would lead to an expansion of roughly one third in the engineering industries' share of MVA, matched by a corresponding fall in the share of consumer non-durables.

The situation in small countries is somewhat different. In those with modest endowments of natural resources, the share of consumer non-durables in MVA declines markedly with increases in income or population. In the same countries, the relative gains in mineral processing that can be associated with an increase in population are even greater than those for engineering. This is probably due to the fact that demand at the lower levels of total income (i.e. total GDP) is so small that a serious constraint is imposed on the development of basic or heavy industries. In other words, the minimal plant size in industries such as steel, non-metallic minerals and metal transformation may not be easily accommodated, owing to the limited size of the domestic markets in some small countries. Other countries belonging to the same group, but having larger populations, may be better able to overcome the obstacle.

[18]The structure used in table II.11 differs from that used in table II.10. In the latter, the aggregation procedure weights the structure of every developed market economy by the size of value added in the industrial branch concerned, whereas in the former all structures are given the same weight.

Table II.11. Hypothetical composition of MVA in selected country groups, 1975-1981

(Percentage)

Industrial branch	Developed market economies			Large developing countries			Small developing countries with modest natural resources			Small developing countries with ample natural resources		
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*
Consumer non-durables	28.1	24.5	23.5	43.4	36.1	32.8	69.1	63.3	60.0	46.8	46.2	44.2
Chemicals	15.1	15.1	15.2	17.1	17.3	18.0	10.2	11.9	12.2	14.2	14.0	14.2
Mineral transformation	13.8	13.9	14.7	14.2	14.9	15.0	6.7	7.7	9.4	15.6	15.8	16.7
Engineering	43.0	46.4	46.6	25.3	31.7	34.2	14.0	17.1	18.3	23.3	24.0	24.8

Key:

	GDP per capita (dollars)	*Population (million)*		*GDP per capita (dollars)*	*Population (million)*		*GDP per capita (dollars)*	*Population (million)*		*GDP per capita (dollars)*	*Population (million)*
A	4 000	20	D	600	60	G	400	4	J	1 600	4
B	6 000	20	E	1 000	60	H	600	4	K	2 400	4
C	6 000	30	F	1 000	100	I	600	6	L	2 400	6

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

Table II.12. Hypothetical values of gross output in selected industrial branches in three groups of developing countries, 1975-1981

(Millions of dollars, 1975)

Industrial branch	Large developing countries			Small developing countries with modest natural resources			Small developing countries with ample natural resources		
	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
Consumer non-durables	4 123.2	7 371.0	11 625.7	197.2	303.6	448.9	637.8	908.3	1 324.0
Chemicals	1 621.0	3 530.8	6 365.7	28.6	56.7	91.2	194.5	275.2	426.1
Mineral transformation	1 356.5	3 027.2	5 320.3	19.0	37.2	70.0	211.6	311.3	501.4
Engineering	2 402.0	6 458.2	12 110.7	39.6	82.0	136.4	318.1	472.9	742.3

Key:

	GDP per capita (dollars)	*Population (million)*		*GDP per capita (dollars)*	*Population (million)*		*GDP per capita (dollars)*	*Population (millions)*
A	600	60	D	400	4	G	1 600	4
B	1 000	60	E	600	4	H	2 400	4
C	1 000	100	F	600	6	I	2 400	6

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

The situation differs again in small countries having ample natural resources; here, the composition of MVA reveals more stability in the relative size of the four industrial branches. In many of these countries, the growth of income is closely tied to conditions in the fields of petroleum refining and production of petroleum and coal products. These close links outweigh the implications of growth for the rest of the manufacturing sector. They also mean that performance in the more dynamic parts of the manufacturing sector is particularly dependent on international markets for petroleum and related products.

Table II.12 shows how the same two broad determinants—GDP per capita and population—are related to shifts in gross output between the four industrial branches.[19] In small developing countries with modest resource endowments, for example, an increase of GDP per capita from $400 to $600 (compare columns D and E) would be associated with an increase of from $19 million to $37 million in the output of the mineral transformation industries. Similarly, an increase in population, from 4 million to 6 million, would imply an expansion in gross ouput of almost 90 per cent, i.e. from $37 million to $70 million (compare columns D and F). In general, table II.12 suggests that the gross output of all four branches of industry will increase more than proportionately with a rise in per capita income in large developing countries and in small developing countries with modest natural resources. Conversely, gross output is seen to be less responsive to growth in income in small developing countries with ample natural resources. In all three groups of countries, the production of consumer non-durables responds less than proportionately to growth in population, while the reverse is true for the other industrial branches considered.

In conclusion, growth, be it the result of development (GDP per capita) or expansion in the size of the domestic market (as suggested by an increase in population or even through greater international integration of markets) often seems to entail a shift away from the consumption-oriented to the engineering industries. This type of shift has serious implications for the composition and level of imports (i.e. with regard to capital and technology requirements) and thereby complicates the long-term task of resource allocation. However, a skilful exploitation of the dynamics of structural change may help to promote industrialization. Economic co-operation among developing countries may be a powerful instrument in this regard. By integrating their markets, developing countries could directly influence the broad determinants of structural change, thereby increasing their opportunities to establish new industries or to expand existing ones.

APPENDIX I

SHARE OF CHINA IN WORLD MVA

In estimating China's share in world MVA, the compilers of the present *Survey* used data produced by the State Statistical Bureau of China to the extent possible.

[19]The regression equation $\ln MVA = a + b \ln y + c \ln P$ was applied to the data available for the relevant countries over the years 1975-1981 in order to find MVA. Gross output was derived using the equation MVA = 0.4 gross output.

Indicators such as gross output in industry (defined as including mining, electricity and gas, as well as manufacturing) or the percentage change in national income, entailed certain assumptions, however, that could not be tested.

The first step was to obtain figures for the value of net output in industry in 1979. These were arrived at using an estimate for the share of industry in net material product (at current prices). An implicit price deflator for industry (1975=100) was then employed to express the value in 1975 prices. The next step was to estimate the share of manufacturing in industry, as specific data for net output of the manufacturing sector were not available. Information on gross output (at 1970 prices) was available in greater detail, however. Moreover, gross output data were available for electric power, petroleum and gas extraction, coal mining and non-metallic mineral mining. Using these data, estimates of the contribution of mining, electricity and gas were made and these activities were then excluded from the figure for manufacturing. The mining components in the chemicals, iron and steel and non-ferrous metals industries were also estimated using separate sources of data.

The estimated share of manufacturing in industry (89.6 per cent in 1979) was then applied to net output in industry to obtain a figure for manufacturing. Finally, the estimate was expressed in United States dollars using the 1975 exchange rate ($1.00 = 1.865 Yuan).[a] Approximate figures for net output in manufacturing for the years 1980 to 1982 were obtained by applying the rates of increase of the manufacturing group index[b] to the estimated figure for net output in manufacturing in 1979. The resultant world distribution of MVA in the period 1979 to 1982 is provided in the following table.

Estimated shares of economic groupings and of China in world MVA (at constant 1975 prices), 1977-1982

(Percentage)

Economic grouping or country	*1979*	*1980*	*1981*	*1982*
Developing countries	9.85	10.27	10.21	10.73
Centrally planned economies	22.15	22.93	23.25	24.33
Developed market economies	64.55	63.07	62.71	61.00
China[a]	3.45	3.73	3.83	3.94
World	100.00	100.00	100.00	100.00

Source. UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Calculations are based on data supplied by the State Statistical Bureau of China and on unpublished data.

APPENDIX II

COUNTRIES INCLUDED IN SELECTED GROUPINGS

Large developing countries

Argentina
Bangladesh
Brazil
Burma

[a]*International Financial Statistics*, Supplement on exchange rates, 1981.
[b]*Statistical Yearbook of the Republic of China 1983*, p. 138, table 48.

Large developing countries (continued)

Colombia
Egypt
Ethiopia
India
Indonesia
Iran (Islamic Republic of)
Mexico
Nigeria
Pakistan
Philippines
Republic of Korea
Thailand
Turkey
Zaire

Small developing countries or areas with modest natural resources

Afghanistan
Bolivia
Botswana
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Comoros
Congo
Benin
Dominican Republic
Ecuador
El Salvador
Equatorial Guinea
Fiji
Gambia
Guatemala
Guinea
Guinea-Bissau
Haiti
Honduras
Hong Kong
Ivory Coast
Jordan
Kenya
Lesotho
Madagascar
Malawi
Mali
Mauritania
Mauritius
Morocco
Mozambique
Nicaragua
Niger
Paraguay
Peru
Puerto Rico
Reunion
Rwanda
Senegal
Sierra Leone
Singapore
Somalia
Sri Lanka
Sudan
Swaziland
Syrian Arab Republic
Togo
Tunisia
Uganda
United Republic of Tanzania
Zimbabwe

Small developing countries with ample natural resources

Algeria
Angola
Barbados
Chile
Costa Rica
Cyprus
Gabon
Ghana
Guyana
Iraq
Jamaica
Kuwait
Liberia
Libyan Arab Jamahiriya
Malaysia
Namibia
Panama
Saudi Arabia
Trinidad and Tobago
Uruguay
Venezuela
Zambia

III

World trade in manufactures

INTERNATIONAL trade provides one of the most obvious and easily identifiable means of gauging the nature and extent of global interdependence. Links with the external sector are particularly important for manufacturers of modern industrial products. Few of these manufacturers are not dependent in some way on foreign economies. They rely on imported raw materials, intermediate inputs and supplies and on foreign suppliers of capital equipment and technologies. Or, they depend on foreign markets to consume their products. The determinants of the level and composition of trade are complex, however, and vary widely with time and from country to country, which makes it difficult to be precise when analysing global interdependence in the context of international trade. Nevertheless, concrete information is available today that can be used with some degree of certainty to assess the extent to which trade in manufactures acts as a form of economic interdependence between developing and developed countries and among countries in the same economic grouping.

The present chapter begins with a survey of recent global trading patterns in the field of manufacturing. Prominent features of trade among the three major economic groupings are identified and discussed in the light of long-term trends. A look is then taken at the growth of trade in manufactures, the performance of individual countries, and changes in the composition of the trade. Next, the focus shifts to the relationship between trade, foreign exchange earnings and the international financial obligations of selected countries. The chapter concludes with a detailed study of recent trade performance by developing and developed countries, measured by share of exports in manufacturing production. The consequences of the recession which began in the mid-1970s are also evaluated.

Overview

Since the Second World War, manufactures have accounted for the bulk of exports by the developed countries. They have accounted for a smaller proportion of the developing countries' exports. Table III.1 illustrates these trends, showing manufactures as a percentage of total exports and as a percentage of non-oil exports (i.e. excluding SITC 3). At the global level, manufactures have consistently accounted for between 50 and 60 per cent of total trade (i.e. SITC 0-9) since 1960. The developed market economies, which are particularly dependent on their exports of manufactures (currently almost 75 per cent of the grouping's total exports), consistently export more manufactures than the other economic groupings. Exports of manufactures from the centrally planned economies declined slightly in the late 1970s and currently account for slightly less than 50 per cent of those economies' total

Table III.1. Share of manufactures (SITC 5-8 less 68) in total exports, by economic grouping, 1960-1983

Economic grouping	*Basis*[a]	*1960*	*1970*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*[b]
World	A	51.5	60.9	57.4	57.0	57.5	60.4	57.5	54.7	55.3	56.8	58.2
	B	57.1	67.1	71.1	71.5	71.7	72.9	72.2	72.0	73.1	74.2	...
Developed market economies	A	64.6	71.9	73.1	73.5	74.1	74.8	72.8	71.6	71.7	72.3	73.0
	B	67.2	74.4	77.0	77.4	78.0	78.4	77.3	76.9	77.7	78.8	...
Centrally planned economies	A	54.1	58.2	55.2	54.5	53.9	54.9	52.5	50.6	48.6	47.9	47.3
	B	60.7	63.9	66.8	67.1	66.7	67.9	68.0	68.2	67.2	68.1	...
Developing countries	A	9.2	17.3	15.1	16.6	17.3	21.0	19.8	17.8	20.8	22.9	25.2
	B	12.8	25.9	37.0	40.3	40.3	44.5	46.1	47.1	52.4	53.3	...

Source: United Nations, *Monthly Bulletin of Statistics*, various issues.

[a] A = manufactures as percentage of total exports; B = manufactures as percentage of total exports excluding SITC 3, mineral fuels and related materials. All figures calculated from data expressed in current prices.

[b] Estimate.

exports. In the developing countries, the share of manufactures in total exports (25 per cent in 1983) is significantly below the levels of the other economic groupings.

The distinction between the three groupings is less marked when trade in non-oil products is considered. The proportion of manufactures in the total non-oil exports of the developing countries has risen dramatically since 1970, accounting for 53 per cent in 1982. This shift would seem to contradict the notion that the developing countries depend predominantly on exports of agricultural products. Moreover, whereas the rise in the share of mineral fuel exports (SITC 3) in total exports since the 1970s is largely attributable to price increases and does not reflect a significant shift in the commodity composition of exports from the developing countries, the same observation cannot be made with respect to the growth in exports of manufactures from those countries; this growth is not primarily a price phenomenon, but reflects costly and arduous efforts to industrialize.

Table III.2 shows the volume of world exports of manufactures in the period 1969-1983. It is seen that exports fell during the early 1980s; in 1983 they were less than in 1980. This represents a significant departure from recent trends: exports of manufactures had expanded rapidly during the late 1960s and early 1970s and continued to grow at a moderate pace during the remainder of the 1970s. The relative shares of the three economic groupings were not affected by this fall, however. The share of the developing countries continued to increase, though slowly, and while the shares of the developed market economies and the centrally planned economies declined slightly, the decline was of little significance. The developed market economies still account for the overwhelming proportion of world trade in manufactures: over 80 per cent in 1983.

Distinctions between the economic groupings can be found by looking at the direction of trade in manufactures. Table III.3 shows that in the developed

Table III.2. World exports of manufactures (SITC 5-8 less 68) and the shares of the major economic groupings

Year	*Total (billions of dollars)*[a]	*Increase over preceding year (percentage)*	*Developing countries (percentage)*	*Centrally planned economies (percentage)*	*Developed market economies (percentage)*
1969	165.0	17.4	4.6	10.4	85.0
1970	189.9	15.2	5.0	10.0	85.0
1971	216.0	13.7	5.2	9.6	85.2
1972	258.9	19.9	5.7	9.9	84.4
1973	346.9	34.0	6.7	9.4	83.9
1974	458.4	32.2	6.8	8.5	84.7
1975	500.1	9.1	6.3	9.3	84.4
1976	564.4	12.8	7.5	8.9	83.6
1977	647.3	14.7	7.8	8.9	83.3
1978	784.0	21.1	8.1	8.7	83.2
1979	941.0	20.0	8.7	8.4	82.9
1980	1 090.2	15.9	9.1	8.1	82.8
1981	1 087.0	−0.3	10.5	8.0	81.5
1982	1 042.1	−4.1	10.7	8.7	80.6
1983[b]	1 051.0	0.9	10.9	8.8	80.3

Source: United Nations, *Monthly Bulletin of Statistics*, various issues.

[a]At current prices.

[b]Estimate.

Table III.3. World trade in manufactures (SITC 5-8 less 68), by origin, destination and economic grouping at current prices, selected years

		Exports to developing countries		*Exports to centrally planned economies*[a]		*Exports to developed market economies*	
Origin of exports	*Year*	*Value (millions of dollars)*	*Share (percentage)*	*Value (millions of dollars)*	*Share (percentage)*	*Value (millions of dollars)*	*Share (percentage)*
Developing countries	1963	1 404	41.2	102	3.0	1 902	55.8
	1970	3 231	33.7	559	5.8	5 808	60.5
	1975	11 935	37.9	1 172	3.7	18 352	58.3
	1980	37 560	38.1	3 222	3.3	57 764	58.6
	1982	41 520	37.6	3 760	3.4	65 046	59.0
Centrally planned economies	1963	1 635	15.1	8 043	74.3	1 147	10.6
	1970	2 899	15.2	13 381	70.2	2 804	14.7
	1975	6 790	14.6	31 835	68.6	7 756	16.7
	1980	15 784	18.0	54 692	62.3	17 268	19.7
	1982	19 807	21.9	53 651	59.3	17 062	18.8
Developed market economies	1963	16 950	25.7	2 168	3.3	46 470	71.0
	1970	32 462	20.2	6 634	4.1	121 256	75.6
	1975	111 298	26.5	26 518	6.3	282 155	67.2
	1980	233 721	26.0	42 430	4.7	622 646	69.3
	1982	234 088	28.1	36 346	4.4	563 642	67.6

Source: United Nations Conference on Trade and Development, *Handbook of International Trade and Development Statistics*, various issues; and *Monthly Bulletin of Statistics*, various issues, with estimates by the UNIDO secretariat.

[a]Excluding trade among the centrally planned economies of Asia.

countries the bulk of trade in manufactures has traditionally taken place among countries in the same economic grouping, and in spite of the recent moderate decline, this pattern of "bloc trading" still prevails. In 1982, over 59 per cent of all manufactures exported from the centrally planned economies were imported by other centrally planned economies. The comparable figure for the developed market economies was even higher, 68 per cent. Trade among the developing countries was a relatively low 38 per cent. (Some 59 per cent of this grouping's manufactures were exported to developed market economies.)

Table III.3 also reveals a large imbalance between developing and developed countries in the value of trade in manufactures. While this imbalance has been declining somewhat since 1970, exports of manufactures from the developed market economies to the developing countries in 1982 were still roughly 3.6 times greater than exports from the latter grouping to the former. The centrally planned economies also continue to enjoy a surplus in their manufacturing trade with the developing countries, although the total value of this trade is considerably less.

Increased trade in manufactures among the developing countries themselves is regarded by some economists as essential to spurring growth in those economies.[1] This thesis is based, in part, on the opinion that the present slowdown in the developing countries is attributable to the decline that has been apparent in the rate of economic growth of the developed countries since the mid-1970s. Although the value of overall trade among the developing countries has increased (amounting to $41.5 billion in 1982), the share of manufactures has not. In fact, it is probably less today than it was in 1963.

Export performance in selected countries

Direction of trade in manufactures

Trading links between the developing countries and the developed market economies can be examined in more detail in terms of export performance in individual countries. In table III.4, trade performance is expressed in terms of net exports (i.e. exports less imports) and is measured according to two slightly different yardsticks. The first, "Industrially processed goods and intermediates", covers all activities normally regarded as part of the manufacturing sector in production statistics (i.e. products and processes included in ISIC 300). The second, "Net exports of manufactures", is based on a narrower definition of trade in manufactures (SITC 5-8 less 68).[2] Both measures are expressed in net terms, i.e. exports less imports.

Although most of the major exporters among the developing countries are considered, there are very few instances where a positive balance of trade in manufactures can be noted for any year. This statement applies regardless

[1] See, for example, W. A. Lewis, "The slowing down of the engine of growth", *American Economic Review*, vol. 70, No. 4 (1980), pp. 555-564.

[2] It excludes several products—mainly agricultural commodities that receive some form of industrial processing prior to export—regarded as part of the manufacturing sector in production statistics but frequently omitted from statistics of trade in manufactures. See appendix I.

Table III.4. Net exports of *(a)* industrially processed goods and intermediates and *(b)* manufactures from selected developing countries and areas to the developed market economies, 1970, 1980 and 1981

(Millions of dollars at current prices)

Country or area	Industrially processed goods and intermediates[a]			Manufactures (SITC 5-8 less 68)		
	1970	1980	1981	1970	1980	1981
Argentina	−418.2	−4 387.3	−3 844.2	−976.6	−5 891.5	−5 292.4
Brazil	−1 205.0	−2 772.4	339.5	−1 596.3	−5 906.2	−3 719.3
Hong Kong	21.2	−665.5	−800.5	84.4	−236.0	−190.0
India	−334.5	−2 766.4	...	−251.9	−2 122.8	...
Kuwait	−307.9	−2 824.2	−4 046.8	−345.1	−3 507.2	−4 174.7
Malaysia	−300.4	−2 886.8	−3 563.5	−628.2	−4 102.9	−4 559.4
Mexico	−1 404.8	−7 860.3[b]	...	−1 634.9	−7 780.2[b]	...
Pakistan	−565.3	−1 728.6	−1 621.8	−464.7	−1 579.3	−1 344.6
Philippines	−548.5	−1 661.8	−1 621.9	−727.9	−2 471.9	−2 245.4
Republic of Korea	−705.6	−491.2	−226.8	−506.1	928.5	1 347.8
Singapore	−884.7	−4 806.6	−5 198.7	−966.8	−5 805.8	−6 140.8
Thailand	−861.3	−2 844.5	−3 259.0	−873.6	−3 189.0	−3 514.8
Turkey	−372.8	−2 453.2	−2 655.6	−528.2	−2 307.0	−2 824.1
Venezuela	−613.7	−3 413.1	−7 431.8	−1 252.3	−7 292.1	−7 826.1
Total	−8 501.5	−41 561.9	...	−10 668.2	−51 263.4	...

Source: UNIDO data base and data supplied by the Statistical Office of the United Nations Secretariat.

[a]For a definition of trade in industrially processed goods and intermediates, see appendix I. See also, *Changing Patterns of Trade in World Industry: An Empirical Study on Revealed Comparative Advantage* (United Nations publication, Sales No. E.82.II.B.1), pp. 21-23.

[b]1979.

which of the two yardsticks is employed.[3] In their manufacturing trade with the developed market economies, the 14 countries listed had a net imbalance of between $40 billion and $50 billion in 1980 compared to one of $8 billion to $10 billion in 1970. Moreover, the net trade position of several of them continued to deteriorate after 1980. Global interdependence, when gauged in terms of the broad trading patterns sketched here, implies the existence of an extensive system of trading links among developed countries within the same economic grouping. The developing countries are lagging behind in establishing such links, which apparently shape the pattern of trade in manufactures.

Major exporters of manufactures

One of the constant features of trade in manufactures has been the fact that a small number of countries account for an overwhelming proportion of the exports by each economic grouping. Table III.5 shows 12 developing countries' growth rates and shares in total exports of manufactures by their own economic grouping. With regard to the 12 countries' share in total exports of manufactures by their own economic grouping, in 1970 they accounted for

[3]A comparison of the corresponding values for the two shows that, in most cases, the imbalance is largest when manufactures are defined as SITC 5-8 less 68. This is a reflection of the fact that several of the products and industries included in the broader definition account for an important part of manufacturing production and exports in the developing countries.

Table III.5. Exports of manufactures (SITC 5-8 less 68) by selected developing countries and areas, 1970-1982

(Percentage)

Country or area[a]	*Average annual growth rate*[b]		*Share in total*			
	1970-1980	*1980-1982*	*1970*	*1980*	*1981*	*1982*
Republic of Korea	37.8	22.1[c]	6.0	14.4	15.2	...
Hong Kong	21.0	0.3	18.5	12.0	11.0	10.6
Singapore	35.7	5.6	4.0	8.3	8.0	8.1
Brazil	35.4	1.5	3.4	6.9	7.3	6.2
India	15.5	...	9.8	4.0	...	...
Malaysia	36.2	6.4	1.0	2.2	1.8	2.2
Kuwait	37.2	15.5[c]	0.9	2.0	2.0	...
Argentina	22.4	−0.3	2.3	1.7	1.4	1.5
Mexico	16.1	−5.7[c]	3.7	1.6	1.3	...
Thailand	47.8	5.6	0.3	1.5	1.4	1.4
Pakistan	12.1	4.4	3.8	1.1	1.1	1.1
Philippines	31.4	−1.9	0.7	1.1	1.1	0.9
Other countries	25.6	...	45.6	43.2	...	...
All developing countries	26.3	6.8	100.0	100.0	100.0	100.0

Source: UNIDO data base and data supplied by the Statistical Office of the United Nations Secretariat; United Nations, *Monthly Bulletin of Statistics*, vol. XXXVIII, No. 5 (May 1984) (ST/ESA/STAT/SER.Q/137); *1981 Yearbook of International Trade Statistics* (United Nations publication, Sales No. E/F.82.XVII.7); and estimates by the UNIDO secretariat.

[a]Ranked by value of exports in 1980.

[b]Compound growth rates.

[c]Annual growth rate in 1981 over 1980.

almost 55 per cent, a figure which, it is estimated, would have risen by the 1980s.

With regard to the growth rates, the data show that whereas in 1970-1980 most of the major exporters matched or even exceeded the average for all developing countries, in 1980-1982 they declined sharply—consonant with the effects of the global recession. This effect was equally evident in the growth rates recorded for all developing countries: between 1970 and 1980, exports of manufactures expanded at an annual rate of 26.8 per cent, but in 1980-1982, the corresponding figure was only 6.8 per cent. Thus, the slow-down in exports after 1980 was a general one which apparently affected the major as well as the marginal exporters of manufactures.

The pattern of export concentration is similar in the developed market economies. Table III.6 gives comparable data for this economic grouping. Three countries—the Federal Republic of Germany, Japan and the United States—accounted for almost 48 per cent of exports in 1970. As the result of a marked increase in Japan's share, that proportion had risen to 50.6 per cent in 1982. The predominance of these three exporters reflects the relative importance, or size, of their economies—whether measured in terms of population, GDP or MVA. The same qualification is less applicable to the developing countries, many of which are relatively large in terms of population or industrial base but only marginal in terms of exports of manufactures.[4]

[4]For comparable data on population and the global distribution of MVA, see chapter II of the present *Survey*.

Table III.6. Exports of manufactures (SITC 5-8 less 68) from the developed market economies, 1970-1982

Country[a]	*Average annual growth rate, 1970-1982*[b] *(percentage)*	*Value of exports in 1982 (millions of dollars)*[c]	*Share in exports of economic grouping (percentage)*	
			1970	*1982*
Germany, Federal Republic of	14.3	149 445	18.8	18.0
United States	14.1	137 927	17.8	16.6
Japan	18.2	132 919	11.2	16.0
France	14.8	68 243	8.2	8.2
United Kingdom	12.4	62 915	9.7	7.6
Italy	15.4	60 921	6.9	7.3
Canada	13.1	35 804	5.1	4.3
Belgium and Luxembourg	12.5	35 508	5.4	4.3
Netherlands	14.1	32 091	4.1	3.8
Switzerland	14.7	23 749	2.9	2.9
Sweden	12.6	21 035	3.2	2.5
Other 13 countries[d]	17.0	71 356	6.8	8.6
Total	14.7	831 913	100.0	100.0

Source: UNIDO data base and data supplied by the Statistical Office of the United Nations Secretariat.

[a]Ranked by value of exports in 1982.

[b]Compound growth rates.

[c]At current prices.

[d]Australia, Austria, Denmark, Finland, Greece, Iceland, Ireland, Israel, Malta, New Zealand, Norway, Portugal and Spain.

Composition of trade in manufactures

A common feature of trade in manufactures is that a country's trade may be concentrated in just a few product lines or industries. The ability to provide a widening range of manufactured products, whether for domestic consumption or for export, is one measure of progress towards national self-reliance, attained through a more broadly based manufacturing sector and a more diversified pattern of trade. The composition of trade in manufactures will, of course, change over time as it is subject to a variety of factors such as income growth and its effects on demand, changes in the relative prices of manufactured products, and shifts in the competitive abilities of exporting and import-substituting industries.

One way of examining the net effects of these factors is to look at the functional composition of trade (e.g. capital goods, consumer durables and non-durables and intermediate supplies). Table III.7 provides such a breakdown for trade in industrially processed goods and intermediates. The growth and share of each product category is shown for the developed market economies, several of the major exporters among the developing countries and a residual group of 47 other developing countries. A significant feature of these data emerges from a comparison of rates of growth in exports and imports. Among the developed market economies, exports have consistently expanded faster than imports. This relationship, which applies to trade in all industrially processed goods as well as in major product categories,[5] has been maintained in

[5]The only exception is in the use of consumer non-durables where, during the entire period 1970-1981, imports grew at a rate slightly exceeding that for exports.

Table III.7 Growth and composition of trade by the developed market economies and the developing countries and areas in industrially processed goods and intermediates, 1970-1981[a]

(Percentage)

Economic grouping	*Year*	*Product group[b]*				
		Consumer non-durable goods	*Intermediates*	*Capital goods and consumer durables*	*Other industrially processed goods*	*All industrially processed goods and intermediates*
Average annual growth rate of exports, 1970-1981/1979-1981[c]						
Developed market economies		16.9/7.1	15.3/3.6	17.1/8.7	18.3/9.6	16.7/7.0
Developing countries and areas (major exporters)[d]		22.6/12.8	24.4/16.8	35.3/22.4	23.3/21.4	25.7/18.6
Other developing countries[e]		27.8/16.2	13.1/3.4	26.0/24.9	14.2/−6.8	15.0/0.4
Average annual growth rate of imports, 1970-1981/1979-1981[c]						
Developed market economies		18.1/4.5	14.1/07	16.3/5.0	17.9/6.9	16.0/3.9
Developing countries and areas (major exporters)[d]		23.3/23.7	18.5/8.3	22.4/15.9	20.6/18.3	20.8/14.2
Other developing countries[e]		17.9/18.2	18.5/13.9	19.7/15.9	23.0/24.1	19.7/16.7
Share in total exports of industrially processed goods and intermediates						
Developed market economies	1970	8.9	34.2	47.1	9.8	100.0
	1981	9.2	30.1	49.2	11.5	100.0
Developing countries and areas (major exporters)[d]	1970	28.1	25.9	12.9	33.0	100.0
	1981	21.3	23.1	28.8	26.7	100.0
Other developing countries[e]	1970	3.4	44.8	2.3	49.4	100.0
	1981	10.8	37.1	6.4	45.7	100.0
Share in total imports of industrially processed goods and intermediates						
Developed market economies	1970	10.2	36.3	39.8	13.7	100.0
	1981	12.5	30.3	40.9	16.3	100.0
Developing countries and areas (major exporters)[d]	1970	6.7	39.3	40.8	13.2	100.0
	1981	8.4	31.8	46.9	12.9	100.0
Other developing countries[e]	1970	7.3	34.2	45.4	13.1	100.0
	1981	6.2	30.6	45.4	17.8	100.0

Source: UNIDO data base and data supplied by the Statistical Office of the United Nations Secretariat.

[a]For a definition of trade in industrially processed goods and intermediates, see appendix I. See also *Changing Patterns of Trade in World Industry: An Empirical Study on Revealed Comparative Advantage* (United Nations publication, Sales No. E.82.II.B.1).

[b]For a definition of the product groups, see *World Industry Since 1960: Progress and Prospects* (United Nations publication, Sales No. E.79.II.B.3).

[c]Compound growth rates.

[d]Argentina, Brazil, Hong Kong, Kuwait, Malaysia, Republic of Korea and Singapore. Excluding India and Mexico, for which comparable data for 1981 were not available.

[e]Forty-seven for which comparable data were available for 1970 and 1981.

recent years despite the appreciable reduction registered in growth rates of both exports and imports. Data for the major exporters among the developing countries show a similar pattern. In most of the developing countries, however, imports of industrially processed goods have risen at rates considerably higher than those for exports throughout the period 1970-1981. This applies to total trade in such goods and to several of its components. The same relationship is even more apparent when rates of growth for 1979-1981 are considered: exports stagnated subsequent to 1979 (when annual growth was only 0.4 per cent) while imports continued to expand, at a rate of 16.7 per cent per annum.

With regard to the composition of trade, the import figures show little variation among the three economic groupings, but the export figures reveal a different pattern. Exports from the developed market economies are distinguished by a large percentage of capital goods and consumer durables (almost 50 per cent of all industrially processed goods and intermediates in 1981). That product category, however, is much less significant in the exports of most developing countries. Differences can also be noted in the composition of exports by the two sub-groups of developing countries. Among the major exporters, the distribution is fairly equally dispersed across the four product categories, but for the others—the majority—exports of all consumer and capital goods accounted for no more than 17.2 per cent of the total in 1981. These countries mainly export industrial inputs and supplies, semi-finished manufactures and partly assembled goods.

The potential significance of the developed market economies as consumers of the developing countries' manufactures can also be illustrated in terms of the composition of the trade in manufactures. Table III.8 provides a breakdown of

Table III.8. Manufactures imported by the developed market economies from the world and from the developing countries, 1975 and 1982

	From world			*From developing countries*				
Manufactures	*1975*	*1982*	*Growth rate[a] 1975-1982 (per-centage)*	*1975*	*1982*	*Growth rate[a] 1975-1982 (per-centage)*	*Developing countries' share in imports from world (percentage)* 1975	1982
	(millions of dollars)[b]			*(millions of dollars)[b]*				
Non-ferrous metals (68)	14 778	27 560	9.3	3 746	6 659	8.6	25.3	24.2
Steel (67)	24 184	38 681	6.9	705	2 743	21.4	2.9	7.1
Chemicals (5 + 862 + 863)	41 355	96 266	12.8	1 570	4 464	16.1	3.8	4.6
Other semi-manufactures[c]	28 777	56 872	10.2	1 879	5 068	15.2	6.5	8.9
Engineering products[d]	160 495	348 481	11.7	4 649	19 861	23.1	2.9	5.7
Textiles (65)	17 321	29 942	8.1	2 681	5 906	11.9	15.5	19.7
Clothing (84)	14 265	33 344	12.9	4 438	14 132	18.0	31.1	42.4
Other consumer goods[e]	27 453	69 304	14.1	2 601	9 816	20.9	9.5	14.2
Total	328 628	700 450	11.4	22 269	68 649	17.4	6.8	9.8

Source: UNIDO data base and data supplied by the Statistical Office of the United Nations Secretariat.

[a] Compound growth rate.

[b] At current prices.

[c] Defined as SITC 61 + 62 + 63 + 64 + 66 (less 665, 666).

[d] Defined as SITC 69 + 7 + 86 (less 862, 863) + 8911.

[e] Defined as SITC 665 + 666 + 8 (less 84, 86).

imports by these economies, by major product categories. It shows imports from the world at large, rates of growth, and the share of the developing countries. These countries are seen to be relatively important suppliers of clothing, non-ferrous metals[6] and, to a lesser extent, textiles and other consumer goods. There is no product category, however, for which they constitute the predominant source of supply. Indeed, their share exceeds 20 per cent only in the case of clothing. The bulk of the manufactures imported by the developed market economies consists of engineering products and chemicals. In 1982, these accounted for 63 per cent of all imports of manufactures by that grouping. The developing countries provided little more than 10 per cent of imports in these two manufacturing categories (5.7 and 4.6 per cent respectively).

The import growth rates provide more grounds for optimism: imports from the developing countries increased more rapidly than those from other sources. This suggests that the competitiveness of the developing countries has improved since 1975. In terms of the composition of these imports, however, the main reason why the developing countries have not made greater gains continues to be their inability to establish themselves as suppliers in the two major product categories—engineering products and chemicals.

Recent trade performance by the major international borrowers

Up to now, this chapter has covered the general subject of trade performance, focusing in particular on the growth, composition and direction of trade in manufactures. But a country's trade performance can also be judged by other standards. These include capital flow and debt, issues which can be critical in the short to medium term and which are interrelated with trade performance. Several recent developments have accentuated the importance of these issues for borrowers in developing countries. The recession in the developed countries, for example, has reduced the developing countries' export earnings, while high real rates of interest have increased their debt-service obligations. Moreover, since a large part of the developing-country debt is denominated in United States dollars, the appreciation of that currency in recent years has added to the debt burden. Thus, a satisfactory trade performance, measured in terms of a favourable balance of trade or, at least, rapid improvement in export performance, is essential for countries obliged to service large foreign debts.

The ability of many developing countries to improve upon their recent trade performance has been curtailed, however, by the growing number of restrictions on world trade in manufactures. The seriousness of this trend should not be underestimated. Information regarding the spread of the restrictions is limited, but according to one estimate 45 per cent of the manufactures imported by the United States, for example, are subject to at least one form of non-tariff barrier.[7] The spread of protectionism in the developed

[6] Some trade classifications do not regard this category as part of the manufacturing sector.

[7] The estimate, made by the Institute for International Economics, Washington, D.C., ignores tariff restraints. See *Far Eastern Economic Review*, 25 October 1984.

countries is limiting the ability of the developing countries to export at a time when they are in dire need of foreign exchange.

The magnitude and growth of the developing countries' debt burden is shown in table III.9. Between 1977 and 1984 the total debt rose by almost $500 billion. While the bulk of this is sovereign debt, owed by national Governments, a growing portion is private. The figures relating debt to total exports (i.e. all goods and services) offer little reassurance. The debt/export ratio increased significantly in 1982 and this relationship has persisted. The debt-service burden has followed a similar pattern. Finally, debt as a share of GDP was almost 36 per cent in 1984, up from 25 per cent in 1977.

Table III.9. Indicators of external debt relative to exports of all goods and services and to the GDP of the developing countries[a]

Indicator	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*
				Billions of dollars[b]				
External debt	327.6	396.0	469.3	559.1	650.8	741.0	782.0	826.7
of which, long term	270.3	325.6	387.5	445.9	514.7	590.8	651.3	727.8
				Percentage				
Debt/exports	124.4	131.0	118.0	108.6	120.1	145.8	154.5	146.8
Debt service[c]/exports	15.1	19.1	19.0	17.4	20.2	24.4	22.1	21.5
Debt/GDP	24.6	25.5	25.4	25.5	28.5	32.8	35.3	35.6

Source: International Monetary Fund, *World Economic Outlook, 1984*, and *World Economic Outlook, Revised Projections*, Occasional Paper 32 (International Monetary Fund, Washington, D.C., September 1984).

[a]Excluding the following oil-exporting countries: Iran (Islamic Republic of), Iraq, Kuwait, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia and United Arab Emirates.

[b]At current prices.

[c]Including interest and amortization.

Most developing countries have come to depend increasingly on the manufacturing sector as a source of domestic growth and as an earner of foreign exchange. Expanding manufacturing production and exports is seen as a way of meeting international financial obligations. In the paragraphs that follow, recent trends in international indebtedness are examined in relation to trade in manufactures with particular reference to eight of the most heavily indebted developing countries: Argentina, Brazil, Chile, Indonesia, Republic of Korea, Mexico, Philippines and Venezuela.[8] While the picture presented by the examination is only a partial one, it does nevertheless reveal an important dimension of the interrelationship between trade and international finance.

Table III.10 shows the composition of trade in these countries, with growth rates for exports and imports of industrially processed goods throughout the period 1975-1981. These rates do not indicate any improvement in the balance of trade in manufactures. Although exports rose more rapidly than imports in four countries, the situation was the reverse for the others. The

[8]W. Cline, *International Debt and the Stability of the World Economy* (Washington, D.C., Institute for International Economics, 1983) and United Nations Conference on Trade and Development, *UNCTAD Statistical Pocket Book* (United Nations publication, Sales No. 84.II.D.20), p. 92.

Table III.10. Annual trends in exports and imports of industrially processed goods in selected countries, 1975-1981[a]

(Percentage change)

Country	*1975-1976*	*1976-1977*	*1977-1978*	*1978-1979*	*1979-1980*	*1980-1981*	*1975-1981*
			Exports				
Argentina	46.9	44.4	14.2	20.8	6.2	−1.2	20.3
Brazil	−2.1	39.7	20.4	26.4	36.6	25.0	25.5
Chile	33.4	−9.2	15.1	72.4	9.2	−25.6	15.5
Indonesia	1.1	46.8	7.7	61.6	29.6	−0.3	26.4
Mexico	5.4	8.3	39.3	4.9	. . .	. . .	15.4[b]
Philippines	11.4	22.1	6.8	35.1	23.8	−1.6	17.6
Republic of Korea	57.6	25.6	30.2	18.2	18.8	21.7	26.3
Venezuela	25.1	−3.7	5.8	63.7	21.9	−48.7	10.4
			Imports				
Argentina	−27.2	40.3	−3.0	78.8	62.8	−9.6	24.6
Brazil	−9.0	−5.9	8.7	21.0	16.8	−17.3	4.6
Chile	7.7	22.0	33.9	51.6	32.3	33.9	31.8
Indonesia	20.3	5.0	7.3	4.8	46.1	25.8	15.7
Mexico	−0.5	−12.4	46.7	54.5	.	. . .	17.5[b]
Philippines	−1.5	8.5	21.3	30.7	12.2	−2.7	13.8
Republic of Korea	21.2	25.2	50.4	29.7	−8.0	16.2	22.8
Venezuela	4.5	63.6	10.4	−11.3	9.6	11.5	12.4

Source: UNIDO data base and data supplied by the Statistical Office of the United Nations Secretariat.

[a] For a definition of trade in industrially processed goods, see appendix I.

[b] 1975-1979.

case of Brazil appears to be an extreme one, in view of the fact that imports grew at a rate of only 4.6 per cent per annum during the period. Annual percentage changes show wide swings in the levels of trade in all eight countries. Performance in 1980-1981 was particularly poor: relative to the previous year, the absolute value of exports declined in five of the seven countries for which data were available. This volatility in the levels of trade, the most prominent feature yielded by the data, poses serious problems for Governments attempting to gauge their foreign exchange requirements and, thus, their ability to service the foreign debt.

Such instability, of course, reflects a whole variety of factors relating to both demand and supply. Table III.11 highlights the role of demand for manufactures in 1975-1981, showing exports and imports according to their composition. The import figures reveal a similar pattern for all eight of the countries listed. Consumer non-durables formed a negligible proportion of the total, with capital goods and consumer durables[9] accounting for the bulk and industrial intermediates and supplies accounting for a smaller share. An important implication of these figures is that any restriction on imports —dictated, for example, by a shortage of foreign exchange or the need to

[9] Ideally, a distinction should be made between these two types of goods, since they are purchased for different purposes, and any shortfall in imports of either of them would have entirely different consequences for the importing country. This distinction could not be made in the present instance, however, owing to the nature of the relevant data and the way it is classified.

Table III.11. Shifts in the composition of trade in manufactures in selected developing countries, 1975-1981 (as percentages of exports and imports of manufactures)[a]

	Consumer non-durables		*Industrial intermediates*		*Capital goods and consumer durables*	
Country and year	*Exports*	*Imports*	*Exports*	*Imports*	*Exports*	*Imports*
Argentina						
1975	9.0	3.3	12.0	63.4	28.4	29.6
1977	14.0	3.7	14.2	41.3	16.2	50.5
1979	16.4	5.4	15.2	38.3	12.9	43.9
1981	11.7	9.0	19.1	29.8	10.7	55.4
Brazil						
1975	8.8	2.7	20.8	41.4	19.8	51.5
1977	7.4	2.9	18.3	43.1	22.2	48.3
1979	8.3	3.4	26.1	42.1	25.9	45.7
1981	6.5	3.2	23.5	39.0	26.4	50.1
Chile						
1975	0.5	4.1	89.8	28.5	1.8	54.2
1977	0.9	6.5	85.3	26.4	3.1	56.3
1979	0.3	8.1	86.7	28.1	2.6	52.5
1981	0.4	10.6	79.5	24.5	4.4	53.4
Indonesia						
1975	2.9	1.8	15.0	40.1	4.3	44.3
1977	2.2	2.3	25.7	29.3	5.1	45.7
1979	4.1	2.3	38.1	37.6	5.2	40.8
1981	5.1	2.1	33.9	35.2	6.3	44.7
Mexico						
1975	9.8	4.0	51.6	28.9	20.2	60.3
1977	10.2	4.6	55.1	31.0	19.3	59.0
1979	10.0	4.2	46.3	30.7	27.2	59.9
Philippines						
1975	8.2	2.9	15.6	34.5	1.2	51.6
1977	12.4	3.2	20.7	39.5	3.5	44.2
1979	18.0	3.1	28.0	38.8	4.6	45.6
1981	22.2	3.5	21.9	35.5	6.7	45.3
Republic of Korea						
1975	40.6	4.3	31.9	41.9	19.7	45.7
1977	38.4	5.5	30.1	41.3	27.2	47.1
1979	35.1	4.6	34.5	37.4	28.1	50.8
1981	32.3	5.2	33.9	37.9	30.7	46.5
Venezuela						
1975	0.3	5.2	2.5	29.8	0.6	58.4
1977	0.3	4.1	3.4	29.1	0.6	58.6
1979	0.1	6.4	6.5	28.6	0.6	56.0
1981	0.3	7.1	21.3	27.8	3.2	52.6

Source: UNIDO data base and data supplied by the Statistical Office of the United Nations Secretariat.

[a]Percentages do not add up to 100 as trade in other types of manufactures which could not be associated with any of these product categories is excluded.

conserve such exchange in order to service a foreign debt—will impose a heavy burden on the manufacturing sector, normally the principal user of imported capital goods and industrial intermediates.

With regard to exports, the Republic of Korea and to a lesser extent Argentina and the Philippines are seen to depend on foreign markets for consumer non-durables. Industrial intermediates are especially prominent in the case of Chile and moderately so for the other countries, while exports from Brazil, the Republic of Korea and Mexico include a comparatively large share of capital goods and consumer durables. The composition of exports, therefore, varies widely among developing countries and the role of external demand as a determinant of export performance varies accordingly.

Finally, table III.12 shows debt-service requirements in relation to total exports and exports of industrially processed goods and intermediates. The year-to-year changes are significant, the result primarily of the volatility in the rates of exports (both total and industrial). Like conditions in the developing countries in general, debt service trends in the countries listed differ from one country to another. The figures for Indonesia show very little change between 1975 and 1981, and only a moderate rise can be observed in the figures for the Republic of Korea. The changes are more significant in the case of the other developing countries.

The relationship between debt service and exports also differs widely from country to country. A wide gap between total exports and industrial exports reflects the fact that the latter account for a relatively minor proportion of the total (e.g. as in the case of Indonesia, Mexico and Venezuela, all of which are oil exporters). In the Republic of Korea, industrial exports account for the bulk of the total and the relationship between the two is close.

Table III.12. Relationship between debt service and exports, 1975-1981[a]

(Percentage)

Country[b]	*Debt service relative to*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*
Argentina	total exports	33.3	44.9	22.7	49.9	26.1	42.6	48.1
	industrial exports	62.4	75.8	38.2	83.4	44.1	69.8	90.8
Brazil	total exports	43.4	48.2	51.4	62.7	69.0	64.2	71.3
	industrial exports	76.1	100.9	92.2	97.6	102.3	92.0	94.6
Indonesia	total exports	6.0	7.0	8.2	9.5	7.3	5.0	5.5
	industrial exports	48.6	67.2	68.7	78.9	50.4	37.0	42.0
Mexico	total exports	61.4	88.6	105.8	110.7	115.6	...	...
	industrial exports	108.0	181.4	233.5	258.1	359.4	...	...
Republic of Korea	total exports	13.9	11.3	11.9	14.6	16.4	20.5	21.9
	industrial exports	15.6	12.2	13.3	15.9	17.8	21.9	23.4
Venezuela	total exports	3.6	8.5	10.5	16.5	17.1	16.1	22.6
	industrial exports	12.6	25.3	33.2	47.1	46.2	48.1	119.9

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat with estimates by the UNIDO secretariat; W. Cline, *International Debt and the Stability of the World Economy* (Cambridge, Massachusetts, MIT Press, 1983), pp. 130-131.

[a]Total exports are SITC 0-9. Industrial exports refer to industrially processed goods and intermediates For a definition, see appendix I.

[b]Data for Chile and the Philippines were not available.

Manufacturing is generally regarded as the sector with the most dynamic growth prospects for most developing countries. The data presented in table III.12 indicate, however, that the growth in exports of manufactures has not matched the growth in debt-service requirements. A comparison of the figures for 1975 and 1981 show only one instance (Indonesia) where debt service relative to exports has fallen. The fact that exports from the manufacturing sector have not grown at a pace that would exceed the growth in the debt-service burden, at least in many countries, suggests an urgent need for remedial steps. These might involve basic revisions in international financial policies and practices as well as steps to reduce import restrictions in the major markets.

Share of exports in output of manufactures

The relationship between export performance and economic advancement in the field of manufactures has long been of interest to economists concerned with theoretical, structural or policy-related issues. Many of them have addressed the question in terms of extent of import penetration, degree of worker displacement, or national performance relative to growth in world trade. In the present *Survey*, a different approach is taken: export performance is analysed in relation to the industrial base of the exporting country. Table III.13 shows recent growth trends in MVA, exports of manufactures and merchandise, and GDP in each of the three major economic groupings. Most of the data presented will be familiar, but they are repeated here because they provide a useful backdrop to the analysis.

The high rates of growth in total income[10] recorded for the 1960s and early 1970s indicate that economi growth during that period was exceptional. The consequences of the subsequent global recession are also evident: the growth of income in developing and developed countries alike declined noticeably after 1974. A similar pattern is observed in the case of total exports (SITC 0-9), although the decline seems to have been particularly abrupt for the developing countries. Other indicators in table III.13 support the thesis that for many developing countries manufacturing should have been the sector with the most impressive growth. This is clear from a comparison of the growth rates for GDP and manufacturing during 1960-1970. But then the picture becomes less sharp, especially after 1974 when the two growth rates seem to converge.[11]

Research has shown that a stable and long-term relationship exists between exports and production in the manufacturing sector, with the growth rate of the former exceeding that of the latter.[12] The data in table III.13 confirm that, prior to 1974, growth in exports of manufactures (in current dollars) in all three economic groupings far exceeded growth in MVA. Furthermore, that relationship continued in later years, although, again, the differences in the growth rates diminished.

[10]Income is measured in terms of GDP for developed market economies and developing countries and in terms of net material product (NMP) for centrally planned economies.

[11]In the developed market economies, the growth of MVA approximately equalled that of GDP (at constant prices). In the centrally planned economies, the industrial sector continued to expand at a more rapid pace than NMP, despite the slow-down. Post-1974 trends in manufacturing and GDP are treated in some detail in chapter II of the present *Survey*.

[12]R. Batchelor, R. Major and A. Morgan, *Industrialization and the Basis for Trade* (London, Cambridge University Press, 1980), pp. 16-17.

Table III.13. A comparison of growth rates for GDP, MVA and exports of manufactures, 1960-1980[a]

(Percentage)

Indicator	*1960-1970*	*1970-1974*	*1974-1980*	*1970-1980*
		Developing countries		
GDP, in current dollars	7.8	20.7	16.8	18.3
GDP, in constant dollars	5.6	6.9	5.4	6.0
Total exports in current dollars	7.1	40.4	16.4	26.2
Total exports; volume index/constant dollars	6.9/7.3	4.3/7.3	2.3/4.4	1.5/4.4
MVA, in current dollars	3.7	20.9	15.2	17.5
MVA, production index/constant dollars	5.9/7.1	9.1/8.8	6.0/6.0	6.9/6.9
Manufactured exports, in current dollars	13.7	36.3	23.0	26.6
Manufactured exports, quantum index	...	...	13.4[b]	...
		Developed market economies		
GDP, in current dollars	8.4	14.4	13.2	13.7
GDP, in constant dollars	5.1	4.3	3.2	3.2
Total exports in current dollars	10.0	25.2	15.7	18.9
Total exports; volume index/constant dollars	8.5/8.0	9.6/8.6	5.3/5.6	6.1/6.2
MVA, in current dollars	8.1	15.1	12.2	12.5
MVA, production index/constant dollars	6.1/6.3	5.5/5.5	3.1/3.3	3.0/3.3
Manufactured exports, in current dollars	11.5	24.8	15.7	19.0
Manufactured exports, quantum index	10.0	9.6	5.3	6.5
		Centrally planned economies		
NMP, in constant dollars	6.7	6.6	4.4	5.4
Total exports in current dollars	9.8	22.3	16.0	18.6
Index of industrial production	9.0	8.9	6.2	7.5
Manufactured exports, in current dollars	10.0	20.4	14.7	17.0

Source: GDP and constant price data for total exports and manufacturing output: United Nations, *Yearbook of National Accounts Statistics*, vol. II, international tables, various issues. Manufacturing production index: United Nations, *Yearbook of Industrial Statistics*, vol. I and *Monthly Bulletin of Statistics*, various issues. MVA in current prices: UNIDO data base. Volume index for total exports: United Nations Conference on Trade and Development, *Handbook of International Trade and Development Statistics, 1983* (United Nations publication, Sales No. E/F.83.II.D.2). Other export data were calculated from United Nations, *Yearbook of International Trade Statistics* and *Monthly Bulletin of Statistics*, various issues.

[a] SITC 5-8 less 68.

[b] 1975-1980.

Like earlier studies,[13] the present *Survey* is concerned with export performance in the field of manufactures viewed in the light of the recession that began in the 1970s. That recession is unique in comparison with earlier long-term cyclical recessions. It has been noted, for example, that relationships between total trade and aggregate demand, as well as between trade in manufactures and primary products, are quite different during the present recession.[14] The recession is exceptional also in the sense that it represents the first time that a decline has applied only to the growth rate of income, and not to the income itself.

[13] See, for example, J. Riedel, "Trade as the engine of growth in developing countries, 'revisited'", *Economic Journal*, vol. 94, 1984.

[14] See M. Michaely, "Trade in a changed world economy", *World Development*, vol. 11, No. 5 (1983), p. 399.

The empirical measure employed here was suggested by researchers who reasoned that during periods of expanding demand an increase in the share of exports in gross manufacturing output would demonstrate the importance of external demand to export success.[15] Conversely, the share of exports might be expected to decline when rates of growth in world income are falling, for three reasons. First, imports are particularly sensitive to the business cycle and to changes in income. In the downward phase of previous long-term cycles, the ratio of trade to income has tended to decline. If this trend were common to most countries, the balancing measures necessary would be minimal, since one country's imports are another's exports. Secondly, in the case of manufactures, the argument can be extended by noting that the income elasticity of demand for those goods exceeds unity and that the propensity to import manufactures would presumably be higher than that for other goods. Finally, in periods of declining income, new import restraints would most frequently be imposed on products offering direct competition (mainly manufactures)[16] and any contraction in trade would most likely occur in this field. This line of reasoning suggests that with a decline in world income the share of exports in gross manufacturing output might be expected to fall.

When estimating the share of exports in gross manufacturing output, emphasis was placed on the need to cover all activities specified by ISIC as being part of the manufacturing sector.[17] This approach led to the adoption of the broad definition of manufactures—industrially processed goods and intermediates—used earlier in this chapter. The definition includes several "processing industries" which are regarded as manufacturing activities in production statistics but are often omitted from statistics covering trade in manufactures.[18] Although such industries' value added per unit of output is relatively small, their contribution to total MVA and gross manufacturing output is considerable in the developing countries. If processing industries are taken to be those producing food, beverages, tobacco, petroleum and non-ferrous metals, for example, they accounted for an estimated 31 per cent of the developing countries' total MVA in 1981. The corresponding figure for the developed market economies was 14.9 per cent.[19]

Sufficient data were available for the period 1970-1980 to include 32 countries in the analysis: 21 developing countries and 11 developed market

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[15]Other indicators might include: *(a)* an association between the timing of changes in exports and in GNP, with the latter following the former; *(b)* a concentration of exports in rapidly growing industries and/or exceptional growth in industries linked to export industries; and *(c)* the attraction of foreign capital to export industries or to supporting industries. See I. Kravis, "Trade as a handmaiden of growth: similarities between the nineteenth and twentieth centuries", *Economic Journal*, vol. 80, 1970, pp. 850-872.

[16]See, for example, G. K. Helleiner, "Structural aspects of third world trade: some trends and prospects", *Journal of Development Studies*, vol. 15, No. 3 (1979), p. 80.

[17]The opposite approach has been followed by others. See, for example, the definitions employed by D. Keesing, "World trade and output of manufactures: structural trends and developing countries' exports", World Bank Staff Working Paper No. 316 (Washington, D.C., 1979), and Batchelor, Major and Morgan, *op. cit.*, appendix C.

[18]Moreover, the industries omitted vary. Compare, for example, the list adopted by Keesing, *op. cit.*, p. 10 with that of Batchelor, Major and Morgan, *op. cit.*, p. 281.

[19]*A Statistical Review of the World Industrial Situation, 1984* (UNIDO/IS.506), p. 13.

economies.[20] Most of the major exporters and producers of manufactures within these two economic groupings were included in the analysis. In 1980 the 11 developed market economies accounted for 76.4 per cent of all exports of manufactures and 75.8 per cent of total MVA of the two economic groupings. The 21 developing countries accounted for 8.3 and 10.9 per cent respectively. (They also accounted for 72.7 per cent of all manufacturing exports and 77.8 per cent of total MVA of all developing countries.[21])

Table III.14 summarizes the basic results of the analysis. Exports of manufactures from the developing countries grew at a pace slightly above that of the developed market economies.[22] Growth rates for individual countries indicate that exports of manufactures from the developing countries are more volatile in performance, reflecting a more diverse range of trade performance, than those from the developed market economies. The relationship between exports and gross manufacturing output is of more interest, however. Contrary to expectations, the average share of gross manufacturing output devoted to exports did not decline during the recession. In the period 1974-1980 the weighted averages for both groups of countries were higher than those in the early 1970s. The country data reveal, however, that subsequent to 1974 five developing countries suffered a decrease (of more than 1 per cent) in the export/output ratio while the developed market economies did not.

These trends, while somewhat unexpected, did confirm other basic propositions concerning export/output relationships. In particular, there were few instances where a country's exports exceeded one third of its gross manufacturing output. This comparatively small proportion underlines the importance of domestic demand and the need to expand the domestic markets. Related data show that, at least in extreme cases, the degree of export dependence varies inversely with the size of the domestic market. Countries and areas with relatively small domestic markets—Belgium-Luxembourg, Hong Kong, the Netherlands and Singapore—exported an unusually high proportion of gross manufacturing output during the 1970s. Conversely, with the exception of Pakistan and the Federal Republic of Germany, all of the larger countries (Brazil, India, Mexico, Nigeria, Japan and the United States) exported a comparatively modest proportion.

Finally, the figures in table III.14 provide a basis for comparing the recent export performance of the developing countries with that of the developed market economies. For the years 1970-1974, the average export/output shares for the two groupings were almost identical, but then they tended to diverge. Subsequent to 1974, exports as a percentage of gross manufacturing output rose to a modest average of 14.7 per cent for the developing countries, but increased to 17.0 per cent for the developed market economies. Despite the sluggish growth in world income and demand, foreign markets have accounted for an increasing share of manufacturing output—but particularly that of the developed market economies.[23]

[20]For want of comparable statistics, the centrally planned economies were not included in the analysis.

[21]Figures derived from the UNIDO data base.

[22]Growth rates based on an alternative definition of trade in manufactures—SITC 5-8 less 68—are given in table III.13 for all developing and developed countries. Adoption of the broader definition had little effect on the growth rate figures.

[23]The gap between the two groupings would be even more marked if the list of developing countries could be extended to include many of the marginal exporters of manufactures.

Table III.14. Exports of industrially processed goods as share of gross manufacturing output, 1970-1980

(Percentage)

Country or area	Growth of exports 1970-1980	Exports-gross output (unweighted average)		Share of exports in total of grouping	
		1970-1974	1974-1980	1970	1980
Developing countries or areas					
Brazil	26.7	5.9	6.0	8.6	14.0
Chile	15.5	22.7	28.0	8.1	3.6
Colombia	21.5	7.0	8.1	1.1	1.2
Ecuador	45.3	6.9	14.0	0.1	0.6
Egypt	4.9	24.9	19.1	5.0	1.0
Ghana	12.2	19.3	13.0	0.6	0.2
Hong Kong	21.1	62.3	64.1	15.1	13.1
India	15.2	7.9	8.8	10.3	4.9
Indonesia	33.6	24.2	25.5	1.0	2.9
Kenya	24.4	19.7	19.4	0.8	0.8
Malaysia	25.7	44.9	45.2	5.4	6.0
Mexico	15.9	5.8	5.5	6.1	4.9
Nigeria	7.6	9.6	3.8	1.3	0.4
Pakistan	14.9	32.5	32.4	3.9	2.3
Peru	10.5	16.0	13.7	5.9	1.9
Philippines	22.0	17.2	19.0	3.5	3.1
Republic of Korea	38.8	23.8	27.4	5.0	16.2
Singapore	29.0	61.6	69.8	6.4	11.3
Thailand	29.6	13.7	16.3	2.1	3.6
Turkey	15.5	6.9	4.9	2.4	1.6
Venezuela	21.2	22.0	21.4	7.3	6.4
Average[a]	22.8	13.7	14.7	100.0	100.0
Developed market economies					
Belgium-Luxembourg	17.9	52.3	57.7	6.1	5.9
Canada	14.2	22.6	23.7	7.1	4.8
France	20.5	18.2	22.3	9.3	10.9
Germany, Federal Republic of	19.0	25.2	28.8	19.1	19.4
Italy	20.2	24.8	28.9	7.4	8.0
Japan	20.9	10.5	12.6	11.2	13.8
Netherlands	19.4	43.2	50.6	5.9	6.6
Sweden	16.5	34.3	38.2	3.7	3.1
United Kingdom	17.6	17.1	20.2	10.3	9.7
United States	17.5	5.7	7.5	19.9	17.8
Average[a]	18.7	13.8	17.0	100.0	100.0

Source: See appendix II.

[a]Averages calculated by aggregating each country's exports and gross manufacturing output for the years 1970-1980 and deriving therefrom the corresponding growth rates. Gross manufacturing output was first expressed in United States dollars using annual average exchange rates given in International Monetary Fund, *International Financial Statistics*.

The distinction between the two economic groupings becomes more pronounced when growth rates are considered. Table III.15 provides comparative figures for 1970-1974 and 1974-1980, showing the growth rates for exports and gross manufacturing output as well as differences in these growth rates. The effects of the global recession are evident for all countries. In general, after

Table III.15. Growth rates for exports of industrially processed goods and gross manufacturing output, 1970-1980[a]

(Percentage)

Country or area[b]	Exports		Output		Difference (exports less output)	
	1970-1974	1974-1980	1970-1974	1974-1980	1970-1974	1974-1980
Developing countries or areas						
Singapore	44.8	21.5	40.9	18.5	3.9	3.0
Hong Kong	23.3	20.9	16.4	23.5	6.9	−2.6
Malaysia	32.9	21.0	36.9	20.8	−4.0	0.2
Pakistan	20.4	16.0	−2.7	15.6	23.1	0.4
Indonesia	70.5	20.4	37.3	21.5	33.2	−1.1
Chile	18.0	13.1	7.9	18.6	10.1	−5.5
Republic of Korea	61.7	27.9	36.1	29.6	25.6	−1.7
Venezuela	39.9	11.2	20.0	17.1	19.9	−5.9
Egypt	17.9	−3.2	16.7	1.8	1.2	−5.0
Philippines	33.3	14.5	25.7	16.2	7.6	−1.7
Kenya	20.7	22.8	27.6	22.7	−6.9	0.1
Ecuador	47.9	42.9	20.1	25.5	27.8	17.4
Thailand	46.5	21.2	47.1	18.3	−0.6	2.9
Peru	8.2	12.8	20.1	6.7	−11.9	6.1
Ghana	18.7	6.2	19.7	15.0	−1.0	−8.8
India	19.4	9.6	14.2	14.3	5.2	−4.7
Brazil	46.5	20.5	34.1	13.6	12.4	6.9
Colombia	46.9	10.6	18.9	18.2	28.0	−7.6
Mexico	31.1	15.1	17.9	12.3	13.2	2.8
Turkey	34.5	9.3	30.7	12.9	3.8	−3.6
Nigeria	7.8	9.8	19.5	24.5	−11.7	−14.7
Group average[c]	32.8	18.3	24.3	15.9	8.5	2.4
Developed market economies						
Belgium-Luxembourg	27.0	14.5	24.0	11.0	3.0	3.5
Netherlands	30.0	14.0	23.7	10.2	6.3	3.8
Sweden	24.8	11.8	19.1	9.7	5.7	2.1
Italy	23.1	18.4	24.1	13.8	−1.0	4.6
Germany, Federal Republic of	28.2	14.9	20.1	16.2	8.1	−1.3
Canada	16.0	14.1	17.9	9.4	−1.9	4.7
France	27.2	17.1	21.0	13.9	6.2	3.2
United Kingdom	17.9	17.5	15.3	14.4	2.6	3.1
Japan	28.9	16.0	26.0	15.8	2.9	0.2
United States	21.5	14.0	13.2	11.5	8.3	2.5
Group average[c]	24.7	15.4	17.8	13.3	6.9	2.1

Source: See appendix II.

[a] Least squares estimates, based on observations for the entire period.

[b] Ranked by average share of exports in output during the entire period 1970-1980.

[c] Calculated by first converting all data into terms of United States dollars, then aggregating country data to obtain group totals for exports and output throughout the period 1970-1980. Growth rates for each group estimated by least squares.

1974 export growth rates declined at a much more significant pace than those for gross manufacturing output. But data for the two economic groupings, while broadly similar, leave different impressions. For the developing countries, the average differential between the two rates fell from 8.5 per cent in 1970-1974

to 2.4 per cent in 1974-1980. In fact, for 12 of those countries, including several relatively important exporters, gross manufacturing output actually expanded more rapidly than exports. The effects of the recession were not so dramatic in the case of the developed market economies. In general, the traditional relationship between the two growth rates was maintained: exports continued to expand more rapidly than output (except in the Federal Republic of Germany). The data suggest a disparity in export performance between the developing countries and the developed market economies, with the former grouping being more seriously affected by considerations relating to external demand.

Despite the relatively hostile trading environment that developed with the onset of the recession, manufactures for export continued to claim a growing share of production in many countries. Nevertheless, recent export performance in most countries has not been impressive, the result, mainly, of a fall in external demand. The developing countries appear to be particularly sensitive to this fall.

In conclusion, casual acceptance of the proposition that internal factors will always play a more important role than external demand in determining export performance is not justified—particularly when growth is generally slow in all countries. Recent trends in export performance underline the need to remove trade restrictions on exports from the developing countries and to assist in those countries' integration into the world trading community.

APPENDIX I

SITC CATEGORIES WHICH TOGETHER CONSTITUTE "TRADE IN INDUSTRIALLY PROCESSED GOODS AND INTERMEDIATES"[a]

SITC code	*Description*
01	Meat and meat preparations
02	Dairy products and eggs
032	Fish, in airtight containers, n.e.s. and fish preparations
042.2	Rice, glazed or polished
046	Meal and flour of wheat or of meslin
047	Meal and flour for cereals except of wheat or of meslin
048	Cereal preparations and starch
052	Dried fruit
053	Fruits, preserved and fruit preparations
055	Vegetables, roots and tubers, preserved or prepared
06	Sugar, sugar preparations and honey
071.3	Coffee extracts, essences, concentrates and similar preparations
072.2	Cocoa powder, unsweetened
072.3	Cocoa butter and cocoa paste
073	Chocolate and other food preparations containing cocoa or chocolate n.e.s.

[a]This definition is based upon a concordance between the ISIC and the SITC, as described in *Classification of Commodities by Industrial Origin*, Series M, No. 43, Rev. 1 (United Nations publication, Sales No. E.71.XVII.15). (See also appendix II.)

074	Tea and maté
081	Feeding-stuff for animals
09	Miscellaneous food preparations
11	Beverages
122	Tobacco manufactures
221.9	Flour and meal of oil-seeds, oil nuts and oil kernels
231	Crude rubber (including synthetic and reclaimed)
less 231.1	less: natural rubber and similar natural gums
243	Wood, shaped or simply worked
251	Pulp and waste paper
262.6	Wool shoddy
262.7	Wool or other animal hair, carded or combed (excluding tops)
262.8	Wool tops
262.9	Waste of wool and of other animal hair n.e.s.
263	Cotton
266	Synthetic and regenerated (artificial) fibres
267	Waste materials from textile (including rags)
332	Petroleum products
4	Animal and vegetable oils and fats
5	Chemicals
6	Manufactured goods classified chiefly by material
less 667	less: pearls and semi-precious stones
7	Machinery and transport equipment
8	Miscellaneous manufactured articles
less 863 and 896	less: developed cinematographic film, works of art, collectors' pieces and antiques

APPENDIX II

CALCULATING THE SHARE OF EXPORTS IN GROSS MANUFACTURING OUTPUT

In order to obtain comparable sets of data for production and exports of manufactures, it is necessary to develop a workable concordance between the two statistical classifications (ISIC and SITC). One way of doing this is to adopt a traditional definition of trade in manufactures (e.g. SITC 5-8 less 68) and then attempt to identify the corresponding products or industries in the production statistics. An alternative approach, and the one taken in the present *Survey*, is to adopt the traditional definition of manufacturing production (ISIC 3) and compile the trade statistics to match it. This approach, which results in the inclusion of various industries that are predominantly engaged in the processing of natural resources (e.g. food, beverages, petroleum products and non-ferrous metals),[a] offers several advantages. First, trade data are reported in

[a] D. Keesing, "World trade and output of manufactures: structural trends and developing countries' exports", World Bank Staff Working Paper No. 316 (Washington, D.C., 1979), opted for the former approach and excluded several industries—food, beverages, tobacco, petroleum products, basic non-ferrous metals along with certain pulp and paper products—from his analysis. R. Batchelor, R. Major and A. Morgan, *Industrialization and the Basis for Trade* (London, Cambridge University Press, 1980) p. 281, followed a similar procedure, although the list of industries excluded differs from that cited by Keesing.

more detail than production data. A more precise concordance is achieved by identifying the appropriate trade categories than by adjusting production data to coincide with a predetermined definition of trade in manufactures. Second, whereas there is no generally accepted definition of trade in manufactures (several versions can be found in the literature),[b] there is general agreement as to the definition of manufacturing production. Third, while the preferred method admittedly results in the inclusion of several industries with relatively low levels of value added per unit of output, these industries—which include food processing, beverages, tobacco, petroleum refining and non-ferrous metals—are important in terms of their contribution to a country's foreign exchange earnings and manufacturing production.

Developing this workable concordance between the two statistical systems also meant the adoption of certain assumptions and estimates.[c] Difficulties arose when the products comprising a SITC category were produced by establishments in more than one economic sector (a situation which occurs most frequently in the case of agro-based exports). In order to cope with the problem, most of the commodities assigned to a particular SITC category were associated either with the manufacturing or the agricultural sector in the production classification, and the export category was treated accordingly. A related problem was that in the industrial classification establishments are defined according to their main activity, although some may produce secondary products associated with another industry. The SITC, by contrast, is essentially a classification of commodities for trade. The distinction made here could introduce serious distortions in the case of an industry-specific study, but when an entire sector is considered the distortions are of only minor consequence.[d]

Coverage of the manufacturing sector can vary among countries, according to the importance attached to the size of the manufacturing establishment. Some countries' statistics exclude establishments employing less than 20 workers. But although such small firms are unlikely to be important importers or exporters, their contribution to gross output can be significant. Their exclusion may mean over-estimation in the share of exports in gross manufacturing output. Whenever possible, United Nations data have been adjusted to provide standard coverage for all firms employing 5 or more. Adjustments have been made using data from national censuses which reported the share of firms with 5 to 19 employees in gross output of the manufacturing sector. These data, although generally given for only one year, were used to present a more realistic picture of the gross output of the sector for all years included in the *Survey*.

Gross output data may include some duplication, for when establishments in a given industry are involved at various stages of the production process, a considerable amount of double counting can occur. Moreover, when a high degree of vertical specialization exists, estimates of the share of exports in gross output become distorted. This phenomenon is probably more prevalent ... the developed than in the developing countries. When it occurs, gross output is over-estimated and the resultant trade ratios in the developed countries are under-estimated, relative to those for the developing

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[b]These include: *(a)* SITC 5-8; *(b)* SITC 5-8 less 68; and *(c)* SITC 5-8 less 67 and 68. More detailed definitions involving a larger number of SITC categories have been suggested and employed by UNCTAD and the United Nations. For more on this subject see V. Prakash, "Measuring industrial efforts: a comparative study of variations arising from differences in definition", World Bank Staff Working Paper No. 225 (Washington, D.C., 1976).

[c]For a partial concordance between the two statistical systems, see United Nations, *Classification of Commodities by Industrial Origin*, Series M, No. 43, Rev.1 (United Nations publication, Sales No. E.71.XVII.15). A more precise one, however, requires that either or both of the classifications be extended to a greater level of detail.

[d]The distortions could become acute if many establishments were to supply a mixture of manufactures and services. This, however, is a statistical problem inherent in all studies that are not economy-wide and its effects would be difficult to judge. A similar comment applies to the role of the "hidden economy" which is thought to be extensive in some countries.

countries. Increasing vertical specialization can also make it difficult to compare the figures for individual countries over different time frames.

The valuation concept used to measure gross manufacturing output also varies among countries. Some report it according to producers' prices, meaning that indirect taxes are included and subsidies are excluded. Others report it as factor costs, omitting indirect taxes, but including subsidies. The data available were insufficient to permit adjustment for these variations, but, again, the consequences of using different valuation concepts are most apparent at the level of specific industries and less so when attention is focused on the entire manufacturing sector.

When data were not available, or appeared to be contradictory, estimates were made. For example, for some countries the United Nations *Yearbook of National Accounts* provides a complete time series covering gross output in the manufacturing sector. The figures provided, however, differ from those derived from national censuses and published in the United Nations *Yearbook of Industrial Statistics* (and, for that matter, from those compiled by UNIDO).[c] In this case, the procedure followed was to calculate annual ratios between the relevant data contained in the two *Yearbooks* for the period 1970-1980. Next, an unweighted average of these ratios was applied to the *Yearbook of National Accounts* figures, and the corresponding census data were then estimated. When gross manufacturing output was not reported in the *Yearbook of National Accounts*, value added, from the same source, was used as the basis for estimation. The ratio of value added to gross manufacturing output (according to census concepts) was then calculated for all years in the period 1970-1980 for which data were available, and the unweighted average was used to estimate output in the other years.

[c]The discrepancies result from differences in national accounting and census concepts.

IV

Patterns of consumption in manufactures

THE purpose of the present chapter is to document recent trends in the consumption of manufactures through an analysis carried out in terms of commodity balances and taking into account the production, import and export aspects of each manufacture.[1] An analysis of consumption patterns in manufactures is useful for several reasons. First, a primary goal of industrialization is to increase the volume of manufactures of household consumer goods as well as of industrial goods for use in manufacturing or in other economic sectors. Accordingly, any assessment of industrial progress would be incomplete without some indication of the extent to which such consumption needs are being met.

Secondly, there is a continuous need for information on sources of supply of manufactures (both foreign and domestic) and on the uses of such manufactures (whether for home consumption or export), as the relationship between trade and output is of vital concern to policy makers and industrial strategists. (For example, if imports tend to grow in relation to consumption, this may indicate a need for corrective policies. The aim of such policies might be to generate foreign exchange through export promotion or to reduce foreign exchange requirements through import substitution.) Finally, as commodity balances provide basic information to planners, project evaluators and market analysts, a study of consumption trends in different economic groupings and in countries at different stages of development is useful.

However, although such information is essential to a thorough understanding of industrial progress, data for the calculation of balances are available for only a limited number of commodities.[2] As these data are scanty, much effort is required in matching the figures for output of manufactures with the appropriate trade figures in order to obtain estimates of commodity balances.[3] These statistical limitations have obviously imposed constraints on the scope and nature of the present analysis.

Altogether 82 commodities are considered here, most of them food products and industrial intermediates which go to satisfy the basic needs of the population. Consumer durables and capital goods are not considered, for want of sufficient information. The commodity balances are measured in physical units rather than in units of value. This means that consumption totals for

[1]Consumption is defined as production, plus imports, less exports. Since variations in stocks are not taken into consideration, it is more appropriate to speak of apparent consumption than of real consumption. In this chapter, therefore, the term consumption is used to refer to the concept of apparent consumption.

[2]The data used here are from the *Handbook of Industrial Statistics, 1984* (United Nations publication, Sales No. E/F.84.II.B.8). The *Handbook* contains estimates of apparent consumption of 100 commodities in some 150 countries over two periods, 1972-1974 and 1979-1981.

[3]The procedures and assumptions adopted are described in detail in the *Handbook of Industrial Statistics, 1984*.

broad groups of products or industries cannot be derived; much of the analysis is carried out in respect of individual commodities. In order to facilitate the presentation, however, most of the results of the analysis are summarized in terms of averages for individual commodity balances and arranged in nine product groups.[4]

The chapter begins with a comparison of per capita consumption levels in developed and developing countries and shows that a wide gap exists between the two levels. The ratio of production to consumption is then examined and explanations offered for the different trends to be observed in the two groups of countries. Finally, the chapter focuses on the degree of trade exposure of, and the trade balances recorded for, various commodities.

Levels of per capita consumption

Table IV.1 shows levels of per capita consumption of manufactures in 1972-1974 and 1979-1981 for both the developed and the developing countries.

Table IV.1. Growth and relative levels of average per capita consumption, by commodity group, in developed and developing countries

Commodity group	*Ratio of average per capita consumption for 1979-1981 to that for 1972-1974*[a]		*Ratio of average per capita consumption in the developed countries to that in the developing countries*[b]	
	Developed countries	*Developing countries*	*1972-1974*	*1979-1981*
Food and other consumer goods	1.036	1.202	7.156	5.963
Agricultural and construction inputs except metal products	1.182	1.514	13.930	10.580
Textile yarn and fabrics	0.887	1.268	7.556	4.884
Pulp	0.881	1.067	25.302	22.205
Paper	1.059	1.206	26.924	25.576
Industrial chemicals except fertilizers	1.027	1.523	29.798	19.664
Petroleum products	1.038	1.239	13.816	11.519
Primary-processed products of basic metals	0.982	1.280	21.280	16.468
Finished products of basic metals	0.939	1.441	29.556	17.171

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a] In symbols, $\sum_{i}^{n}\left[\left(\sum_{j}^{m} C_j^i / \sum_{j}^{m} N_j\right)_{DD} \div \left(\sum_{j}^{m} C_j^i / \sum_{j}^{m} N_j\right)_{DG}\right] \div n$

[b] In symbols, $\sum_{i}^{n}\left[\left(\sum_{j}^{m} C_j^i / \sum_{j}^{m} N_j\right)_{II} \div \left(\sum_{j}^{m} C_j^i / \sum_{j}^{m} N_j\right)_{I}\right] \div n$

Note: In footnotes *a* and *b* above:

C_j^i = annual average of total domestic consumption of commodity i in country j;
N_j = annual average population in country j;
m = number of countries included, j = 1, 2, . . ., m;
n = number of commodities included, i = 1, 2, . . ., n;
I and II refer to periods 1972-1974 and 1979-1981, respectively;
DD and DG refer to the developed countries and the developing countries, respectively.

[4] Listed in table IV.1.

It also provides a comparison of the relative levels. In 1972-1974, consumption levels in the developed countries were far greater than those in the developing countries. Per capita levels for industrial chemicals and finished products of basic metals, for example, were almost 30 times greater. Growth in consumption is seen to have been most rapid in those countries where the original levels were extremely low. In two product categories—chemicals and inputs for agriculture and construction—increases in consumption of more than 50 per cent were recorded in the developing countries. In six other categories, consumption in those countries increased by more than 20 per cent. In the developed countries, the highest increase was 18 per cent, recorded in the case of agricultural and construction inputs. In four other product categories, per capita consumption decreased.

If all nine product categories were regarded as being equal in value (i.e. having the same weight), the index of change for the entire group could be derived from the mean of the indices for the nine. With the help of this admittedly simplistic assumption, a rough indication of growth in per capita consumption can be derived for the commodities considered here. Thus, a comparison for the two time-frames shown in table IV.1 yields a mean of 1.3 for the developing countries and one of 1.0 for the developed countries. In a global sense, then, this crude measure implies that per capita consumption of manufactures has increased by 30 per cent in the developing countries and remained unchanged in the others.

Consumption trends do not usually differ markedly from trends in domestic production because domestic production is frequently the main source of consumption. One way of checking the reliability of an estimate of global consumption of manufactures, therefore, is to compare the estimate against estimates of manufacturing production derived from other sources. In chapter II it was shown (table II.6) that between 1973 and 1981 per capita MVA increased by 25 per cent in the developing countries and by 6.5 per cent in the developed market economies (by far the largest number of countries in the developed countries group). Thus, it appears that, on the whole, consumption trends, as derived from the commodity sample considered here, do not differ to any great extent from those for manufacturing production in the two economic groupings. It should be noted, however, that in the developing countries consumption increased relative to MVA between 1973 and 1981, whereas in the developed market economies the opposite occurred. The relative shifts between consumption and production reflect adjustments in product balances made in response to new trade and financial conditions during the 1970s. These are described later in this chapter.

A comparison of consumption levels in the two groups of countries is provided in the last two columns of table IV.1. The figures show a decline in the ratios of per capita consumption in the developed countries relative to those of the developing countries. A far more significant feature, however, is the wide difference in consumption levels of the two groups. In 1979-1981, per capita consumption of textile yarns and fabrics was almost five times higher in the developed countries than in the developing ones. The difference for other product groups was even greater, however—almost 20 times greater in the case of industrial chemicals and more than 25 times in the case of paper products. Again, these figures are roughly in line with those for MVA. In 1981, for

instance, the developed market economies' per capita MVA was 17 times higher than that of the developing countries (table II.6) while their consumption—again assuming that all commodity groups listed in table IV.1 have the same weight—was 15 times higher. When account is taken of the fact that the population of the developing countries is roughly twice that of the developed countries, it is seen that in order to equalize per capita levels of consumption in the two groups the present global consumption would have to be increased by a factor of 2.6.

The ratio of 1 to 15 ascribed to the full range of 82 commodities is a plausible estimate of the global disparity between developing and developed countries, but it conceals considerable variations at the commodity level. From inspection of the relative per capita consumption levels of individual commodities, it can be seen that the disparity tends to be narrower in the case of non-durable consumer goods. When levels of per capita consumption in the two country groups were compared for each of the 82 commodities, it was found that in only 10 instances was the ratio in the range of 1.0 to 3.0.[5] The disparity was much wider in the case of intermediate goods, however. All commodities for which the consumption levels of the developing countries were less than 5 per cent of those of the developed countries were industrial intermediates. They included particle board, mechanical wood pulp, sulphite pulp, machine-made paper other than kraft, methanol, chlorine, nitric acid, potassic fertilizers, light steel plates, unwrought refined copper, copper plates, copper tubes, and aluminium bars and rods.

The method of comparison used here,[6] dictated by the fact that measurements of consumption are expressed in different units, provides no information with regard to variations in levels of per capita consumption of a given commodity in different countries. Some impression of the extent of these variations can be obtained from table IV.2, which shows consumption per thousand inhabitants and relates the figures to levels of GNP per capita. Consumption patterns, however, are sensitive not only to the level of per capita GNP—they are also influenced by the size of the domestic market. Wherever the statistical analysis showed that the latter factor was also significant, two figures of per capita consumption were given. The first is an estimate of consumption in countries with a population of 0.5 million; the second is an estimate of consumption in countries with a population of 30 million.

The general impression given by table IV.2 is that the consumption of basic consumer goods (e.g. dried and condensed milk and cream, wheat flour, sugar, soft drinks, cigarettes and soap) and industrial inputs (e.g. nitrogenous fertilizers, vegetable oils, cotton yarn and fabrics, pulp of fibres other than wood and kerosene) increases rapidly at the early stages of development. This upward movement continues until GNP per capita reaches levels of around $3,000. At higher levels, the consumption of foods and textile products tends to

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[5]The commodities included were soap, cotton woven fabrics, wheat flour, raw sugar, tinned fish, refined sugar, dried milk and cream, pulp of fibre other than wood, cotton yarn and veneer sheet. Seven of these are non-durable consumer goods.

[6]The ratios estimated for individual commodities are derived from two mean values: the numerator is the mean of consumption levels recorded for developed countries, the denominator is the mean of those recorded for developing countries. For a complete description of the method of calculation used, see table IV.1.

Table IV.2. Expected consumption per thousand inhabitants, at selected levels of per capita GNP and population size[a]

Commodity	Unit of measurement	Per capita GNP = $200		Per capita GNP = $600		Per capita GNP = $3,000		Per capita GNP = $6,000	
		Population[b]		Population[b]		Population[b]		Population[b]	
		0.5 million	30 million	0.5 million	30 million	0.5 million	30 million	0.5 million	30 million
Food and other consumer goods									
Milk and cream, condensed	Ton	0.47		1.15		2.54		2.94	
Milk and cream, dried	Ton	0.44		1.41		3.33		4.26	
Butter	Ton	0.24		0.53		2.16		4.06	
Cheese	Ton	0.29		1.20		4.78		7.82	
Vegetables, tinned or bottled	Ton	0.09		0.45		3.66		8.53	
Fish, tinned	Ton	0.13		0.43		1.51		2.16	
Margarine, imitation lard etc.	Ton	0.28		0.77		3.51		6.72	
Vegetable oils	Ton	3.64		7.82		17.32		21.64	
Flour, wheat	Ton	7.97		25.55		58.67		60.89	
Raw sugar	Ton	5.89		20.33		37.06		30.76	
Refined sugar	Ton	5.39		16.72		38.52		40.81	
Cocoa powder	Kilogram	22.46		59.85		251.56		466.85	
Cocoa butter	Kilogram	10.91		36.29		211.19		450.85	
Wine	Hectolitre	1.26		9.18		69.87		121.27	
Malt	Ton	0.38		1.19		5.28		9.37	
Beer	Hectolitre	32.27		86.23		347.97		624.16	
Soft drinks	Hectolitre	28.77		128.46		410.80		464.55	
Cigarettes	Thousand units	193.26		566.18		1 472.81		1 771.78	
Footwear	Thousand pairs	0.21		0.60		1.80		2.72	
Soap	Ton	1.19		2.45		3.08		2.50	
Washing powder and detergents	Ton	0.25		1.68		7.90		12.97	
Agricultural and construction inputs									
Veneer sheets	Cubic metre	0.43		0.64		2.24		4.23	
Particle board	Cubic metre	0.30		1.21		13.19		38.69	
Cement	Ton	27.74		123.30		444.87		555.24	
Prepared animal feeds	Ton	1.34		18.47		132.22		234.53	
Nitrogenous fertilizers	Ton	0.54	1.78	2.02	6.71	6.25	20.76	7.54	25.03
Phosphatic fertilizers	Ton	0.15	0.70	0.70	3.17	2.87	12.99	4.68	21.16
Potassic fertilizers	Ton	0.20		1.01		8.14		17.70	

Table IV.2 *(continued)*

Commodity	Unit of measurement	Per capita GNP = $200		Per capita GNP = $600		Per capita GNP = $3,000		Per capita GNP = $6,000	
		Population[b]		Population[b]		Population[b]		Population[b]	
		0.5 million	30 million	0.5 million	30 million	0.5 million	30 million	0.5 million	30 million
Textile yarn and fabrics									
Wool yarn, pure and mixed	Ton	0.03		0.12		0.58		0.88	
Cotton yarn, pure and mixed	Ton	0.02	0.32	0.09	1.30	0.29	4.00	0.33	4.63
Cotton woven fabrics	Thousand square metres	4.00		6.87		12.11		14.22	
Woollen woven fabrics	Thousand square metres	0.01	0.02	0.06	0.20	0.41	1.37	0.54	1.82
Knitted fabrics	Ton	0.07		0.17		0.57		0.96	
Pulp									
Wood pulp, mechanical	Ton	0.02	0.09	0.07	0.24	0.96	3.45	4.79	17.29
Pulp of fibres other than wood	Ton	—	0.26	0.02	0.72	0.04	1.10	0.04	1.13
Wood pulp, dissolving grades	Ton	—	0.01	—	0.07	0.05	0.86	0.16	2.49
Wood pulp, sulphate and soda	Ton	—	0.08	0.02	1.19	0.30	18.04	0.63	37.99
Wood pulp, sulphite	Ton	0.01	0.04	0.03	0.18	0.27	1.74	0.73	4.66
Wood pulp, semi-chemical	Ton	0.01	0.03	0.03	0.13	0.21	1.01	0.51	2.43
Paper									
Newsprint	Ton	0.13		0.83		7.46		15.78	
Other printing and writing paper	Ton	0.11	0.31	0.70	1.89	5.82	15.72	11.91	32.14
Kraft paper and paperboard	Ton	0.04	0.22	0.41	2.39	3.70	21.67	5.92	34.62
Other machine-made paper and paperboard, simply finished	Ton	0.04	0.22	0.38	1.81	3.47	16.67	6.48	31.13
Industrial chemicals except fertilizers									
Methanol	Ton	—	0.05	0.02	0.20	0.15	1.63	0.37	4.01
Glycerine	Kilogram	0.36	4.65	2.74	35.31	16.62	214.42	23.58	304.15
Chlorine	Ton	—	0.03	0.01	0.23	0.25	4.14	0.86	14.37
Sulphuric acid	Ton	0.01	0.14	0.15	1.67	2.32	26.22	5.45	61.47

Nitric acid	Ton	—	0.01	—	0.11	0.12	3.38	0.55	14.86
Zinc oxides	Kilogram	0.65	4.58	5.01	35.40	29.21	206.46	52.10	368.29
Ammonia	Ton	0.01	0.12	0.06	1.14	1.00	18.45	3.07	56.46
Caustic soda	Ton	0.14	0.40	0.59	1.64	3.46	9.66	6.68	18.66
Soda ash	Ton	0.04	0.30	0.18	1.50	1.11	9.05	2.23	18.16
Calcium carbide	Ton	0.02	0.05	0.11	0.22	0.49	0.98	0.82	1.64
Dyestuffs, synthetic	Kilogram	8.83	25.16	29.23	83.24	116.26	331.12	183.80	523.46
Rubber, synthetic	Ton	0.01	0.06	0.03	0.29	0.23	2.29	0.56	5.45
Non-cellulosic staple and tow	Ton	0.01	0.06	0.10	0.42	0.55	2.30	0.72	3.02
Petroleum products									
Motor gasoline	Ton		9.72		37.44		196.90		358.36
Kerosene	Ton		3.20		11.38		20.45		16.53
Distillate fuel oils	Ton		18.64		72.11		360.49		628.73
Residual fuel oils	Ton		8.33		70.54		481.18		705.73
Lubricating oils	Ton		1.03		3.29		14.07		23.98
Liquefied petroleum gas	Ton		0.59		5.00		31.67		43.67
Primary processed products of basic metals									
Pig iron	Ton	—	0.12	0.02	2.11	0.40	54.63	1.12	153.06
Copper, refined, unwrought	Ton	—	0.08	0.01	0.30	0.08	1.94	0.18	4.34
Aluminium, unwrought	Ton		0.05		0.43		4.63		10.19
Lead, refined, unwrought	Ton	0.01	0.04	0.08	0.24	0.65	1.94	1.27	3.82
Zinc, unwrought	Ton	0.01	0.08	0.04	0.28	0.24	1.72	0.52	3.76
Tin, unwrought	Kilogram	0.15	1.21	1.17	9.52	9.13	74.33	15.52	126.22
Finished products of basic metals									
Iron and steel:									
Wire rods	Ton	0.03	0.16	0.34	1.79	3.80	19.96	7.03	36.90
Angles, shapes and sections	Ton	0.25	0.75	1.35	4.02	9.56	28.52	20.68	61.67
Heavy plates, over 4.75 mm.	Ton		0.14		1.20		13.60		30.29
Medium plates, 3 to 4.75 mm.	Ton		0.06		0.34		2.91		6.23
Sheets, under 3 mm.	Ton	0.09	0.76	0.54	4.57	4.63	38.93	9.73	81.83
Tin plate	Ton	0.03	0.14	0.30	1.26	1.92	8.13	2.59	10.98
Railway track material	Ton		0.20		0.31		1.07		2.35
Wire, plain	Ton		0.12		0.78		5.59		9.95
Tubes, seamless	Ton		0.13		0.71		5.10		9.87
Tubes, welded	Ton		0.25		1.00		7.37		17.46

Table IV.2 *(continued)*

Commodity	Unit of measurement	Per capita GNP = $200		Per capita GNP = $600		Per capita GNP = $3,000		Per capita GNP = $6,000	
		Population[b]		Population[b]		Population[b]		Population[b]	
		0.5 million	30 million	0.5 million	30 million	0.5 million	30 million	0.5 million	30 million
Finished products of basic metals (continued)									
Non ferrous metals:									
Copper bars, rods, angles, shapes, sections and wire	Kilogram	1.62	13.71	17.42	147.69	222.75	1 888.33	473.82	4 016.68
Copper plates, sheets, strip and foil	Kilogram	0.46	2.05	4.52	20.26	75.31	337.93	207.48	931.07
Copper tubes and pipes	Kilogram	1.75		18.65		303.61		786.69	
Aluminium bars, rods, angles, shapes, sections and wire	Ton	0.01	0.04	0.06	0.22	0.50	1.75	1.06	3.71
Aluminium plates, sheets, strip and foil	Ton	0.05		0.20		1.56		3.80	
Aluminium tubes and pipes	Kilogram	1.20		10.37		132.44		316.58	

[a]Arrived at by fitting cross-country data to various functional relationships between the endogenous variable, average annual per capita consumption, 1979-1981, and the two exogenous variables, per capita GNP at constant dollars and population size (as a proxy for market size) in 1980. The number of countries included in the analysis ranged between 31 and 110, varying from commodity to commodity. For each commodity, eight different functional forms were tested for fit of data and statistical significance. The estimated equation giving the best fit was selected.

[b]Only one figure (middle column) is reported for products whose consumption is not sensitive to population levels.

stagnate or even decline. Cases of decreasing consumption can be attributed to the substitution processes, whereby consumers switch from an original product, or preference, to another, as their budget increases. Examples of such substitution are suggested by raw sugar, which may be replaced by refined sugar, soap which may be replaced by washing powder or detergents, and kerosene which may be replaced by electricity or other petroleum fuels. Other demand-related considerations that may influence consumption patterns can be expressed in terms of income elasticity (the rate of increase of commodity consumption that corresponds to a given increase in the level of income). For some commodities, the elasticity is relatively high, but it remains constant at any income level.[7] For other commodities, however, it tends to increase as income rises.

These varying patterns of per capita consumption have far-reaching implications for industrial policy. If income elasticity is particularly high, demand constitutes an important stimulus for growth in production. In the case of many commodities, however, this elasticity is sensitive to changes in GNP per capita. This means that in an economy whose income is growing rapidly, patterns of demand can alter rapidly and the balance of productive activities must be adjusted accordingly. In order to cope with the changing composition of exports and imports that would result from shifts in the pattern of consumption, adjustments may also be required in existing patterns of domestic resource allocation as well as in trade policies.

The share of production in consumption

Domestic production and imports are the two sources, or components, of supply. The shares of these components in the total consumption of a given commodity are influenced by several factors, the most important of which is, perhaps, the level of economic development of the country concerned. In countries at the early stages of industrialization, the bulk of manufactures are imported. Eventually, however, local producers enter the market, thereby setting in motion a process of import substitution. As industrialization advances, measures to protect these local producers may lead to a drastic reduction in imports. Another highly relevant factor is the size of the domestic market. The range of commodities demanded in small countries may be similar to that demanded in large countries, but the resources available to the former to produce those commodities may be limited. In addition, the need to attain the necessary economies of scale can restrict the range of manufactures produced in countries with small domestic markets. For both reasons, production in small countries tends to be specialized; a large share of the total supply of commodities is thus left to imports.[8]

One of the simplest means of gauging a country's level of development and the size of the domestic market is by its level of income. Table IV.3 shows

[7] Examples of such commodities include wood pulp (dissolving grades), sulphite, nitric acid, welded tubes, pipes of iron and steel, refined copper, unwrought zinc, aluminium plates, sheets, strip and foil.

[8] Other factors, such as the balance of payments, industrial policies, and competitive advantage, also play a role.

Table IV.3. Ratio of production, by commodity group, in selected country groups, 1972-1974 and 1979-1981

Country group	Number of observations	Production as percentage of consumption		Percentage distribution of observations			
				No increase in consumption		Increase in consumption	
		1972-1974	1979-1981	No increase in ratio	Increase in ratio	No increase in ratio	Increase in ratio
Food and other consumer goods							
Low-income developing countries	533	83.7	88.0	13.7	10.5	46.9	28.9
High-income developing countries	564	100.3	94.7	11.9	9.8	50.4	28.0
Developed countries	433	103.4	115.5	10.9	21.9	37.2	30.0
Agricultural and construction inputs, except metal products							
Low-income developing countries	235	39.3	33.4	26.0	4.3	58.3	11.5
High-income developing countries	234	90.4	64.3	15.4	6.0	53.9	24.8
Developed countries	169	122.1	132.2	11.2	18.3	46.8	23.7
Textile yarn and fabrics							
Low-income developing countries	83	48.0	47.4	54.2	6.0	24.1	15.7
High-income developing countries	94	44.0	42.2	46.8	6.4	34.0	12.8
Developed countries	98	87.8	84.5	41.8	23.5	21.4	13.3
Pulp							
Low-income developing countries	66	37.3	39.1	37.9	4.6	33.3	24.2
High-income developing countries	129	34.4	35.7	31.8	10.9	43.4	14.0
Developed countries	123	109.9	123.8	25.2	22.8	32.5	19.5
Paper							
Low-income developing countries	167	15.3	16.5	34.7	3.6	51.5	10.2
High-income developing countries	138	29.5	31.5	15.9	4.4	62.3	17.4
Developed countries	94	124.0	136.8	13.8	13.8	44.7	27.7
Industrial chemicals, except fertilizers							
Low-income developing countries	361	15.1	13.2	49.9	1.1	45.7	3.3
High-income developing countries	346	19.2	24.0	33.5	1.2	55.5	9.8
Developed countries	202	82.4	87.7	17.3	19.3	37.6	25.7
Petroleum products							
Low-income developing countries	275	49.9	52.8	20.0	8.7	57.8	13.5
High-income developing countries	276	276.4	141.6	11.6	10.5	50.4	27.5
Developed countries	159	91.4	89.1	16.4	16.4	37.7	29.6

Country group	Number of observations	Production as percentage of consumption		Percentage distribution of observations			
				No increase in consumption		Increase in consumption	
		1972-1974	1979-1981	No increase in ratio	Increase in ratio	No increase in ratio	Increase in ratio
Primary-processed products of basic metals							
Low-income developing countries	147	98.5	149.3	60.5	4.1	32.0	3.4
High-income developing countries	151	77.0	56.6	41.1	4.0	39.7	15.2
Developed countries	115	101.1	105.5	22.6	20.9	35.7	20.9
Finished products of basic metals							
Low-income developing countries	596	1.7	1.5	47.3	—	51.7	1.0
High-income developing countries	458	11.9	12.8	26.9	1.5	65.9	5.7
Developed countries	217	95.9	102.6	21.2	26.3	27.2	25.4
All commodities							
Low-income developing countries	2 463	39.6	43.1	35.2	4.6	48.5	11.7
High-income developing countries	2 390	79.7	59.9	22.7	5.9	53.4	18.0
Developed countries	1 610	101.1	108.7	17.6	20.9	36.0	25.5

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

domestic production as a percentage of consumption in three groups of countries: low-income developing countries, high-income developing countries, and developed countries. Where figures exceed 100 per cent, the implication is that domestic production not only satisfies domestic consumption but also provides for exports. With the exception of petroleum products and primary processed products of basic metals, production always accounts for a higher share of consumption in developed than in developing countries. Moreover, domestic production tends to rise relative to the level of income. With respect to the commodities considered here, table IV.3 shows that in 1979-1981 domestic production represented, on average, 43.1 per cent of consumption in low-income developing countries, 59.9 per cent in high-income developing countries, and 108.7 per cent in the developed countries.[9] In the developing countries, self-sufficiency (i.e. a situation in which domestic production fully meets domestic demand) was attained in only two product categories, namely petroleum products and primary-processed products of basic metals, both of which rely heavily on natural resources and are not exposed to competition from imports. Apart from these two product groups, production accounted for

[9]In the present chapter, low-income developing countries are defined as those having a GNP per capita of less than $600 in 1980. High-income developing countries are those with a GNP per capita equal to or higher than $600 in 1980. Developed countries include developed market and centrally planned economies.

more than 50 per cent of consumption in only two categories — food and other consumer goods and inputs for agriculture and construction.

The last four columns of table IV.3 provide some impression of the extent to which levels of consumption increased between 1972 and 1981 and the degree to which the increases can be attributed to relative gains in production. These gains may, of course, take place even when the level of consumption does not increase and the data are presented in a form which distinguishes between the various possibilities. A comparison of the figures reveals that in the developed countries, increases in per capita consumption were less frequent than in the developing countries (61.5 per cent of all observations, as compared to 65.7 per cent). In the developed countries, moreover, the share of production in total consumption increased in 46 per cent of the instances registered[10]—as opposed to only 20 per cent in the developing countries.

The fact that imports are increasingly meeting the consumption needs of the developing countries may suggest that import substitution policies are no longer as effective as they used to be—at least in the case of the basic commodities considered in the present analysis. Alternatively, the diminishing share of local production in total supply may be due to the serious balance-of-payments problems encountered by some developing countries. (In this respect, it is important to distinguish the high-income developing countries from others. This group can usually finance its external payments through oil revenues, or it may have relatively easy access to international credit.)

Increases in consumption levels occurred in 71 per cent of the observations registered. The increases were largely caused by an expansion in imports relative to domestic production (in 53 per cent of the cases considered). For many commodities, and particularly those produced by heavy industries (e.g. industrial chemicals and finished products of basic metals), the low-income developing countries tend to depend almost entirely on imports. In these circumstances, any reduction in imports (for example, as the result of balance of payments difficulties) will bring about reduced consumption without any corresponding increase in the share of domestic production.

Trade exposure and trade ratios

It is clear from the foregoing that consumers in the developing countries depend—often extensively—on foreign rather than on domestic suppliers. Such a situation can lead to trade deficits which, in the long term, can in turn lead to reduced rates of economic growth (as it becomes more difficult to pay for imports of capital goods and other essentials). In such instances, the external imbalance will have to be redressed either by curbing imports (a step that may hinder domestic growth) or expanding exports. An increase in exports without an associated increase in domestic capacity would also lead to a fall in domestic consumption. In any case, a decision to boost exports also depends not only on

[10]This figure is the sum of two percentages: in 25.5 per cent of the cases, an increase in consumption was associated with an increase in production as a share of consumption; however, the share of production also rose in an additional 20.9 per cent of the cases where no increase in consumption had occurred.

access to foreign markets but also on the export potential of the goods currently being produced and consumed domestically. A curb on the consumption of non-tradable goods will not improve export prospects immediately—but it will release resources through a reduction in production. The redeployment of these resources to the production of tradable goods will promote exports. Such a restructuring of domestic production can be a lengthy process, however. Moreover, the fact that mobility of factors used in the manufacturing sector is often low may also give rise to problems. Thus, a decision to increase manufactured exports usually entails a curb on the consumption of tradable goods. This possibility is examined in closer detail below by using data relating to commodity balances and an index of trade exposure.

A priori commodities which are both traded and produced domestically offer possibilities for altering production/trade relationships. In this respect, it is useful to distinguish between those commodities for which trade is important relative to production and those for which it is not. The index of trade exposure,[11] which measures the volume of trade relative to domestic production, uses values ranging from 0 to 1, with the higher values indicating greater trade exposure, i.e. greater volume of trade relative to production. The results suggest that the role of trade is important for commodities whose index assumes values equal to or larger than 0.2 and of little consequence for commodities whose index has a value below this benchmark. Data for 1979-1981 suggest that in the low-income developing countries some 78 per cent of the commodities considered in the present analysis may be described as "exposed" to trade. In the high-income developing countries and in the developed countries the shares are 74 and 67 per cent respectively. These figures point up the constraints placed upon manufacturing activities in developing countries by those countries' susceptibility to the vagaries of international trade.

Trade exposure also reflects a combination of import penetration and export orientation. The significance of the relationship between these two factors can be appreciated by observing the ratio of net exports (exports less imports) to total trade (exports plus imports). The ratio varies between −1.0 (indicating trade consisting only of imports) and +1.0 (indicating trade consisting only of exports). Values close to zero show a balance between exports and imports. Table IV.4 shows the distribution of the ratio for commodities which are exposed to trade and those which are not. A large proportion of the trade ratios for the developing countries are negative—indicating a predominance of imports in the total trade of those countries. This is particularly true in the case of low-income developing countries. In 1979-1981, for instance, 87 per cent of the commodities surveyed in those

[11] In symbols, this index reads: $TE = \frac{X}{Q} + \left(1 - \frac{X}{Q}\right) \cdot \frac{M}{C}$ where X = exports, Q = production, M = imports, C = consumption. $\frac{X}{Q}$, the share of production which is exported, is supposed to be exposed to foreign competition; $1 - \frac{X}{Q}$ the share of production sold on the domestic market, is supposed to be exposed to foreign competition to the extent of import penetration $\frac{M}{C}$. (See M. Delattre, "Points forts et points faibles du commerce extérieur industriel", Economie et Statistique, les Collections de l'INSEE, Revue mensuelle, No. 157, juillet-août 1983, p. 15.)

Table IV.4. Observations on trade exposure and trade ratios, by country groups, 1972-1974 and 1979-1981

(Percentage)

Country groups	Number of observations	Trade exposure[a]	Trade ratio (TR)									
			1972-1974					1979-1981				
			$TR=-1.0$	$-1.0<TR\leq-0.2$	$-2.0\leq TR\leq 0.2$	$0.2<TR<1.0$	$TR=1.0$	$TR=-1.0$	$-1.0<TR\leq-0.2$	$-2.0\leq TR\leq 0.2$	$0.2<TR<-1.0$	$TR=10$
Low-income developing countries	1 971	Not exposed to trade	0.0	13.0	1.6	3.2	4.2	0.0	14.2	0.9	2.9	3.7
		Exposed to trade	29.6	42.3	0.5	3.8	1.9	31.8	41.2	0.5	3.2	1.8
High-income developing countries	2 113	Not exposed to trade	0.0	16.1	1.4	4.4	4.3	0.0	15.2	1.9	4.6	3.8
		Exposed to trade	19.2	45.2	1.3	5.6	2.6	20.7	43.5	1.2	6.1	2.9
Developed countries	1 580	Not exposed to trade	0.0	17.3	4.8	12.8	3.3	0.0	15.1	3.7	10.7	3.6
		Exposed to trade	3.2	31.5	7.3	18.4	1.5	3.4	33.3	8.8	19.9	1.5

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Trade exposure is defined according to the index for that measure. A commodity having a value of less than 0.2 is regarded as not being exposed to trade. An index with a value greater than or equal to 0.2 is described as being exposed to trade.

countries had a trade ratio less than or equal to −0.2. In the high-income developing countries, the figure was 79 per cent. In the developed countries, it was only 52 per cent.[12] As import dependence in the present context means that most of the commodities considered are both imported and produced locally,[13] these findings suggest that possibilities may still exist for import substitution, even though the "easy" phase of this process is over. Thus, developing countries may, on occasion, have good reason not to proceed with such efforts.

Table IV.4 also provides an indication of the extent of intra-commodity trade, i.e. exports and imports of the same commodity by a given country. The complete absence of intra-commodity trade is indicated when the ratio is ±1.0 (meaning that trade consists only of exports or imports). In low-income developing countries, 63 per cent of all commodities exposed to trade include a certain amount of intra-commodity trade. In high-income developing countries, the corresponding figure is 73 per cent. In the developed countries it rises to 91 per cent. Thus, intra-commodity trade is common, though it tends to occur more frequently at higher levels of income. The proportion of intra-commodity trade to total trade may reflect the fact that multilateral trading links *per se* stimulate exports.[14] In this respect, the developed market economies enjoy a superior marketing position thanks to their better organized trading and financial infrastructure as well as to the traditional and cultural links that exist between them and their former colonies. The marketing networks of the developing countries on the other hand are known to be polarized around a limited number of outlets. Improved economic ties among those countries could lead to greater diversification of trading opportunities.

Table IV.5 provides more specific data with respect to export performance. It shows that in 1979-1981 the share of exports in production was 14.3 per cent in the low-income developing countries, 27.1 per cent in the high-income developing countries, and 25.6 per cent in the developed countries. Compared to 1972-1974, the share increased in the developed countries, remained constant in the high-income developing countries, and fell in the low-income developing countries. The fall in the low-income group was the result mainly of a negative performance in three product categories: primary processed products of metal; petroleum products; and agricultural and construction inputs. In the first two categories, the fall was probably due to a reduction in demand by the developed countries. In the last category, the decline could be attributed to growth in domestic demand, which diverted a part of the production from exports to domestic consumption. In several product categories, exports' share was higher in developing countries than in developed countries. This reflects

[12]Percentages refer to trade in all commodities, whether defined as being exposed to trade or not, having trade ratios in the range of $-1.0 \leq TR < -0.2$.

[13]Commodities with high import dependence which are both imported and produced locally have a trade ratio in the range of $-1.0 < TR < -0.2$. The corresponding figures in 1979-1981 are 55 per cent in low-income developing countries, 59 per cent in high-income developing countries and 48 per cent in developed countries.

[14]For those who adhere to the comparative advantage theory of trade, the existence of two-way trade implies multilateral trading whereby a country imports from trading partners having a comparative advantage in the production of the commodity and exports to partners having a comparative disadvantage. It follows that multilateral trading links are favourable to intra-commodity trade.

Table IV.5. Share of exports in production, by commodity groups, in selected country groups, 1972-1974 and 1979-1981

(Percentage)

Commodity group	*Low-income developing countries*		*High-income developing countries*		*Developed countries*	
	1972-1974	*1979-1981*	*1972-1974*	*1979-1981*	*1972-1974*	*1979-1981*
Food and other consumer goods	9.5	7.4	15.0	15.4	15.2	20.9
Agricultural and construction inputs	16.2	11.4	20.1	19.0	21.4	24.8
Textile yarn and fabrics	6.6	6.8	14.8	16.5	17.6	23.8
Pulp	7.9	7.8	25.5	22.2	22.9	24.8
Paper	19.4	18.7	39.2	37.0	24.3	30.6
Industrial chemicals except fertilizers	26.5	26.3	34.2	34.7	22.1	23.7
Petroleum products	19.9	14.9	24.9	23.8	17.3	17.9
Primary-processed products of metals	46.4	41.0	29.0	28.3	33.0	34.9
Finished products of basic metals	68.8	68.3	65.9	66.7	31.3	37.7
All commodities	16.8	14.3	27.4	27.1	21.5	25.6

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

the fact that many resource-based industries have been established in developing countries with the main purpose of supplying foreign processors. Since almost all of the production of these industries is already earmarked for export, there is only limited opportunity for further increases in exports. On the contrary as industrialization proceeds, the domestic market will grow and local outlets will develop.

Of the commodities covered in the present analysis, those found to have comparatively low export/production ratios, and thus immediate export potential, were confined mainly to two categories: food and other consumer goods, and textile yarn and fabrics. For the time being, therefore, the low-income developing countries are not in a position to divert production from domestic consumption to exports. The fact that the ratios recorded in high-income developing countries were somewhat higher, does, however, suggest that opportunities for expanding exports could be boosted if additional industrial capacity were to be installed in those countries. If that new capacity were operated at satisfactory levels of efficiency, new opportunities to release more exports from domestic production would doubtless open up.

V

International patterns of comparative advantage

GLOBAL patterns of production, consumption and trade can change rapidly in response to a wide range of domestic and international stimuli. Policy makers in industry and government must continually adapt their policies to keep abreast of these changes, to take advantage of new opportunities as they present themselves, and to minimize the impact of adverse developments. To manage effectively, they must be knowledgeable concerning the economic forces that affect their industries. To be able to react in a decisive fashion, they must be capable of anticipating economic changes and their consequences.

The purpose of the present chapter is to analyse the determinants of international comparative advantage (CA) and to show how they fit into the pattern of international trade. In the first section, some of the problems encountered in measuring CA are summarized. In the second section, the results of an international analysis of CA in several industries—textiles and apparel; iron and steel products; wood and wood products; and consumer electronics—are reported. In the concluding section, industrial interdependence is examined. Special attention is given to the developments that occur as items move through the various processing stages, from raw materials to finished manufactures.

Measuring CA

According to the law of comparative advantage, trade can benefit all participants simultaneously. Each country gains by specializing in the production of items in which it enjoys a comparative (cost) advantage and exchanging (exporting) them for items in which it does not. Yet, while the concept is well understood, policy makers in industry and government seldom use it to guide them in their decisions. This lack of practical application is partly explained by the fact that CA is based on a relationship between prices that would prevail in the absence of trade. And because trade itself influences prices, pre-trade prices cannot be observed. CA, therefore, cannot be measured directly. An alternative approach is needed, one that indirectly draws the relevant implications using post-trade observations.

A primary problem encountered in measuring CA concerns the lack of standardization in the data available. For example, a large country having a relatively minor cost advantage (i.e. a small degree of CA) could be an important exporter relative to a smaller one enjoying a larger cost advantage. The measures of CA must therefore be adjusted to account for differences in country size. This may be accomplished *(a)* by relating exports to domestic production, or *(b)* by relating imports to domestic consumption. The first alternative would indicate the degree of CA, the second the degree of comparative disadvantage (CD).

This approach might solve the problem of differing country sizes, but other data problems abound. For example, statistics are not available for each product traded: the measure used is product category. As a result, most countries are shown to be both importers and exporters of the same "measured" product.[1] Therefore, in addition to "standardizing" the data to account for country size, it is necessary to do so to account for "two-way" or intra-industry trade. The most common approach in this instance is to use net exports (exports less imports) to adjust for intra-industry trade flows. If a country has CA in one article, but CD in another, its exports of the first article should exceed its imports of the second. Its net exports should therefore read "positive". Conversely, a negative value (i.e. net imports) would imply a greater degree of CD.

Some of these problems are illustrated in the following example, which is based on 1980 trade data for two countries, Japan and Sweden, both of which export and import iron and steel.

Iron and steel	*Japan*	*Sweden*
	(Thousand tons)	
Production	107 535	4 283
+ Imports	1 165	1 981
= New supply	108 700	6 264
− Exports	29 693	2 125
= Consumption	79 007	4 139

In the case of Japan, exports exceed imports. The country produces more than it consumes. This implies that Japan enjoys a net CA in iron and steel: its CA in the articles that it exports is greater than its CD in the articles that it imports. Data for Sweden reveal a similar relationship. But which country enjoys the greater degree of CA? Before this question can be answered, the relevant data must be made comparable—i.e. standardized. Several different indices may be used. The following (in percentages) were calculated for the data given above:

Ratio	*Japan*	*Sweden*
Exports to production (X/P)	28	50
Imports to consumption (M/C)	1	48
Net exports to production (T/P)	27	3
Production to consumption (P/C)	136	103

The first two indices indicate that Sweden has a greater CA in iron and steel than Japan; however, the remaining indices indicate the reverse. All four indices are derived from the most basic interpretation of the CA concept. Yet, when they are applied to actual data on trade, production and consumption, an inconsistency is apparent. Two explanations may be offered for this. First, the level of data aggregation is so great that the true pattern of CA may be hidden. Japan enjoys CA across the entire product spectrum of the iron and steel industry. Sweden, however, has specialized in the production of sophisticated steel products. To satisfy its raw material needs, Sweden imports crude iron and steel (rather than iron ore and coal, as is the case in Japan). Thus, the inconsistencies mask the fact that Sweden enjoys CA at the higher

[1] A country may export one article and import a different one, with the data for both being reported in the same product category.

stages of processing only. Second, the degree of government incentive or protection accorded an industry may be such that trade performance does not faithfully reflect the underlying pattern of CA that would prevail in a world of completely free trade. A Government may, through policy measures, limit imports sufficiently to produce a low ratio of imports to consumption.

Researchers have attempted to minimize the first problem by using data for more narrowly defined product categories. A major difficulty with this solution is that most countries use different classifications for production statistics than they do for trade statistics. Sometimes comparable data for production, imports and exports can be obtained only by combining products into highly aggregated categories. In order to study CA for narrowly defined product ranges, it may be necessary to construct indices that are based purely on trade data (trade-only measures).

Researchers have two ways of coping with the ambiguities attributable to government policies. One is based on the selection of indices that do not incorporate imports. It implicitly assumes that government policies do not "create" CA and that the existence of exports is therefore a valid indicator.[2] The other is based on the contention that Governments which support a particular industry by restricting imports also tend to subsidize production, directly or indirectly, through subsidized research and development, plant construction, credit allocations, tax incentives and the like. Researchers adopting this concept favour indices based on net trade flows.[3]

Mention should also be made of the interpretation that may be given to any measure. Generally speaking, an analysis of this nature should yield precise indicators that will permit their user to distinguish between countries according to absolute differences in the estimated value of CA for a particular product or industry. Such indicators are called "cardinal" measures of CA. However, less stringent interpretations are also acceptable. For example, the measures may be treated as indicators of the degree of CA enjoyed by one country relative to another, without drawing implications regarding magnitudes. These indicators provide commodity-specific rankings of countries, by degree of CA, and are referred to as "ordinal" indices. Still another possibility is to regard each measure as a dichotomous indicator, identifying countries that have CA in a particular commodity relative to countries that do not.

In view of the ambiguities that attend the subject, the authors of the present chapter conducted a number of tests before determining which measures to use and which interpretations to attach to their results. The tests covered *(a)* measures based on data for trade and domestic production (trade-cum-production (consumption) indices), and *(b)* measures based solely on trade data (trade-only indices). The trade-cum-production indices comprise the four obvious and directly observable quantitative relations used in the Japan-Sweden example cited earlier, i.e. the ratios of exports to production (X/P), of imports to consumption (M/C), of net trade (exports less imports) to

[2]See, for example, B. Balassa, "'Revealed' comparative advantage revisited: an analysis of relative export shares of the industrial countries, 1953-1971", *The Manchester School of Economic and Social Studies*, vol. 45, No. 4 (December 1977), pp. 327-344.

[3]J. Donges and J. Riedel, "The expansion of manufactured exports in developing countries: an empirical assessment of supply and demand issues", *Weltwirtschaftliches Archiv*, Band 113, Heft 1 (1977), pp. 58-87.

production (T/P), and of production to consumption (P/C). The trade-only indices comprise the ratio of net exports to the sum of exports and imports (T/XM) and two versions of an indicator of revealed CA.[4]

Three different types of consistency tests were employed to accord with the three different ways of interpreting the revealed CA indices. These were: simple correlations of cardinal measures; rank correlations of ordinal measures; and counts of consistent versus inconsistent indications of CA (or CD) by dichotomous measures. In the case of the trade-cum-production indices, those measures which incorporated information on exports, imports and production—namely T/P and P/C—proved to be acceptably consistent in the cardinal as well as in the ordinal sense. Moreover, they were perfectly consistent as dichotomous indicators of CA. The trade-only indices, on the other hand, were not very consistent as cardinal measures. A higher degree of consistency was achieved when they were used as ordinal interpretations, and a very high one when they were used as dichotomous interpretations.[5] The results of the tests indicated the following guidelines for selecting appropriate indices of CA in empirical work:

(a) If data are available for trade-cum-production (consumption) indices, measures that incorporate both production and consumption (exports and imports) figures should be selected;

(b) If trade-only indices are to be used, the export-only (Balassa-type) index may be more suitable. This index, however, may not be as suitable in the case of narrowly defined product categories. In such a case, an index incorporating net trade, rather than exports only, would be preferable.

The general impression derived from the tests was that indices of trade performance may not enable users to measure precise degrees of CA for specific products in different countries. That is, a cardinal interpretation of the measures may not be appropriate. Several indices were found, however, that consistently indicated the existence of CA or CD (a dichotomous interpretation). In addition, significant consistency between indices was noted when countries were ranked according to degrees of CA (i.e. when an ordinal interpretation was adopted). In accordance with these findings, two measures are employed in the next section to examine international CA patterns: *(a)* the ratio of production to consumption (P/C), as the primary trade-cum-production (consumption) index; and *(b)* the ratio of net exports (exports less imports) to total trade (exports plus imports), as being representative of the trade-only class of indicator.

International CA patterns

In the present section, international CA patterns in several industries—textiles and apparel; iron and steel; wood and wood products; and consumer

[4]One suggested by Balassa and the other by Donges and Riedel. The two indicators are standardized measures of exports (see Balassa, *loc. cit.*) and net exports (see Donges and Riedel, *loc. cit.*), respectively.

[5]The strength of the association also varied with the level of aggregation of the underlying trade data.

electronics—are analysed. The analysis is based on an extensive range of data covering production, consumption, exports and imports. Such data, however, are not uniformly reported by all countries, nor are they available for all products produced by each industry. The analysis, therefore, is accompanied by a parallel examination of more detailed trade-only data. Because of the data limitations, the two sets of results offered (one based on trade-cum-production data, the second on trade-only data) are not always perfectly comparable. For example, the textiles and apparel industries cover items made from cotton and man-made fibres. The relevant trade-cum-production data cover two distinct groups of products: textiles (which include many non-cotton and non-man-made fibre items) and apparel (which includes all fibre items). Since textiles data are significantly influenced by inputs relating to non-cotton natural fibres, they were not considered in the initial analysis. (They were, however, examined using trade-only measures.) Apparel data also incorporate data on other natural fibres (such as wool and silk). The resultant combination of industrial activities, however, is dominated by cotton and man-made fibre items. Implications concerning CA patterns in the cotton and man-made apparel industries can therefore be drawn from data covering the more aggregated apparels group, without fear of unreasonable bias. The trade-cum-production data and the trade-only data were given the following coverage:

Industry	*Trade-cum-production*	*Trade-only*
Textiles and apparel	Apparel (ISIC 322)	Textiles (SITC 65)
Iron and steel	Iron and steel (ISIC 371)	Iron and steel (SITC 67)
Wood and wood products	Wood and wood products (ISIC 331)	Wood and wood products (SITC 243, 631, 632)
Consumer electronics	Electronics (ISIC 383)	Consumer electronics (SITC 724.1-.2, 729.3, 891.11)

Coverage of the iron and steel and the wood and wood products industries is essentially comparable (i.e. ISIC 371 with SITC 67; and ISIC 331 with SITC 243, 631, 632). The consumer electronics industry includes consumer electronics (SITC 724.1-.2, 729.3) and other electronic items (ISIC 383). Finally, the apparel and textiles industries do not overlap: the latter is a critical input to the former.

CA measured on the basis of trade-cum-production data

Table V.1 presents data on production, consumption, exports and imports in the major trading countries, by industry.[6] Two types of index are used, one based on the ratio of production to consumption and indicating dichotomous, ordinal and cardinal measures, the second based on the ratio of net exports to the sum of exports and imports. The countries surveyed have been divided into two groups, one with CA, the other with CD, as indicated consistently by the two dichotomous measures. The essential features of the table are summarized below.

[6] As data for the centrally planned economies are limited, these economies have been excluded from the analysis.

Table V.1. International CA patterns (trade-cum-production indices), 1979-1980

Country or area	Production (P)	Consumption (C)	Exports	Imports	P/C[d]		T/XM[d]	
		(Millions of current US dollars)[c]			Ordinal	Cardinal	Ordinal	Cardinal
			Apparel and textiles (ISIC 322)					
CA countries and areas								
Italy	6 603	2 883	4 368	649	6	2.29	22	0.74
Hong Kong	4 517	743	4 308	534	3	6.08	21	0.78
Yugoslavia	1 996	1 685	334	23	14	1.18	14	0.87
Finland	912	460	636	183	9	1.99	25	0.55
Singapore	367	95	396	123	4	3.87	26	0.53
Republic of Korea	...	...	2 791	13	...	...	3	0.99
India	...	...	563	0	...	...	1	1.00
Portugal	...	...	556	11	...	...	9	0.96
Greece	...	...	354	33	...	...	17	0.83
Spain	...	...	298	124	...	...	27	0.41
Other (19)[a]	...	...	2 860	294	...	...	18	0.81
Other (11)[b]	7 420	6 105	1 403	88	13	1.26	14	0.88
Total (29)[a]	...	...	17 464	1 987	...	...	20	0.80
Total (16)[b]	21 815	11 972	11 445	1 600	10	1.82	22	0.75
CD countries and areas								
United States	36 150	41 692	1 010	6 551	23	0.87	48	−0.73
Japan	10 587	11 799	415	1 627	21	0.90	43	−0.59
Germany, Federal Republic of	9 930	14 903	2 714	7 687	32	0.67	40	−0.48
United Kingdom	6 824	7 818	1 680	2 674	23	0.87	33	−0.23
Belgium	1 464	2 215	934	1 684	33	0.66	37	−0.29
Netherlands	1 327	3 263	810	2 746	34	0.41	41	−0.54
Sweden	499	1 444	268	1 213	35	0.35	46	−0.64
Norway	248	827	60	638	36	0.30	49	−0.83
Switzerland	...	...	331	1 349	...	...	44	−0.61
Saudi Arabia	...	...	11	594	...	...	53	−0.96
Other (16)[a]	...	...	3 626	5 968	...	...	35	−0.24
Other (10)[b]	18 394	20 185	3 357	5 148	21	0.91	33	−0.21
Total (26)[a]	...	...	11 859	32 731	...	...	40	−0.47
Total (20)[b]	85 423	104 146	11 248	29 968	27	0.82	40	−0.45

Iron and steel (ISIC 371)

CA countries and areas								
Japan	76 373	62 251	15 047	925	5	1.23	1	0.88
Germany, Federal Republic of	39 912	35 240	11 458	6 785	6	1.13	8	0.26
France	22 632	20 830	7 049	5 247	8	1.09	13	0.15
Spain	15 064	13 924	1 876	737	9	1.08	4	0.44
Brazil	7 144	6 860	834	551	11	1.04	11	0.20
Belgium	5 499	852	6 487	1 840	1	6.46	3	0.56
Republic of Korea	4 403	4 003	1 473	1 073	7	1.10	12	0.16
Sweden	4 174	3 343	2 229	1 397	4	1.25	10	0.23
South Africa	3 887	2 812	1 345	270	2	1.38	2	0.67
Austria	3 748	2 724	1 719	696	2	1.38	5	0.42
Other (6)[a]	...	...	3 750	3 139	...	...	14	0.09
Other (4)[b]	14 410	13 932	3 523	3 044	12	1.03	14	0.07
Total (16)[a]	...	...	53 267	22 660	...	...	7	0.40
Total (14)[b]	197 246	166 771	53 040	22 565	5	1.18	7	0.40
CD countries and areas								
United States	81 300	87 096	2 747	8 542	18	0.93	24	−0.51
United Kingdom	16 755	17 193	2 591	3 029	16	0.97	19	−0.08
Yugoslavia	5 863	6 596	238	971	21	0.89	29	−0.61
Mexico	4 688	5 566	132	1 009	22	0.84	34	−0.77
Venezuela	1 130	1 732	84	685	25	0.65	35	−0.78
Indonesia	245	1 008	34	797	37	0.24	45	−0.92
Saudi Arabia	...	...	13	1 858	...	...	57	−0.99
Switzerland	...	...	393	1 199	...	...	24	−0.51
India	...	...	123	809	...	...	32	−0.74
Algeria	...	...	20	799	...	...	50	−0.95
Other (42)[a]	...	...	7 349	16 576	...	..	21	−0.39
Other (26)[b]	30 415	35 896	9 330	12 220	22	0.85	19	−0.10
Total (52)[a]	...	...	13 724	36 274	...	...	22	−0.46
Total (32)[b]	140 396	155 087	12 565	27 253	20	0.91	21	−0.37

Table V.1 *(continued)*

Country or area	Production (P)	Consumption (C)	Exports	Imports	P/C[d]		T/XM[d]	
		(Millions of current US dollars)[c]			Ordinal	Cardinal	Ordinal	Cardinal
			Wood and wood products (ISIC 331)					
CA countries and areas								
Canada	7 769	4 490	3 743	464	8	1.73	12	0.78
Sweden	4 673	3 438	1 552	317	11	1.36	14	0.66
Brazil	3 006	2 715	329	38	14	1.11	11	0.79
Finland	2 677	1 087	1 653	63	4	2.46	6	0.93
Yugoslavia	2 310	1 992	408	90	12	1.16	15	0.64
Republic of Korea	1 349	821	558	31	9	1.64	9	0.89
Philippines	599	196	405	2	3	3.06	1	0.99
Singapore	357	113	521	277	2	3.15	20	0.31
Austria	...	...	1 063	267	...	...	16	0.60
Malaysia	...	...	837	22	...	...	3	0.95
Other (15)[a]	...	...	1 268	192	...	...	12	0.74
Other (13)[b]	4 116	3 097	1 147	128	11	1.33	11	0.80
Total (25)[a]	...	...	12 337	1 763	...	...	12	0.74
Total (21)[b]	26 856	17 949	10 316	1 410	10	1.50	12	0.76
CD countries and areas								
United States	35 250	37 538	1 857	4 144	23	0.94	34	−0.38
EEC	26 664	34 079	3 311	10 968	12	0.78	26	−0.54
Japan	26 643	28 651	174	2 182	24	0.93	46	−0.85
Saudi Arabia	...	...	11	643	...	...	50	−0.97
Switzerland	...	...	128	373	...	...	37	−0.49
Algeria	...	...	3	231	...	...	51	−0.98
Egypt	...	...	0	203	...	...	54	−1.00
Other (25)[a]	...	...	898	1 936	...	...	34	−0.37
Other (20)[b]	5 269	6 141	429	1 059	28	0.85	35	−0.42
Total (31)[a]	...	...	6 282	20 680	...	...	39	−0.54
Total (22)[b]	93 826	106 409	5 771	18 353	27	0.88	38	−0.52

Consumer electronics (ISIC 383)

CA countries and areas								
Japan	46 884	34 708	13 547	1 371	1	1.35	1	0.82
Republic of Korea	3 198	2 636	1 585	1 024	4	1.21	2	0.22
Sweden	2 073	1 702	1 298	928	3	1.22	3	0.17
Singapore	2 053	1 594	2 321	1 861	2	1.29	4	0.11
Germany, Federal Republic of	...	...	6 202	5 004	...	...	4	0.11
Netherlands	...	...	2 626	2 309	...	...	6	0.06
Belgium	...	...	1 529	1 362	...	...	6	0.06
Other (0)[a]	...	...	0	0	...	...	...	...
Other (0)[b]	0	0	0	0	...	...	...	...
Total (7)[a]	...	...	29 108	13 859	...	...	2	0.36
Total (4)[b]	54 208	40 640	18 751	5 184	1	1.33	1	0.57
CD countries and areas								
United States	71 100	73 795	8 061	10 756	7	0.96	13	−0.14
United Kingdom	12 217	12 580	2 670	3 033	6	0.97	10	−0.06
Canada	2 628	3 721	731	1 824	15	0.71	22	−0.43
Australia	874	1 514	48	688	20	0.58	37	−0.87
Argentina	334	796	20	482	25	0.42	42	−0.92
Venezuela	158	566	1	409	27	0.28	49	−0.99
Italy	...	...	1 348	2 287	...	...	19	−0.26
Saudi Arabia	...	...	16	1 276	...	...	44	−0.97
Spain	...	...	184	750	...	...	28	−0.61
Brazil	...	...	207	583	...	...	24	−0.48
Other (37)[a]	...	...	7 646	12 869	..	...	18	−0.25
Other (18)[b]	14 775	17 183	2 891	5 302	9	0.86	20	−0.29
Total (47)[a]	...	...	20 932	34 907	...	...	19	−0.26
Total (24)[b]	102 086	110 155	14 422	22 494	7	0.93	16	−0.22

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Countries and areas for which only incomplete data were available.

[b]Countries and areas for which complete data were available.

[c]Two-year averages for 1979-1980.

[d]The measures of revealed CA are two-year averages for 1979-1980. The rankings cover all countries for which data were available. T/XM stands for net exports divided by the sum of exports plus imports.

Textiles and apparel

Of the 55 countries and areas surveyed, 19 failed to supply production and consumption data. Since some of them are major traders, they have, nevertheless, been included in the analysis. Altogether 29 of the 55 were identified as having CA in the apparel industry.

Two thirds of the exports of the 29 are accounted for by just three exporters: Italy, Hong Kong and the Republic of Korea. No other country accounts for more than 5 per cent of this group's exports of apparel. It is of interest to note that this concentration involves two completely different types of exporter: one capital-rich (Italy) and two with relatively abundant labour resources (Hong Kong and the Republic of Korea). In a sense, the world-wide apparel industry might be described as consisting of two parts: one based on high fashion, with relatively high per-unit profit margins, the second based on low production costs.

With regard to imports, two countries (the United States and the Federal Republic of Germany) account for almost 50 per cent of the total for all countries identified as having CA. The major markets for apparel are the United States, Japan and the EEC (excluding Italy). Together, these accounted for over 75 per cent of the total imports of all the countries and areas considered in the analysis (including those having CA).

In relating trade to the domestic economy, an interesting anomaly can be observed. The major exporters have developed their industries on the basis of the export markets, as production far exceeds domestic consumption. On the other hand, the major importers satisfy the bulk of their consumer needs through domestic production. On average, over 80 per cent of the consumption needs of countries having CD in apparel is met by domestic production.[7]

Iron and steel

Of the 68 countries surveyed for this industry, 16 were identified as having CA. The dominant exporter is Japan, which supplies 28 per cent of the total exports of all countries in this group. Moreover, Japan accounts for 46 per cent of the group's net exports (exports less imports). Other major exporters (measured in terms of volume of exports rather than degree of CA) are Belgium, France and the Federal Republic of Germany. These three countries account for almost 50 per cent of the total exports of all countries having CA, and 36 per cent of their net exports. The other 12 CA countries supply only 25 per cent of the group's exports and 18 per cent of its net exports.

As for imports, the two major markets are the United States and the United Kingdom. Together, these account for almost 33 per cent of the imports of all CA countries. The other major countries in this group account for only 22 per cent, which indicates that the world import market for iron and steel is widely diversified.

The relationship between trade and domestic production in iron and steel is quite different from that for apparel. Most CA countries exploit this feature

[7] One might question the extent to which this is due to excessive import constraints imposed under the GATT multi-fibre arrangement.

only as an extension of their domestic markets. Even Japan consumes in excess of 80 per cent of its domestic production. On average, for all countries that have CA in iron and steel, production exceeds consumption by only 18 per cent. CD countries satisfy the bulk of their needs through domestic production. On average, domestic production in these countries is 91 per cent of consumption. There are exceptions: Algeria, Indonesia and Saudi Arabia, for example, depend heavily on imports to satisfy their domestic iron and steel needs.

Wood and wood products

Of 56 countries surveyed, 25 were found to have CA. Essentially two groups of countries dominate the industry. One consists of Austria, Canada, Finland and Sweden. The second consists of ASEAN countries and the Republic of Korea. Countries in the former group, especially Canada, produce coniferous products for housing and construction purposes, and to a smaller extent, hardwood furniture and other products. The ASEAN countries dominate the market for the finishing woods (mahogany, teak etc.) used in decorative panelling, furniture and other wood products. Of the total exports of the CA countries, the first group accounts for 65 per cent, and the second for 22 per cent.[8] The import markets for wood and wood products are dominated by the EEC, the United States and Japan. Together, these account for 84 per cent of imports into the CA countries.

In relating trade to domestic production, it is seen again that CA countries produce for export markets whereas CD countries use imports to supplement domestic production. On average, the former group produces 50 per cent more than it consumes, while the latter group imports only 12 per cent of what it consumes. The two major markets, the United States and Japan, import 6 and 7 per cent of their domestic consumption, respectively. A significant portion of this trade is undoubtedly related to the different types of wood and wood products that are domestically available.

Consumer electronics

Of the 54 countries surveyed, only 7 (Belgium, Germany, Federal Republic of, Japan, Netherlands, Sweden, Republic of Korea and Singapore) were found to have CA.[9] Japan accounts for 46 per cent of the exports and 80 per cent of the net exports of the seven. Import markets are widely diversified. The United States and the other members of the EEC account for just over half of all imports by CD countries. The other 39 countries together account for the remaining half.

In the case of consumer electronics, comparing trade to domestic production and consumption shows a picture slightly different from that obtained for the other three industries. As in the case of iron and steel, CA countries serve export markets as an extension of domestic production for

[8]The remaining 15 countries with CA in wood and wood products supply only 13 per cent of the group's exports.

[9]As in the case of apparel, the analysis had to be based on country data which were not always complete. Again, as in the case of apparel, problems arose in respect of the definition of the industry, which covers more than just consumer electronics.

home consumption. The net exports of Japan, the world's dominant exporter, are only 25 per cent of domestic production. With respect to imports, two patterns emerge. The developed countries do not depend upon imports: rather, they use them to augment domestic consumption. More than 70 per cent of their consumption is satisfied through domestic production.[10] By contrast, the developing countries, especially the less advanced ones, depend heavily on imports to satisfy domestic consumption.

CA measured on the basis of trade-only data

In table V.2, aggregated exports and imports are reported, together with a trade-only index of revealed CA (the ratio of net exports to the sum of exports and imports). The country coverage is limited to the developed market economies and developing countries that submit data to the Statistical Office of the United Nations.[11]

In the textile industry, only one group of countries is seen to have CD on the basis of the T/XM index, namely the developed market economies other than the United States, the EEC and Japan. The developing countries are seen to enjoy CA. This pattern of world trade in textiles is significantly different from what might be expected, given the results of the earlier analysis of the apparel sector. Apparel, however, involves the design and manufacture (cutting and sewing) of garments, whereas the textile industry is dominated by the processing of cotton and man-made fibres into fabrics (often blends of cotton and synthetic materials). Man-made fibres are an end product of the petrochemical industry. Their production technologies have little in common with the labour-intensive technologies used in the apparel industry. As a result, the modern textile industry employs sophisticated technologies in plants located in high-wage countries. This is consistent with international CA patterns.

The pattern of trade in iron and steel, as seen from table V.2, is fully consistent with that which emerged from the trade-cum-production analysis. The United States and several developing countries have a significant degree of CD, while Japan and members of the EEC enjoy CA.[12] The EEC's apparent degree of CA may be largely attributable to subsidization policies which lead to over-production and excessive concentration on exports. A more correct interpretation, however, may be that, world-wide, the iron and steel industry is undergoing adjustment, and that new CA patterns are yet to emerge.

The wood and wood products industry, as outlined earlier, is resource-based and the principal exporters are those which enjoy an abundance of natural resources. A notable exception is the United States, which has tremendous forest resources and which yet is a major net importer of wood products. The United States, however, is the world's second largest exporter;

[10]Actual imports are somewhat higher, because of intra-industry trade (i.e., the exportation of some electronic items and the importation of others).

[11]In the aggregate, because the country coverage is not complete, exports from developed market economies and developing countries do not equal imports from those groupings.

[12]Such aggregations often mask counter trends in individual countries. For example, the developing countries of Brazil and the Republic of Korea are emerging CA countries. Similarly, in the EEC, international competitiveness in the iron and steel industry ranges from highly efficient to inefficient.

Table V.2. International CA patterns, 1979-1980 (trade-only indices)

Country or area	*Exports* (Millions of current United States dollars)[a]	*Imports*	*T/XM*[a]
	Textiles and apparel		
Developed market economies and developing countries	47 498	40 634	0.08
Developed market economies	36 184	34 015	0.03
United States	3 403	2 414	0.17
EEC	22 482	21 643	0.02
Japan	4 552	1 844	0.42
Other	5 747	8 114	−0.17
Developing countries	11 085	6 364	0.27
Semi-industrialized	4 653	1 751	0.45
Other	6 432	4 613	0.16
	Iron and steel		
Developed market economies and developing countries	65 033	56 381	0.07
Developed market economies	60 871	41 572	0.19
United States	2 727	8 184	−0.50
EEC	33 076	23 247	0.17
Japan	14 784	896	0.89
Other	10 284	9 244	0.05
Developing countries	3 751	14 429	−0.59
Semi-industrialized	2 986	4 438	−0.20
Other	765	9 991	−0.86
	Wood and wood products		
Developed market economies and developing countries	18 541	20 890	−0.06
Developed market economies	14 477	19 093	−0.14
United States	1 832	4 023	−0.37
EEC	3 175	10 340	−0.53
Japan	159	2 137	−0.86
Other	9 311	2 593	0.56
Developing countries	4 064	1 797	0.39
Semi-industrialized	2 244	685	0.53
Other	1 820	1 112	0.24
	Consumer electronics		
Developed market economies and developing countries	28 471	26 846	0.03
Developed market economies	21 197	20 688	0.01
United States	4 033	6 902	−0.26
EEC	6 933	10 284	−0.19
Japan	9 350	803	0.84
Other	881	2 698	−0.51
Developing countries	7 274	6 158	0.08
Semi-industrialized	6 044	4 138	0.19
Other	1 230	2 020	−0.24

Source: UNIDO data base: information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]The values represent two-year averages for 1979-1980. T/XM stands for net exports divided by the sum of exports plus imports.

thus, its imports may simply reflect a demand for wood types that are not available domestically. Trade consists of exports from the countries that are resource endowed (Austria, Canada, Finland and Sweden, as well as ASEAN countries and the Republic of Korea) and imports into those that are not (the EEC, Japan and numerous other countries with small domestic markets).

Trade in consumer electronics follows patterns similar to those outlined above—with one major difference: CA countries include Japan and some developing countries in Asia, but not EEC countries whose CA in electronics does not include consumer products. The major CD countries include the United States, most other developed countries and the remaining developing countries.

With respect to the two methods of analysing the four industries, two important differences can be noted. First, trade data are reported for more narrowly defined product sectors than are production data. Thus, the trade data more accurately reflect the industries under study. Second, countries reporting trade data outnumber those reporting production data. (In the trade-only survey, an average of 98 countries per industry reported. In the trade-cum-production survey, the figure was only 58.)

For textiles, data were available for 103 countries and areas, of which 27 were CA. The 10 principal performers in table V.3 accounted for 79 and 83 per

Table V.3. International CA patterns, 1980 (trade-only indices)

Country or area[a]	*Exports* (Millions of current United States dollars)	*Imports*	*T/XM*[b] *Ordinal*	*Cardinal*
	Textiles and apparel			
CA countries and areas				
Japan	5 102	1 654	12	0.51
Italy	4 109	2 615	18	0.22
United States	3 625	2 541	21	0.18
Belgium	3 548	2 320	19	0.21
China	2 377	561	9	0.62
Republic of Korea	2 197	409	5	0.69
China (Taiwan Province)	1 667	295	4	0.70
India	1 141	72	1	0.88
Pakistan	876	202	8	0.63
Brazil	654	78	2	0.79
Other (17)	6 547	3 545	17	0.30
Total	31 843	14 292	14	0.38
CD countries and areas				
Germany, Federal Republic of	6 255	6 810	31	−0.04
France	3 410	4 099	36	−0.09
United Kingdom	3 109	3 552	35	−0.07
Hong Kong	909	2 966	54	−0.53
Saudi Arabia	13	1 337	97	−0.98
Canada	306	1 281	59	−0.61
Australia	133	1 103	70	−0.78
Sweden	417	967	46	−0.40
Singapore	367	847	46	−0.40
Finland	196	616	51	−0.52
Other (66)	5 815	10 888	42	−0.30
Total	20 930	34 466	40	−0.24

Country or area[a]	Exports (Millions of current United States dollars)	Imports	T/XM[b] Ordinal	T/XM[b] Cardinal
	Iron and steel			
CA countries and areas				
Japan	15 454	894	2	0.89
Germany, Federal Republic of	11 551	6 732	9	0.26
France	7 290	5 372	15	0.15
Belgium	6 410	1 863	5	0.55
Sweden	2 276	1 418	11	0.23
Spain	1 945	808	6	0.41
Austria	1 677	726	7	0.40
Republic of Korea	1 649	987	10	0.25
South Africa	1 229	326	4	0.58
Other (5)	3 809	2 707	7	0.17
Total	54 526	22 132	6	0.42
CD countries and areas				
United States	3 116	8 153	25	−0.45
United Kingdom	2 289	3 364	21	−0.19
China	250	2 065	43	−0.78
Switzerland	398	1 317	28	−0.54
China (Taiwan Province)	335	1 092	27	−0.53
Mexico	124	1 002	43	−0.78
Yugoslavia	229	970	32	−0.62
Denmark	341	911	26	−0.46
Singapore	212	867	30	−0.61
India	85	841	50	−0.82
Other (68)	8 961	23 132	25	−0.44
Total	16 340	43 714	26	−0.46
	Wood and wood products			
CA countries and areas				
Canada	3 510	417	20	0.79
Finland	1 875	67	13	0.93
Sweden	1 596	341	27	0.65
Austria	1 158	287	29	0.60
Malaysia	841	22	10	0.95
China (Taiwan Province)	781	62	16	0.85
Singapore	522	277	34	0.31
Republic of Korea	485	36	15	0.86
Yugoslavia	441	80	23	0.69
Philippines	368	1	2	0.99
Other (31)	2 190	352	22	0.72
Total	13 767	1 942	22	0.75
CD countries and areas				
EEC	3 394	11 108	57	−0.53
United States	2 002	3 496	48	−0.27
Japan	152	2 393	71	−0.88
Saudi Arabia	17	683	78	−0.95
Switzerland	124	398	56	−0.52
Spain	191	345	49	−0.29
Algeria	0	299	95	−1.00
Norway	141	285	51	−0.34
Egypt	0	266	95	−1.00
Hong Kong	11	170	70	−0.87
Other (44)	444	1 581	59	−0.56
Total	6 476	21 025	57	−0.53

Table V.3 *(continued)*

Country or area[a]	*Exports* (*Millions of current United States dollars*)	*Imports*	*T/XM*[b] *Ordinal*	*T/XM*[b] *Cardinal*
	Consumer electronics			
CA countries and areas				
Japan	10 759	839	1	0.86
Singapore	2 200	1 638	7	0.15
China (Taiwan Province)	1 684	544	2	0.51
Republic of Korea	1 355	659	4	0.35
Other (6)	1 172	1 043	9	0.06
Total	17 170	4 723	2	0.57
CD countries and areas				
EEC	7 389	11 444	22	−0.22
United States	4 592	7 394	17	−0.23
Saudi Arabia	13	583	51	−0.96
Switzerland	159	577	29	−0.57
Sweden	156	569	29	−0.57
Spain	43	447	40	−0.82
Argentina	3	416	55	−0.98
Australia	6	372	53	−0.97
Venezuela	1	293	66	−0.99
China	39	212	33	−0.69
Other (53)	2 173	3 738	18	−0.26
Total	14 574	26 045	18	−0.28

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]The numbers in parentheses indicate the number of countries in the "outer" category.

[b]T/XM stands for net exports divided by the sum of exports plus imports. The rankings include all countries for which data are available.

cent of this group's exports and net exports, respectively. Hong Kong, a major exporter of apparel, is not in this group. Indeed, Hong Kong is the single largest net importer of textiles, and is seen to have CD in this sector. Other CD countries include Saudi Arabia, Singapore and several developed market economies. The 66 unlisted countries identified as having CD in textiles account for slightly more than 25 per cent of the group's total imports and slightly more than 33 per cent of its net imports. Thus, the imports side of the world market shows considerable diversification across countries.

The extent to which countries both import and export textiles should be noted. Much of this intra-industry trade is due to the high degree of aggregation used to define the textiles industry. For example, certain countries export certain textile items and import others. CA countries tend to export far more textiles than they import. CD countries are also substantial exporters, however. They export, on average, 60 per cent more than they import.

In iron and steel, only 15 countries, from a total of 93 surveyed, were identified as having overall CA. All are prominent exporters, supplying over 70 per cent of the world's exports (excluding that of the centrally planned economies). Their imports are widely diversified. Those with CA still account

for 33 per cent of the imports of the group surveyed. The 10 countries identified as CD import the same volume as the 10 major CA countries. Clearly, the iron and steel industry is characterized by substantial intra-industry trade.

Trade in the wood and wood products industry is somewhat different than that in textiles or steel: the incidence of intra-industry trade is much smaller. CA countries are dominant exporters. Their imports, however, are only 14 per cent as large as their exports—compared with figures in excess of 40 per cent for the textiles and apparel and the iron and steel industries. Their location, moreover, is largely determined by proximity to their sources of raw materials.

Consumer electronics is the most concentrated of the industries analysed. Only 10 countries were identified as having CA. Surprisingly, perhaps, neither the United States nor any of the EEC members are among these. The group is dominated by one country, Japan, which alone accounts for 63 per cent of the group's total exports and 80 per cent of its net exports. The group includes only three other major exporters: China (Taiwan Province), Republic of Korea and Singapore. Import markets for consumer electronics are similarly concentrated, with the EEC and the United States accounting for over 60 per cent of world imports (excluding those of the centrally planned economies). These countries, however, also export substantial amounts.[13]

The analysis indicates a high degree of consistency between primary trade flows (exports from CA countries and imports into CD countries) and the index of comparative advantage (T/XM). The reverse trade flow (imports into the former countries and exports from the latter) is more difficult to explain. In the following section, an attempt is made to do so by disaggregating flows into narrowly defined product categories. Trade in intermediate products is identified as the products move through the various stages of processing from raw material to final form. The patterns of CA are also examined by stage of processing.

CA by stage of processing

International trade is not the reflection of a simple CA pattern showing some countries exporting products from one or more sectors and other countries exporting products from other sectors. Trade is much more than the processing of indigenous raw materials into final goods for domestic consumption and export. It is a highly interdependent process whereby some countries export raw materials to others which then process them into intermediate-stage products and export them to yet other countries for further processing. The degree of this interdependence, the number of processing stages involved, and their location, differs among industries. In some cases, more than one processing stage may be located in the same country, and even, for reasons of production efficiency, in the same plant. Each stage should be located where the economic environment offers the greatest efficiency. The international integration of processing activities does not mean that jobs need be "exported";

[13]Balassa's index of relative export performance places the United States in the CA group. Thus, American exports of consumer electronics relative to American exports of manufactures in general are higher than would appear from the world pattern. Since production is often aimed at domestic consumption, this may also reflect a high propensity to consume electronic products.

it could, however, mean a restructuring of employment patterns in particular countries. While jobs would be lost in processing activities that might be accomplished more efficiently in other countries, they would be gained at those stages in which the "home" country enjoyed CA. The nature of CA is such that no country can have CD in all sectors: job creation consistent with international efficiency should therefore occur in all countries.

The present exercise represents a first attempt to compile statistics on trade by stage of processing.[14] Four stages of processing are identified in the case of textiles and apparel; iron and steel; and wood and wood products. Two are identified for consumer electronics. Data are presented by stage of processing, using the following definitions:

Industry	*Stage of processing*
Textiles and apparel	1. Cotton and man-made fibres
	2. Cotton and man-made yarns
	3. Cotton and man-made fabrics
	4. Cotton and man-made apparel
Iron and steel	1. Pig iron
	2. Ingots
	3. Bars, rods, shapes, plates etc.
	4. Selected steel products in the transportation and machinery sectors
Wood and wood products	1. Rough saw-logs
	2. Sawn, shaped and simply worked wood
	3. Veneer and plywood
	4. Manufactures of wood
Consumer electronics	1. Transistors and other components
	2. TV and radio receivers and recorders

For textiles and apparel the summary statistics shown in table V.4 reveal a significant (though not unexpected) pattern. The United States is the dominant country at the first stage of processing, because of its advantage in the petrochemical-based, man-made fibre industry. It does not engage in much trade at stage 2. Instead, it processes the fibres into yarn and then processes the yarns into fabrics (probably in multi-stage plants). Thus, the United States enjoys a strong competitive position in fibres and fabrics. At the final stage, however, it is very definitely at a comparative disadvantage. Japan is an importer of fibres (mainly cotton), an exporter of fabrics, and an importer of apparel. On the other hand, developing countries, especially the more advanced, are significant importers of fibres and exporters of apparel.

In iron and steel, little trade takes place at stage 1 and the CA pattern remains relatively consistent at later stages. Japan is the dominant exporter. The developing countries are mainly importers, with the more advanced having a slightly smaller CD. The CA pattern seems to alter only in the case of the United States, which has a CD in steel and a CA in steel products.

[14]The analysis of interdependence in the industries should be considered an exploratory exercise rather than a definitive test. It is an extension of the analysis of international CA in industry presented in the last three issues of the *Industrial Development Survey*.

Table V.4. CA by stage of processing, 1979-1980

Country or area	*Exports*	*Imports*	*T/XM*[a]
	(Millions of current United States dollars)[a]		
Textiles and apparel: stage 1			
Developed market economies and developing countries	8 609	9 175	−0.03
Developed market economies	6 455	5 920	0.04
United States	3 281	65	0.96
EEC	1 788	2 919	−0.24
Japan	592	1 369	−0.40
Other	795	1 567	−0.33
Developing countries	2 153	3 255	−0.20
Semi-industrialized	259	1 097	−0.62
Other	1 894	2 158	−0.07
Textiles and apparel: stage 2			
Developed market economies and developing countries	10 144	8 074	0.11
Developed market economies	7 781	6 951	0.06
United States	616	138	0.63
EEC	4 927	4 791	0.01
Japan	778	372	0.35
Other	1 460	1 649	−0.06
Developing countries	2 363	1 124	0.36
Semi-industrialized	1 242	272	0.64
Other	1 121	852	0.14
Textiles and apparel: stage 3			
Developed market economies and developing countries	16 252	13 046	0.11
Developed market economies	12 023	10 581	0.06
United States	1 328	852	0.22
EEC	6 625	6 779	−0.01
Japan	2 665	399	0.74
Other	1 404	2 551	−0.29
Developing countries	4 229	2 466	0.26
Semi-industrialized	1 865	930	0.33
Other	2 364	1 536	0.21
Textiles and apparel: stage 4			
Developed market economies and developing countries	25 634	30 441	−0.09
Developed market economies	16 961	28 842	−0.26
United States	874	5 846	−0.74
EEC	12 376	16 751	−0.15
Japan	393	1 425	−0.57
Other	3 319	4 820	−0.18
Developing countries	8 672	1 598	0.69
Semi-industrialized	5 075	234	0.91
Other	3 597	1 364	0.45
Iron and steel: stage 1			
Developed market economies and developing countries	541	635	−0.08
Developed market economies	475	547	−0.07
United States	9	71	−0.77
EEC	252	322	−0.12
Japan	5	98	−0.91
Other	209	56	0.58

Table V.4 *(continued)*

Country or area	Exports (Millions of current United States dollars)[a]	Imports	T/XM[a]
	***Iron and steel* (continued)**		
Developing countries	66	88	−0.14
Semi-industrialized	21	28	−0.14
Other	45	60	−0.14
	Iron and steel: stage 2		
Developed market economies and developing countries	7 210	6 423	0.06
Developed market economies	6 714	5 075	0.14
United States	171	225	−0.13
EEC	4 314	3 733	0.07
Japan	1 441	153	0.81
Other	787	964	−0.10
Developing countries	495	1 348	−0.46
Semi-industrialized	458	998	−0.37
Other	37	350	−0.81
	Iron and steel: stage 3		
Developed market economies and developing countries	53 144	44 516	0.09
Developed market economies	50 450	32 711	0.21
United States	1 838	7 455	−0.60
EEC	27 378	17 284	0.23
Japan	13 272	294	0.96
Other	7 962	7 677	0.02
Developing countries	2 694	11 806	−0.63
Semi-industrialized	2 188	3 339	−0.21
Other	506	8 467	−0.89
	Iron and steel: stage 4		
Developed market economies and developing countries	267 187	227 386	0.08
Developed market economies	259 656	185 942	0.17
United States	47 452	38 976	0.10
EEC	137 697	88 013	0.22
Japan	37 163	3 913	0.81
Other	37 344	55 039	−0.19
Developing countries	7 531	41 445	−0.69
Semi-industrialized	5 260	14 015	−0.45
Other	2 271	27 430	−0.85
	Wood and wood products: stage 1		
Developed market economies and developing countries	3 723	9 302	−0.43
Developed market economies	2 300	7 920	−0.55
United States	1 666	27	0.97
EEC	271	1 432	−0.68
Japan	5	5 897	−1.00
Other	358	564	−0.22
Developing countries	1 423	1 382	0.01
Semi-industrialized	21	1 311	−0.97
Other	1 402	71	0.90

Country or area	Exports	Imports	T/XM[a]
	(Millions of current United States dollars)[a]		
Wood and wood products: stage 2			
Developed market economies and developing countries	10 923	13 272	−0.10
Developed market economies	9 297	12 481	−0.15
United States	1 145	2 729	−0.41
EEC	986	6 982	−0.75
Japan	47	1 180	−0.92
Other	7 120	1 590	0.63
Developing countries	1 625	791	0.35
Semi-industralized	686	421	0.24
Other	939	370	0.43
Wood and wood products: stage 3			
Developed market economies and developing countries	4 154	4 478	−0.04
Developed market economies	2 708	4 088	−0.20
United States	445	748	−0.25
EEC	962	2 054	−0.36
Japan	76	818	−0.83
Other	1 224	468	0.45
Developing countries	1 446	390	0.57
Semi-industrialized	1 090	214	0.67
Other	356	176	0.34
Wood and wood products: stage 4			
Developed market economies and developing countries	3 233	2 671	0.10
Developed market economies	2 472	2 497	0.00
United States	242	546	−0.39
EEC	1 227	1 304	−0.03
Japan	36	139	−0.59
Other	967	507	0.31
Developing countries	761	174	0.63
Semi-industrialized	468	50	0.81
Other	293	124	0.41
Consumer electronics: stage 1			
Developed market economies and developing countries	12 369	13 385	−0.04
Developed market economies	8 914	9 503	−0.03
United States	3 362	3 207	0.02
EEC	3 363	4 651	−0.16
Japan	1 993	676	0.49
Other	196	969	−0.66
Developing countries	3 455	3 882	−0.06
Semi-industrialized	2 412	2 934	−0.10
Other	1 043	948	0.05
Consumer electronics: stage 2			
Developed market economies and developing countries	16 100	13 349	0.09
Developed market economies	12 283	11 185	0.05
United States	672	3 696	−0.69
EEC	3 570	5 633	−0.22
Japan	7 357	127	0.97
Other	684	1 728	−0.43

Table V.4 (continued)

Country or area	*Exports* (Millions of current United States dollars)[a]	*Imports*	*T/XM*[a]
	Consumer electronics (continued)		
Developing countries	3 817	2 165	0.28
Semi-industrialized	3 633	1 204	0.50
Other	184	961	−0 68

Source: UNIDO secretariat calculations.

[a]Two-year average for 1979-1980. T/XM stands for net exports divided by the sum of exports plus imports.

A wide diversity of experience is apparent in the case of wood and wood products, some countries being consistently CD (Japan and EEC members) and others consistently CA. The situation in some countries has undergone dramatic change. The United States is a dominant exporter of rough saw-logs and an importer of wood products from stage 2 upwards. The more advanced developing countries import saw-logs and export wood products, primarily veneers and plywoods.

In consumer electronics, Japan is the only major industrialized country enjoying CA at stage 1. Interestingly, there is only one CD group, and that is composed of the other developed market economies. Most country groups are close to the "neutral" line, in CA terms. At stage 2, on the other hand, dramatic differences are to be seen, ranging from a large degree of CA for Japan and the advanced developing countries to definite degrees of CD for other countries.

Table V.5 summarizes the results of a detailed, country-specific examination of CA patterns, by stage of processing.

Table V.5. CA by stage of processing, 1980

Country or area	*Stage*[a]	*Exports* (Millions of current United States dollars)	*Imports*	*T/XM*[b] *Dichotomous*	*Ordinal*	*Cardinal*
		Textiles and apparel				
Belgium	1	55	297	CD	49	−0.69
	2	478	730	CD	30	−0.21
	3	873	620	CA	19	0.17
	4	967	1 723	CD	45	−0.28
China	1	14	1 616	CD	62	−0.98
	2	194	232	CD	27	−0.09
	3	937	194	CA	9	0.66
	4	1 363	12	CA	8	0.98
China (Taiwan Province)	1	91	426	CD	47	−0.65
	2	445	43	CA	2	0.82
	3	681	171	CA	11	0.60
	4	2 271	3	CA	1	1.00
Germany, Federal Republic of	1	725	676	CA	33	0.03
	2	1 647	1 391	CA	18	0.08
	3	2 042	1 566	CA	23	0.13
	4	2 687	7 251	CD	50	−0.46

Country or area	Stage[a]	Exports (Millions of current United States dollars)	Imports	T/XM[b] Dichotomous	Ordinal	Cardinal
Hong Kong	1	9	420	CD	57	−0.96
	2	66	615	CD	44	−0.81
	3	563	1 298	CD	38	−0.40
	4	4 333	620	CA	26	0.75
Italy	1	252	831	CD	44	−0.54
	2	899	628	CA	17	0.18
	3	1 235	932	CA	22	0.14
	4	4 345	704	CA	27	0.72
Japan	1	659	1 401	CD	40	−0.36
	2	896	318	CA	11	0.48
	3	2 916	361	CA	7	0.78
	4	462	1 317	CD	51	−0.48
Republic of Korea	1	44	643	CD	55	−0.87
	2	524	98	CA	7	0.69
	3	956	194	CA	9	0.66
	4	2 507	10	CA	5	0.99
Switzerland	1	58	179	CD	42	−0.51
	2	426	153	CA	12	0.47
	3	464	283	CA	16	0.24
	4	324	1 288	CD	55	−0.60
United States	1	3 712	67	CA	5	0.96
	2	676	146	CA	9	0.64
	3	1 398	896	CA	17	0.22
	4	986	6 204	CD	59	−0.73
		Iron and steel				
Austria	1	0	17	CD	21	−0.99
	2	145	54	CA	8	0.45
	3	1 357	588	CA	7	0.40
	4	2 698	4 556	CD	17	−0.26
Belgium	1	3	21	CD	13	−0.74
	2	1 045	394	CA	8	0.45
	3	5 186	1 286	CA	4	0.60
	4	9 845	11 543	CD	14	−0.08
Brazil	1	119	0	CA	1	1.00
	2	64	57	CA	14	0.06
	3	534	577	CD	16	−0.04
	4	2 371	2 591	CD	12	−0.04
Canada	1	95	0	CA	3	0.99
	2	74	32	CA	10	0.39
	3	1 380	1 180	CA	13	0.08
	4	12 934	19 709	CD	15	−0.21
Italy	1	1	141	CD	21	−0.99
	2	259	1 171	CD	21	−0.64
	3	3 450	2 489	CA	12	0.16
	4	17 951	13 539	CA	7	0.14
Republic of Korea	1	22	1	CA	4	0.88
	2	302	486	CD	18	−0.23
	3	1 334	496	CA	6	0.46
	4	473	2 427	CD	28	−0.67

Table V.5 *(continued)*

Country or area	Stage[a]	Exports (Millions of current United States dollars)	Imports	T/XM[b] Dichotomous	Ordinal	Cardinal
		Iron and steel (continued)				
Spain	1	5	11	CD	12	−0.39
	2	158	211	CD	17	−0.14
	3	1 696	531	CA	5	0.52
	4	3 932	3 675	CA	10	0.03
Switzerland	1	0	18	CD	19	−0.98
	2	9	57	CD	23	−0.74
	3	399	1 225	CD	22	−0.51
	4	6 450	5 623	CA	9	0.07
United Kingdom	1	6	40	CD	13	−0.74
	2	136	380	CD	20	−0.47
	3	1 978	2 752	CD	17	−0.16
	4	24 699	18 399	CA	5	0.15
United States	1	8	71	CD	17	−0.80
	2	249	200	CA	13	0.11
	3	1 971	7 535	CD	27	−0.59
	4	51 132	40 766	CA	8	0.11
		Wood and wood products				
Austria	1	89	126	CD	15	−0.17
	2	878	166	CA	19	0.68
	3	158	37	CA	15	0.62
	4	121	85	CA	24	0.18
Canada	1	58	56	CA	13	0.01
	2	2 976	273	CA	13	0.83
	3	203	70	CA	18	0.49
	4	331	74	CA	14	0.63
China (Taiwan Province)	1	9	384	CD	27	−0.95
	2	65	45	CA	24	0.18
	3	367	15	CA	8	0.92
	4	349	2	CA	1	0.99
Denmark	1	6	10	CD	17	−0.29
	2	51	324	CD	34	−0.73
	3	40	82	CD	30	−0.34
	4	194	47	CA	15	0.61
Italy	1	1	600	CD	30	−1.00
	2	83	1 543	CD	38	−0.90
	3	151	168	CD	23	−0.05
	4	288	81	CA	19	0.56
Republic of Korea	1	0	860	CD	30	−1.00
	2	83	16	CA	19	0.68
	3	354	17	CA	9	0.91
	4	49	3	CA	8	0.88
Singapore	1	5	36	CD	24	−0.74
	2	278	173	CA	23	0.23
	3	221	92	CA	20	0.41
	4	23	12	CA	23	0.32

Country or area	Stage[a]	Exports (Millions of current United States dollars)	Imports	T/XM[b] Dichotomous	Ordinal	Cardinal
Spain	1	1	164	CD	29	−0.99
	2	41	320	CD	35	−0.77
	3	73	5	CA	11	0.87
	4	77	21	CA	18	0.58
Sweden	1	10	42	CD	20	−0.61
	2	1 295	120	CA	13	0.83
	3	101	147	CD	27	−0.18
	4	199	74	CA	21	0.46
United States	1	1 581	22	CA	8	0.97
	2	1 183	2 308	CD	26	−0.32
	3	542	651	CD	24	−0.09
	4	277	537	CD	30	−0.32
		Consumer electronics				
Brazil	1	64	273	CD	23	−0.62
	2	100	29	CA	4	0.55
China (Taiwan Province)	1	481	459	CA	7	0.02
	2	1 204	85	CA	2	0.87
Germany, Federal Republic of	1	1 218	1 814	CD	14	−0.20
	2	1 651	1 708	CD	12	−0.02
Hong Kong	1	295	697	CD	18	−0.41
	2	882	495	CA	7	0.28
Japan	1	2 307	713	CA	2	0.53
	2	8 452	126	CA	1	0.97
Republic of Korea	1	517	527	CD	10	−0.01
	2	838	132	CA	3	0.73
Malaysia	1	1 053	971	CA	6	0.04
	2	49	132	CD	17	−0.45
Netherlands	1	560	499	CA	5	0.06
	2	410	795	CD	15	−0.32
Singapore	1	1 187	1 178	CD	9	0.00
	2	1 013	461	CA	6	0.37
United States	1	3 800	3 653	CA	7	0.02
	2	791	3 741	CD	25	−0.65

Source: UNIDO secretariat calculations. These data do not always correspond perfectly with the branch totals given in tables V.1 and V.3. In table V.1, data for apparel correspond well with data for textiles at stage 4. Data for the other three textiles stages do not correspond well with the totals given in table V.3, however. Iron and steel data correspond well with those for iron and steel at stages 1, 2 and 3. Data for wood and wood products correspond well with those for wood and wood products at stages 2, 3 and 4. Consumer electronics data correspond quite closely with the branch totals in table V.3, but not in table V.1.

[a]See text for precise definition of stages.

[b]T/XM stands for net exports divided by the sum of exports plus imports. Rankings include all countries for which data are available; CA = comparative advantage; CD = comparative disadvantage.

Textiles and apparel

The textiles and apparel industries were the most complex to analyse. They involve the production of two very different products—industrial textiles and

labour-intensive apparel—and two very different materials—industrial man-made materials and natural cotton. The CA pattern reflects these differences. At stage 1 (fibres), exports originate mainly from three sources: the United States; India and cotton-producing developing countries in the Middle East and Central America; and the EEC and Japan. The last group consists of large net importing countries identified as CD. At stage 2, the CA pattern is less pronounced. The United States, Japan and the Asian developing countries enjoy CA, yet the volume of trade of the United States and Japan is quite modest. Only the Asian developing countries are significant exporters.

The same pattern continues into stage 3, with a decline in the competitive position of the United States (which still enjoys CA) and an increase in that of Japan (a large net exporter at this stage). Asian developing countries continue to enjoy CA, though they have not increased their net exports (compared with stage 2); instead, they process fabrics into apparel. At stage 4, the United States is seen to have CD, followed closely by Japan and the EEC (with the exception of Italy). The highly competitive countries are the developing countries of Asia and elsewhere, many of which do not export in large volume.

Iron and steel

As mentioned before, there is relatively little international trade in the stage 1 product: pig iron. At the other three stages, Japan is the dominant net exporting country. The EEC also enjoys CA at these stages. Intra-industry trade, however, much of it intra-EEC trade, is substantial. France, the Federal Republic of Germany and Italy are net exporters at the higher stages. The Netherlands is a net importer at these stages. Belgium and the United Kingdom have trading patterns that mirror each other: Belgium enjoys CA at stages 2 and 3 and has CD at stage 4; the situation in the United Kingdom is just the opposite. The United States has CD at stage 3 and CA at stage 4. The developing countries, especially the less advanced ones, are large net importers at stages 3 and 4 (except for the Republic of Korea, which enjoys CA at stage 3).

Wood and wood products

Trade in wood and wood products provides evidence of international co-operation in industrial processing. A credible picture of world trade in this industry can be gleaned from the data available. The major exporter of saw-logs is the United States. Most of these logs are exported to Japan to be used in housing construction.[15] Indonesia and Malaysia are also significant exporters of the basic raw material. The major exporters of stage 2 products are Austria, Canada, Finland and Sweden, which export sawn wood products rather than rough saw-logs. The distinction between stages 2 and 3 is not a sequential one: stage 2 output is not a stage 3 input. Stage 2 output comprises saw-mill products, whereas stage 3 products include veneers and plywoods. Both types of products would be used in the construction and furniture industries. This trade is largely determined by the wood types available—those from North

[15] At stage 1, total imports far exceed exports, probably because the centrally planned economies of Eastern Europe are large net exporters of rough saw-logs.

America and the northern countries of Europe having characteristics quite different from those from Asia. The major exporters are the traditional suppliers from the developed market economies and, surprisingly, several developing countries. The latter are major importers of raw materials and exporters of veneers and plywoods. At the final stage, the volume of trade is much smaller than at the earlier stages, which contrasts somewhat with the other industries examined. Moreover, the countries that enjoy CA account for only a relatively small share of world trade.

Consumer electronics

This branch has certain interesting aspects. As noted before, Japan holds the dominant position in net exports. The United States is CA "neutral" at stage 1 and non-competitive at stage 2. The advanced developing countries have CD at stage 1 and CA at stage 2. Obviously, these countries import components and process them into consumer electronic products. The reverse situation obtains in the case of the other developing countries: they enjoy CA in components, but have CD in consumer electronic products. Closer examination shows, however, that the stage 1 advantage depends entirely on exports from Malaysia. Apparently, industrial complementarity exists in Asia: stage 1 plants located in particular Asian countries supply various components to the region's stage 2 processors. This permits the stage 1 plants to reach efficient scales of operation that would not be possible if each country attempted domestic production of the components needed for its stage 2 operations. In 1979-1980, the Asian countries' exports of components were worth $3.5 billion, compared with their total imports of $3.8 billion. The consumer electronics industry in Asia would seem, therefore, to demonstrate the advantages of industrial co-operation and international interdependence.

Summary and conclusions

The present chapter addresses two questions: What does the pattern of international CA in the industries studied look like at the beginning of the 1980s? And, can countries derive mutual benefit from international industrial co-operation in those industries? In answering the first question, two categories of CA indices are used—one based on trade-cum-production relationships, the other on trade-only data.[16] The international CA pictures obtained through the two methods turn out to be acceptably consistent, even allowing for the fact that availability of trade-only data meant that that approach could be treated in greater detail. With regard to industrial interdependence, the hypothesis was examined that industrialization involves processing activities rather than the production of finished goods. Countries that are endowed with indigenous raw materials find that their CA lies in extracting and processing these materials into intermediate products for export, rather than in using them to make

[16]Both indices incorporate production and consumption factors and/or export and import factors.

finished products. Other countries import the intermediate products for processing into higher-stage intermediate products, which they, in turn, export. Eventually, the finished product emerges from this chain of processing.

This hypothesis is examined in light of the experiences of the industries, and the pattern of CA, by stage of processing, is identified. The conclusions, in brief, are:

(a) In the textiles and apparel industries, the textile-fibre stage is dominated by cotton-producing developing countries and by capital-intensive petrochemical plants, mainly in the United States;

(b) The apparel industry is dominated by Asian developing countries;

(c) The CA pattern in iron and steel is uniform across all stages of processing, with the developed market economies, especially Japan, having the advantage;

(d) The wood and wood products industry, being raw-material-based, is heavily influenced by Austria, Canada, Finland, Sweden and the United States, as well as by Indonesia and Malaysia;

(e) Several Asian developing countries successfully process imported wood into higher-stage products;

(f) The major exporting country in consumer electronics is Japan, at all stages;

(g) The Asian developing countries boast an integrated electronics industry, with some countries deeply involved at stage 1 processing and others at stage 2. (Some are involved at both stages.)

Most of the findings involve Japan and the developing countries and areas of Asia. Clearly, these latter are efficient processors of imported materials into higher-stage goods. A corollary is that they have benefited from industrial interdependence. More important, they have rationalized their industrial structures to bring them into line with the concept of industrial interdependence. They are not simply importers of raw materials and exporters of final goods. Hong Kong, for example, exports 17 per cent of the world's apparel (excluding that of the centrally planned economies of Eastern Europe), yet it is a net importer of textiles at all stages. And Japan, which is a net importer of textile fibres and apparel (the first and fourth stages), is a net exporter of products at the two intermediate stages. The conclusion to be drawn from this would appear to be that industrial interdependence among countries is mutually beneficial. Governments should recognize the advantages of such interdependence and formulate their policies accordingly.

Finally, the reader is reminded that the analysis reported in this chapter, and especially the data transformations, are based on an on-going research effort. Work on measuring CA began several years ago and progress reports have been included periodically in the *Industrial Development Survey*. Research on industrial interdependence, on the other hand, is a new undertaking, but the initial results are very encouraging. It is expected that in time this research will contribute to a better understanding of the industrial process and suggest avenues by which developing countries can better integrate their industrial sectors into the world economy.

VI

The technology factor and North-South trade in manufactures

TECHNOLOGY and international trade are fields in which the elements of global interdependence figure prominently. The international linkages formed through the flow of trade in goods are complemented by those formed through the flow of information on technology.[1] In these two fields, a special case of interdependence exists between the developed and the developing countries. The latter are largely dependent on the former in matters concerning the transfer of technology. However, as new technologies are introduced in the developing countries, those countries' competitive position *vis-à-vis* the developed countries tends to change—especially as their exports of technology-intensive goods increase. This heightened competitiveness in turn affects adjustment processes in the developed countries. It is in this context that the technological element of international trade in manufactures is of such significance.[2]

Popular attempts to explain the role of technology in trade concentrate on the temporary monopolies enjoyed by countries that can boast superior technologies.[3] The strength of such monopolies lies in the varying rates of technological innovation existing in different countries, and in the imperfections inherent in the process of disseminating technological information. The resulting "technology gap" is widest between the developed and the developing countries and has a strong impact on the nature of North-South trade in manufactures. In time, however, as a result of the dynamics of technical change, the technology-related characteristics of North-South trade are likely to alter. In the present chapter, developments in trade relationships between the developed countries and the developing countries are assessed in the context of the technology gap and the changing scientific and technological resources of both groups of countries. The first section contains an empirical assessment of the relationship between competitive advantage and technological capability in

[1]It has been contended that technology may soon have the effect of reducing trade, in the sense that the exchange of technical information is likely to replace, to some extent, the export of goods. (See R. Vernon, "Technology's effects on international trade: a look ahead", *Emerging Technologies: Consequences for Economic Growth, Structural Change, and Employment, Symposium 1981*, H. Giersch, ed. (Tübingen, J.C.B. Mohr, 1982), pp. 145-166.)

[2]Technology and trade are interdependent. The influence of the former on the latter is the subject of the present chapter. While the impact of international trade on technological developments is not examined here, it is instrumental in evolving the technological capabilities of the developing countries.

[3]This is true of both the "technology gap" and the "product cycle" models of international trade. The first model features in the work of M. V. Posner, "International trade and technical change", *Oxford Economic Papers*, vol. 13, 1961, pp. 323-341. The second is usually associated with R. Vernon, "International investment and international trade in the product cycle", *Quarterly Journal of Economics*, vol. 80, 1966, pp. 190-207.

90 manufacturing industries. An indicator of R and D orientation is developed and subsequently employed to classify those industries. The second section deals with the relationship between a country's level of technological sophistication and the composition of its exports and imports of manufactures. Broad technological characteristics of North-South trade in manufactures, and the way they change over time, are the subject of the third section. The chapter concludes with some remarks on the significance of the relationship between technological change and technology transfer, on the one hand, and the pattern of international trade in manufactures, on the other.

Revealed comparative advantage and technological capability: an industry perspective

The composition (or structure) of trade in manufactures may be summarized as follows: *(a)* most of the products associated with manufacturing are exported in large volume by the developed countries; *(b)* certain manufactured products rank high among the exports of the developing countries and low among the exports of the developed countries; and *(c)* a number of manufactured products cannot be clearly assigned to the export domain of either grouping, as members of both groupings are internationally competitive in that range. This typology is based on what might be termed an "impressionistic" view of trade patterns. It can, however, be refined in various ways to show a more comprehensive picture of international competitiveness in manufacturing. Instead of loosely circumscribing the export domains of developed and developing countries, the relationship between countries' income levels and trade structures can be assessed.[4] More specifically, the association between the structure of exports and imports of manufactures, on the one hand, and the international distribution of resources, on the other, can be examined. This exercise in turn provides some insight into the relationship between resource endowments and specialization in production and trade.[5] Moreover, technology-related factors can be examined with a view to detecting if a systematic relationship exists between countries' trade structures and levels of technological sophistication.

A vast body of literature is available which deals with technological differences between countries as determinants of trade patterns.[6] Part of it is based on a "neo-factor proportions" approach to technology. According to this approach, these differences are differences in endowments of the factor inputs that are closely associated with science and technology.[7] Certain trade patterns

[4] See M. Michaely, "Income levels and the structure of trade", *The World Economic Order: Past and Prospects*, S. Grassman and E. Lundberg, eds. (London, MacMillan, 1981), pp. 121-164.

[5] Investigations along these methodological lines can be found in *International Comparative Advantage in Manufacturing: Changing Profiles of Resources and Trade* (United Nations publication, forthcoming).

[6] A survey of both theoretical and empirical contributions to this theme is found in L. Cheng, "International trade and technology: a brief survey of the recent literature", *Weltwirtschaftliches Archiv*, vol. 120, No. 1 (1984), pp. 165-189.

[7] As an example, see L. Sveikauskas, "Science and technology in United States foreign trade", *Economic Journal*, vol. 93, 1983, pp. 542-554.

emerge from the interaction between factor abundance and the intensity of factor usage in the production of goods. This notion of a technology factor also provides a conceptual basis for analysis of the relationship between trade structures and levels of technological sophistication.

If science and technology can be represented as just another factor of production (as it is assumed to be in the "neo-factor proportions" approach), a country's abundance of the "technology factor" may be expected to partly shape its pattern of competitiveness. Thus, it is possible to determine whether a high technological capability favours or disfavours exports of a given product group. In this way, industries can be classified according to whether the association (among countries) between competitive advantage and levels of technological sophistication is positive, negative or indefinite. A rough impression of the overall relationship between technological capability and international competitiveness is thus obtained.

Before an empirical analysis of this association can be made, appropriate measurement concepts must be decided upon. The trade side of the analysis is best represented by a "revealed" comparative advantage (RCA) indicator. This facilitates evaluation of country- and industry-specific trade performance against a background of world patterns of trade in manufactures. One possible indicator is the value of net exports of a given product by a given country, adjusted to allow for the size of the country and the weight of the product in world trade in manufactures.[8] Measuring a country's science-technology endowment is more difficult. In view of the complexity of science-technology inputs in manufacturing, the means of measuring national technological capability suggested in the relevant literature must be considered rather crude proxies, although they can serve to highlight aspects of the role which technology plays in connection with international competitiveness. The measure chosen for the purposes of the present analysis is economy-wide expenditure on R and D per worker.

To measure the association between the RCA of a given industry and national technological capability, an across-country correlation has been employed. Support for this choice can be found in recent literature on the "neo-factor proportions" model. It has been demonstrated that the statistical association (correlation) among trade variables, factor intensities and factor endowments can be interpreted in the spirit of the Heckscher-Ohlin Theorem.[9] Because of the obvious geometric interpretation of this measure, the correlation mentioned above may be called the "R and D orientation of RCA".

Empirical results of index value rankings, based on this "R and D orientation of RCA" concept, are shown in table VI.1. By measuring the

[8] Where i stands for the product, j for the country, w for the world, a dot for total manufactures, X for exports, and M for imports, this version of an RCA indicator can be written as

$$RCA_{ij} = (X_{ij} - M_{ij})/(T_{.j}(T_{iw}/T_{.w}))$$

with $T = (X + M)/2$.

(The problems involved in designing an empirical indicator of comparative advantage are discussed in some detail in chapter V.)

[9] See, for example, A. Deardorff, "The general validity of the Heckscher-Ohlin theorem", *American Economic Review*, vol. 72, 1982, pp. 638-694. In order to correct for the influence of capital abundance on comparative advantage, partial instead of simple correlations were used. Physical capital per worker was taken to be a co-determinant of trade patterns.

Table VI.1. R and D orientation of RCA, by industry, 1976-1978

SITC	*Industry*	*Index value*	*Rank*
512	Organic chemicals	0.375	20
513	Inorganic chemicals: elements, oxides, halides	−0.038	71
514	Other inorganic chemicals	0.499	6
515	Radioactive and associated materials	−0.127	79
521	Mineral tar and crude chemicals from coal, petroleum	0.186	40
531	Synthetic organic dyestuffs	0.296	28
532	Dyeing and tanning extracts and materials	−0.125	78
533	Pigments, paints, varnishes and related materials	0.360	22
541	Medicinal and pharmaceutical products	0.425	15
551	Essential oils, perfume and flavour materials	0.275	31
553	Perfumery and cosmetics, except soaps	0.318	24
554	Soaps, cleansing and polishing preparations	0.522	4
561	Fertilizers, manufactured	0.006	65
571	Explosives and pyrotechnic products	0.288	30
581	Plastic materials, regenerated cellulose, resins	0.557	2
599	Chemical materials and products, n.e.s.	0.461	11
611	Leather	−0.064	74
612	Manufactures of leather or reconstitutes	−0.115	77
613	Fur skins, tanned or dressed	−0.206	84
621	Materials of rubber	0.438	14
629	Articles of rubber, n.e.s.	0.111	50
631	Veneers, plywood boards, reconstituted wood	−0.217	86
632	Wood manufactures, n.e.s.	−0.206	85
633	Cork manufactures	−0.082	76
641	Paper and paperboard	−0.186	83
642	Articles of pulp, paper or paperboard	−0.027	69
651	Textile yarn and thread	0.169	43
652	Cotton fabrics, woven	0.210	38
653	Textile fabrics, woven, other than cotton	0.271	33
654	Tulle, lace, embroidery, ribbons etc.	0.012	63
655	Special textile fabrics and related products	0.404	17
656	Made-up articles, chiefly of textiles	0.083	56
657	Floor covering, tapestries etc.	0.054	58
661	Lime, cement, building materials, excl. glass and clay	−0.225	89
662	Clay and refractory construction materials	0.018	62
663	Mineral manufactures, n.e.s.	0.163	45
664	Glass	0.373	21
665	Glassware	0.046	59
666	Pottery	0.023	61
671	Pig iron, spiegeleisen, sponge iron etc.	−0.222	87
672	Ingots and forms of iron or steel	0.061	57
673	Iron and steel bars, rods, angles etc.	−0.150	81
674	Universals, plates and sheets of iron or steel	0.033	70
675	Hoop and strip of iron or steel	0.318	25
676	Rails and railway track construction materials	0.041	60
677	Iron and steel wire	0.085	53
678	Tubes, pipes and fittings of iron or steel	0.174	41
679	Iron and steel castings, forgings, unworked	−0.048	72
691	Finished structures and structural parts, n.e.s.	0.150	46
692	Metal containers for storage and transport	−0.008	68
693	Wire products (excl. electric), fencing grills	−0.068	75
694	Nails, screws, nuts, bolts, rivets etc.	0.150	47
695	Tools for use in the hand or in machines	0.498	8
696	Cutlery	0.164	44
697	Household equipment of base metals	0.007	64
698	Manufacture of metals, n.e.s.	0.334	23

SITC	*Industry*	*Index value*	*Rank*
711	Power generating machinery, excl. electric	0.403	18
712	Agricultural machinery and implements	0.244	36
714	Office machines	0.463	10
715	Metalworking machinery	0.309	26
717	Textile and leather machinery	0.292	29
718	Machines for special industries	0.445	12
719	Machines, appliances (excl. electric), parts	0.399	19
722	Electric power machinery, switchgear	0.412	16
723	Equipment for distributing electricity	0.130	49
724	Telecommunications apparatus	0.216	37
725	Domestic electrical equipment	0.108	51
726	Electrical apparatus for medical purposes	0.586	1
729	Other electrical machinery and apparatus	0.499	7
731	Railway vehicles	0.138	48
732	Road motor vehicles	0.245	35
733	Road vehicles other than motor vehicles	0.274	32
734	Aircraft	0.489	9
735	Ships and boats	0.170	42
812	Sanitary, plumbing, heating and lighting fixtures	0.207	39
821	Furniture	−0.182	82
831	Travel goods, handbags and similar articles	−0.062	73
841	Clothing except fur clothing	−0.132	80
842	Fur clothing and articles made of furskins	−0.225	88
851	Footwear	−0.311	90
861	Scientific, medical, optical, measuring instruments	0.440	13
862	Photographic and cinematographic supplies	0.539	3
864	Watches and clocks	0.265	34
891	Musical instruments, sound recorders and reproducers	0.088	52
892	Printed matter	0.300	27
893	Articles of artificial plastic materials, n.e.s.	0.083	55
894	Perambulators, toys, games, sporting goods	−0.007	67
895	Office and stationery supplies, n.e.s.	0.514	5
897	Jewellery, gold and silver wares	−0.007	66
899	Manufactured articles, n.e.s.	0.084	54

Source: Data supplied by the United Nations Statistical Office and the United Nations Educational, Scientific and Cultural Organization, with estimates by the UNIDO secretariat. The composition of the country sample can be seen from table VI.3.

concordance between the distribution of technological capability and the pattern of trade performance among countries, the orientation indices give an indication of the impact of science-technology factors on RCA. They cover 90 industries defined (in accordance with most empirical analyses of this type) as 3-digit SITC groups. They are taken from SITC sections 5 to 8, less division 68 (non-ferrous metals). The data cover a three-year period (1976-1978) and represent a sample of 32 countries, both developed and developing.[10]

Since the index is defined as a correlation coefficient, its theoretical range is between −1 and +1. A value of −1 would indicate maximum disagreement between technological capability and RCA in a given industry, whereas a value

[10]For want of sufficiently detailed information concerning their international trade, the centrally planned economies could not be included.

of +1 would indicate perfect agreement.[11] Table VI.1 shows that the actual range of R and D orientation indices is narrower than the theoretical one. The maximum value, 0.586, is found in the case of electrical apparatus for medical purposes (SITC 726). The minimum value, −0.311, is recorded for footwear (SITC 851). The dispersion of the index across the 90 industries is characterized by a standard deviation of 0.229 from an unweighted mean of 0.158.

The results of an aggregation of R and D orientation indices into six broad groups of manufactured goods are shown in table VI.2. A ranking of the groups' averages largely conforms with what might be expected concerning the relationship between technological capabilities and trade patterns among industries in the manufacturing sector. The highest average index values, for example, were recorded for chemicals, followed by engineering products. This accords with the commonly held view that the technology-intensive industries are concentrated in those two broad groups. All other groups show index values of around zero. This applies to the labour-intensive groups (textiles and clothing; other consumer goods), a technologically "mature" group (iron and steel), and to groups that are heavily dependent on natural resources (e.g. for the production of semi-manufactures).

In order to more closely identify links between technological capability and RCA, a more disaggregate analysis is needed, however. In studies such as the present one, the practice of choosing industries as units of observation and associating them with the three-digit SITC groups is seen as a reasonable compromise between the need to cover sufficiently homogeneous product groups and the need to retain some leeway in the handling of empirical data. Although the claim expressed earlier regarding the homogeneity of industries with respect to factor input requirements and related characteristics cannot be fully upheld in this framework, analyses of RCA at the three-digit SITC level do nevertheless take sufficiently into account the diversity that exists both in market conditions and in production techniques.

Table VI.2. R and D orientation of RCA: weighted means; minimum and maximum values of indices, by broad product groups, 1976-1978[a]

Product group	*Mean*	*Minimum*	*Maximum*
Iron and steel	0.001	−0.222	0.318
Chemicals	0.368	−0.127	0.557
Semi-manufactures	−0.053	−0.225	0.438
Engineering products	0.325	−0.068	0.586
Textiles and clothing	−0.068	−0.225	0.404
Other consumer goods	−0.012	−0.311	0.514
Total manufactures	0.233	−0.311	0.586

Source: Table VI.1.

[a] For each 3-digit SITC group included, the weight is given in terms of the 1977 value of total exports plus total imports for the 32 countries covered.

[11] The first case is geometrically represented by the vectors (of deviations from the mean) of technological capability and RCA pointing in opposite directions, in country space. The second case is represented by parallel vectors. This explains the geometric term "orientation" used in the present analysis. The use of a product-moment correlation implies that the two extreme cases of the association between RCA and technological abundance are represented by linear relationships. (More on this methodological approach can be found in *International Comparative Advantage in Manufacturing . . . .*)

If a "neo-factor proportions" view of international trade is adopted (as in the present analysis), it has to be borne in mind that the pattern of international competitiveness for many countries, factors and goods can at best be predicted in an "average" sense. The composition of exports and imports cannot be ascertained solely by examining the interrelationship between the factor intensities and factor endowments that pertain in the countries concerned. The same is true for the "technology factor". While it cannot be predicted whether a particular commodity will be exported or imported by a particular country, R-and-D-abundant countries will tend to export R-and-D-intensive goods and to import goods whose production is less demanding with respect to science-technology inputs.

An examination of the distribution of industries across the range of the R and D orientation index of RCA yields some insight into the relationship between technological sophistication and competitive advantage. Members of the chemical and the engineering products groups are seen to dominate the industries that enjoy a positive association between technological capability and RCA. The largest among these industries—in terms of their total value of trade at the time the 32 countries were surveyed—are the residual categories in non-electrical machinery and appliances (SITC 719) and in electrical machinery and apparatus (SITC 729), together with organic chemicals (SITC 512). These are followed in size by non-electric power generating machinery (SITC 711), plastic materials (SITC 581), and machines for special industries (SITC 718). Examples of industries with a high R and D orientation index, from groups other than chemicals and engineering products, include scientific instruments (SITC 861), photographic supplies (SITC 862), and printed matter (SITC 892)—as well as one industry each from the iron and steel and the textile groups, namely, hoop and strip of iron or steel (SITC 675) and special textile fabrics (SITC 655).

The positive R and D orientation of RCA for these industries is reflected in the composition of the major exporters of the corresponding product groups. If the leading five countries for each industry (measured in terms of net exports) are considered, several major developed countries appear in almost every instance.[12]

In summary, the technological sophistication of industries in the chemical and engineering groups appears to be reflected in the pattern of international competitiveness projected by those industries. The markedly positive R and D orientation of RCA that is associated with a considerable number of them underlines the significance of the technology factor in determining competitive advantage in the production and export of chemicals and engineering products.

At the other end of the range of the R and D orientation index, only one industry—footwear (SITC 851)—exhibits a markedly negative value. Relatively low (but statistically insignificant) values were recorded for SITC groups engaged in the production of semi-manufactures (6 groups), iron and steel (2 groups), chemicals (2 groups) and clothing (2 groups). The largest of these groups, measured by the value of trade, is clothing (SITC 841),[13] followed by

[12]The Federal Republic of Germany is among the "top five" countries for all 11 industries under consideration, the United States and Japan for 10, and the United Kingdom for 6.

[13]These goods accounted for 3.6 per cent of the value of trade in manufactures of the country sample.

paper and paperboard (SITC 641), iron and steel bars, rods and angles (SITC 673) and furniture (SITC 821). Industries with an index value of less than −0.1, which account for a smaller proportion of trade, include leather manufactures (SITC 612), cement (SITC 661), wood manufactures (SITC 631 and 632) and pig iron (SITC 671).

Significant exporters of product groups that have a somewhat negative R and D orientation are found in both the developed and the developing countries. Clothing is a typical example. The five major traders of this product group (defined by net exports) include two developing countries (India and the Republic of Korea), together with Italy, Finland and Portugal. A similar picture emerges for footwear: of the 15 net exporters in the countries surveyed, 9 are developing countries. Brazil and the Republic of Korea are among the five major traders. The net exporters of iron and steel bars, rods and angles also include developing countries, namely (in descending order, by value of net exports) India, Brazil and Argentina.

Industries with an index value of around zero form a third group. These R-and-D-neutral industries (which can be loosely defined as having a statistically insignificant index) occupy an intermediate position between the international competitiveness of countries that are technologically advanced and countries possessing only modest technological capability. These industries are of particular interest when the dynamic aspects of trade patterns are examined, since changes in the pattern of international competitiveness are most likely to occur in industries that have a less-pronounced factor-related character. Among the larger product groups showing R-and-D-neutral patterns of international trade are universals, plates and sheets of iron or steel (SITC 674) together with four other groups from the iron and steel division (SITC 672, 676, 677 and 679), as well as domestic electrical equipment (SITC 725) and sound recorders and reproducers (SITC 891).

On the whole, examination of the R and D orientation of RCA by industry lends some support to the "neo-factor proportions" interpretation of the relationship between the technology factor and international trade patterns. Most of the examples cited thus far suggest that, on average, the pattern of trade reveals competitive advantages in R-and-D-intensive products for R-and-D-abundant countries. According to one empirical study,[14] the following product groups can be classified as R-and-D-intensive: organic chemicals, inorganic chemicals, medicinal and pharmaceutical products, office machinery, miscellaneous electrical machinery, electrical power equipment, aircraft, scientific, medical and optical instruments, and photographic and cinematographic supplies. Table VI.1 shows that, with the exception of SITC 513 (inorganic chemicals: elements, oxides, halides etc.) and SITC 515 (radioactive materials), all the 3-digit SITC groups corresponding to these product groups exhibit a positive R and D orientation of RCA. This is in line with the theory that, across industries and countries, the interaction between the science-technology intensity of products and the technological capability of countries determines competitive advantage to some extent.

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[14]See B. Balassa, "'Revealed' comparative advantage revisited: an analysis of relative export shares of the industrial countries, 1953-1971", *Manchester School of Economic and Social Studies*, vol. 45, No. 4 (1977), pp. 327-344.

R and D expenditure and the structure of trade: a country perspective

In the previous section, the analysis focused on the relationship between RCA and technological capability, viewed across countries and for specific industries. As a complement to this industry-specific approach, country-specific aspects of the relationship are examined in the present section. One way to do this is to derive, from the industry-specific R and D orientation indices, a measure of the R and D orientation of each country's total trade in manufactured products. This will indicate the role of the R and D factor in the country's trade pattern.[15]

Table VI.3 presents such data for the 32 countries covered in the analysis. The table is based on the information yielded by table VI.1 and the composition of national trade in the 90 industries over the period 1976-1978. While the theoretical range of country indices in the exercise lies between −0.311 and 0.586 (the minimum and maximum industry-specific indices shown in table VI.1), the observed ranges are narrower both for exports and imports. The R and D orientation index of exports shows a maximum of 0.288 for Switzerland and a minimum of 0.001 for the Philippines. For imports, the corresponding figures are 0.264 for Brazil and 0.128 for Japan. Exports, therefore, exhibit a wider range of R and D orientation than imports, extending from near-zero values for the developing countries to positive values for the developed countries. The index for imports, on the other hand, is a range of positive values. In the case of the developing countries, these reflect import dependence with regard to technology-intensive products. In the case of the developed countries, they reflect the large volume of trade in such products among those countries themselves. It follows from the definition of the R and D orientation of country exports (imports) that, on average, the pertinent index is positively (negatively) related with the underlying proxy measure of technological capability. Technologically advanced countries, for example, show a positive R and D orientation in exports. Using this predefined average relationship between technological capability and country indices, it is possible to gauge the extent to which each country conforms to, or deviates from, the relationship.

The relationship itself can be expressed in terms of "expected" R and D orientation, using simple regression procedures.[16] The results of such a regression procedure, for exports and imports in the 32 countries surveyed, and

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[15]The algebraic expression of country j's R and D orientation of exports is given as

$$\sum_{i=1}^{m} (X_{ij}/X_{.j})t_i$$

where t_i stands for the R and D orientation of industry i, m for the number of industries, a dot for total manufacturing, X for exports, and M for imports.

[16]By regressing the country index of exports or imports on the measure of technological capability, each country can be assigned an expected R and D orientation of exports or imports which will correspond to its level of technological sophistication. The difference between actual and expected orientation, therefore, allows an evaluation to be made of the correspondence between a country's technology-factor endowment and its trade structure. For a similar treatment of income levels, see Michaely, *loc. cit.*

Table VI.3. R and D orientation of exports and imports, 1976-1978

Country	*Exports*		*Imports*		*Rank in terms of R and D expenditure per worker*
	Index value	*Rank*	*Index value*	*Rank*	
Argentina	0.067	24	0.255	2	25
Australia	0.055	25	0.228	11	14
Austria	0.157	11	0.200	17	17
Belgium	0.161	10	0.175	24	9
Brazil	0.075	21	0.264	1	21
Canada	0.129	16	0.242	8	11
Chile	0.008	31	0.246	4	22
Colombia	0.085	19	0.245	5	31
Denmark	0.149	13	0.164	29	13
Finland	0.042	27	0.238	10	15
France	0.200	6	0.182	21	7
Germany, Federal Republic of	0.253	3	0.143	30	5
Greece	0.012	30	0.200	16	26
India	0.069	23	0.173	26	30
Ireland	0.147	14	0.175	23	19
Israel	0.195	7	0.222	15	8
Italy	0.153	12	0.188	18	16
Japan	0.222	5	0.128	32	10
Netherlands	0.177	8	0.166	27	4
New Zealand	0.029	29	0.226	13	18
Norway	0.100	17	0.186	20	6
Pakistan	0.070	22	0.174	25	32
Philippines	0.001	32	0.240	9	29
Portugal	0.075	20	0.227	12	27
Republic of Korea	0.048	26	0.246	3	24
Singapore	0.144	15	0.224	14	28
Spain	0.097	18	0.244	6	20
Sweden	0.171	9	0.186	19	3
Switzerland	0.288	1	0.175	22	2
Turkey	0.032	28	0.242	7	23
United Kingdom	0.238	4	0.164	28	12
United States	0.279	2	0.136	31	1

based on R and D expenditure per worker in the period 1976-1978, are as follows:

Dependent variable	*Regression coefficient*	*R^2 (adjusted)*	*Standard error of estimate*
Exports	0.063	0.584	0.052
	(6.674)		
Imports	−0.024	0.360	0.031
	(−4.296)		

For each regression coefficient, the corresponding t-value is given in parentheses. The coefficients are significant at the 0.1 per cent level and carry the expected signs. A country's index may be arbitrarily classified as being "normal" or "above" ("below") the expected level, according to whether the corresponding regression residual is smaller in absolute size than one standard

deviation of the regression estimate, or greater in absolute size than that threshold, and positive (negative). Countries that export or import "above" or "below" their expected R and D orientation levels are listed in table VI.4. For seven countries—Austria, Ireland, Italy, Japan, Singapore, Switzerland and United Kingdom—the indices of exports are somewhat higher than might be expected, given those countries' technological capabilities. By contrast, eight countries—Australia, Chile, Finland, Greece, New Zealand, Norway, Philippines and Sweden—can be said to be exporting "below" their technological level. For the remaining 16 countries, the R and D orientation of exports is "normal", according to the criteria established previously. With respect to imports, four countries—Brazil, Canada, Finland and Israel—show index values that are significantly higher than might be expected, while five others—Denmark, India, Ireland, Japan and Pakistan—show values that are clearly below the expected levels.

In general, complementarity between the relative R and D orientation of exports and that of imports exists in the sense that deviations from the expected levels for exports are negatively associated with those for imports. The pertinent simple correlation of −0.489 is significant at the 1 per cent level, as is the Spearman rank correlation of −0.505. This means that, on average, countries whose exports show a higher-than-expected index value would tend to

Table VI.4. Countries with deviating R and D orientations of exports or imports, 1976-1978

	Residuals in units of standard deviation[a]	
Country	*For exports*	*For imports*
Australia	−1.35	
Austria	1.21	
Brazil		1.32
Canada		1.55
Chile	−1.15	
Denmark		−1.16
Finland	−1.44	1.03
Greece	−1.04	
India		−1.71
Ireland	1.17	−1.35
Israel		1.26
Italy	1.12	
Japan	1.37	−2.10
New Zealand	−1.23	
Norway	−2.02	
Pakistan		−1.71
Philippines	−1.15	
Singapore	1.52	
Sweden	−1.12	
Switzerland	1.02	
United Kingdom	1.77	

Source: Tables VI.1 and VI.5.

[a]Only residuals that exceed one standard deviation in absolute size are shown.

import a commodity bundle characterized by a comparatively low index—and vice versa. Countries with this type of trade performance include Finland, Ireland and Japan. In the case of Finland, the technological sophistication of exports (imports) appears to be lower (higher) than might be expected, given that country's technology-factor endowment. The opposite relationship holds true for the other two countries.

Most of the countries showing a deviating R and D orientation in exports—both "above" and "below" expected levels—are developed countries. Thus, a number of those countries have the potential to export above the levels indicated by their technology endowments. On the other hand, an equal number of those countries have failed to technologically upgrade their export structure to one that would match their actual level of technological sophistication. Most of the developing countries covered in the analysis exhibit a commodity composition of exports that seems to accord with their technology endowments. A notable exception is Singapore, which shows the second highest positive deviation from the expected index value in the entire range of countries surveyed. This proves that, despite that country's modest R and D expenditure per worker, its R and D exports orientation index resembles that of more industrialized countries, such as Canada, Denmark and Italy.

The technology gap in North-South trade: a bilateral perspective

The results of the empirical analysis carried out thus far show that in the developed countries, competitive advantages are clearly enjoyed by industries commonly regarded as being R and D intensive. Economic theory suggests, however, that an even more pronounced difference exists between developed and developing countries as regards the contribution of technology to international competitiveness. One technology gap (or product cycle trade) model,[17] for example, is based on a simple distinction between trading regions in the world, with one region "predominantly innovating" and the other "predominantly imitating". In the innovating region, technologically "new" industries are continually being developed and their products exported. Imports to that region consist of goods produced by "old" industries forced by low-wage competition to relocate in the imitating region.

This reasoning is more fully appreciated when the technology factor in North-South trade in manufactures is examined in the light of empirical data. To this end, and in order to obtain a more detailed picture of North-South trade flows, the developed and the developing countries are divided here into a number of subgroups. One subgroup is composed of the three major traders of the North, namely the United States, the EEC and Japan. Two subgroups of developing countries and areas are considered. The first is composed of major exporters of manufactures, and includes Argentina, China (Taiwan province), Brazil, Hong Kong, Mexico, Republic of Korea and Singapore. The second is

[17] See P. Krugman, "A model of innovation, technology transfer, and the world distribution of income", *Journal of Political Economy*, vol. 87, 1979, pp. 253-266.

labelled "new exporting countries" and is composed mainly of countries that recorded extraordinarily high rates of growth for manufactured exports over the 1970s.[18] These include five countries from South and East Asia (Indonesia, Malaysia, Philippines, Sri Lanka and Thailand), three from Latin America (Colombia, Peru, Uruguay) and four from North Africa or the Middle East (Cyprus, Jordan, Morocco and Tunisia). India, because of its large export volume, has been included in this subgroup.[19]

The object of the present exercise is to shed some light on the relationship between the science-technology characteristics of manufactured products and the trade in those products between the subgroups mentioned. Technological sophistication can be measured in terms of national R and D expenditure. In the same way, industry expenditure on R and D can be used as a basis for identifying technology intensity. Table VI.5 shows the distribution of R and D expenditure across broad industry groups in the subgroup of developed market economies. Industrial R and D is seen to be highly concentrated in the engineering (electrical, electronic, aerospace, transport equipment and machinery) and chemical industries.

Table VI.5. Shares of industry groups in total expenditure on R and D in manufacturing: United States, EEC and Japan, 1970 and 1980[a]

(Percentage)

	Share in R and D expenditure					
	United States		*EEC[b]*		*Japan*	
Industry	*1970*	*1980*	*1970*	*1980*	*1970*	*1980*
Electrical-electronic group	24.3	21.5	23.5	26.5	26.8	24.8
Chemical group	13.2	14.5	22.8	22.9	24.3	21.5
Aerospace group	30.1	21.5	17.6	11.9	...	0.1
Other transport group	9.2	12.0	13.0	12.6	12.5	17.6
Basic metals group	2.8	3.0	3.7	4.1	9.0	8.8
Machinery group[c]	14.2	20.9	12.3	14.7	15.1	14.3
Chemical-linked group	3.2	3.3	4.4	4.7	6.0	7.7
Other manufactures group	3.0	3.3	2.7	2.7	6.3	5.2
Total manufacturing	100.0	100.0	100.0	100.0	100.0	100.0

Source: Organisation for Economic Co-operation and Development data bank of the Science and Technology Indicators Unit of the Directorate for Science, Technology and Industry.

[a] R and D expenditure of the business enterprise sector from all sources of funds.

[b] The EEC shares are weighted averages based on data for Belgium, Denmark, France, Germany, Federal Republic of, Italy and United Kingdom. For statistical reasons, Denmark and the United Kingdom are included in the calculations for 1970, although they were not members of the EEC in that year.

[c] Including computers.

[18] The term "new exporting countries" and its definition are taken from O. Havrylyshyn and I. Alikhani, "Is there cause for export optimism? An inquiry into the existence of a second generation of successful exporters", *Weltwirtschaftliches Archiv*, vol. 118, No. 4 (1982), pp. 651-663.

[19] Classifications such as the present one are not based on rigorous quantitative criteria and therefore reflect subjective judgement to some extent. A case in point is India which belongs in the category of developing countries significant exporters of manufactures. The main reason why it was not classified as a "major exporter of manufactures" is that its share of MVA in GDP is low relative to the average standard of that subgroup.

Other manufacturing industries (among them basic metals, food, textiles and leather) accounted for only slightly more than 10 per cent of total manufacturing R and D in all countries of the subgroup during the 1970s.[20] For a number of the industry groups listed in the table, investment in R and D differed substantially between the United States, the EEC and Japan. Moreover, significant changes sometimes occurred between 1970 and 1980. This is reflected, for example, in the drastic relative decline of aerospace.

To identify with even more precision the technological characteristics of the various industries covered, a "factor-share" measure, based on R and D expenditure, may also be employed. Table VI.6 presents empirical information on the R and D intensity[21] of 22 industrial branches in the United States and Japan in 1970 and 1980.[22] While the R and D "factor share" values differed substantially between the two countries, the rankings of industries by R and D intensity were similar for both years.[23] Overall stability of the orderings between the two years was even greater, as evidenced by the rank correlation coefficients of 0.965 for the United States and 0.950 for Japan.

The data again support the broad view that the engineering and chemical industries are R and D intensive, whereas basic metals, chemical-linked and other manufacturing industries are relatively less so. In both years, the highest share of R and D expenditure in value added was recorded for the United States aerospace industry.[24] In 1980, in terms of R and D intensity, that industry was followed by office and computing machinery, motor vehicles, electronic equipment and components, drugs and instruments. In Japan, in the same year, electronics, drugs, instruments, chemicals and computers (listed in descending order of the R and D "factor share") were the most R-and-D-intensive product groups.

On the basis of the foregoing data, and on data pertaining to the structure of trade, indicators of R and D intensity, applicable to total trade in manufactures, were compiled. These are given in table VI.7. In view of the fairly high level of aggregation of the underlying data, these indicators should be regarded as providing only a broad impression of the technological intensity of the trade flows considered: they are not precise measures of the science-technology content of trade. Obviously, only some general features of the technology-trade relationship can be assessed on the basis of this empirical exercise, with the caveat that variations within the 22 industry groups are not reflected. Nevertheless, those features may be taken as a rough indication of the impact of technological elements on the nature of trade relationships between developed market economies and developing countries.

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[20]Organisation for Economic Co-operation and Development, *OECD Science and Technology Indicators* (Paris, 1984), p. 58.

[21]The share of R and D expenditure in value added as a measure of technological intensity is commonly found in works of an empirical nature, e.g. in R. M. Stern and K. E. Maskus, "Determinants of the structure of U.S. foreign trade, 1958-76", *Journal of International Economics*, vol. 11, 1981, pp. 207-224.

[22]For most of the EEC countries, data were not available in sufficient detail.

[23]Spearman rank correlations were 0.868 and 0.915 for 1970 and 1980, respectively.

[24]This industry, however, is an exceptional case, as about three quarters of all OECD aerospace R and D is performed in the United States. Moreover, it is largely government financed because of its close association with defence.

Table VI.6. R and D intensity by industry group and subgroup: United States and Japan, 1970 and 1980

(Percentage)

	R and D expenditure as share of value added[a]			
	United States		*Japan*	
Industry group/subgroup	*1970*	*1980*	*1970*	*1980*
Electrical-electronic group	15.4	12.3	6.4	8.2
Electrical machinery	11.8	10.2	5.8	5.6
Electronic equipment and components	18.6	13.6	7.0	10.9
Chemical group	6.1	6.2	5.8	7.5
Chemicals	4.8	4.7	5.8	7.8
Drugs	9.5	13.2	7.6	10.1
Petroleum refining	9.4	6.0	2.8	3.7
Aerospace	37.8[b]	26.3	...	...
Other transport group	...	...	...	7.0
Motor vehicles	9.9	14.3	4.9[c]	6.7[c]
Ships	...	...	...	9.0
Other transport equipment	1.8[b]	3.0	...	...
Basic metals group	1.1	1.3	1.5	2.0
Ferrous metals	1.0	1.4	1.8	2.5
Non-ferrous metals	2.3	2.0	3.4	3.3
Fabricated metal products	0.9	1.0	0.7	1.1
Machinery group	9.0	6.8	3.1	4.0
Instruments	8.4	10.8	5.5	7.9
Office and computing machinery	29.7[b]	21.8	6.4	6.9
Machinery, n.e.c.	6.0	2.3	2.5	3.0
Chemical linked group[d]	0.8	0.9	0.9	1.4
Food, drink and tobacco	0.7	0.8	1.0	1.4
Textiles, footwear and leather	0.2	0.2	0.7	0.7
Rubber and plastic products	3.2	2.9	1.1	3.0
Other manufactures group	1.0	1.1	...	1.1
Stone, clay and glass	1.7	1.7	1.4	2.2
Paper and printing	0.6	0.7	0.5	0.4
Wood, cork and furniture	0.6	0.6	...	0.4
Other manufacturing	2.5	3.0	4.9	3.1
Total manufacturing	5.8	5.5	2.8	3.9

Source: Organisation for Economic Co-operation and Development, Science and Technology Indicators Unit data bank; UNIDO data base.

[a] R and D expenditure of the business enterprise sector from all sources of funds.

[b] 1972.

[c] Including other transport equipment.

[d] Linkage mainly in terms of R and D.

With regard to the technology gap and its implications for the structure of international trade in manufactures, the indicators provide some evidence of differences among country groups and of changes over time. Differences in the degree of R and D intensity between exports and imports, as well as variations in the indicators of different trading regions, can be interpreted accordingly.

Table VI.7. Indicators of R and D intensity in trade flow, 1970 and 1980

(Percentage)

	Trade-weighted average of share of R and D expenditure in value added[a]					
	United States		*EEC*[b]		*Japan*	
Exports from/imports to	*1970*	*1980*	*1970*[c]	*1980*	*1970*	*1980*
World	6.04/4.97	6.25/5.95	4.31/3.94	4.41/4.24	3.42/3.24	5.51/3.94
Developed market economies	6.25/5.34	6.92/6.71	4.15/4.19	4.37/4.50	3.70/3.64	6.24/4.44
Developing countries and areas	5.61/3.77	5.50/4.53	4.61/1.74	4.60/2.62	3.09/2.41	4.94/3.34
Major exporters of manufactures	6.46/3.72	6.05/4.72	5.48/1.56	5.63/3.55	3.08/2.12	5.04/3.45
South and East Asia	6.73/4.49	6.23/4.73	4.65/2.09	5.70/4.61	3.01/2.18	4.96/3.48
Latin America	6.35/2.72	5.95/4.69	5.99/1.25	5.57/1.62	3.62/1.97	5.52/3.32
New exporting countries	5.04/1.22	6.14/4.09	4.82/1.23	4.92/1.90	3.16/2.12	4.86/3.12
South and East Asia	4.69/1.02	6.53/4.92	4.91/1.42	5.24/2.08	3.14/2.09	4.82/3.20
Latin America	5.98/1.54	5.50/1.40	5.57/0.91	5.66/1.10	3.34/. . .[d]	5.04/. . .[d]
North Africa and Middle East	3.60/. . .[d]	4.76/. . .[d]	4.23/1.46	4.23/2.13	3.33/. . .[d]	5.37/. . .[d]

Source: Organisation for Economic Co-operation and Development, Science and Technology Indicators Unit data bank; UNIDO data bank; data supplied by the Statistical Office of the United Nations Secretariat.

[a] The weights are taken from the distribution, across industry groups, of exports and competitive imports, respectively. The aerospace industry, because of its large defence component, is excluded.

[b] Figures based on weighted averages of industry-specific R and D intensity in France, Germany, Federal Republic of, Italy, and United Kingdom. For reasons of statistical comparability, the 1980 country composition of the EEC has been applied in the calculations for 1970 as well.

[c] Based on industry-specific R and D intensity for 1980.

[d] Figures not shown separately because of insignificance of underlying trade flow values.

The theoretical framework of North-South trade as outlined above predicts a high level of "technology intensity" in the North's exports to the South and a comparatively low level in its imports from the South. The gap, in terms of R and D, is clear from table VI.7.

Just as the North-South technology gap can change in "width" (as a result, for example, of changing rates of innovation and technology transfer), so too can the R and D intensity gap in trade flows. In trade between the United States and all developing countries, the export-import ratio of R and D intensity declined by almost 20 per cent between 1970 and 1980. While this decline was considerable *vis-à-vis* the major exporters, it was most dramatic in the case of the new exporters (mainly South and East Asian countries). In 1980, both subgroups reported ratios of the same order of magnitude. In trade between the EEC and the developing countries, the export-import ratio of R and D intensity also decreased considerably over the 1970s, the result, mainly, of a remarkable narrowing of the "trade-revealed" technology gap between the EEC and the subgroup of major exporters. Trade between Japan and the developing countries does not show the same trends. While the export-import ratio relating to trade with all developing countries increased over the 1970s (the result, apparently, of technological upgrading in Japanese exports), it remained basically unchanged for Japan's trade with the two subgroups of developing countries.

The narrowing of the "trade-revealed" technology gap should be directly observable as an increase in the R and D intensity of import competition from the South in Northern markets. As may be seen from table VI.7, such an increase was registered for all three major markets of the North. Japan's R and D intensity values for 1980, however, also reflect increases in R and D expenditure throughout the Japanese manufacturing industries.[25] Figures for the United States, which are probably less distorted by this factor, show considerable increases in the average R and D intensity of competitive imports from certain suppliers, in particular new exporters from South and East Asia. By 1980, countries in this region had become not only significant exporters of manufactured goods from developing countries, but had reached an R and D intensity of import competition that was comparable to that achieved by the major exporters among the developing countries 10 years earlier. Moreover, the major exporters in South and East Asia (and in Latin America) succeeded in technologically upgrading their exports over the 1970s.

An alternative way of picturing the technological evolution of North-South trade in manufactures is to gauge the performance of developing country exporters in the three major Northern markets. This can be done for broad industry groups with differing degrees of R and D intensity. Table VI.8 gives the shares of the developing countries in imports of the United States, the EEC and Japan in 1970 and 1980. (The industry groups are the same as those listed in table VI.5.) For total manufactures (including products of the petroleum refining industry), the share of imports from the developing countries throughout the period 1970-1980 increased to almost 30 per cent in the United States and to over 35 per cent in Japan. The corresponding share for the EEC,

[25] In comparisons concerning the three major Northern markets, it should be borne in mind that during the 1970s Japanese imports of manufactures from the South amounted to between one quarter and one third those of the United States or the EEC.

Table VI.8. Northern imports from South, by industry group, 1970 and 1980

(Percentage share in imports from all sources)

	Importer					
	United States		*EEC*[a]		*Japan*	
Source of imports	*1970*	*1980*	*1970*	*1980*	*1970*	*1980*
Electrical-electronic group						
Developing countries and areas	20.07	48.73	1.37	7.14	6.04	24.36
Major exporters of manufactures	19.41	37.46	0.92	5.62	6.02	20.87
New exporting countries	0.05	10.01	0.12	1.07	0.02	3.49
Chemical group						
Developing countries and areas	50.01	54.34	5.12	11.90	30.26	53.33
Major exporters of manufactures	2.34	3.84	0.68	0.78	7.06	13.11
New exporting countries	1.06	3.47	0.42	0.91	4.89	9.09
Aerospace group						
Developing countries and areas	0.25	7.77	1.29	1.14	0.00	0.04
Major exporters of manufactures	0.00	2.97	0.09	0.07	0.01	0.03
New exporting countries	0.02	1.53	0.16	0.37	0.00	0.01
Other transport group						
Developing countries and areas	0.48	2.09	0.23	3.17	1.84	7.69
Major exporters of manufactures	0.46	2.01	0.06	0.76	0.04	1.32
New exporting countries	0.01	0.04	0.03	0.49	0.30	0.99
Basic metals group						
Developing countries and areas	14.27	21.97	15.58	9.65	41.20	44.06
Major exporters of manufactures	2.92	10.64	0.44	1.73	2.32	13.82
New exporting countries	8.05	5.73	1.36	1.80	5.71	13.60
Machinery group						
Developing countries and areas	2.60	11.18	0.69	2.66	0.54	9.27
Major exporters of manufactures	2.47	10.41	0.31	1.83	0.50	8.40
New exporting countries	0.05	0.47	0.09	0.22	0.01	0.82
Chemical-linked group						
Developing countries and areas	34.03	52.72	14.98	15.17	40.52	35.70
Major exporters of manufactures	18.40	36.19	5.82	7.32	16.76	24.80
New exporting countries	8.56	7.29	3.55	3.65	7.40	7.28
Other manufactures group						
Developing countries and areas	18.24	27.14	3.45	6.29	16.24	23.86
Major exporters of manufactures	15.58	21.91	2.13	4.07	10.98	16.26
New exporting countries	1.61	3.78	0.62	1.13	3.73	6.75
Total manufacturing						
Developing countries and areas	18.83	29.59	7.86	8.86	23.59	35.41
Major exporters of manufactures	9.04	16.41	2.01	3.42	6.59	15.61
New exporting countries	3.46	4.02	1.29	1.56	3.82	7.30

Source: Data supplied by the Statistical Office of the United Nations Secretariat.

[a] For reasons of statistical comparability, the same country composition, namely that of 1980, has been applied in the calculations for both years.

by contrast, was less than 10 per cent. The highest shares were recorded for the chemical group, the result of the heavy imports of petroleum products from developing countries by developed countries. The South also attained high shares in Northern imports of industries which in R and D terms are linked to the chemical group, mainly on the basis of favourable export performance of traditional labour-intensive industries like textiles and clothing, leather, and footwear. With respect to exports of electrical-electronic products to the Northern markets, the performance of the two subgroups of developing countries and areas was outstanding. Between 1970 and 1980, the value of imports from those countries and areas, as well as the share of those imports in imports from all sources of that product group, increased dramatically in all three Northern markets. By 1980, electrical-electronic products accounted for 16 per cent of United States imports of manufactures from developing countries. Most of these imports came from the two subgroups. High relative increases in the import shares of the developing countries and areas were observed in the case of still another product group that is generally considered R and D intensive, namely non-electrical machinery. The share of the major exporters of non-electrical machinery in imports of the United States more than quadrupled, to over 10 per cent, in 1980. Corresponding shares in EEC and Japanese imports also rose quite remarkably.

Summary and conclusions

Competitive advantage in industry is, to a certain extent, revealed by the structure of international trade in manufactures. Among the determinants of such advantage—and consequently of trade patterns—technological factors are particularly important. In the present analysis, an effort has been made to trace the influence of science and technology on international competitiveness in industry. Using a heuristic concept of R and D orientation, industries are broadly classified according to the impact which technological differences among countries have on patterns of international specialization. The resulting typology of industries accords with theoretical projections in the sense that competitive advantage in technology-intensive industries tends to lie with technology-abundant countries. Nevertheless, while this rule holds true in general, the composition of manufactured trade in a number of countries has been found to deviate substantially from the technology-related norm.

The technology gap is bound to manifest itself in trade between developed and developing countries. Of greater significance than the mere revelation of that gap, however, are the differences in its width that appear among country groups and over time. Subgroups of developing countries show differences in their trade-revealed technological "distance" from the North. The data suggest, moreover, that this distance is subject to change over time. Some of the more advanced developing countries seem to have succeeded in narrowing the technology-trade gap with the developed countries. The international transfer of technology is the major driving force behind this development, which can be expected to improve the terms of trade of the developing countries.[26] The

[26] See Krugman, *loc. cit.*

analysis also points up the considerable differences existing among various groups of developing countries with regard to the role of technology in international competitiveness. These differences are related to the extent and the effectiveness of technology transfer, as well as to the ability to build up an indigenous technological base.[27]

The fact that a number of developing countries have gained international competitiveness within industry groups that are generally considered R and D intensive points to the dynamic nature of the technology gap and its impact on international specialization.[28] At the same time, it underlines the importance of the innovation process to the competitive position of the developed countries. In this connection, a rate of technological innovation in developed countries that is high enough to balance (in a competitive sense) the rate of technology transfer to the developing countries should be deemed desirable also from the point of view of the latter countries. It might help to offset any technologically motivated protectionist trends in the major markets.

[27]The importance of indigenous technological developments in developing countries, as a complement to the transfer of technology, is emphasized in *Technological Capability in the Third World*, M. Fransman and K. King, eds. (London, MacMillan, 1984).

[28]One author expresses the view that the technology gap between the developed and the developing countries, which has been narrowing in the recent past, might "reopen" in the near future for various reasons (see R. Kaplinsky, "Trade in technology—who, what, where and when?", *Technological Capability in the Third World*, M. Fransman and K. King, eds. (London, MacMillan, 1984).

VII

Employment and productivity within the manufacturing sector

GROWTH rates for labour productivity in manufacturing began to slow down in most countries in the early 1970s. In the developed market economies, the slowdown began around 1973: growth rates which in 1969-1973 had averaged 5.2 per cent dropped to 2.8 per cent for the remainder of the decade.[1] In the centrally planned economies, the effect appears to have been less abrupt, but a slowdown was, nevertheless, evident after 1975.[2] As for the developing countries, in some of them growth rates in the second part of the 1970s were even negative.

In the present chapter, various aspects of the growth of labour productivity in manufacturing are examined. The first section provides an analysis of labour productivity trends in developed market economies and developing countries—trends which are closely related to patterns of structural change. Conducted at the industrial branch level, the analysis examines productivity gains in the largest and most rapidly growing branches in each country.

As the slowdown in productivity growth has persisted into the 1980s, economists and policy makers everywhere have intensified their search for causes, explanations and solutions. A global analysis of all of the issues involved would be beyond the scope of the *Survey*, but in the second section of the present chapter one specific and important aspect is examined in some detail—the role of small-scale manufacturing in developing countries. At the international level, little is known about the contribution of this sub-sector. The examination begins, therefore, with an assessment of the contribution of small-scale enterprises to employment and output in manufacturing. Within this framework, estimates of labour productivity are derived and compared with estimates for large-scale establishments.

In the final section of the chapter, productivity trends in European centrally planned economies are studied. National data for the 1960s, 1970s and early 1980s show the increasingly important contribution to growth in output which can be attributed to gains in labour productivity. Some of the factors that contribute to these gains are also looked at.

Trends in developed market economies and developing countries

An extensive review of the relevant data sources provided sufficient information to undertake a detailed analysis of labour productivity trends in

[1] A. Lindbeck, "The recent slowdown of productivity growth", *The Economic Journal*, vol. 93, No. 369 (March 1983), p. 14.

[2] See, for example, *Economic Survey of Europe in 1980* (United Nations publication, Sales No. E.81.II.E.1), p. 128.

11 developed market economies and 15 developing countries.[3] Because patterns of labour productivity differ widely among industrial branches, separate estimates were made for each branch studied and for each year in the period 1970-1981. This led, inevitably, to a considerable amount of information being compiled, but major trends were discernible and it is these that are summarized here.

Table VII.1 relates the distribution of productivity levels for one year in the period studied to each industrial branch's contribution to MVA and employment. When branches are arranged according to their levels of productivity, these levels are seen to be particularly uneven in the developing countries. In Honduras, for example, only one branch attained a productivity level higher than $10,000 per employee, yet it contributed almost one quarter of total MVA. In Iraq, three branches had levels in excess of $10,000 and accounted for one third of total MVA. In Chile, Ghana, Nicaragua, Panama and Zambia, industrial branches with high productivity levels provided more than half of the total MVA. In several other developing countries, however, the bulk of both manufacturing employment and MVA was attributable to branches operating at productivity levels of $5,000 per employee or less.

In countries where labour productivity in manufacturing tends to be low, but where the sector accounts for only a small share of GDP, the effects on per capita GDP are not significant. When productivity levels are many times greater than per capita GDP, however, an inequitable distribution of income can result. Data for the developed market economies do not reveal the large differences in levels of productivity and per capita GDP that are to be observed in the case of certain developing countries. Branches that have levels of productivity per employee in excess of $15,000 still account for a large proportion of employment (often more than half).

Table VII.2 shows more recent trends in the growth of value added, employment and productivity. During the early 1970s a number of developing countries experienced a rise in productivity, though growth rates were consistently below the corresponding rates for employment. In the latter half of the 1970s, however, productivity trends in developing countries were adversely affected by external economic conditions. Growth in output and productivity fell sharply after 1975. Although the pace of employment was generally maintained, only a few developing countries (e.g. Chile, India and Kenya) managed to achieve substantial gains in productivity as well. Although the data provided in table VII.2 apply to only a limited number of developing countries, they do suggest that in many instances manufacturing output increased mainly as the result of expansion in employment; productivity gains were registered, but they were, comparatively, very small. Thus, labour-intensive branches were often characterized by low productivity levels. Moreover, they continued to dominate performance in the manufacturing sector, although in several countries their share in MVA declined somewhat.

In the developed market economies, gains in productivity provided a greater impetus for growth. During 1970-1974, industrial progress was heavily dependent on gains in productivity; expansion of employment played only a secondary role. In the second half of the 1970s, however, growth rates for all three measures—output, productivity and employment—slackened. Productivity

[3]The statistical considerations involved are reviewed in the appendix to this chapter.

Table VII.1 Distribution of value added and employment, by extent of labour productivity, 1975

Country	Per capita GDP (dollars)	Share of MVA in GDP (percentage)	Percentage share in total value added (employment) of branches with labour productivity				Average productivity in manufacturing (dollars)
			<$2 500	$2 500-5 000	$5 000-10 000	>$10 000	
Developing countries							
Argentina	1 563	31.9	1.3 (4.4)	6.8 (13.0)	82.1 (78.3)	9.8 (4.3)	6 204
Chile	841	20.5	— (—)	3.3 (10.3)	22.0 (45.2)	74.7 (44.4)	13 168
Cyprus	1 147	14.1	— (—)	31.1 (42.8)	63.4 (51.1)	5.5 (0.7)	5 410
Ghana	460	14.2	9.9 (28.3)	18.6 (36.7)	12.6 (14.3)	58.9 (20.7)	6 709
Guatemala	584	16.9	10.9 (20.3)	23.4 (29.8)	47.6 (43.3)	18.1 (6.6)	5 900
Honduras	362	15.6	16.0 (36.2)	51.2 (51.5)	8.4 (6.1)	24.4 (6.2)	3 823
India	144	15.6	80.5 (92.4)	17.8 (7.4)	— (—)	1.7 (0.2)	1 358
Iraq	1 236	6.0	37.9 (65.8)	17.6 (19.8)	11.3 (5.8)	33.2 (8.6)	3 958
Kenya	242	11.8	19.2 (43.0)	48.0 (42.8)	28.7 (13.9)	4.1 (0.3)	3 377
Nicaragua	673	22.5	— (—)	4.9 (17.4)	14.8 (23.1)	80.3 (59.5)	13 178
Nigeria	562	5.4	0.1 (0.2)	3.9 (9.3)	60.4 (77.6)	35.6 (12.9)	7 886
Panama	1 097	12.8	— (—)	7.3 (17.8)	25.7 (36.1)	67.0 (46.1)	10 194
Turkey	892	19.7	— (—)	1.7 (3.4)	61.4 (82.5)	36.9 (14.1)	8 787
Zambia	501	16.6	— (—)	33.8 (70.6)	15.0 (14.4)	51.2 (15.0)	7 136
Zimbabwe	562	25.0	— (—)	35.4 (49.5)	53.9 (45.8)	10.7 (4.7)	5 971
Developed market economies			<$10 000	$10 000-15 000	$15 000-20 000	>$20 000	
Australia	6 970	24.2	3.0 (4.9)	32.6 (38.0)	44.1 (43.0)	20.3 (14.1)	16 204
Finland	5 889	27.2	8.8 (16.1)	55.6 (58.5)	27.1 (20.9)	8.5 (4.5)	14 186
France	6 437	30.1	0.4 (0.9)	38.4 (51.3)	34.5 (34.2)	26.7 (13.6)	17 990
Germany, Federal Republic of	6 764	37.9	— (—)	15.9 (23.2)	41.1 (47.5)	43.0 (29.3)	19 808
Greece	2 313	19.9	78.3 (87.6)	12.2 (9.3)	— (—)	9.5 (3.1)	8 608
Israel	3 781	19.5	21.4 (35.1)	41.4 (41.7)	18.8 (13.9)	18.4 (9.3)	12 343
Italy	3 440	29.0	9.2 (14.6)	42.8 (47.8)	36.0 (31.2)	12.0 (6.4)	14 791
Netherlands	6 378	29.3	1.5 (3.8)	11.4 (16.5)	62.5 (66.9)	24.6 (12.8)	18 568
Norway	7 120	23.1	8.4 (15.7)	15.2 (19.9)	50.5 (49.6)	25.9 (14.8)	16 554
United States	7 206	24.0	— (—)	7.8 (15.0)	3.8 (5.6)	88.4 (79.4)	25 764
Yugoslavia	1 354	35.1	94.7 (98.4)	0.4 (0.2)	2.9 (1.0)	2.0 (0.4)	5 742

Source: UNIDO data base; information supplied by the office for Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

Note: Figures in parentheses represent shares in employment. For want of precise data, the following ISIC branches have been excluded from the analysis: Chile—356, 385; Cyprus—356, 362; Ghana—354, 361; Guatemala—354, 356, 361; Honduras—384; India—356; Iraq—371; Kenya—371, 372, 385; Nigeria—371, 385; Turkey—332, 356, 361, 385; Zambia—324, 353, 362, 372, 385; Zimbabwe—323, 354, 355, 356, 385; Australia—323, 356; France—322, 390; Italy—322, 381, 390; Netherlands—385, 390.

Table VII.2. Growth of labour productivity in manufacturing

(Percentage)

Country	*Period*	*Growth rates*		
		Value added	*Employment*	*Productivity*
Developing countries				
Argentina	1970-1974	4.5	3.5	1.0
	1974-1981	−1.8	−5.7	4.1
	1970-1981	0.3	−1.9	2.3
Chile	1971-1974	−0.3	1.0	−1.3
	1974-1979	2.8	−2.6	5.6
	1971-1979	−1.2	−2.4	1.2
Cyprus	1974-1980	12.5	8.6	3.6
Ghana	1970-1974	8.7	6.4	2.1
	1974-1975	−3.6	4.8	−8.1
	1970-1975	7.1	6.5	0.6
Guatemala	1971-1974	6.8	3.9	2.8
	1974-1975	0.7	3.5	−2.7
	1971-1975	5.4	4.0	1.3
Honduras	1971-1974	4.6	7.1	−2.3
	1974-1975	0.4	7.8	−6.9
	1971-1975	3.5	7.7	−3.9
India	1970-1974	2.3	2.9	−0.6
	1974-1978	6.4	4.3	2.0
	1970-1978	4.1	3.8	0.3
Iraq	1970-1974	8.9	8.5	0.4
	1974-1975	14.3	8.7	5.2
	1970-1975	9.4	7.8	1.5
Kenya	1970-1974	8.9	10.6	−1.5
	1974-1980	14.6	5.2	8.9
	1970-1980	11.3	6.6	4.4
Nicaragua	1973-1974	10.9	14.7	−3.3
	1974-1977	6.9	6.1	0.8
	1973-1977	7.6	7.5	0.1
Nigeria	1970-1974	6.9	9.2	−2.1
	1974-1975	20.6	31.2	−8.1
	1970-1975	7.8	12.0	−3.7
Panama	1970-1974	5.5	5.1	0.3
	1974-1979	3.4	2.0	1.4
	1970-1979	3.0	2.2	0.8
Turkey	1970-1974	10.6	7.3	3.1
	1974-1979	5.7	3.9	1.7
	1970-1979	7.9	5.3	2.4
Zambia	1970-1974	7.3	6.2	1.1
	1974-1975	−4.4	3.2	−7.3
	1970-1975	5.6	6.2	−0.5
Zimbabwe	1970-1974	9.7	7.9	1.7
	1974-1980	0.2	0.3	−0.1
	1970-1980	2.5	2.6	−0.1

Country	Period	Growth rates		
		Value added	*Employment*	*Productivity*
Developed market economies				
Australia	1975-1981	1.6	−1.2	2.9
Finland	1970-1974	6.8	3.2	3.5
	1974-1981	3.8	0.1	3.7
	1970-1981	3.7	0.9	2.8
France	1970-1974	5.4	1.8	3.5
	1974-1981	1.3	−1.5	2.8
	1970-1981	2.0	−0.5	2.5
Germany,	1970-1974	2.3	−1.1	3.5
Federal	1974-1976	0.4	−4.6	5.3
Republic of	1970-1976	0.9	−2.4	3.4
Israel	1970-1974	7.7	5.2	2.4
	1974-1981	4.1	1.2	2.9
	1970-1981	5.1	2.1	2.9
Italy	1970-1974	4.8	2.2	2.5
	1974-1980	3.0	−1.2	4.3
	1970-1980	2.9	−0.0	2.9
Netherlands	1970-1974	3.5	−2.0	5.7
	1974-1981	1.4	−2.0	3.5
	1970-1981	1.6	−2.1	3.8
Norway	1970-1974	4.8	0.8	3.9
	1974-1981	−0.3	−0.7	0.4
	1970-1981	1.1	−0.1	1.2
United States	1970-1974	6.1	1.3	4.8
	1974-1980	3.8	1.6	2.2
	1970-1980	3.6	0.8	2.8
Yugoslavia	1970-1974	8.6	5.2	3.3
	1974-1980	7.2	5.1	2.0
	1970-1980	7.6	5.1	2.4

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

Note: For want of precise data, the following ISIC branches have been excluded from the analysis: Chile—356, 385; Cyprus—356, 362; Ghana—354, 361; Guatemala—354, 356, 361; Honduras—384; India—356; Iraq—371; Kenya—371, 372, 385; Nigeria—371, 385; Turkey—332, 356, 361, 385; Zambia—324, 353, 362, 372, 385; Zimbabwe—323, 354, 355, 356, 385; Australia—323, 356; France—322, 390; Italy—322, 381, 390; Netherlands—385, 390.

continued to climb in only a few countries (e.g. Federal Republic of Germany, Finland and Italy). In general, growth in manufacturing employment was most seriously affected after 1975: in 1980 employment levels in several developed market economies were below those in 1970-1974.

Broad trends in the developing countries and the developed market economies are summarized in figures I and II, respectively. In the former grouping, MVA grew at a rate of 3.4 per cent per annum in 1970-1978 and employment at 3.3 per cent. Productivity gains, therefore, were only a meagre 0.1 per cent per annum. These relationships were reversed in the developed market economies. In the same period, manufacturing output rose at a rate of

3.2 per cent per annum, but productivity increased at an estimated 2.7 per cent per annum, which meant that employment expanded at a nominal rate of 0.5 per cent.

A much clearer picture of productivity patterns can be obtained from the figures for specific industrial branches. At this level of analysis, markedly different patterns of productivity growth in the two economic groupings can be noted. In the developing countries, many branches experienced a decline in productivity even when production was expanding. Accordingly, employment gains exceeded rates of growth in output in these branches. This relationship —which was most frequently observed in the case of food products, beverages, tobacco, textiles, paper and paper products and chemicals—may be attributed to any of several factors. In most developing countries, growth of output has been closely associated with reliance on relatively labour-intensive technologies. In several of those countries, many modern large-scale firms have had to curtail their plans to increase capacity because of a shortage of the foreign exchange

Figure I. Developing countries: growth of MVA (△), employment (×) and labour productivity (□), 1970-1978[a]

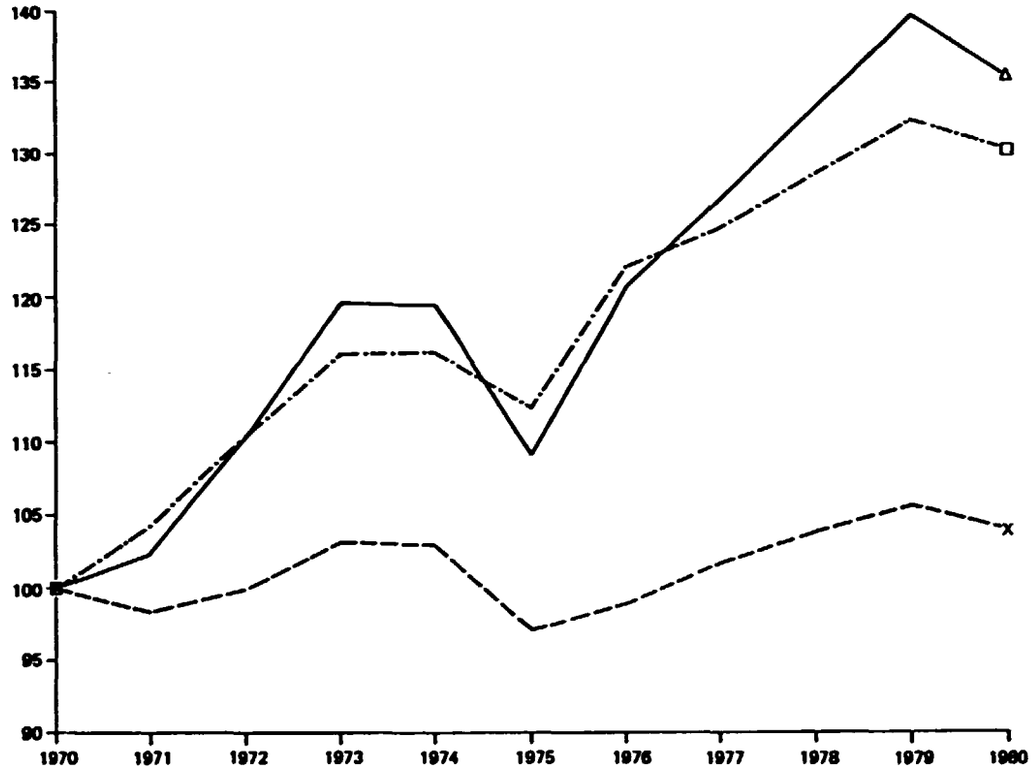
(Index: 1970 = 100)

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Indices are based on the country sample shown in table A.2 of the appendix to the present chapter.

Figure II. Developed market economies: growth of MVA (△), employment (×) and labour productivity (□), 1970-1980[a]

(Index: 1970 = 100)



Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Indices are based on the country sample shown in table A.2 of the appendix to the present chapter.

needed to import capital goods or because of the imposition of higher indirect taxes on their products.

A different type of relationship was also to be observed in certain developing countries: in some industrial branches, even declines in production were associated with increases in employment. This was frequently the case in branches concerned with the production of petroleum and coal; pottery, china and earthenware; glass; and professional and scientific instruments. Most often, the phenomenon resulted from the fact that the production of large-scale, capital-intensive plants was curtailed while that of smaller, labour-intensive ones was stepped up to fill the gap.

Growth patterns such as these are seldom observed in the developed market economies. Increases in output have been achieved through gains in productivity, resulting in declines in employment levels. In branches where the growth of output has slowed, the trend has been accompanied by an even more rapid decline in employment.

In terms of their implications for the growth of productivity, the possible relationships between growth of output and employment are numerous. For example, a gain in productivity would result from any one of the following:

(a) An increase in the growth of output associated with a more modest one in the growth of employment;

(b) An increase in the growth of output associated with a contraction in the growth of employment;

(c) A decrease in the growth of output associated with an even greater one in the growth of employment.

Similarly, a decline in productivity could be attributed to:

(d) An increase in the growth of output associated with a more rapid one in employment;

(e) A decrease in output associated with a more modest one in employment;

(f) A decrease in output associated with an increase in employment.

In most developing countries, the pattern of growth is similar to *(d)* above. In a smaller number, the results conform to *(f)*. Most developed market economies on the other hand exhibit growth patterns similar to *(c)*. Thus, in the developing countries industrial progress has generally provided a modest boost to employment while in the developed market economies, where it continues to be characterized by technological advancement (notwithstanding the slowdown in such advancement), it has frequently brought a reduction in employment.

Trends in rapidly expanding branches of industry

The significance of these broad trends can be judged in terms of their effects on rapidly expanding branches, i.e. branches whose output has expanded at rates in excess of the average for the manufacturing sector and which account, therefore, for an increasing share in total MVA. Table VII.3 identifies the three most rapidly expanding branches in each of the countries covered. Among the developing countries, these branches represent a heterogeneous group. They include not only branches of light industry such as beverages, tobacco, leather, wood and furniture, but also some heavy ones such as iron and steel, non-ferrous metals, non-electrical machinery and transport equipment.

All these branches could be termed "rapidly expanding" in the period 1970-1981. Their shares in MVA were nevertheless very small. In only two countries, Chile and Cyprus, did the first three leading branches together account for more than 15 per cent of total MVA. In three countries, the share was less than 5 per cent. Furthermore, high rates of growth were not always associated with rapid increases in productivity. In many of these branches, growth in output was largely due to expansion in employment; moreover, productivity increases were only modest. In Panama, for example, output of industrial chemicals increased at an annual rate of 13.8 per cent. The bulk of this output, however, was due to gains in employment rather than productivity. The industry, in fact, accounted for less than 1 per cent of total MVA.

Table VII.3. Growth trends in most rapidly expanding branches, selected countries and years

(Percentage)

Country	*Period*	*Industrial branch (ISIC)*	*Growth rates*		*Share in MVA in 1975*
			Value added	*Productivity*	
Developing countries					
Argentina	1970-1981	Professional and scientific equipment (385)	4.0	4.2	0.7
		Non-electrical machinery (382)	2.5	7.2	6.0
		Tobacco (314)	2.1	3.5	0.5
		Total manufacturing (300)	0.3	2.3	
Chile	1971-1979	Non-ferrous metals (372)	6.3	8.5	18.1
		Paper and products (341)	4.4	2.2	3.6
		Tobacco (314)	2.2	10.9	2.9
		Total manufacturing (300)	−1.2	1.2	
Cyprus	1974-1980	Footwear (324)	24.5	12.8	5.5
		Leather and fur products (323)	20.5	2.4	1.4
		Other non-metallic mineral products (369)	19.6	9.9	12.4
		Total manufacturing (300)	12.5	3.6	
Ghana	1970-1975	Rubber products (355)	15.5	5.0	2.1
		Beverages (313)	14.5	0.6	10.2
		Industrial chemicals (351)	14.0	12.9	0.8
		Total manufacturing (300)	7.2	0.6	
Guatemala	1971-1975	Non-ferrous metals (372)	51.4	31.4	0.0
		Iron and steel (371)	21.3	19.2	1.4
		Other non-metallic mineral products (369)	14.3	9.3	5.0
		Total manufacturing (300)	5.4	1.4	
Honduras	1971-1975	Furniture and fixtures (332)	12.6	−5.6	1.6
		Non-electrical machinery (382)	10.8	−6.1	0.3
		Rubber products (355)	8.7	−10.2	1.9
		Total manufacturing (300)	3.4	−3.9	
India	1970-1978	Industrial chemicals (351)	10.4	5.3	7.4
		Wood and cork products (331)	9.6[a]	10.5[a]	0.7[a]
		Furniture and fixtures (332)			
		Total manufacturing (300)	4.1	0.4	
Iraq	1970-1975	Paper and products (341)	28.4	−1.5	1.3
		Plastic products (356)	20.9	0.6	0.5
		Transport equipment (384)	20.3	26.6	4.2
		Total manufacturing (300)	9.4	1.4	
Kenya	1970-1980	Transport equipment (384)	26.4	25.1	7.5
		Plastic products (356)	24.4	11.6	1.4
		Leather and fur products (323)	16.0	3.6	0.5
		Total manufacturing (300)	11.3	4.4	
Nicaragua	1973-1977	Transport equipment (384)	20.0	30.9	0.3
		Tobacco (314)	18.1	19.0	4.0
		Furniture and fixtures (332)	16.5	−7.0	0.9
		Total manufacturing (300)	7.6	0.0	
Nigeria	1970-1975	Non-electrical machinery (382)	33.5	35.3	0.3
		Non-ferrous metals (372)	29.7	9.9	2.0
		Furniture and fixtures (332)	26.2	12.0	1.1
		Total manufacturing (300)	7.8	−3.7	

Table VII.3 *(continued)*

Country	*Period*	*Industrial branch (ISIC)*	*Growth rates*		*Share in MVA in 1975*
			Value added	*Productivity*	
Developing countries (continued)					
Panama	1970-1979	Leather and fur products (323)	16.6	10.7	0.4
		Industrial chemicals (351)	13.8	1.0	0.8
		Electrical machinery (383)	12.2	4.5	0.6
		Total manufacturing (300)	3.0	0.8	
Turkey	1970-1979	Industrial chemicals (351)	21.1	6.2	5.3
		Non electrical machinery (382)	19.3	9.4	4.8
		Printing and publishing (342)	16.5	15.9	1.4
		Total manufacturing (300)	7.9	2.4	
Zambia	1970-1975	Industrial chemicals (351) Other chemicals (352) Rubber products (355)	10.5[b]	2.4[b]	13.1[b]
		Total manufacturing (300)	5.6	−0.5	
Zimbabwe	1970-1980	Other manufactures (390)	6.2	3.7	1.3
		Beverages (313)	5.7	2.6	7.3
		Footwear (324)	5.6	2.6	2.3
		Total manufacturing (300)	2.5	−0.1	
Developed market economies					
Australia	1975-1981	Industrial chemicals (351)	7.9	8.7	2.9
		Professional and scientific equipment (385)	6.9	8.7	0.9
		Non-ferrous metals (372)	5.6	4.1	3.8
		Total manufacturing (300)	1.6	2.9	
Finland	1970-1981	Iron and steel (371)	9.2	5.8	4.0
		Professional and scientific equipment (385)	7.8	0.4	0.6
		Non-electrical machinery (382)	6.1	4.9	11.8
		Total manufacturing (300)	3.7	2.8	
France	1970-1981	Glass (362)	6.1	6.2	1.2
		Electrical machinery (383)	5.9	5.2	8.3
		Plastic products (356)	3.2	2.5	1.6
		Total manufacturing (300)	2.0	2.5	
Germany, Federal Republic of	1970-1976	Plastic products (356)	6.8	5.5	1.8
		Electrical machinery (383)	3.3	5.0	11.0
		Glass (362)	2.8	6.3	0.8
		Total manufacturing (300)	0.9	3.4	
Israel	1970-1981	Transport equipment (384)	8.4	6.8	9.2
		Electrical machinery (383)	8.2	2.5	10.3
		Other chemicals (352)	7.6	−0.3	4.4
		Total manufacturing (300)	5.1	2.9	
Italy	1970-1980	Furniture and fixtures (332)	9.3	9.8	1.8
		Plastic products (356)	8.1	5.2	2.1
		Non-electrical machinery (382)	4.4	3.6	10.5
		Total manufacturing (300)	2.9	2.9	
Netherlands	1970-1981	Beverages (313)	6.3	8.9	2.0
		Plastic products (356)	4.5	5.8	1.3
		Electrical machinery (383)	4.5	5.9	11.1
		Total manufacturing (300)	1.6	3.8	

Country	Period	Industrial branch (ISIC)	Growth rates: Value added	Growth rates: Productivity	Share in MVA in 1975
Norway	1970-1981	Non-electrical machinery (382)	6.0	0.9	9.1
		Non-ferrous metals (372)	4.4	4.1	4.8
		Glass (362)	4.4	1.9	0.5
		Total manufacturing (300)	1.1	1.2	
United States	1970-1980	Plastic products (356)	9.9	4.0	1.7
		Industrial chemicals (351)	5.9	5.6	5.6
		Other chemicals (352)	5.6	7.3	4.8
		Total manufacturing (300)	3.6	2.8	
Yugoslavia	1970-1980	Plastic products (356)	12.6	6.2	1.5
		Petroleum refineries (353)	12.3	10.6	2.0
		Other chemicals (352)	11.3	7.2	3.4
		Total manufacturing (300)	7.6	2.4	

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

Note: For want of precise data, the following ISIC branches have been excluded from the analysis: Chile—356, 385; Cyprus—356, 362; Ghana—354, 361; Guatemala—354, 356, 361; Honduras—384; India—356; Iraq—371; Kenya—371, 372, 385; Nigeria—371, 385; Turkey—332, 356, 361, 385; Zambia—324, 353, 362, 372, 385; Zimbabwe—323, 354, 355, 356, 385; Australia—323, 356; France—322, 390; Italy—322, 381, 390; Netherlands—385, 390.

[a]Data on value added for these two branches are reported as a combined total in most years.

[b]Data on value added for these three branches are reported as a combined total in most years.

Three important points should be noted here. First, growth in output and productivity usually had only limited consequences for performance in the manufacturing sector, owing to the relatively small size of the branches classified as rapidly expanding. Second, in countries where per capita income has been rising, demand for the goods produced by these branches should have increased and, in many cases, led to improvements in technology and productivity. Because of the small size of the branches, however, and the frequent absence of strong linkages between them and other branches, the diffusion of productivity gains has been limited. Third, in a small number of developing countries, efforts to boost employment by focusing on specific branches have resulted in a decline in productivity.

Again, the developed market economies present a very different picture. While the chemicals, machinery and transport equipment branches were frequently to be found among those classified as most rapidly expanding, branches manufacturing consumer goods were significant producers in only a few cases.[4] In most of the countries surveyed, growth in the output of the latter branches was due mainly to increases in productivity; employment sometimes declined in absolute terms. Although recent gains in productivity are generally below the levels of previous years, this component continues to be the primary explanation for growth in the manufacturing sector.

[4]Examples include furniture and fixtures in Italy and beverages in the Netherlands.

Productivity trends in major industries

Labour productivity can also be analysed in terms of the major, or dominant, branches of industry, i.e. those accounting for the largest share of total MVA.[5] Table VII.4 illustrates the productivity patterns that emerge when this perspective is used. In most developing countries, food products was found to be the dominant industrial branch. It accounted for 42 per cent of MVA in Panama, 38 per cent in Nicaragua and more than 25 per cent in Guatemala, Honduras and Kenya. In several other countries, its share was above 15 per cent. Developing countries in which food products is not the dominant branch tend to be dependent on resource endowment and the creation of industrial facilities to process available resources. Examples of such countries are Chile (non-ferrous metals), Zimbabwe (iron and steel) and Iraq (petroleum refining). The dominant branch in each of these countries is seldom one of the rapidly expanding ones; as a rule, its share in MVA has declined. Estimates of growth in employment and productivity in the dominant branches reinforce the observation made earlier that in the developing countries expansion in manufacturing has generally been achieved through increased employment, but that gains in productivity have not kept pace.

In the developed market economies, the range of dominant branches is more diversified. Food products plays a relatively minor role. The comparatively small proportion of MVA accounted for by the dominant branch is a reflection of the diversified structure of the manufacturing sector in the economic grouping as a whole. Again, the figures in table VII.4 support the observation that for those economies productivity gains played the leading role in the growth of manufacturing production. The marked differences between the productivity patterns of this economic grouping and the developing countries points to the need for analysis at a more detailed level. In the case of the developing countries, as mentioned earlier, comparatively little is known about small-scale enterprises and their contribution to manufacturing output, employment and productivity. This, despite the fact that such enterprises account for a large portion of all manufacturing in the developing countries. The following section focuses, therefore, on recent trends in the field of small-scale manufacturing.

Small-scale manufacturing in the developing countries

Manufacturing enterprises in the developing countries fall into three general categories:

(a) Large enterprises using modern technology and located mainly in urban areas where infrastructure, manpower and skills are available;

(b) Modern small- to medium-scale enterprises using intermediate levels of technology and located mainly in urban areas;

(c) Small enterprises and artisan workshops using traditional, or slightly more sophisticated, technologies and located in both rural and urban areas.

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[5]The year 1975 was chosen as the reference year as it was common to all countries covered in the analysis.

Table VII.4 Dominant branch and growth of labour productivity

(Percentage)

Country	Dominant branch (ISIC)	Share of branch in MVA in 1975	Period	Growth rate		
				Value added	Employment	Productivity
Developing countries						
Argentina	Food products (311/2)	18.1	1970-1981	1.7	−0.7	2.4
Chile	Non-ferrous metals (372)	18.1	1971-1979	6.3	−2.1	8.5
Cyprus	Food products (311/2)	14.9	1974-1980	6.1	2.7	3.2
Ghana	Food products (311/2)	18.8	1970-1975	4.7	8.3	−3.3
Guatemala	Food products (311/2)	29.4	1971-1975	6.9	3.7	3.1
Honduras	Food products (311/2)	25.6	1971-1975	3.1	6.6	−3.4
India	Textiles (321)	18.7	1970-1978	0.9	2.1	−1.2
Iraq	Petroleum refineries (353)	13.9	1970-1975	11.3	8.0	3.1
Kenya	Food products (311/2)	26.3	1970-1980	8.1	10.4	−2.1
Nicaragua	Food products (311/2)	38.4	1973-1977	7.3	6.0	1.2
Nigeria	Food products (311/2)	16.9	1970-1975	8.8	14.9	−5.3
Panama	Food products (311/2)	42.4	1970-1979	6.0	5.3	0.7
Turkey	Petroleum refineries (353)	15.4	1970-1979	9.9	21.2	−9.3
Zambia	Beverages (313)	28.6	1970-1975	3.1	4.0	−0.9
Zimbabwe	Iron and steel (371)	13.4	1970-1980	2.8	6.8	−3.8
Developed market economies						
Australia	Food products (311/2)	14.3	1975-1981	0.5	−0.9	1.4
Finland	Paper and products (341)	13.8	1970-1981	2.2	0.4	1.8
France	Non-electrical machinery (382)	14.0	1970-1981	2.9	−0.6	3.5
Germany, Federal Republic of	Non-electrical machinery (382)	13.0	1970-1976	0.1	−1.8	2.0
Israel	Metal products (381)	12.2	1970-1981	4.3	5.7	−1.4
Italy	Transport equipment (384)	12.0	1970-1980	2.8	2.1	0.7
Netherlands	Food products (311/2)	14.4	1970-1981	3.3	−1.0	4.4
Norway	Transport equipment (384)	13.0	1970-1981	0.1	−0.5	0.6
United States	Non-electrical machinery (382)	12.0	1970-1980	4.8	2.5	2.3
Yugoslavia	Food products (311/2)	9.8	1970-1980	6.3	9.0	−2.5

Source: UNIDO data base; information supplied by the United Nations Statistical Office, with estimates by the UNIDO secretariat.

Note: For want of precise data, the following ISIC branches have been excluded from the analysis: Chile—356, 385; Cyprus—356, 362; Ghana—354, 361; Guatemala—354, 356, 361; Honduras—384; India—356; Iraq—371; Kenya—371, 372, 385; Nigeria—371, 385; Turkey—332, 356, 361, 385; Zambia—324, 353, 362, 372, 385; Zimbabwe—323, 354, 355, 356, 385; Australia—323, 356; France—322, 390; Italy—322, 381, 390; Netherlands—385, 390.

More precise definitions of the three categories of enterprise are difficult to render as industrial statistics are seldom presented in a form that affords the researcher a measure of the size of the enterprise. National data generally refer to enterprises in excess of some minimum size, which may be based on number of employees, value of gross output, total investment or investment in fixed assets. Thus, most industrial statistics cover the enterprises described in *(a)* and *(b)* above, but rarely those described in *(c)*, which are also referred to as the informal sector.

Despite the general paucity of regularly reported data on the informal sector, some developing countries do carry out censuses of manufacturing and tabulate the results by extent of employment in the enterprises canvassed. These national censuses constituted the main source of the empirical evidence used in the present analysis. In general, enterprises with less than 10 employees or persons engaged were assumed to represent the informal sector. Exceptions were made in the case of Cyprus, Kenya and Mexico, however: for the first two countries, enterprises employing up to 19 persons were included and in Mexico up to 14 persons were included.[6]

The countries for which data were available are listed in table VII.5, which also gives the average extent of employment per establishment. It will be seen that,

Table VII.5. Extent of employment in informal and formal sectors of manufacturing in selected developing countries and areas

		Average number of employees or persons engaged per establishment	
Country or area	*Year*	*Informal sector*[a]	*Formal sector*
Brazil	1980	4[b]	56
Colombia	1979	7[b]	86
Cyprus	1972	3[c]	53
El Salvador	1977	7[d]	95
Hong Kong	1981	4[b]	49
Kenya	1976	3[c]	162
Mexico	1975	3[e]	114
Pakistan	1980	7[f]	144
Puerto Rico	1977	4[f]	108
Singapore	1978	7[g]	83
Turkey	1970	2[g]	106

Source: UNIDO data base; information supplied by the Statistical Office of the United Nationas Secretariat, with estimates by the UNIDO secretariat.

Note: Cross-country differences in averge extent of employment would result from variations in cut-off points as well as incomplete coverage of the informal sector. Some countries' data collection covers only a small part of the informal sector. Colombia, El Salvador and Pakistan are included in this category.

[a]Unless otherwise specified, the informal sector, as referred to in subsequent tables, has the same coverage of establishments as that indicated here, and data pertain to the years shown above.

[b]Persons engaged: 1-9.

[c]Persons engaged: 1-19.

[d]Persons engaged: 5-9.

[e]Persons engaged: 1-14.

[f]Employees: 1-9.

[g]Employees: 5-9.

[6]The criteria and concepts used are elaborated on in the appendix to the present chapter.

although the cut-off point was 9 persons, the average number of employees per establishment is very low in the informal sector in almost all the countries considered. Thus, the bulk of employment in that sector is accounted for by enterprises employing considerably fewer than nine persons.

Many of the characteristics of the informal sector are common to all developing countries. The sector, for example, usually consists of a large number of widely dispersed, labour-intensive enterprises which operate at comparatively low levels of labour productivity. The product mix is often distinct from that of larger or more modern establishments: as a rule, it consists of low-quality goods intended for local consumption. The sector relies heavily on local raw materials, skills and hand tools (which results in a low capital-output ratio). Finally, its activities are often household-based.

In the course of economic growth, manufacturing activity, measured in terms of size of enterprise, tends to pass through three phases. In the first phase, household manufacturing predominates, often providing up to three quarters of total manufacturing employment. Two factors weigh heavily in favour of household manufacturing. The first is traditional: such manufacturing is not far removed from agricultural and other rural forms of economic activity that are centred on the household. The second is economic: the introduction of better farming techniques, improved varieties of seeds, chemical fertilizers and superior irrigation facilities has served to raise agricultural output and productivity. This, in turn, has raised the demand for manufactures, both for consumption and capital formation. In this first development phase, increases in demand can be met easily by expansion of the informal sub-sector. The fragmented nature of the local markets and the general lack of infrastructure render it unfeasible to establish large-scale enterprises in rural areas. Household and cottage enterprises are more flexible when it comes to adapting to changes in local supply and demand.

Table VII.6 provides some idea of the importance of the informal sector at the early phase of development. Two general observations may be made on the basis of the figures presented. First, because its operations are relatively labour intensive, the sector absorbs the bulk of the manufacturing labour force. Second, large differences in the shares of manufacturing employment and value added imply wide gaps in labour productivity between the informal and the formal sectors.

In the second development phase, small workshops and factories using modern technology and equipment tend to displace household manufacturing. As countries pass through this phase, fundamental changes in the composition of demand take place which can reduce the importance of the informal sector. For example, as incomes rise, demand patterns change in favour of the comparatively more sophisticated goods produced by modern technology. Jaggery loses ground to refined sugar, food grains to processed food, natural fibres to synthetics, and earthenware to glass and plastic. At this point, structural changes in demand and investment may begin to erode the importance of the informal sector.

Finally, in the third phase, large-scale production begins to dominate, sometimes crowding out what remains of phase-one activity and a great proportion of phase-two activity. These trends are discernible from table VII.7. In some instances, the decline in the informal sector is a relative one, owing to the fact that larger enterprises have grown at a slow pace. In other instances, the decline provides an indirect indication that the first phase of industrial development has

Table VII.6. Distribution of employment and MVA in very small and in large-scale enterprises, selected developing countries

(Percentage)

Region and country (year)	*Employment*		*MVA*	
	Very small enterprises	*Large-scale enterprises*	*Very small enterprises*	*Large-scale enterprises*
Asia				
Iran (Islamic Republic of) (1968)	83	17	44	56
Bangladesh (1976-1977)	87	13	45	55
Indonesia (1974-1975)	87	13	20	80
Philippines (1969-1971)	70	30	6	94
Sri Lanka (1968)	71	29	33	67
Africa				
Sierra Leone (1974-1975)	96	4	44	56
Egypt (1966-1967)	33	67	16	84
Ghana (1963)	87	13	39	61
Somalia (1974)	50	50	40	60
United Republic of Tanzania (1961-1964)	50-80	50-20	30	70
Latin America				
Honduras (1975)	98	2	59	41
Ecuador (1974)	78	22	17	83

Source: M. Allal and E. Chuta, "Cottage industries and handicrafts: some guidelines for employment promotion" (Geneva, International Labour Organisation, 1982), p. 12.

been completed. In either case, the original number of informal enterprises may be reduced to a few producing only "differentiated products" such as certain foods, garments and handicrafts. These enterprises, which would have only limited economies of scale, would cater to a small market.

In the initial stages of industrial growth, the informal sector has a valuable role to play in contributing to employment and the equitable distribution of income. Prospects for rural industrialization are furthered when a vigorous informal sub-sector is in place. Informal manufacturing activities can also have considerable multiplier effects throughout the economy via backward and forward linkages. Rural artisans, for example, play an important role in providing inputs to agriculture or for the development of rural transport and construction systems. In urban areas, informal establishments can constitute a valuable market for suppliers in the formal sector. Forward linkages, by contrast, are usually weak; the informal sector sells little of its output to the formal sector.

Certain products from the informal sector enjoy access to major international markets and are important earners of foreign exchange. Examples are carpets (Islamic Republic of Iran) and straw and wooden goods (Haiti). In most instances, however, the sector's products are intended to satisfy the basic needs of the local population. Small establishments use indigenous technology to produce cheap, unsophisticated goods that will satisfy many of the basic needs of the poor. Thus, development of the informal sector in the rural areas can help stem the population flow to the urban areas.

Table VII.7. Changes in the informal sector's shares in MVA

(Percentage)

Country	*Year*	*Share of MVA*	*Year*	*Share of MVA*	*Coverage of establishments in the informal sector with:*
Australia	1975	13	1981	3	Less than 4 employees
Bangladesh	1975	43	1979	18	Less than 5 employees
Belgium	1970	16	1980	14	Less than 5 employees
Ethiopia	1971	39	1981	19	Less than 10 employees
Greece	1970	33	1977	26	Less than 10 persons engaged
Guatemala	1971	39	1978	29	Less than 5 persons engaged
Honduras	1971	24	1975	20	Less than 5 persons engaged
India	1970	38	1980	37	Less than 10 employees using power or less than 20 not using power
Italy	1970	19	1980	16	Less than 20 persons engaged
Kenya	1970	22	1978	14	Less than 50 employees
Mauritius	1970	25	1980	21	Less than 10 employees
Netherlands	1970	18	1979	14	Less than 10 employees
Pakistan	1970	43	1977	50	Less than 10 employees
Swaziland	1971	36	1979	31	Less than 10 employees
Trinidad and Tobago	1974	25	1977	8	Less than 10 persons engaged
United Republic of Tanzania	1970	39	1974	30	Less than 10 persons engaged

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Statistical Office, with estimates by the UNIDO secretariat.

Note: Data for the informal sector were obtained using residuals of MVA from national accounts data and MVA from industrial statistics. National accounts, in principle, cover the entire manufacturing sector, while industrial statistics pertain to establishments of size above a given cut-off point. Because of differences in concepts, classifications and methods of valuation, data from the two sources are not strictly comparable. The estimates of shares should therefore be used only as indicators of trends.

Table VII.8 provides estimates of labour productivity in both the informal and the formal sectors. As might be expected, levels of productivity are generally low in the informal sector. In many industrial branches, levels of productivity were roughly 50 per cent those of the corresponding branches in the formal sector. In some instances, the level was as low as 20 per cent. Although the gap between the two sectors is frequently a wide one, this has not always been the case: levels of productivity achieved by firms in the same branch in the two sectors have at times been comparable.

The contrasts between the two sectors can be further examined by considering the ratio of value added in the gross value of production (i.e. gross output). Table VII.9 provides the relevant data for several developing countries. Within the informal sector, large differences in the ratio can be noted between industrial branches. In Kenya, for example, the proportion of value added in gross output ranged from 6.3 to 34.5 per cent. In Brazil it ranged from 30.3 to 65.3 per cent. The differences in ratio are seen to be much smaller, however, when figures for branches in the informal sector are compared with corresponding ones in the formal sector. In many branches, the ratio attained in the informal sector is the higher of the two. There are a number of explanations for this. First, intensive

Table VII.8. Labour productivity in the informal and

Branch	*ISIC Code*	*Brazil 1980 (000 cruzeiros)*		*Colombia 1979 (000 pesos)*		*Cyprus 1972 (pounds)*		*El Salvador 1977 (000 colones)*		*Hong Kong 1981 (000 Hong Kong dollars)*	
		Informal	*Formal*	*Informal*	*Formal*	*Informal*	*Formal*	*Informal*	*Formal*	*Informal*	*Forma*
Food products	311/2	251	773	179	492	939	1 466	10	16	28	47
Beverages	313	228	878	318	1 328	1 581	2 884	2	42	25	80
Tobacco	314	151	1 088	85	1 993	231	1 987	—	99	—	194
Textiles	321	404	670	151	462	765	951	6	11	26	37
Wearing apparel	322	199[a]	446[a]	178	185	501	809	7	8	26	31
Leather products	323	248	442	145	276	937	958	4	11	36	28
Footwear	324	...	...	123	198	778	899	—	7	17	30
Wood products	331	197	477	145	317	840	1 123	6	8	27	39
Furniture and fixtures	332	184	462	158	168	890	995	8	9	27	36
Paper and products	341	388	1 122	160	735	1 038	1 554	—	23	27	35
Printing and publishing	342	288	821	139	343	1 218	1 427	7	24	26	60
Industrial chemicals	351	1 636	3 607	717	1 104	1 467	2 783	—	154	24	68
Other chemical products	352	800	1 700	147	678	1 216	1 795	24	33		
Petroleum refineries	353	...	...	—	2 721	—	12 929	—	314	...	...
Petroleum and coal products	354	...	...	—	630	—	—	—	30	...	...
Rubber products	355	385	904	134	550	1 483	1 267	10	13	29	29
Plastic products	356	429	834	221	360	1 310	1 337	14	16	28	33
Pottery, china and earthenware	361			111	253	659	—	1	—		
Glass products	362	129	685	116	429	1 333	—	6	12	31	93
Non-metal products, n.e.c.	369			120	393	1 092	1 823	7	17		
Iron and steel	371			146	556	—	—	—	11		
Non-ferrous metals	372	265	901	82	590	—	3 000	24	16	27	56
Metal products	381			148	323	938	1 081	8	12	28	34
Machinery n.e.c.	382	428	760	174	347	1 329	1 137	7	14	27	40
Electrical machinery	383	538	1 055	114	426	989	3 077	—	28	25	44
Transport equipment	384	243	1 097	219	477	889	2 014	—	16	38	54
Professional goods	385	319	866	167	196	1 211	—	9	20	20	33
Other industries	389			169	303	883	784	9	9	30	40
Total		241	885	162	511	869	1 591	9	19	27	37

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with

[a] Includes ISIC 324.

[b] Includes only lubricating oils.

[c] Includes metal furniture.

[d] Including establishments with 10 to 19 employees.

[e] Establishments with 20 and more employees.

formal sectors, selected countries and areas and years

Kenya 1976 (shillings)		*Mexico 1975 (000 pesos)*		*Pakistan 1980 (000 rupees)*		*Puerto Rico 1977 (000 dollars)*		*Singapore 1978 (000 Singapore dollars)*		*Turkey 1970 (000 liras)*	
In-formal	*Formal*	*In-formal*	*Formal*	*In-formal*	*Formal*	*In-formal*	*Formal*	*In-formal*	*Formal*	*In-formal*	*Formal*
672	2 044	31	103	74	111	16	16	8	21	14	46
514	3 859	47	185	125	136	43	52	7	31	18	106
		26	464	—	291	4	34	—	32	—	80
1 843	622	37	86	28	27	9	16	8	12	14	30
685	693	37	54	26	60	8	8	6	7	9[a]	25[a]
603	951	36	91	45	67	7	9	6	10	9	30
		24	52	37	45	10	9	6	8	...	...
332	426	29	55	19	45	9	12	9	18	10	30
523	794	28	68	18	50	10[c]	11[c]	8	9	12	22
450	2 317	57	144	38	51	14[d]	15[e]	7	14	17	61
1 062	1 334	55	111	25	26	10	18	10	17	15	54
67	2 922	200	202	20	125	9	57	9	54	28	61
835	3 891	105	184	102	96	38	112				
		113[b]	418[b]	—	700	72[d]	58[e]	—	255	—	2 003
...	...	182	165	282	182	95[d]	42[e]				
433	2 435	64	182	18	49	17	25	9	18	13	56
856	1 571	64	102	28	44			12	13	...	...
1 333	1 090	10	73	8	29			10	32		
		59	109	21	30	19	21			12	40
266	2 321	24	138	20	145			11	31		
815	1 400	80	211	18	63	23	31	12	50	34	97
		168	157	13	26						
		37	102	20	30	14	18	11	18	11	37
750	2 200	57	127	15	37	13	40	11	21	11	56
730	1 415	64	101	15	60	16	27	8	17	14	39
508	608	57	119	20	31	13	25	16	26	11	27
—	—	69	112	33	30	27	38	8	15	15	52
1 363	786	38	76	32	36	15	20	8	14		
688	1 543	37	121	36	64	15	28	9	21	12	56

estimates by the UNIDO secretariat.

Table VII.9. Ratio of value added to gross output in the

Branch	ISIC Code	Brazil 1980		Colombia 1979		Cyprus 1972		El Salvador 1977		Hong Kong 1981	
		Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal
Food products	311/2	30.3	29.6	23.7	25.7	23.8	28.3	40.1	30.6	29.2	21.8
Beverages	313	46.0	47.1	52.7	67.4	38.2	51.7	9.9	69.2	18.2	31.0
Tobacco	314	41.2	51.4	41.3	71.3	42.9	38.6	—	73.2	—	29.3
Textiles	321	35.4	40.9	43.6	52.3	36.6	46.7	33.1	41.2	36.2	21.0
Wearing apparel	322	38.8[a]	52.2[a]	35.6	45.2	42.0	39.9	37.1	56.2	45.3	29.3
Leather products	323	34.1	39.3	39.6	37.0	27.1	38.0	42.9	46.1	31.2	19.5
Footwear	324	...	...	43.1	47.6	46.1	43.8	—	32.7	34.1	33.0
Wood products	331	56.3	54.1	32.2	54.6	48.3	33.6	49.6	65.6	29.1	19.4
Furniture and fixtures	332	50.8	49.6	58.6	55.3	53.5	52.6	56.8	53.2	42.4	33.9
Paper and products	341	45.8	46.1	50.8	38.8	34.3	24.2	—	43.2	25.5	22.8
Printing and publishing	342	61.5	66.3	50.3	53.6	58.4	54.7	64.3	55.0	39.0	38.8
Industrial chemicals	351	36.2	31.1	65.6	42.5	36.7	62.1	—	53.5	24.4	23.7
Other chemical products	352	52.6	53.8	45.8	48.8	42.3	35.9	62.5	55.5	...	...
Petroleum refineries	353	...	...	—	56.2	—	28.0	—	8.7	...	...
Petroleum and coal products	354	...	...	—	24.0	—	—	—	12.7	...	...
Rubber products	355	45.6	34.5	37.3	43.7	50.1	41.9	55.5	54.0	33.4	31.1
Plastic products	356	46.4	49.3	47.6	38.9	41.1	40.4	52.4	51.0	30.0	31.4
Pottery, china and earthenware	361	64.7	56.2	60.1	59.4	85.3	—	25.0	—	31.1	19.5
Glass products	362			54.1	51.4	80.0	—	69.4	63.1		
Non-metal products, n.e.c.	369			53.6	49.6	58.9	54.3	64.1	48.7		
Iron and steel	371	47.4	34.2	53.5	49.1	—	—	—	27.9	30.1	18.1
Non-ferrous metals	372			54.2	44.5	—	22.7	59.2	23.6		
Metal products	381			37.8	45.3	48.1	34.9	55.6	49.3	33.8	31.4
Machinery n.e.c.	382	65.3	54.6	48.7	46.9	53.4	53.5	67.7	52.6	37.3	31.5
Electrical machinery	383	51.5	50.1	28.3	47.6	65.3	45.7	—	46.9	29.9	23.4
Transport equipment	384	56.5	39.4	34.4	32.2	56.0	70.9	—	60.5	53.0	54.1
Professional goods	385	57.1	62.0	39.7	52.2	62.2	—	80.2	71.2	21.8	16.3
Other industries	389			50.1	55.5	44.2	38.4	44.2	53.0	35.6	27.2
Total		42.0	40.7	35.3	43.7	40.9	40.0	47.6	42.7	34.7	25.8

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with

[a] Includes ISIC 324.

[b] Includes only lubricating oils.

[c] Includes metal furniture.

[d] Includes establishments with 10 to 19 employees.

[e] Establishments with 20 and more employees.

informal and formal sectors, selected countries and areas and years

Kenya 1976		*Mexico 1975*		*Pakistan 1980*		*Puerto Rico 1977*		*Singapore 1978*		*Turkey 1970*	
Informal	*Formal*	*Informal*	*Formal*	*Informal*	*Formal*	*Informal*	*Formal*	*Informal*	*Formal*	*Informal*	*Formal*
9.8	17.3	32.1	26.1	23.6	33.0	42.3	24.2	30.0	16.8	23.1	27.1
19.6	44.9	37.9	47.3	52.5	52.7	30.8	60.9	20.6	39.6	38.0	65.0
		51.1	61.5	—	78.5	30.6	57.0	—	24.0	—	58.6
14.5	27.3	37.6	41.6	15.0	26.4	45.4	57.0	28.8	32.7	26.0	38.6
23.3	22.5	40.5	37.3	28.2	41.9	50.6	47.4	34.0	32.6	39.1[a]	29.2[a]
14.2	23.9	39.7	40.4	22.1	25.6	9.8	50.3	20.4	26.3	31.2	27.6
		52.3	40.8	30.2	40.8	48.2	40.8	26.0	36.3	...	...
8.7	30.1	46.7	45.8	31.4	39.4	40.3	45.5	33.4	32.8	30.4	36.0
19.8	22.8	49.8	39.2	35.5	52.6	52.5[c]	54.2[c]	31.6	37.5	33.4	34.6
9.8	29.3	37.6	34.3	32.8	38.3	39.6[d]	30.7[e]	23.1	34.2	21.5	54.7
24.7	30.4	48.4	47.0	49.1	38.6	54.6	73.6	46.1	50.8	44.6	53.8
10.2	31.5	28.8	35.8	27.6	48.3	26.9	24.2	29.3	49.7	18.9	46.5
		33.9	42.1	43.2	41.8	62.6	74.8				
10.8	11.4										
		33.0[b]	32.9[b]	—	15.8	44.8[d]	6.4[e]	—	10.5	—	73.8
—	—	49.9	33.4	28.1	30.4	92.6[d]	31.2[e]	—		—	
34.5	32.7	42.4	46.4	33.3	35.2	60.4	62.3	28.9	7.5	34.2	43.8
16.2	27.4	39.7	40.6	20.3	39.1			34.9	34.1	...	...
9.2	31.0	63.3	55.0	36.4	54.4			24.3	50.4		
		53.9	51.6	27.7	49.3	41.8	44.9			31.8	55.7
10.8	35.8	51.4	46.4	54.5	62.0			40.8	32.4		
27.9	21.7	28.5	35.9	22.7	34.6	52.0	53.1	32.8	42.3	23.6	49.6
		46.6	25.8	36.4	24.6						
		47.9	44.7	20.2	33.3	46.5	39.2	35.1	35.1	33.2	38.3
24.6	23.1	55.5	48.7	30.6	34.6	50.3	53.4	44.0	47.3	36.8	44.8
12.3	33.5	41.5	46.0	33.2	37.5	56.1	56.3	47.4	31.9	35.7	38.0
7.2	40.8	42.9	30.4	34.7	29.2	75.9	59.0	38.1	47.7	52.5	36.7
—	—	52.7	48.2	50.4	38.0	71.7	62.9	54.9	52.1	19.3	49.2
6.3	23.1	52.3	50.3	47.1	34.8	39.9	37.9	31.0	29.8		
13.8	22.0	38.7	38.1	24.7	34.1	47.1	40.3	34.8	25.4	31.0	44.7

estimates by the UNIDO secretariat.

processing of raw materials may lead to a high proportion of value added in the gross output of producers of handicrafts such as carpets, embroidered textiles, toys, earthenware, woven baskets, hand-made wooden furniture and many other wood products. In the manufacture of many of these products, the cost of raw materials constitutes a comparatively small portion of the total value of production (i.e. gross output). For this reason, the share of value added in gross output tends to be comparatively high. Second, a high ratio can be a statistical artifact. This is the case, for example, when many enterprises are engaged in subcontracting. In "jobwork" forms of subcontracting, most raw materials are purchased by the principal and then provided to the subcontractor, without transfer of ownership. In such instances, the output of the subcontractor excludes the cost of the materials received by him from the principal. Value added, therefore, accounts for the bulk of gross output. Engineering goods and wearing apparel provide examples of products to which this practice is common. In developing countries, certain food items—e.g. flour, rice and milled oil—are also produced through a "jobwork" form of subcontracting.

Among the factors that determine the size of the informal sector are the availability of local raw materials (especially agricultural), the size of the domestic market, and the national development strategies. Thus, the sub-sector tends to be most extensive in countries that have large populations as well as a comparatively large agricultural sector. In India, Indonesia, Pakistan and Turkey, for example, the informal sector accounts for 40 to 50 per cent of manufacturing employment, although its share in MVA is low. The size of the informal sector, however, whether measured in terms of employment or value added, varies among industrial branches. Informal activities tend to be of major importance in branches such as food products, wearing apparel, leather and footwear, wood products, furniture, non-metallic mineral products and metal products. Firms in these branches cater to the consumption needs of low-income buyers or serve as suppliers of capital goods to other informal operations in the fields of agriculture, construction or transport.

In many respects, the informal sector is well suited to the socio-economic structure of the developing countries—yet many of those countries have concentrated their efforts on promoting medium- and large-scale enterprises. Countries seeking to achieve an effective balance between the two sectors must bear two points in mind.

First, large-scale enterprises tend to rely on imported technologies and skills and to concentrate on the production of goods that cannot be afforded by the majority of the domestic population. They also tend to be located in urban centres, leaving large parts of the country industrially backward, with low incomes and rampant unemployment. This notwithstanding, the resources and policies employed to foster industrial progress often focus exclusively on the development of medium- and large-scale enterprises. In many instances, the resultant socio-economic imbalances and heavy influx of population from the undeveloped rural areas to the industrial centres has raised unprecedented problems.

Second, whereas the promotion of industrialization through small-scale and household production can be a desirable strategy, it must be backed up by special programmes aimed at providing technical, financial and managerial assistance. Ultimately, the informal sector could be transformed so as to undertake a range of industrial activities to complement those carried out by the formal sector. In the

initial stages of development, however, the role of small production units should not be considered purely in terms of economics (such as the optimal use of production factors): their social aspects must also be considered.

Productivity trends in European members of the Council for Mutual Economic Assistance[7]

For two decades following the Second World War, output growth in all European members of the Council for Mutual Economic Assistance (CMEA-Europe) was particularly high by international standards. Increased productivity was the major explanation for this growth, but expansion in employment also played an important role. Productivity growth, in its turn, had been stimulated by high rates of capital accumulation and investment and by the movement of the labour force away from agriculture to industry. Industrial growth was the primary determinant of the pace of economic advancement in all member countries.

The industrial sector's share in total net material product (NMP) has increased sharply during the past three decades and now accounts for about 50 per cent (an unweighted average) of NMP in CMEA-Europe.[8] This, coupled with the fact that growth in agriculture has been only moderate, largely explains the close relationship between industrial performance and overall economic growth. Table VII.10 shows rates of growth in total NMP for the period 1961-1983. Although recent rates are below those reported for 1961-1975, the figures for several countries—notably Bulgaria, German Democratic Republic and USSR—continue to be high by international standards.

In most instances, rates of industrial growth have slightly exceeded those for total NMP in the period under review. Thus, measures to spur industrial growth, whether through improvements in productivity or expansion in employment, have important consequences for overall economic performance in CMEA-Europe.

Since data on industrial output and productivity in CMEA-Europe are compiled by the statistical offices of the countries concerned in terms of the gross value of output, this concept provides a statistical basis for analysis. A comparable analysis, based on the net value of output, would also be informative, but the relevant data are not easily obtainable. Table VII.11 shows, nevertheless, that in recent years, growth in both net and gross output, in the case of the total economy, has been nearly identical. Slight differences can be seen when industry alone is looked at. These differences, which would be greater if specific branches of industry were compared, reflect, among other things, changes in real terms (e.g. in material input per unit of output), the impact of relative prices, and the effect of double-deflation procedures.

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[7]Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania and USSR together account for the bulk of industrial activity by the centrally planned economies. Cuba, Mongolia and Viet Nam are also members of the CMEA, but their share in its industrial output is relatively low.

[8]The percentage shares in 1983 were: Bulgaria, 58.1; Czechoslovakia, 62.0; German Democratic Republic, 68.5; Hungary, 45.3; Poland, 50.0; Romania, 60.8; and USSR, 46.4.

Table VII.10. CMEA-Europe: growth rates of net material product[a]

(Percentage)

Country	*1961-1970*	*1971-1975*	*1976-1980*	*1981*	*1982*	*1983*	*1981-1983*	*Plan for 1981-1985*
Bulgaria	7.8	7.8	6.1	5.0	4.3	3.0	4.1	3.7
Czechoslovakia	4.4	5.5	3.7	−0.1	0.2	2.2	0.8	2.0-2.6
German Democratic Republic	4.4	5.4	4.2	4.8	2.5	4.4	3.9	5.1
Hungary	5.5	6.5	3.2	2.5	2.6	0.4	1.8	2.7-3.2
Poland	6.1	9.8	1.2	−12.0	−5.5	6.0	−3.8	...
Romania	8.4	11.4	7.3	2.2	2.6	3.4	2.7	7.1
USSR	7.2	5.7	4.3	3.3	4.0	4.2	3.8	3.4

Source: Z. Roman, "Productivity trends in CMEA countries", consultant paper, as compiled from *Statisticheskij ezhegodnik stran-chlenov Soveta Ehkonomicheskoj Vzaimopomoshi 1984* (Moscow, 1984); *Statisticheski godisnik na Narodna Republika Bolgarija 1984* (Sofia, 1984); *Statistická rocenka Ceskoslovenské Socialistické Republiky 1984* (Prague, 1984); *Statistisches Jahrbuch 1984 der Deutschen Demokratischen Republik* (Berlin, 1984); *Statisztikai évkönyv 1983* (Budapest, 1984), *Rocznik statystyczny 1984* (Warsaw, 1984); *Anuarul statistic al Republicii Socialista Romania 1983* (Bucarest, 1984); *Narodnoe khozjajstvo SSR v 1983 p.: Statisticheskij ezhegodnik* (Moscow, 1984) and *Economic Survey of Europe in 1983* (United Nations publication, Sales No. E.84.II.E.1).

[a] All figures are compound rates of growth.

Table VII.11. Ratio of the growth indices of net and gross output in 1976-1980

Country	*Total economy*	*Industry*
Bulgaria	1.01	1.06
Czechoslovakia	1.01	0.94
German Democratic Republic	1.00	1.01
Hungary	1.01	1.03
Poland	...	0.90
Romania	0.99	0.99
USSR	1.00	1.02

Source: See table VII.10.

With regard to the growth of labour productivity in industry, unweighted averages for the period 1961-1970 indicate that roughly one third of the growth of industrial production can be attributed to an increase in employment, with the remaining two thirds being explained by productivity gains. During the first half of the 1970s, the growth impetus attributable to improvements in productivity was significant. Only one quarter of industrial growth in that period can be explained by increases in employment: the remainder was due to productivity. This relationship has continued in recent years. Table VII.12 shows rates of growth in industrial labour productivity throughout the period 1961-1983. In CMEA-Europe, as in other parts of the world, rates of growth in labour productivity have been lower in recent years. In a very broad sense, this development can be attributed to changing demographic conditions, the

Table VII.12. CMEA-Europe: growth rates of industrial labour productivity[a]

(Percentage)

Country	*1961-1970*	*1971-1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1976-1980*	*1981-1983*
Bulgaria	6.9	6.7	6.5	6.6	6.2	4.1	2.7	3.0	3.8	3.0	5.3	3.3
Czechoslovakia	4.5	6.0	5.1	5.1	4.4	3.1	2.7	1.8	0.6	2.3	4.0	1.6
German Democratic Republic	5.7	5.4	5.3	4.5	4.3	4.0	4.4	3.8	2.5	3.5	4.5	3.3
Hungary	4.3	6.3	5.5	6.7	4.9	4.6	0.7	5.0	4.5	3.1	4.5	4.2
Poland	5.0	7.6	8.9	5.1	4.9	2.8	—	−10.6	2.7	7.5	4.3	−0.1
Romania	7.5	6.4	8.4	8.8	6.7	5.7	4.2	2.0	1.4	0.8	6.7	1.3
USSR	5.2	6.0	3.3	4.0	3.6	2.4	2.6	2.5	1.9	3.5	3.3	2.6

Source: See table VII.10.

[a]All figures are compound rates of growth. Labour productivity is measured by gross value of output per employee.

emphasis placed on the development of other economic sectors, and a slowdown of the movement of the labour force from agriculture to industry. Bulgaria and Romania led CMEA-Europe in the growth of industrial labour productivity during the 1960s, and again after 1975. Annual rates of growth in smaller countries of the group fluctuated throughout most of this period. In the USSR, however, they were between 3 and 4 per cent per annum in 1976-1980. They averaged 2.6 per cent in 1981-1983.

Productivity trends in industrial branches

Productivity performance in individual industrial branches can be examined on the basis of CMEA data for State-owned enterprises and co-operatives, classified by industry.[9] Several features of the data should be noted, however. First, as index numbers measuring growth and productivity are expressed at constant prices they do not reflect the impact of changes in relative prices. This applies, in particular, to gains or losses resulting from changes in terms-of-trade, whether generated by external factors or internal, structural ones. Second, labour inputs, when measured by number of employees, do not reflect changes in working hours. Since the work week in all CMEA countries has recently been reduced, adjusting the figures accordingly would reveal somewhat higher productivity growth rates. Finally, in assessing productivity trends, it is important to bear in mind that economic policies, as a rule, follow multiple goals, some of which may involve economic or industrial considerations that take precedence over productivity growth. (Some of these considerations are addressed later in the present chapter.)

[9]Differences between these data and those quoted in the previous section are negligible as far as growth rates are concerned. The share of the "state-owned and co-operatives industry" in the total gross output of industry in 1982 was 100 per cent both in Czechoslovakia and the USSR. Elsewhere in CMEA-Europe, the figure ranged between 97 and 100 per cent.

Table VII.13 gives unweighted average growth rates, by industrial branch,[10] for CMEA-Europe. Figures for individual branches show a comparatively wide variation among countries. A prominent feature is the generally high rate of productivity growth recorded in the engineering and metalworking branch. In Bulgaria, Czechoslovakia, German Democratic Republic and USSR, the growth of labour productivity in this branch has outstripped that of all other branches; and it is among the highest in all other countries. In view of the fact that engineering and metalworking typically accounts for the largest portion of NMP generated within industry, productivity trends in this branch are of special significance. At the other end of the spectrum, energy-related branches (electricity and heating and fuels), followed by food processing, have generally recorded comparatively low rates of productivity growth. Finally, with few exceptions, labour productivity in branches regarded as part of heavy industry (e.g. ferrous and non-ferrous metallurgy, chemicals and rubber, as well as engineering and metalworking) has tended to grow more rapidly than that in branches of light industry.

When trends in labour productivity were examined from a longer-term perspective (1961-1983), rates of growth were found to be most stable in light industries such as textiles, leather and footwear, clothing and food processing. Conversely, trends were most volatile in energy-intensive branches such as fuels, chemicals and rubber, electricity and heating. This characteristic, which is also common to many non-CMEA countries, may be attributed to the relative changes in price and investment patterns which occurred during the 1970s.

Table VII.13. Productivity growth rates for 1976-1983, by branches[a]

Branch	*Bulgaria*	*Czecho-slovakia*	*German Democratic Republic*	*Hungary*	*Poland*	*Romania*	*USSR*
Electricity and heating	0.5	3.1	2.9	4.8	1.4	−2.0	1.9
Fuels	1.6	0.3	3.3	2.1	−0.7	−2.0	0.7
Ferrous metallurgy	4.1	1.6	3.0	1.9	—	5.0	1.0
Non-ferrous metallurgy	...	1.0	4.8	3.4	1.1	2.0	...
Engineering and metal working	7.7	4.9	5.5	4.8	4.2	6.8	5.7
Chemicals and rubber	5.7	3.8	4.0	7.3	3.9	4.0	4.1
Construction materials	5.1	2.7	1.2	3.8	1.2	5.3	1.9
Wood and wood processing	4.6	4.0	2.8	5.3	4.5	5.3	2.3
Pulp and paper	0.1	3.0	3.9	5.6	3.0	4.7	2.1
Glass and china	3.9	4.0	3.7	5.7	7.1	6.4	4.4
Textiles	4.8	3.4	4.4	4.3	2.7	6.9	2.1
Clothing	2.2	3.8	4.7	2.6	2.9	5.7	3.4
Leather and footwear	3.0	2.8	4.2	1.5	3.5	5.7	2.7
Printing	6.3	3.6	1.5	6.6	9.2	3.5	...
Food processing	3.4	2.2	1.1	3.3	0.7	4.8	1.9
Total industry	4.5	3.2	4.1	4.5	2.5	5.5	3.0

Source: See table VII.10.

[a] All figures are compound rates of growth.

[10] Calculated using CMEA statistics and the CMEA classification of branches. The latter differs from the ISIC, *inter alia*, by covering mining and manufacturing activities which contribute to the same final products.

Finally, in the engineering and metal products branch, which in 1983 accounted for roughly 30 per cent of the industrial output of CMEA-Europe, rates of growth in productivity decreased slightly after 1975.

Because engineering and metalworking accounts for 25-40 per cent of total industrial employment in CMEA-Europe, its productivity performance is considered here in more detail. During the period 1961-1975, productivity gains for that branch ranged between 6 and 9 per cent per annum, compared to between 5 and 7 per cent for total industry. In 1976-1983, they averaged 5.7 per cent (ranging from 4 to 7 per cent in individual countries), compared to 3.9 per cent for total industry. The effects of demand and supply are evident among the factors contributing to these trends. In particular, a lower share of investment in construction, coupled with a higher share of equipment in the composition of investment, have served to boost growth in output and productivity. Conversely, the worldwide slowdown in economic growth has had a depressing effect on investment in general. It has brought about a reduction in demand for the machinery and equipment produced by the branch, as well as a reduction in investment in the branch itself.

Technological improvements in engineering and metalworking receive high priority in CMEA-Europe. Progress has been promoted through licensing and know-how agreements as well as through imports of capital goods and efforts to accelerate the pace of technological development. In the German Democratic Republic and the USSR, and more recently in Czechoslovakia, Hungary and other countries, ambitious plans and programmes for automation and the increased use of robots have been introduced. Simultaneously, areas of co-operation in the field of design technology have been strengthened.

Increased specialization is seen as another means of accelerating the growth r 'e of productivity in engineering and metalworking. This approach is expected to reduce bottlenecks in the supply of standard parts and components, improve co-operation among enterprises, and encourage flexibility in management and organization. Finally, intra-CMEA trade in this branch involves more than 1,000 types of products being traded through bilateral or multilateral agreements. Initially, these agreements were concerned with final products, but they have gradually expanded to include intermediate products, parts and components.

With respect to productivity trends, the proposition that productivity increases most when output increases most (known as Verdoorn's law) would seem to apply for CMEA-Europe. Table VII.14 shows the statistical relationship between productivity and other variables. Correlation coefficients calculated from data on the yearly changes in 1976-1983 for all seven countries of

Table VII.14. Correlation coefficients of yearly changes in industrial productivity and other variables, 1976-1983

	Net material product	*Total investment*	*Industrial output*	*Industrial productivity*
Net material product	1	0.7701	0.8523	0.7177
Total investments		1	0.8019	0.7084
Industrial output			1	0.8913
Industrial productivity				1

CMEA-Europe reveal a close relationship between industrial output and industrial productivity.[11] A slightly weaker association can also be observed between annual changes in total investment and industrial output.

While these statistical results do not confirm the line of causation between the variables examined, they do reflect the impact of common factors which explain changes in the variables concerned. This point is better illustrated when the growth of output is considered in terms of its two major components: change in employment and change in labour productivity. Change in output can be seen in the same light as change in productivity, but change in employment must be examined separately. Growth in employment usually has a positive effect on productivity: either directly, through its contribution to the growth of output (thus permitting greater possibilities to achieve economies of scale), or indirectly, through its encouragement of investment and the creation of new places in the work force. National employment policies and the skill levels of new employees play an important role in this regard. The most rapid inflow of workers from other sectors (e.g. agriculture) to industry occurred in the 1950s and 1960s. The rate of growth of industrial employment was somewhat slower in the 1970s. This change in the employment pattern could have been taken to mean that the growth of labour productivity in industry was slower; but employee skills overall had risen, and this should have had a positive effect on productivity growth.

Foreign trade is among those factors which simultaneously influence the growth of productivity and output in CMEA-Europe. Trade within the group itself is vital to each member country. The share of such trade in the total foreign trade of CMEA-Europe varies between 50 and 75 per cent. Based as it is on an iterative process of information exchange involving planned targets and long-term agreements, intra-CMEA trade facilitates the drafting and co-ordination of national plans. Trade with the rest of the world is also important to the group. In the conduct of such trade, the transfer of technology and other economic and political considerations are taken into account. The USSR accounts for about 45 per cent of the total foreign trade of CMEA-Europe. Gauged in terms of total population or NMP, however, foreign trade has much greater significance for the other six member countries.

Foreign trade turnover increased throughout CMEA-Europe from 1961 until 1980, when, as in the other economic groupings, it decelerated. This meant, in some cases, a contraction in the absolute level of trade. In the USSR, however, it meant only a lower rate of growth. Indeed, that country maintained a favourable foreign trade balance throughout the period 1978-1983 when, for CMEA-Europe in general, it was often negative. The expansion of foreign economic relations has provided a major stimulus to the industrial development of CMEA-Europe: technological progress has been made, skills have been improved, and economies of scale have been achieved.

Table VII.15 shows recent growth rates for investment, both in the industrial sector and economy-wide. Changes in the rate have an impact on productivity by altering demand for output as well as the amount of capital available per worker. Generally speaking, industrial investment has grown more rapidly than total investment. (This is particularly true for the smaller

[11] A similar exercise, using data for industrial branches, yielded comparable, but slightly lower, correlation coefficients.

Table VII.15. CMEA-Europe: growth rates of industrial and total investments[a]

(Percentage)

Country	*Industrial investment 1976-1983*	*Total investments 1976-1983*
Bulgaria	5.6	4.3
Czechoslovakia	1.8	1.0
German Democratic Republic	4.1	1.9
Hungary	0.9	0.3
Poland	−9.0	−5.2
Romania	4.8	4.2
USSR	3.8	3.7

Source: See table VII.10.

[a]All figures are compound rates of growth.

countries of CMEA-Europe where it has boosted productivity gains relative to gains in other sectors.) Although investment is important to the acquisition of new technology, improvements or innovations in products and processes can be implemented without it. In CMEA-Europe, planners and other experts pay considerable attention to ensuring the most effective allocation of resources and selection of projects, as well as fast and economic implementation. In the field of R and D, close links exist between fundamental and applied research and practical application. The importance of improvements in product quality and value added is emphasized.

The changes that took place in the structure of industrial production in the late 1970s and early 1980s had only a slight impact on productivity trends. One reason for this was that structural change, rather than being dominated by shifts of an inter-industry nature, consisted primarily of intra-industry adjustments.[12] The direct effect of the structural change on productivity in 1976-1983, moreover, was minor, because the positive and negative shifts in the shares of industrial branches with above-average or below-average growth rates or relative levels of productivity tended to counterbalance each other.

Finally, the modification of industrial development strategies can also contribute to changes in productivity. In the CMEA countries, such modification occurs through planning, management and organization, both at the macro (national) and the micro (enterprise) level. Each country employs such means, but it may have different orientations and priorities. Hungary, Bulgaria and Poland have introduced several reform measures. The USSR plans reforms that go beyond upgrading the organization of work. Czechoslovakia and the German Democratic Republic stress the efficiency of large industrial complexes (Kombinats). Romania has introduced a number of new elements into the management of its enterprises. Although the effects of these steps cannot be quantified, most analysts see them as leading to increased productivity.

In conclusion, some acceleration in productivity growth in CMEA-Europe is anticipated in the short-term, for several reasons. First, growth in four

[12]In particular, an increase in the share of engineering and metalworking, as well as chemicals and rubber, was coupled with a decrease in the share of food processing and textiles.

countries (Czechoslovakia, German Democratic Republic, Poland, USSR) was higher in 1983 than in 1982 and forecast to rise again in 1984. Second, the external financial position of the CMEA countries has improved in recent years, thus reducing constraints on growth stemming from balance-of-payments and liquidity problems. Third, the recovery that would seem to be taking place in parts of the world economy should boost exports from CMEA countries. Fourth, the slowdown in the growth of human resources in several CMEA countries will mean that increases in productivity will assume added significance in the future. Fifth, improvements being made in the CMEA's system of economic guidance and co-operation should lead to accelerated growth in productivity. Finally, the five-year plans (1986-1990) elaborated for each country stress the intensification of production processes designed to lead to higher levels of labour productivity as well as savings in materials and energy.

APPENDIX

MEASURING PRODUCTIVITY

Labour productivity is defined as production per unit of labour input. The most appropriate measures to use in studying it would be either net value added at factor cost or the contribution to net domestic product at factor cost. These measures avoid the distortions that might arise from different ways of treating indirect taxes, subsidies and the depreciation of fixed assets. Depreciation, however, is an artificial component which many countries, especially developing ones, find it difficult to estimate realistically—particularly when constant prices are being used. In view of this situation, a gross concept of production, that is, the contribution of the branch or industry to GDP, was used in the present analysis.

Like production, labour inputs can also be measured in several ways. The best and most consistent measure to use in estimating operative productivity is the average number of hours worked. Again, however, some countries do not record such data. Indeed, some do not even keep data on the average number of days worked. Thus, the only measures of labour input that are readily available for many countries are: average number of persons engaged and average number of employees. The first of these measures is to be preferred as it provides a more realistic estimate of productivity in manufacturing at the household and cottage levels. As paid workers constitute only a small proportion of the actual labour force involved in such manufacturing, labour inputs would be underestimated if they were based on the average number of employees. In addition to these considerations, the data compiled by various countries differ in terms of concept, classification and coverage of establishment, though, by and large, internationally accepted definitions are followed. Some of the variations in country reporting practices are reviewed below.

Coverage of small-scale establishments

In compiling industrial statistics, many countries apply a cut-off point—a level, defined in terms of employment, gross output or physical capital, below which establishments are not counted. The cut-off point may differ from one country to another and it may change in the course of time. For countries where the cut-off points for value added and employment data differ, realistic estimates of productivity cannot be computed.[a]

[a]For this reason, Belgium, Denmark, Dominican Republic, Ivory Coast, Jamaica, Mexico and Peru are not covered in the present analysis.

Distortions arising from the fact that a country may alter its cut-off points in different years can, however, be dealt with by dividing the period studied into two or more sub-periods with consistent cut-off points. In the present analysis, this has been done in the case of Australia, Federal Republic of Germany, Indonesia and Tunisia. The problem of data availability was not completely solved by these adjustments, however. In some instances, simply for want of data on value added or employment, estimates of productivity could not be made.[b] The 52 countries (33 developing countries and 19 developed market economies) selected for the analysis are listed in table A.1, together with a brief description of their cut-off points.

Table A.1. Initial sample of countries selected for productivity study

Country or area	*Period*	*Cut-off point*
	Developing countries	
Argentina	1970-1981	All establishments
Bangladesh	1970-1979	Registered establishments with 10 or more workers
Bolivia	1975-1979	Enterprises with capital of 50,000 pesos or more
Brazil	1975-1978	5 or more persons engaged
Chile	1971-1979	50 or more persons engaged
Colombia	1971-1980	10 or more persons engaged
Cyprus	1974-1980	All establishments
Ecuador	1970-1979	7 or more persons engaged
Egypt	1970-1977	10 or more persons engaged
El Salvador	1970-1978	5 or more persons engaged
Ethiopia	1971-1981	10 or more persons engaged
Fiji	1970-1979	All establishments employing paid workers
Ghana	1970-1975	30 or more persons engaged
Guatemala	1971-1975	5 or more persons engaged
Honduras	1971-1975	Registered establishments with 5 or more persons engaged
Hong Kong	1973-1981	All establishments
India	1970-1978	10 or more workers using power or 20 or more workers not using power
Indonesia	1970-1980	10 or more persons engaged (1970-1974), 20 or more persons engaged (1975-1980)
Iraq	1970-1975	10 or more employees
Kenya	1970-1980	50 or more employees
Madagascar	1970-1978	All establishments
Nicaragua	1973-1977	All establishments
Nigeria	1970-1975	10 or more persons engaged
Panama	1970-1979	5 or more persons engaged
Republic of Korea	1970-1980	5 or more persons engaged
Singapore	1970-1981	10 or more persons engaged
Syrian Arab Republic	1970-1980	All establishments
Tunisia	1970-1980	5 or more employees (1970-1976), 10 or more employees (1977-1980)
Turkey	1970-1979	All public and private enterprises with 10 or more persons engaged
Uruguay	1970-1979	All establishments
Venezuela	1970-1979	5 or more persons engaged
Zambia	1970-1975	1 or more employees
Zimbabwe	1970-1980	All establishments

[b] In some cases, data for two or more industrial branches were reported as one, combined, observation. When data for value added and employment could not be matched, the branches concerned were omitted from the study.

Table A.1 *(continued)*

Country or area	*Period*	*Cut-off point*
	Developed market economies	
Australia	1970-1981	All establishments (1970-1974), 4 or more employees (1975-1981)
Austria	1970-1980	20 or more persons engaged
Finland	1970-1981	5 or more persons engaged
France	1970-1981	All establishments
Germany, Federal Republic of	1970-1981	10 or more persons engaged (1970-1976), 20 or more persons engaged (1977-1981)
Greece	1970-1977	10 or more persons engaged (1970-1973, 1976-1977), all establishments (1974-1975)
Israel	1970-1981	5 or more persons engaged
Italy	1970-1980	20 or more persons engaged
Japan	1970-1980	All establishments
Netherlands	1970-1981	10 or more employees
New Zealand	1970-1980	2 or more persons engaged
Norway	1970-1981	5 or more persons engaged
South Africa	1972-1979	All private establishments
Spain	1970-1977	All establishments
Sweden	1970-1981	5 or more persons engaged
Switzerland	1970-1981	6 or more workers
United Kingdom	1970-1980	All establishments
United States	1970-1980	1 or more employees
Yugoslavia	1970-1980	All enterprises in socialist sector

Value added

Data on value added—in current prices and expressed in national currencies—are compiled by the Statistical Office of the United Nations. For studies concerned with trends over a period of time, however, it is necessary to express value added in constant prices Moreover, international comparisons of value added data should be carried out using a common currency, such as the United States dollar. The UNIDO data base used in this analysis includes an index of industrial production (1975 = 100) compiled at the 3-digit level of the ISIC. The first step in developing the data was to derive a set of base year weights for 1975 from the original data To obtain 3-digit-level data for value added in constant prices for the entire period 1970-1981, these weights were used in conjunction with the indexes of industrial production. The implicit assumption was made that the basic data used in computing the production index were in conformity with the employment data compiled by the Statistical Office. In most cases, the cut-off point for the collection of current industrial statistics is identical to that for the coverage of establishments which furnish the data used in developing the production index. In some countries, however, the cut-off point for current industrial statistics is based on range of employment. In India, for example, it is 10 or more persons engaged, and using power—or 20 or more, and not using power. By contrast, the data used in developing the index are derived from figures for establishments with plant and machinery valued at one million rupees or more.[c] In the absence of additional information, it is difficult to determine the extent to which the two sets of data (or groups of establishments) will experience similar trends over time. For obvious reasons, the assumption should be realistic for most countries and industrial branches; it should not be expected to vitiate the estimates of productivity.

[c] Recently revised to 2 million.

Differences in value added concepts should also be noted. Some countries use a "census value added" concept, while others use a "national accounts" one (i.e. the contribution of the manufacturing sector to net or gross domestic product). In either case, value added may be expressed in factor or in producers' prices, where the difference between the two valuations results from the treatment of indirect taxes and subsidies. Similarly, some countries may ignore work in progress when computing value added while others may take account of it. Such variations in country practices make international comparisons difficult. Ideally, the figures should be uniformly adjusted to a national accounting concept of net value added, expressed at factor prices. In the present case, however, the information necessary to make such an adjustment was not available. That notwithstanding, it was possible to minimize certain statistical shortcomings resulting from the differences in valuation practices. For example, the estimates of value added in constant prices were obtained by using the 1975 base weights in conjunction with production indexes for 1970-1981. The effects of different ways of treating depreciation, indirect taxes and subsidies were greatly reduced as the estimates covered a period of 11 years. Even in highly specific types of productivity studies (e.g. inter-branch), or in international studies covering a particular year, the results are not likely to be too far off the mark when this method is used.

Employment

It has been suggested earlier that "number of persons engaged" is a better indicator of labour inputs than "number of employees". For the present analysis, however, the UNIDO statisticians have focused primarily on measuring the "number of employees" and on making refinements and adjustments, as necessary, to the data for this variable. The reason for this is that an examination of the data for the two variables revealed that because of the varying cut-off points used by the countries concerned, the differences between the two were not significant, even at the 3-digit level of ISIC. Thus, for the computation of productivity estimates, "number of employees" data were used whenever data for the alternative variable were not available or were incomplete. The nature of the data used is seen from table A.2. Employment data have other drawbacks

Table A.2. Data used to compute productivity

Country	*Period selected for study*	*Basis of employment*	*Valuation concept*	*Cut-off point*
		Developing countries		
Argentina	1970-1981	EM	NA	All establishments
Chile	1971-1979	EM	PP	50 or more PE
Cyprus	1974-1980	EM	PP	All establishments
Ghana	1970-1975	PE	PP	30 or more PE
Guatemala	1971-1975	PE	PP	5 or more PE
Honduras	1971-1975	PE	PP	Registered establishments with 5 or more PE
India	1970-1978	PE	FV	10 or more PE using power or 20 or more PE not using power
Iraq	1970-1975	EM[a]	FV	10 or more EM
Kenya	1970-1980	PE	FV	50 or more EM
Nicaragua	1973-1977	EM	PP	All establishments
Nigeria	1970-1975	EM	PP	10 or more PE
Panama	1970-1979	EM	PP	5 or more PE
Turkey	1970-1979	EM[b]	PP	All public and private enterprises with 10 or more PE
Zambia	1970-1975	EM	PP	1 or more EM
Zimbabwe	1970-1980	EM	FV	All establishments

Table A.2 *(continued)*

Country	*Period selected for study*	*Basis of employment*	*Valuation concept*	*Cut-off point*
		Developed market economies		
Australia	1975-1981	EM	FV	4 or more EM
Finland	1970-1981	EM	FV	5 or more PE
France	1970-1981	EM	PP	All establishments
Germany, Federal Republic of	1970-1976	EM	PP	10 or more PE
Israel	1970-1981	EM	PP	5 or more PE
Italy	1970-1980	EM	NA	20 or more PE
Netherlands	1970-1981	EM	FV	10 or more EM
Norway	1970-1981	EM	NA	5 or more PE
United States	1970-1980	EM	FV	1 or more EM
Yugoslavia	1970-1980	PE	NA	All enterprises in socialist sector

Key: EM = Employees
PE = Persons engaged
FV = Factor values
PP = Producers' prices
NA = Information regarding valuation concept not available

[a] PE, 1976.

[b] PE, 1977 + 1978.

which had also to be borne in mind. These concern the definitions used by different countries when collecting employment statistics. Some of these definitions are given below.

1. *Employment* refers to a single day (generally the last one), or a single pay period, in a reference year. There are slight variations on this. Some countries, for example, have chosen the last day or last pay period in other months of the year. Countries and areas belonging to this category include: Austria, Belgium, Brazil, Colombia, Ecuador, El Salvador, Hong Kong, Ireland, Japan, Madagascar, Malaysia, New Zealand, Portugal, Singapore, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tunisia and United Kingdom.

It is doubtful whether estimates of productivity based on value added for the whole year and employment for a single day or pay period can lend themselves to useful analysis, particularly when they relate to industrial branches that have a strong seasonal character in their patterns of production and employment. In other industrial branches, such estimates may, at best, merely indicate the direction that trends are taking. In these instances, erratic fluctuations must be eliminated by computing average productivity over a suitable range of years.

2. *Employment* refers to an average of a series of observations spanning an entire reference year. Here, again, practices vary. India, for example, gathers data on average daily employment and on this basis computes the annual average. Other countries compile employment figures for a single day or a single pay period during each month of the year, and from these derive an annual figure. Such countries include Argentina, Australia, Canada, Cyprus, Finland, France, Germany, Federal Republic of, Ghana, Greece, Guyana, India, Italy, Mexico, Netherlands, Nicaragua, Norway, Republic of Korea, Turkey, Yugoslavia and Zimbabwe. These countries provide the most useful data for computing productivity.

3. *Annual employment* refers to an average figure derived on the basis of a single day or a single pay period in each quarter of a reference year. Countries using this method include: Barbados, Chile, Denmark, Israel, Nigeria, Panama, Philippines and United States. These countries' estimates of average annual employment, though not ideal, can be used in computing productivity.[d]

4. *Average employment* refers to an average worked out by a country using its own specific method. Kenya, for example, records employment on the first and the last day of a reference year and the annual figure is taken to be the average of the two. In Zambia, annual average employment is based on figures for the last day of June and the last day of December.

5. *Scope of employment* also refers to an average figure. In calculating it, some countries include temporary employees, while others do not—in the same way that some countries treat apprentices as employees while others do not. Some countries, moreover, restrict the scope of employment by excluding unpaid family workers from data on "number of persons engaged". It would be by no means impossible to adjust the data to take account of these variations, but in any event it is unlikely that the variations would mean significant distortions in the overall figures.

After careful consideration of the various methods used to compute figures for annual average employment, the researchers concerned decided to confine the analysis to the following 25 countries: Argentina, Australia, Chile, Cyprus, Finland, France, Germany, Federal Republic of, Ghana, Guatemala, Honduras, India, Iraq, Israel, Italy, Kenya, Netherlands, Nicaragua, Nigeria, Norway, Panama, Turkey, United States, Yugoslavia, Zambia and Zimbabwe.

[d]For the purposes of the analysis which is the subject of the present chapter, Guatemala and Honduras are regarded as belonging to this group. Those countries' employment figures refer to averages during a reference year, but the basis of averaging is not known. It is assumed that their annual averages have been worked out on the basis of four quarterly figures.

VIII

Skill intensity in manufacturing: trends in developed and developing countries

THE possibility that new technologies might demand high levels of skill in the manufacture of products hitherto manufactured using unskilled labour is a cause of concern among producers in the developing countries, as such a development could erode the comparative advantage they currently enjoy in this respect. It is against this backdrop that, in the present chapter, the skill intensity of the manufacturing industries is examined. Recent literature concerning skill intensity and its significance in terms of trade, growth and development is surveyed. Methods of measuring skill intensity are then considered, in light of the quality of the relevant data available, and a statistical comparison is made of skill intensity in 26 industrial branches, in developed and developing countries, in two time frames (1970-1971 and 1979-1980). The chapter concludes with a review of industries that are either contracting or expanding, and with an analysis of the most detailed level of industrial data available: ISIC 4-digit.

No major shifts in factor requirements were noted during the periods considered. In the developed market economies, the fastest-growing industries tended to be relatively intensive in their requirements of skill and physical capital (plant infrastructure, including machinery). In the developing countries, the opposite was the case. Although the comparison shows a relatively stable picture, a close look at the experiences of individual industries reveals notable differences. These differences suggest the need for careful monitoring of the technological changes that may alter factor (particularly skill) requirements in production.

Skill intensity in trade, growth and development

Many studies have demonstrated that skill intensity is often a more determining factor in trade between developing and developed countries than physical capital. This is particularly true in the case of trade in manufactures, which implies that skills are a more scarce and less mobile factor of production than physical capital.[1] Further support for this proposition is found in studies

[1]See, for example, W. H. Branson and N. Monoyios, "Factor inputs in U.S. trade", *Journal of International Economics*, vol. 7, 1977, pp. 111-131; H. Forstner, "The changing pattern of international trade in manufactures: a logit analysis", *Weltwirtschaftliches Archiv*, vol. 120, 1984, pp. 1-17; S. Hirsch, "Capital or technology? Confronting the neo-factor proportions and neo-technology accounts of international trade", *Weltwirtschaftliches Archiv*, vol. 110, 1974, pp. 535-563; D. B. Keesing, "Labor skills and comparative advantage", *American Economic Review*, vol. 56, 1966, Papers and Proceedings, pp. 249-258, and "Labor skills and the structure of trade in

which show that expansion in physical capital and in the labour force explain only a portion of total growth, leaving a substantial residual to be attributed to technological advancement and the intensification of skill.[2]

Given the existing pattern of comparative advantage, the developing countries, which are relatively ill-endowed in terms of skills, might be expected to concentrate their efforts on the production and export of manufactures requiring only modest inputs of skilled labour. If, however, those countries are to diversify the composition of their manufacturing production and exports, and benefit from technological innovations, they must build up their endowments of human skills. Most technological innovations originate in developed countries where the cost of unskilled labour is relatively high, but where physical capital and skilled labour are abundant. The innovations therefore are mainly physical-capital intensive and skill intensive. On the whole, they have a labour-saving bias, that is, they rely less on unskilled labour and more on physical capital supported by a small, highly skilled, work force.[3] In some production processes, the scope for this substitution can be so great as to cause factor intensity reversals. This means that production processes which hitherto required only heavy inputs of unskilled labour may be transformed into processes that are relatively intensive in their use of both physical capital and skills.

The manufacture of products using "old" labour-intensive technologies is still feasible in many cases—particularly in heavily populated, low-wage developing countries—and firms operating along these lines can often maintain their international competitiveness. Nevertheless, the productivity differential resulting from technological innovation can also be of such magnitude that those firms will lose their comparative advantage to firms in high-wage countries using new technology.[4] In this context, studies of relative factor intensity have not revealed significant differences between developed and developing countries. On the whole, the same industries are found to be either physical-capital intensive or skill intensive in both groupings.[5]

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manufactures", *The Open Economy*, P. B. Kenen and R. Lawrence, eds. (New York, Columbia University Press, 1968), pp. 3-18; P. B. Kenen, "Skills, human capital and comparative advantage", *Education, Income and Human Capital*, W. L. Hansen, ed., (New York, Columbia University Press, 1970), pp. 195-230; H. Waehrer, "Wage rates, labor skills, and United States foreign trade", *The Open Economy*, P. B. Kenan and R. Lawrence, eds. (New York, Columbia University Press, 1968).

[2]See E. F. Denison, *Accounting for United States Economic Growth 1929-1969* (Washington, D.C., The Brookings Institution, 1963) and R. Solow, "Technical change and the aggregate production function", *Review of Economics and Statistics*, vol. 39, 1957, pp. 312-320.

[3]See, for example, M. Merhav, *Technological Dependence, Monopoly and Growth* (Oxford, Pergamon Press, 1969).

[4]Furthermore, even if an innovation in the developed countries does not erode the comparative advantage of the developing countries in a certain product, it gives the former countries an edge in absolute advantage, i.e. they obtain the same output for less input.

[5]An early comparison showed the relative factor intensities of the United States, the United Kingdom, Japan and India to be close. See H. B. Lary, *Imports of Manufactures from Less Developed Countries* (New York, Columbia University Press, 1968). When the original data for the United States (which pertained to 1965) were compared with data for 1976, no major changes in relative factor intensity were found. See H. D. Tuong and A. Yeats, "On factor proportions as a guide to the future composition of developing country exports", *Journal of Development Economics*, vol. 7, 1980, pp. 521-539.

Despite this finding, three recent developments may radically alter factor usage. The first is the emergence of a number of developing countries as major exporters of a variety of manufactures, thereby exerting significant competitive pressure on world markets. The pressure is probably greatest in the case of products which of tradition are labour-intensive in their manufacture. The switch to labour-saving innovation has been hastened by the fact that wages paid to unskilled labour are increasing rapidly in most of the developed market economies. The second development is the rise in energy prices, which has made numerous technical innovations economically feasible and led to major changes in production processes. The third development is the improvement that has taken place in information and control systems and in the design of industrial robots following the revolution in semi-conductor technology.

The introduction of radically new techniques with concomitant implications for factor requirements may not extend beyond a limited number of product lines, but other stimuli-response patterns can also lead to shifts. Changes in factor usage in a given industry, for instance, may reflect changes in the product mix. Or, as a response to increased international competition, countries may trim their product lines or areas of specialization and concentrate exclusively on those in which they enjoy a comparative advantage.[6] In any event, when major factor-intensity changes occur in certain industries, the implications for the developing countries are significant.

In the most rudimentary sense, a country's comparative advantage shifts towards greater utilization of physical capital and/or skills when the rate of net investment exceeds the growth of the work force (leaving aside for the moment specific industries' production levels, factor content or commodity trade composition). Prior to investment, capital may be regarded as a malleable, homogeneous input, since investible funds can be used for the production (or import) of capital goods or for the upgrading of skills. Once the investment is made, however, physical capital is no longer malleable but fixed and sector-specific.

As with rates of investment in different sectors, the proportions of investment allocated to physical capital and the development of skills help to determine the future pattern of comparative advantage. In order to build up a diversified manufacturing sector, the developing countries must acquire diversified skills. Even when capital goods embodying new technologies are imported, lack of the skills needed to use or operate them efficiently can constitute a serious bottleneck. It might not be realistic in the case of most developing countries to aspire to the production and export of a wide range of skill-intensive goods, but this does not preclude the need for them to acquire sophisticated skills in specific fields of manufacturing.

By planning investment, countries can influence their future pattern of comparative advantage, within a range determined by their own productive capacities and their ability to raise investible funds. At the same time—and probably more important—they must formulate far-reaching policies for manpower planning, including formal education and training. In this context,

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[6] It is held, for example, that the developed market economies, faced with strong competition from the developing countries, have managed to regain comparative advantage in the manufacture of certain textile products. Although this claim is not well documented, there appears to be evidence of increased specialization, automatization and outward processing.

monitoring the technological innovations that can alter factor requirements, and in particular skill requirements, is seen to be essential. Moreover, a clear awareness of changes in production technology is as valuable as market research when it comes to avoiding costly mistakes in investment (e.g. undertaking unwieldy projects with long gestation periods).

Measuring skill intensity

Basically, the income or value added generated by any productive activity can be attributed to the physical capital and labour force employed. Since labour inputs represent both rudimentary labour services and the application of special skills, the share of wages in value added may be regarded as consisting of two components: compensation for unskilled labour and returns to skills acquired through education and training. Expressed in other terms, the difference between the wage of an unskilled labourer and that of a skilled labourer represents returns to skills acquired. To the extent, therefore, that differences in wage levels reflect differences in productive skill levels, an industry paying a relatively high wage may be regarded as one that is relatively skill intensive. Similarly, except in the absence of excessive profits, the relative level of the non-wage component of value added per employee reflects an industry's intensity in physical capital. Finally, total value added per employee, the standard measure of productivity, can be interpreted as a combined measure of the usage of both physical capital and skills.[7]

Measuring factor intensity according to each input's contribution to total value added has several shortcomings.[8] As in the case of differences in skill requirements, the varying degrees of hardship associated with different occupations affect wage levels. The most prominent distortions, however, may stem from non-competitive market characteristics. When excessive profits exist for an unduly long period, over-estimation of the contribution of physical capital can result. Again, employees in some industries have greater bargaining power than those in other industries; the result is relative wage levels that may not reflect differences in skill levels. Institutional differences among industries and countries can also limit the usefulness of the measure. Finally, international comparisons of relative factor intensity in different industries may suffer from problems that are mainly statistical in nature. These may arise from differences in the product mixes of specific industries in different countries and can be pronounced when the aggregation level of industry data is high. Despite these shortcomings, a number of empirical studies have found that wages per

[7]Use of this aggregation in economic analysis was first suggested by J. Bhagwati "The pure theory of international trade", *Economic Journal*, vol. 74, 1964, pp. 17-26, and P. B. Kenen in "Nature, capital and trade", *Journal of Political Economy*, vol. 73, 1965, pp. 437-470. The practice was followed in several empirical studies. More recently, the conditions under which factors of production can be aggregated in economic analysis have been investigated by E. R. Berndt and L. R. Christensen, "The internal structure of functional relationships: separability, substitution and aggregation", *Review of Economic Studies*, vol. 40, 1973, pp. 403-410.

[8]These shortcomings are treated in greater detail in Lary, *op. cit.*, a comprehensive study which uses this measure of factor intensity.

employee provide a reasonably accurate proxy for the skill intensity of industries in many countries.[9]

Several points should be noted with regard to data sources and statistical issues. For one, although skill intensity was analysed at the industrial branch level, two branches—professional and scientific equipment; photographic and optical goods and other manufactures—were excluded from consideration because their product mixes tend to differ significantly from country to country. The countries included in the analysis were limited to 18. These included 12 developed market economies and 6 developing countries for which data on value added, wages and number of employees were available for 1970 or 1971, and 1979 or 1980, and which were active in 26 industrial branches examined (see table VIII.1).[10]

The main variables in the analysis were: *(a)* wages per employee, used as a measure of skill intensity; *(b)* non-wage value added per employee, regarded as a measure of physical capital intensity; and *(c)* total value added per employee. Whenever data were available, two-year averages (1970-1971 and 1979-1980) were calculated in order to reduce the impact of cyclical factors.[11] The resultant measures (or ratios) for each industrial branch were then converted into industry rankings for each country. Finally, unweighted averages of rankings for the developed market economies and the developing countries were derived.[12]

Comparing skill intensity

The figure summarizes the results of a comparison of average factor intensity rankings in the developing countries and the developed market economies.[13] The comparisons are made in terms of intensity measures of skill, physical capital and both, for 1970-1971 and 1979-1980. The three are found to be closely associated in each instance. The similarities among the rankings for countries in the same economic grouping, between developing countries and developed market economies, and between the two time frames suggest that a uniform pattern of factor usage prevails within the manufacturing sector. That impression must, however, be qualified, in view of the strong correlation that

[9]See, for example, Lary, *op. cit.*

[10]A number of developing countries had to be excluded also because their employment figures pertained to "persons engaged", which includes unpaid family members and active owners. Data for the 18 countries covered contain some statistical discrepancies, namely, differences in the definition of minimum size of establishment and value added (see table VIII.1). While most developed market economies measure value added at factor value (which excludes indirect taxes but includes subsidies to production), most developing countries use producers' prices (which include indirect taxes but exclude subsidies). Data for Norway met the criteria for inclusion in the country sample, but had to be omitted because of an apparent change in the valuation concept used between the two periods under consideration.

[11]The ratios were first calculated for individual years; averages for 1970-1971 and 1979-1980 were then determined.

[12]In establishing group averages, transformation of national data into rankings circumvents the problem of exchange-rate conversions.

[13]Using a standard measure of comparison: the Spearman rank order correlation coefficient.

Table VIII.1. Data coverage of 26 industrial branches in 18 countries, using as variables value added, wages and number of employees[a]

Country	*Minimum size of manufacturing establishment, by number of employees*		*Valuation concept*
	1970-1971	*1979-1980*	
Developed market economies			
Australia	1	4	Factor values
Austria	1 (20)[b]	1 (20)[b]	Producers' prices
Canada	1	1	Factor values
Denmark	6[c]	6[d]	Factor values
Finland	5	5	Factor values
Germany, Federal Republic of	10[e]	20[f]	Producers' prices
Italy	20	20	Unspecified
Japan	1	1	Unspecified
Netherlands	1	1[g]	Factor values
Sweden	5	5	Factor values
United Kingdom	1	1	Factor values
United States	1	1	Factor values
Developing countries			
Chile	10 (50)[b]	10 (50)[b, g]	Producers' prices
Colombia	5 (10)[b, h]	5 (10)[b]	Producers' prices
Malaysia	5	5[i]	Factor values
Philippines	5	1[g]	Producers' prices
Republic of Korea	5	5	Producers' prices
Turkey	1 (10)[b]	1 (10)[b]	Producers' prices

Source: UNIDO data base, with information supplied by the Statistical Office of the United Nations Secretariat and estimates by the UNIDO secretariat.

[a]The countries are all those for which value added, wages and number of employees were reported—or could be estimated—for all 26 3-digit ISIC branches in the time-frames considered. Norway met these criteria, but was excluded because of an apparent change in the valuation concept used between the two periods.

[b]Adjustments made by the UNIDO secretariat to increase the coverage of data; figures in parentheses represent the minimum size of establishment covered in the national source.

[c]Data for 1970 include some small establishments not covered in 1971.

[d]For 1979-1980, value added figures refer only to establishments with 20 or more employees.

[e]Data for 1970-1971 exclude handicraft industries and non-industrial activities.

[f]Data pertain only to 1979 and include handicraft industries and non-industrial activities.

[g]Data for 1979 only.

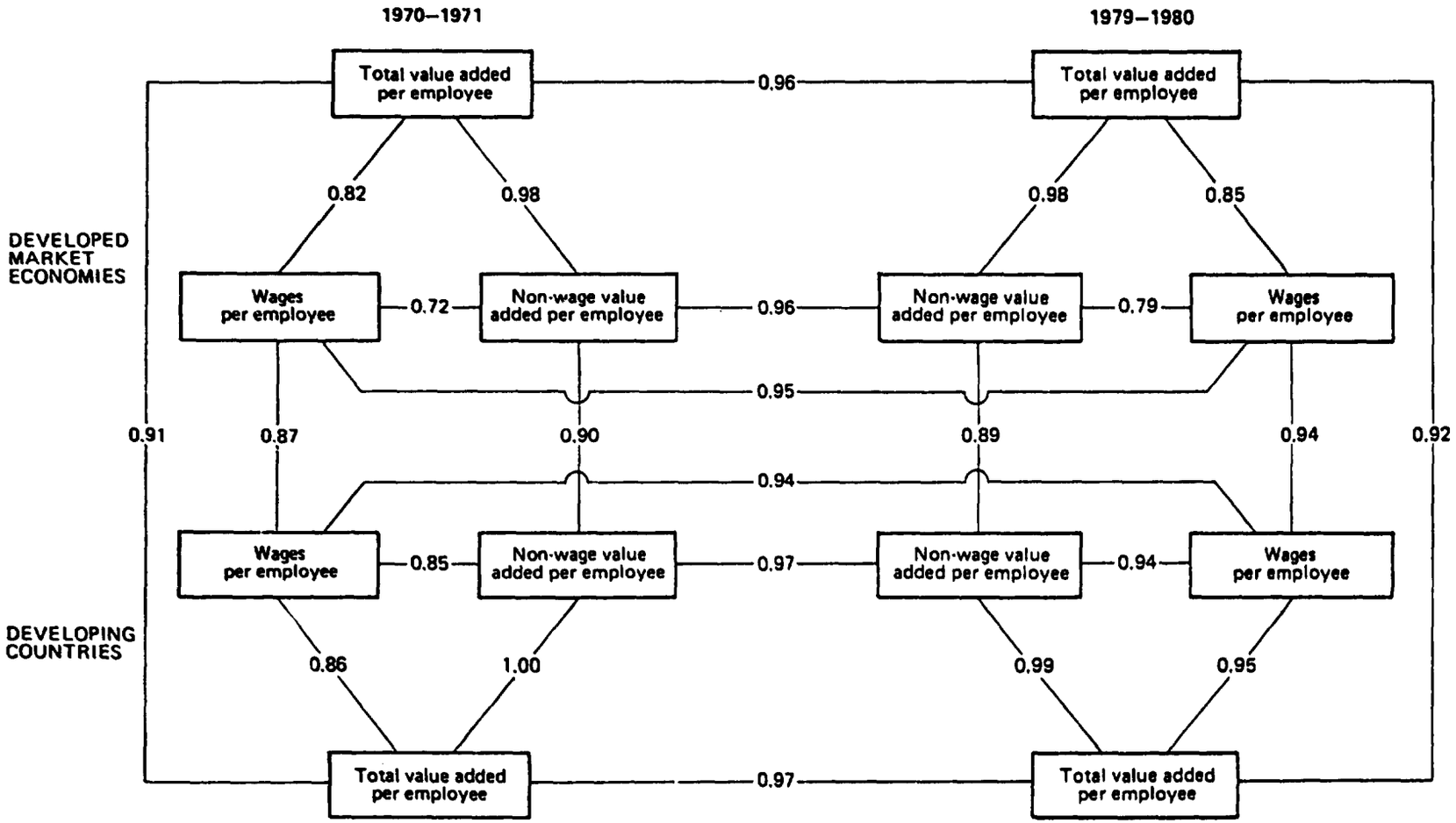
[h]Data for 1970 (national sources considered) cover establishments with 5 or more employees.

[i]Data are for 1979 only and cover some establishments with less than 5 employees.

exists between the measures of skill intensity and physical capital intensity (a mixture of two phenomena: an economic fact and an effect related to the inaccuracy of the proxies used).

In 1970-1971 the correspondence in industry rankings according to skill intensity in the two groups of countries was very close: a rank correlation coefficient of 0.87. By 1979-1980, it had become even closer: 0.94. Table VIII.2 shows the position of the 26 industrial branches surveyed, by decreasing level of skill intensity, at the beginning of the 1970s. It also shows the average rankings and the coefficient of variation (standard deviation divided by the mean) within

Spearman rank order correlation coefficients between average rankings (in value added, wages and non-wage value added per employee) in 26 industrial branches in 12 developed market economies and 6 developing countries, 1970-1971 and 1979-1980[a]



Source: UNIDO data base. See also table VIII.1.

[a]The 26 branches cover all manufacturing at the ISIC 3-digit level, with the exception of ISIC 385 and 390. The 18 countries are listed in table VIII.1.

Table VIII.2 Twenty-six industrial branches ranked by decreasing level of skill intensity in 12 developed market economies and 6 developing countries, 1970-1971[a]

	Developed market economies			*Developing countries*					
	ISIC	*Industrial branch*	*Average ranking (coefficient of variation)*	*ISIC*	*Industrial branch*	*Average ranking (coefficient of variation)*	*ISIC*	*Industrial branch*	*Decreasing order of difference in average ranking[b]*
1	353	Petroleum refineries	1.08 (0.27)	353	Petroleum refineries	1.00 (0.00)	361	Pottery, china and earthenware	7.42
2	351	Industrial chemicals	3.67 (0.39)	351	Industrial chemicals	4.17 (0.67)	352	Other chemicals	3.92
3	371	Iron and steel	5.75 (0.56)	352	Other chemicals	4.67 (0.44)	314	Tobacco	3.17
4	372	Non-ferrous metals	7.00 (0.50)	372	Non-ferrous metals	5.00 (0.74)	321	Textiles	3.00
5	384	Transport equipment	7.17 (0.53)	371	Iron and steel	6.00 (0.38)	372	Non-ferrous metals	2.00
6	342	Printing and publishing	7.67 (0.70)	342	Printing and publishing	8.50 (0.34)	355	Rubber products	1.92
7	352	Other chemicals	8.58 (0.50)	341	Paper and products	9.17 (0.57)	341	Paper and products	1.92
8	382	Machinery, excluding electrical	8.83 (0.17)	313	Beverages	10.17 (0.55)	324	Footwear, excluding rubber or plastic	1.50
9	369	Other non-metallic mineral products	9.58 (0.41)	384	Transport equipment	10.33 (0.44)	383	Electrical machinery	1.50
10	313	Beverages	10.50 (0.44)	314	Tobacco	10.33 (0.70)	362	Glass and products	1.25
11	354	Miscellaneous products of petroleum and coal	10.92 (0.77)	362	Glass and products	11.50 (0.38)	356	Plastic products	1.08
12	341	Paper and products	11.08 (0.38)	383	Electrical machinery	12.17 (0.14)	322	Wearing apparel, excluding footwear	0.58

13	362	Glass and products	12.75 (0.35)	355	Rubber products	12.67 (0.36)	313	Beverages	0.33
14	314	Tobacco	13.50 (0.47)	361	Pottery, china and earthenware	13.33 (0.63)	353	Petroleum refineries	0.08
15	381	Fabricated metal products	13.50 (0.19)	382	Machinery, excluding electrical	13.67 (0.28)	323	Leather products	−0.08
16	383	Electrical machinery	13.67 (0.25)	369	Other non-metallic mineral products	15.00 (0.22)	371	Iron and steel	−0.25
17	355	Rubber products	14.58 (0.28)	354	Miscellaneous products of petroleum and coal	15.17 (0.50)	351	Industrial chemicals	−0.50
18	311/2	Food products	17.92 (0.18)	381	Fabricated metal products	17.00 (0.17)	342	Printing and publishing	−0.83
19	331	Wood products, excluding furniture	19.17 (0.23)	356	Plastic products	18.17 (0.23)	311/2	Food products	−1.58
20	356	Plastic products	19.25 (0.08)	311/2	Food products	19.50 (0.12)	331	Wood products, excluding furniture	−1.67
21	332	Furniture, excluding metal	20.58 (0.15)	321	Textiles	19.83 (0.21)	384	Transport equipment	−3.17
22	361	Pottery, china and earthenware	20.75 (0.13)	331	Wood products, excluding furniture	20.83 (0.18)	381	Fabricated metal products	−3.50
23	323	Leather products	21.08 (0.26)	323	Leather products	21.17 (0.14)	332	Furniture, excluding metal	−3.58
24	321	Textiles	22.83 (0.06)	324	Footwear, excluding rubber or plastic	22.50 (0.12)	354	Miscellaneous products of petroleum and coal	−4.25
25	324	Footwear, excluding rubber or plastic	24.00 (0.09)	332	Furniture, excluding metal	24.17 (0.07)	382	Machinery, excluding electrical	−4.83
26	322	Wearing apparel, excluding footwear	25.58 (0.04)	322	Wearing apparel, excluding footwear	25.00 (0.04)	369	Other non-metallic mineral products	−5.42

Source: UNIDO data base. See also table VIII.1

[a]Skill intensity is measured by wages per employee. The 18 countries are listed in table VIII.1.

[b]A positive/negative difference implies that the industrial branch was relatively less/more skill-intensive in the developed market economies.

each country group, as well as the differences in average rankings between the two groups. Although the order of ranking differs slightly, the branches highest in skill intensity are almost identical in the two groups.[14] The third column in table VIII.2 shows the differences in average skill intensity rankings between the two groups. A positive difference implies that the industry is relatively less skill intensive in the developed market economies, and vice versa.[15]

Table VIII.3 provides similar comparisons for 1979-1980. Table VIII.4 shows changes between the two time-frames. The "difference" columns in that table show changes in average rankings of skill intensity for both groups of countries. The column on the extreme right shows the differences between the two groups. In the developed market economies, five industrial branches became relatively more skill intensive over time, while seven became less skill intensive.[16] In the developing countries, relative shifts in skill intensity were more striking.[17] Finally, the right-hand column of table VIII.4 shows the disparity that developed in relative skill intensity in the two groups between 1970-1971 and 1979-1980. Four branches (pottery, china and earthenware; tobacco products; paper and products; and footwear) registered an increase in skill intensity in the developed market economies and a decrease in the developing countries. Several other branches moved in the opposite direction.[18]

Since these patterns are based on unweighted industrial rankings in individual countries, uniformity in ranking, i.e. the degree of dispersion within the two groups of countries, is essential. The coefficients of variation in rankings (standard deviation divided by sample mean) are shown, in parentheses, in tables VIII.2 and VIII.3. The degree of dispersion varies greatly, depending upon the industry considered, but the average for all 26 industrial branches is in the range of 0.31 to 0.35 for both country groups and both time frames. The dispersion in skill-intensity rankings was closely associated with the relative skill intensity of the industries concerned, and this association became stronger over time.[19]

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[14]With one exception (transport equipment), the same six industrial branches—petroleum refineries; industrial chemicals; iron and steel; non-ferrous metals; printing and publishing; and other industrial chemicals—have the most extensive skill requirements in both groups. Similarly, four of the six industries at the lower end of the skill-intensity scale—wearing apparel; footwear; textiles; and leather products—were common to both lists.

[15]In the case of a positive difference, pottery, china and earthenware heads the list, followed by other chemicals; tobacco; textiles; and non-ferrous metals. At the opposite end of the scale the industrial branches which appeared to be comparatively less skill-intensive in the developing countries included non-metallic mineral products; non-electrical machinery; miscellaneous petroleum and coal products; furniture, excluding metal; fabricated metal products; transport equipment; wood products, excluding furniture; and food products.

[16]More skill-intensive: tobacco products; beverages; paper and products; pottery, china and earthenware; and textiles. Less skill-intensive: fabricated metal products; leather products; non-electrical machinery; transport equipment; other chemicals; iron and steel; and other non-metallic mineral products.

[17]For example, major shifts took place in miscellaneous petroleum and coal products; beverages; non-metallic furniture; food products; other non-metallic mineral products; and industrial chemicals.

[18]Including miscellaneous petroleum and coal products; other non-metallic mineral products; transport equipment; non-metallic furniture; and non-electrical machinery.

[19]For the developed market economies the rank order correlation coefficients were 0.77 in 1970-1971 and 0.81 in 1979-1980. For the developing countries they were 0.61 and 0.75, respectively.

Table VIII.3 Twenty-six industrial branches ranked by decreasing level of skill intensity in 12 developed market economies and 6 developing countries, 1979-1980[a]

	Developed market economies			*Developing countries*					
	ISIC	*Industrial branch*	*Average ranking (coefficient of variation)*	*ISIC*	*Industrial branch*	*Average ranking (coefficient of variation)*	*ISIC*	*Industrial branch*	*Decreasing order of difference in average ranking[b]*
1	353	Petroleum refineries	1.33 (0.49)	353	Petroleum refineries	1.17 (0.35)	352	Other chemicals	5.75
2	351	Industrial chemicals	3.17 (0.38)	351	Industrial chemicals	2.67 (0.31)	354	Miscellaneous products of petroleum and coal	2.92
3	371	Iron and steel	7.17 (0.60)	352	Other chemicals	4.50 (0.27)	355	Rubber products	2.67
4	372	Non-ferrous metals	7.50 (0.54)	372	Non-ferrous metals	7.00 (0.51)	321	Textiles	2.25
5	313	Beverages	7.58 (0.48)	313	Beverages	7.50 (0.67)	362	Glass and products	1.50
6	342	Printing and publishing	8.42 (0.68)	371	Iron and steel	8.00 (0.40)	383	Electrical machinery	0.75
7	341	Paper and products	8.75 (0.50)	354	Miscellaneous products of petroleum and coal	8.50 (0.60)	372	Non-ferrous metals	0.50
8	384	Transport equipment	8.92 (0.42)	384	Transport equipment	9.17 (0.40)	351	Industrial chemicals	0.50
9	314	Tobacco	9.33 (0.61)	341	Paper and products	9.83 (0.59)	361	Pottery, china and earthenware	0.42
10	352	Other chemicals	10.25 (0.55)	342	Printing and publishing	10.17 (0.46)	353	Petroleum refineries	0.17
11	382	Machinery, excluding electrical	10.67 (0.23)	314	Tobacco	11.00 (0.51)	313	Beverages	0.08
12	369	Other non-metallic mineral products	10.92 (0.42)	362	Glass and products	11.17 (0.35)	323	Leather products	0.00
13	354	Miscellaneous products of petroleum and coal	11.42 (0.79)	355	Rubber products	12.17 (0.57)	311/2	Food products	−0.17
14	362	Glass and products	12.67 (0.35)	383	Electrical machinery	13.00 (0.41)	322	Wearing apparel, excluding footwear	−0.25
15	383	Electrical machinery	13.75 (0.28)	382	Machinery, excluding electrical	13.33 (0.22)	356	Plastic products	−0.25

Table VIII.3 *(continued)*

	Developed market economies			*Developing countries*					
	ISIC	*Industrial branch*	*Average ranking (coefficient of variation)*	*ISIC*	*Industrial branch*	*Average ranking (coefficient of variation)*	*ISIC*	*Industrial branch*	*Decreasing order of difference in average ranking*[b]
16	355	Rubber products	14.83 (0.33)	369	Other non-metallic mineral products	13.33 (0.21)	384	Transport equipment	−0.25
17	381	Fabricated metal products	15.58 (0.13)	311/2	Food products	17.83 (0.15)	324	Footwear, excluding rubber or plastic	−0.67
18	311/2	Food products	17.67 (0.24)	381	Fabricated metal products	18.33 (0.11)	371	Iron and steel	−0.83
19	356	Plastic products	18.58 (0.10)	361	Pottery, china and earthenware	18.67 (0.29)	341	Paper and products	−1.08
20	331	Wood products, excluding furniture	18.58 (0.25)	356	Plastic products	18.83 (0.14)	332	Furniture, excluding metal	−1.17
21	361	Pottery, china and earthenware	19.08 (0.30)	321	Textiles	19.50 (0.17)	331	Wood products, excluding furniture	−1.58
22	332	Furniture, excluding metal	21.17 (0.09)	331	Wood products, excluding furniture	20.17 (0.23)	314	Tobacco	−1.67
23	321	Textiles	21.75 (0.12)	332	Furniture, excluding metal	22.33 (0.13)	342	Printing and publishing	−1.75
24	323	Leather products	23.00 (0.08)	323	Leather products	23.00 (0.08)	369	Other non-metallic mineral products	−2.42
25	324	Footwear, excluding rubber or plastic	23.67 (0.12)	324	Footwear, excluding rubber or plastic	24.33 (0.03)	382	Machinery, excluding electrical	−2.67
26	322	Wearing apparel, excluding footwear	25.25 (0.07)	322	Wearing apparel, excluding footwear	25.50 (0.02)	381	Fabricated metal products	−2.75

Source: UNIDO data base. See also table VIII.1

[a] Skill intensity is measured by wages per employee. The 18 countries are listed in table VIII.1.

[b] A positive/negative difference implies that the industrial branch was relatively less/more skill-intensive in the developed market economies.

Table VIII.4 Changes in skill intensity rankings in 26 industrial branches in 12 developed market economies and 6 developing countries, 1970-1971 to 1979-1980[a]

	Industrial branches by decreasing order of difference in average skill intensity rankings, 1970-1971 to 1979-1980								
	Developed market economies			*Developing countries*					
	ISIC	*Industrial branch*	*Difference in rankings[b] 1970-1971 to 1979-1980*	*ISIC*	*Industrial branch*	*Difference in average ranking[b] 1970-1971 to 1979-1980*	*ISIC*	*Industrial branch*	*Decreasing order of difference in 1970-1971 to 1979-1980 changes in skill intensity rankings[b]*
1	314	Tobacco	4.17	354	Miscellaneous products of petroleum and coal	6.67	361	Pottery, china and earthenware	7.00
2	313	Beverages	2.92	313	Beverages	2.67	314	Tobacco	4.83
3	341	Paper and products	2.33	332	Furniture, excluding metal	1.83	341	Paper and products	3.00
4	361	Pottery, china and earthenware	1.67	311/2	Food products	1.67	324	Footwear, excluding rubber or plastic	2.17
5	321	Textiles	1.08	369	Other non-metallic mineral products	1.67	372	Non-ferrous metals	1.50
6	356	Plastic products	0.67	351	Industrial chemicals	1.50	356	Plastic products	1.33
7	331	Wood products, excluding furniture	0.58	384	Transport equipment	1.17	342	Printing and publishing	0.92
8	351	Industrial chemicals	0.50	331	Wood products, excluding furniture	0.67	322	Wearing apparel, excluding footwear	0.83
9	322	Wearing apparel, excluding footwear	0.33	355	Rubber products	0.50	383	Electrical machinery	0.75
10	324	Footwear, excluding rubber or plastic	0.33	321	Textiles	0.33	321	Textiles	0.75
11	311/2	Food products	0.25	362	Glass and products	0.33	371	Iron and steel	0.58
12	362	Glass and products	0.08	382	Machinery, excluding electrical	0.33	313	Beverages	0.25
13	383	Electrical machinery	−0.08	352	Other chemicals	0.17	323	Leather products	−0.08
14	355	Rubber products	−0.25	353	Petroleum refineries	−0.17	331	Wood products, excluding furniture	−0.08
15	353	Petroleum refineries	−0.25	322	Wearing apparel, excluding footwear	−0.50	353	Petroleum refineries	−0.08
16	354	Miscellaneous products of petroleum and coal	−0.50	314	Tobacco	−0.67	362	Glass and products	−0.25

Table VIII.4 *(continued)*

Industrial branches by decreasing order of difference in average skill intensity, rankings, 1970-1971 to 1979-1980									
	Developed market economies			*Developing countries*					
	ISIC	*Industrial branch*	*Difference in rankings[b] 1970-1971 to 1979-1980*	*ISIC*	*Industrial branch*	*Difference in average ranking[b] 1970-1971 to 1979-1980*	*ISIC*	*Industrial branch*	*Decreasing order of difference in 1970-'971 to 1979-1980 changes in skill intensity rankings[b]*
17	372	Non-ferrous metals	−0.50	341	Paper and products	−0.67	355	Rubber products	−0.75
18	332	Furniture, excluding metal	−0.58	356	Plastic products	−0.67	381	Fabricated metal products	−0.75
19	342	Printing and publishing	−0.75	383	Electrical machinery	−0.83	351	Industrial chemicals	−1.00
20	369	Other non-metallic mineral products	−1.33	381	Fabricated metal products	−1.33	311/2	Food products	−1.42
21	371	Iron and steel	−1.42	342	Printing and publishing	−1.67	352	Other chemicals	−1.83
22	352	Other chemicals	−1.67	324	Footwear, excluding rubber or plastic	−1.83	382	Machinery, excluding electrical	−2.17
23	384	Transport equipment	−1.75	323	Leather products	−1.83	332	Furniture, excluding metal	−2.42
24	382	Machinery, excluding electrical	−1.83	372	Non-ferrous metals	−2.00	384	Transport equipment	−2.92
25	323	Leather products	−1.92	371	Iron and steel	−2.00	369	Other non-metallic mineral products	−3.00
26	381	Fabricated metal products	−2.08	361	Pottery, china and earthenware	−5.33	354	Miscellaneous products of petroleum and coal	−7.17

Source: UNIDO data base. See also tables VIII.1, VIII.2 and VIII.3.

[a] Skill intensity is measured in wages per employee. The 18 countries are listed in table VIII.1.

[b] Obtained by subtracting the figures in the corresponding columns of table VIII.3 from those of table VIII.2. A positive/negative figure implies that the industrial branch became relatively more/less skill-intensitive.

The industrial branches with the greatest variations in skill-intensity ranking are listed in table VIII.5. Four (tobacco; paper and products; miscellaneous products of petroleum and coal; and non-ferrous metals) were common to both country groups. Examination of the table reveals some cases where the divergence in skill intensity is attributable to underlying differences in the composition of the products being manufactured rather than to the production technology employed. Transport equipment, for example, is highly skill intensive in the Federal Republic of Germany and the United States, both of which are major suppliers. The branch is not skill intensive in Australia and Austria, however, countries that have comparatively small production capacity. Paper and paper products provides another example. Canada and Finland are among the world's most diversified and competitive suppliers of such manufactures, unlike the Federal Republic of Germany and the United Kingdom whose output is relatively small and comprised of products that are not intensive in their skill requirements.[20] In the developing countries, the wide diversity in the composition of trade, in the product mix of the various industrial branches, and in labour market conditions gives rise to even greater variations in relative skill intensity.

Factor intensity in expanding and contracting industries

As changes occur in comparative advantage, the composition and direction of countries' production patterns also gradually change. Between 1970-1971 and 1979-1980, 8 of the 26 industrial branches examined here experienced a decrease in their share of total MVA in the developed market economies and an increase in their share in the developing countries. Four branches (textiles; wearing apparel; leather products; and footwear) were among the least intensive in terms of skill and physical capital in both groups of countries, while three others (paper and products; rubber products; and glass and products) were only moderately intensive. Iron and steel was the only skill intensive and physical capital intensive industry to experience a relative decline in the developed countries, coupled with a relative expansion in the developing countries.[21]

Table VIII.6 shows that the same broad pattern applies in individual countries when the growth of value added and employment at the branch level is compared with skill intensity and physical capital intensity in the initial period (1970-1971). In all developed market economies where a significant relationship was found, the expansion both in value added and employment was positively correlated with the skill intensity and physical capital intensity of the industries concerned.[22] In the developing countries, the trend appeared to be in the opposite direction. Where growth in value added and employment

[20]Certain extreme values are purely statistical artifacts. A case in point is tobacco products, which appears to be the most skill-intensive industry in Japan.

[21]The share of employment declined, on the average, in the developed market economies for all eight industries. In the developing countries, it increased in wearing apparel; leather products; rubber products; and iron and steel.

[22]Italy was the only exception: the relationship was a negative one where growth in value added was concerned. For Austria and Japan, no significant relationship was found.

Table VIII.5 Industrial branches showing the greatest dispersion in skill intensity rankings[a]

		Developed market economies			*Developing countries*		
ISIC	*Industrial branch*	*1970-1971, 1979-1980 average ranking*	*Countries with highest skill intensity (1970-1971, 1979-1980 average ranking)*	*Countries with lowest skill intensity (1970-1971, 1979-1980 average ranking)*	*1970-1971, 1979-1980 average ranking*	*Countries with highest skill intensity (1970-1971, 1979-1980 average ranking)*	*Countries with lowest skill intensity (1970-1971, 1979-1980 average ranking)*
313	Beverages		Coefficient of variation below 0.50		8.8	Colombia, Philippines (5.0) Malaysia (6.5)	Chile (16.5) Turkey (12.0)
314	Tobacco	11.4	Japan (1.0) Austria (3.5)	Denmark (22.0) United States (15.0)	10.7	Chile (3.0) Republic of Korea (7.0)	Philippines (18.5) Turkey (16.5)
341	Paper and products	9.9	Finland (2.5) Canada (4.5)	Germany, Federal Republic of (16.5) United Kingdom (16.0)	9.5	Colombia (3.5)	Malaysia (19.0)
342	Printing and publishing	8.0	Sweden (2.0) Italy (2.5)	Canada (16.0) Netherlands (15.5)		Coefficient of variation below 0.50	
351	Industrial chemicals		Coefficient of variation below 0.50		3.4	Colombia (2.0)	Chile (6.5)
352	Other chemicals	9.4	Germany, Federal Republic of (3.5) Denmark, Sweden (5.0)	Netherlands (19.0) Australia, United Kingdom (12.0)		Coefficient of variation below 0.50	

354	Miscellaneous products of petroleum and coal	11.2	Germany, Federal Republic of (1.5) Denmark (5.0)	Italy (26.0) Netherlands (25.0)	11.8	Chile (5.0)	Colombia (20.5)
355	Rubber products		Coefficient of variation below 0.50		12.4	Colombia (7.5)	Republic of Korea (21.5)
361	Pottery, china and earthenware		Coefficient of variation below 0.50		16.0	Philippines (6.5) Turkey (10.5)	Republic of Korea (25.5) Malaysia (20.5)
371	Iron and steel	6.5	Canada, United States (3.0)	Netherlands (15.5) Denmark (10.0)		Coefficient of variation below 0.50	
372	Non-ferrous metals	7.3	Netherlands (1.5) Australia (3.0)	Italy (14.0) Sweden (11.5)	6.0	Chile (2.5) Malaysia (3.5)	Colombia (11.5) Republic of Korea (9.0)
384	Transport equipment	8.0	United States (3.0) Germany, Federal Republic of (5.0)	Austria (16.5) Australia (11.5)		Coefficient of variation below 0.50	

Source: UNIDO data base. See also tables VIII.1, VIII.2 and VIII.3.

[a]The table covers all industrial branches for which the coefficient of variation (standard deviation/mean) of skill intensity rankings was 0.50 or above (given in parentheses in tables VIII.2 and VIII.3) in the 12 developed market economies or the 6 developing countries listed in table VIII.1, for 1970-1971 or 1979-1980. For each country group, the two (three) highest and lowest ranking countries are reported, except (in the case of developing countries) where the rankings of the remaining countries approximated the mean ranking.

Table VIII.6. Correlation of growth in value added and employment in 1970-1971 tc 1979-1980 with their factor intensity in 1970-1971

Economic grouping/ selected countries	*Correlation of growth, 1970-1971 to 1979-1980*					
	In value added with 1970-1971			*In employment with 1970-1971*		
	Skill intensity (wages per employee)	*Physical capital intensity (non-wage value added per employee)*	*Total physical capital and skill intensity (total value added per employee)*	*Skill intensity (wages per employee)*	*Physical capital intensity (non-wage value added per employee)*	*Total physical capital and skill intensity (total value added per employee)*
Developed market economies						
Australia		+		+**	+**	+**
Canada	+*			+*		
Denmark	+*	+	+*	+*	+*	+*
Finland	+*			+**	+*	+**
Germany, Federal Republic of	+*	+	+*	+*	+	+*
Italy	−*	−**	−**	+**	+*	+**
Netherlands	+*	+*	+	+	+*	+*
Sweden	+**	+**	+**	+**	+**	+**
United Kingdom		+			+	
United States	+**	+	+			
Developing countries						
Malaysia		−	−		−	
Philippines	−*	−**	−**	−	−*	−*
Republic of Korea	−*	−**	−**	−*	−**	−**
Turkey		−*	−*			

Source: UNIDO data base. See also table VIII.1.

Note: The results are based on Spearman rank order correlation coefficients for 26 industrial branches. Only those signs of coefficients that are significant at the 20 per cent level are given. Significance at the 10 and 1 per cent level is denoted by * and **, respectively. In the case of Austria, Chile, Colombia and Japan, the remaining countries in the sample, none of the coefficients were significant.

were associated to any significant degree with the skill intensity, physical capital intensity and total intensity of the industries, the correlation was a negative one.[23]

Profile of industrial branches with changing levels of skill intensity

Shifts in relative factor intensity may be triggered by relative changes in factor prices or in the prices of intermediate or final goods and services. They may also result from, or be induced by, technological innovations that are unrelated to changes in relative prices. The combinations of stimuli and industrial responses are numerous. An industry faced with competition from lower-priced imports, for example, may try to improve its competitiveness by replacing unskilled labour with automated machines and skilled operators. An industry relying heavily on skilled labour and physical capital may become even more skill intensive as the result of a technological breakthrough.

[23] In Chile and Colombia the correlations were not significant in a statistical sense.

Precise identification of such cases, and of the differences between cause and effect, would require the carrying out of a detailed study at the industrial branch level, and even at the company level. Still, it is possible here to identify a common profile of industries that have become relatively more skill intensive, both in the developed market economies and in the developing countries. The possible association between wage trends, on the one hand, and physical capital intensity as well as growth in value added and employment, on the other hand, in individual countries, is suggested in table VIII.7.

In the developed market economies, wage increases correlated positively with initial wage levels in the case of Austria, the Federal Republic of Germany and the United States. In those countries, industrial branches that were already skill intensive became even more so. In several other countries, however (Australia, Denmark, Italy, Netherlands and United Kingdom), the relationship was a negative one in the sense that wage increases were relatively greater in traditionally low-wage industries. This may point to an upgrading of skills (and/or the displacement of unskilled personnel) in industries hitherto intensive in unskilled labour. The disproportionate wage increases for unskilled labour may also be the result of wage settlements that are tending to discriminate less between skilled and unskilled work. In Austria, Finland, Japan, the United Kingdom and the United States the increase in apparent skill intensity correlated positively with levels of physical capital intensity in the initial period.[24] On the whole, increases in skill intensity in the developed market economies were accompanied by increases in physical capital intensity, implying the replacement or substitution of unskilled labour with machines and equipment.

With respect to the relationship between skill intensity and the expansion or contraction of industries, in several countries (Federal Republic of Germany, Italy, Netherlands, United Kingdom and United States) increases in skill intensity were found to correlate positively with value added in the industrial branch concerned. No developed market economy registered a negative relationship. Expansion of employment also correlated positively with increases in skill intensity in Denmark, the Federal Republic of Germany and the United Kingdom, but not so in Australia, Austria, Canada, Italy and the United States.

Owing to the greater heterogeneity of the developing countries, it is difficult to generalize about the profile of industrial branches in those countries which are experiencing growth in skill intensity. On the whole, it appears that skills in industries that are characterized by low wage levels have tended to be upgraded over time. In Colombia, Malaysia, the Philippines and the Republic of Korea for example, wage increases correlated negatively with 1970-1971 wage levels. This trend was also, no doubt, a reflection of the upward surge in wages for unskilled labour.

In only two countries did increases in skill intensity correlate significantly with the initial level of physical capital intensity. In four other countries, it was accompanied by intensification in the use of physical capital. In Chile and Colombia, the largest wage increases occurred in the industries that were expanding most rapidly. In Colombia, employment also expanded in those

[24]The only developed market economy for which an exception was noted was Italy where the correlation was statistically s gnificant.

Table VIII.7 Correlation of increase in skill intensity with other industry characteristcs, 1970-1971 to 1979-1980

	*Increase in skill intensity 1970-1971 to 1979-1980: countries yielding coefficients significant at the 20 per cent (denoted by *) level*[a]			
	Developed market economies		*Developing countries*	
Correlation with:	*Positive correlation*	*Negative correlation*	*Positive correlation*	*Negative correlation*
Skill intensity (wages per employee), 1970-1971	Austria, Germany, Federal Republic of, United States*	Australia,* Denmark, Italy,* Netherlands, United Kingdom		Colombia,* Malaysia,* Philippines, Republic of Korea
Physical capital intensity (non-wage value added per employee)				
1970-1971	Austria,* Finland, Japan,* United Kingdom,* United States*	Italy*	Chile*	Malaysia*
Increase[a] in 1970-1971 to 1979-1980	Australia, Canada,* Denmark, Italy,* Netherlands,* United States*		Malaysia,* Philippines,* Republic of Korea,* Turkey*	
Growth 1970-1971 to 1979-1980				
Value added[a]	Germany, Federal Republic of,* Italy,* Netherlands,* United Kingdom,* United States*		Chile, Colombia*	Republic of Korea
Employment[a]	Denmark,* Germany, Federal Republic of,* United Kingdom*	Australia,* Austria,* Canada, Italy,* United States*	Colombia*	Malaysia, Republic of Korea*

Source: UNIDO data base. See also table VIII.1.

[a]The results are based on Spearman rank order correlation coefficients for 26 industrial branches. Changes over the period 1970-1971 to 1979-1980 are measured both by changes in rankings and by rates of increase. Those countries are indicated for which a significant coefficient was obtained using one or both of the measures.

industries. On the other hand, in the Republic of Korea, a major produ exporter of relatively sophisticated manufactures, increases in skill in measured in terms of wages, were relatively small in those industries were growing most rapidly in vaiue added and employment.

Skill and physical capital requirements in specific industries

The identification of changing requirements of skill and physical ca often hampered by lack of adequate data. In the present case, in additio 26 ISIC-3-digit industrial branches under consideration, detailed dat obtainable for only 9 ISIC-4-digit industrial groups in most of the co covered by this chapter.[25] In order to capture possible shifts in requirements at a relatively detailed level, the skill and physical capital i of these groups were studied in relation to corresponding trends in th manufacturing sector of each country surveyed.

Table VIII.8 shows the relative skill and physical capital i (unweighted averages), as well as the average employment and value shares, of the nine industrial groups, both in the developed market eco and in the developing countries. The results are given in table VIII.9. W exception of two groups (spinning, weaving and finishing textiles; and and medicines), the shares in total manufacturing employment and MVA developed market economies were greater than in the developing countri general, industries having relatively greater shares in the developed economies are expected to be relatively intensive in their skill and p capital requirements, and with two exceptions, this expectation was co among the nine groups considered here.[27] In the developed market eco the skill and physical capital intensity of all nine groups exceeded the a for the manufacturing sector as a whole.[28] Spinning, weaving and fi textiles was the only group with a relative skill intensity less than the for the manufacturing sector in the developing countries. That and television and communications apparatus were the only groups whose physical capital intensity was less than the sectoral average for the dev countries.

All nine groups were found to be more skill intensive in the dev countries than in the developed market economies.[29] There are two expla for this. First, the average overall level of skill intensity in the manufa sector of the developing countries is lower than that of the developed economies, and this average is used as the basis for comparing

[25]Data were not available for Italy, Malaysia, Netherlands and Philippines. For the countries, data were available for most of the nine groups, in both periods. (See also table

[26]In 1979-1980, the value added share of synthetic resins, plastic materials and n fibres in the developing countries caught up with that in the developed market economies.

[27]The exceptions were: spinning, weaving and finishing textiles; and radio, telev communication equipment and apparatus.

[28]Shipbuilding and repairing also had below-average, non-wage value added per This reflects the extremely depressed state of the industry, however, rather than its relati capital intensity.

[29]The only exception was the manufacture of basic industrial chemicals other than for the period 1979-1980.

Table VIII.8. Employment, value added, relative skill and physical capital intensity in nine industrial groups: averages for developed market economies and developing countries, 1970-1971 and 1979-1980[a]

(Percentage)

Economic grouping	Share in total manufacturing: Employment 1970-1971	Employment 1979-1980	Employment Rate of change[d]	Value added 1970-1971	Value added 1979-1980	Value added Rate of change	Relative skill intensity[b] 1970-1971	Relative skill intensity 1979-1980	Relative skill intensity Rate of change	Relative physical capital intensity[c] 1970-1971	Relative physical capital intensity 1979-1980	Relative physical capital intensity Rate of change
Spinning, weaving and finishing textiles (ISIC 3211)												
Developed market economies[e]	3.6	2.6	−28	2.6	1.7	−35	82	83	1	65	63	−3
Developing countries[e]	12.5	10.9	−13	7.6	7.8	3	90	90	—	63	66	5
Manufacture of pulp, paper and paperboard (ISIC 3411)												
Developed market economies	2.7	2.5	−7	3.6	3.5	−3	120	122	2	127	135	6
Developing countries	1.4	1.2	−14	1.9	2.0	5	153	159	4	140	155	11
Manufacture of basic industrial chemicals except fertilizers (ISIC 3511)												
Developed market economies	1.2	1.3	8	2.2	2.4	9	124	130	5	234	227	−3
Developing countries	0.7	0.7	—	0.9	1.1	22	162	122	−25	113	167	48
Manufacture of synthetic resins, plastic materials and man-made fibres except glass (ISIC 3513)												
Developed market economies	0.9	0.9	—	1.4	1.3	−7	128	125	−2	185	177	−4
Developing countries	0.6	0.5	−17	1.1	1.4	27	132	158	20	166	370	123

Manufacture of drugs and medicines (ISIC 3522)												
Developed market economies	0.7	0.8	14	1.3	1.5	15	112	112	—	242	215	−11
Developing countries	2.0	1.7	−15	2.9	2.3	−21	151	164	9	135	164	22
Manufacture of office, computing and accounting machinery (ISIC 3825)												
Developed market economies	1.1	1.1	—	1.2	1.4	17	111	112	1	121	139	15
Developing countries	0.1	0.1	—	0.3	0.1	−67	138	140	1	107	97	−9
Manufacture of radio, television and communication equipment and apparatus (ISIC 3832)												
Developed market economies	3.5	3.6	3	3.0	3.4	13	98	98	—	73	70	−4
Developing countries	1.4	2.7	93	1.3	1.8	38	110	113	3	76	75	−1
Shipbuilding and repairing (ISIC 3841)												
Developed market economies	2.5	2.2	−12	1.9	1.5	−21	114	108	−5	42	47	12
Developing countries	1.1	0.9	−18	0.5	1.0	100	131	123	−6	48	83	73
Manufacture of motor vehicles (ISIC 3843)												
Developed market economies	4.2	4.8	14	5.2	5.4	4	112	111	−1	106	94	−11
Developing countries	2.0	2.8	40	2.3	2.7	17	132	123	−7	131	119	−9

Source: UNIDO data base, with data supplied by the Statistical Office of the United Nations Secretariat and estimates by the UNIDO secretariat. (For qualifications concerning the data, see table VIII.1.)

[a]The nine groups are those for which data were available at the ISIC 4-digit level.

[b]Wages per employee as percentage of the same for total manufacturing.

[c]Non-wage value added per employee as percentage of the same for total manufacturing.

[d]Rate of change from the first period, 1970-1971, to the second period, 1979-1980.

[e]Unweighted average for countries covered in each industrial group listed in table VIII.9.

Table VIII.9. Employment, value added and relative skill and physical capital intensity in nine industrial groups in developed market economies and developing countries, 1970-1971 and 1979-1980[a]

(Percentage)

Economic grouping/selected countries	Share in total manufacturing: Employment 1970-1971	Share in total manufacturing: Employment 1979-1980	Share in total manufacturing: Value added 1970-1971	Share in total manufacturing: Value added 1979-1980	Relative skill intensity[b] 1970-1971	Relative skill intensity[b] 1979-1980	Relative skill capital intensity[c] 1970-1971	Relative skill capital intensity[c] 1979-1980
Spinning, weaving and finishing textiles (ISIC 3211)								
Developed market economies[d]	3.6	2.6	2.6	1.7	82	83	65	63
Australia	3.5	2.1	2.7	1.8	85	95	70	74
Austria	5.1	4.7	3.8	2.8	83	83	69	72
Canada	2.8	2.0	2.1	1.5	81	82	63	70
Denmark	1.8	1.2	1.6	1.0	92	90	82	72
Finland	3.1	1.9	2.4	1.3	80	83	76	59
Japan	7.3	4.6	5.0	3.1	78	79	56	59
Sweden	1.7	1.1	1.3	0.8	88	89	64	66
United Kingdom	4.3	2.9	2.9	1.8	77	77	56	50
United States	3.1	2.6	1.8	1.5	71	71	47	49
Developing countries[d]	12.5	10.9	7.6	7.8	90	90	63	66
Chile	10.9	9.9	6.0	4.1	85	68	47	33
Colombia	3.1	4.7	3.6	4.0	101	107	105	78
Republic of Korea	16.2	15.6	9.8	10.9	83	82	53	63
Turkey	19.7	13.5	11.1	12.2	90	103	46	90
Manufacture of pulp, paper and paperboard (ISIC 3411)								
Developed market economies	2.7	2.5	3.6	3.5	120	122	127	135
Australia	0.8	0.8	1.2	1.1	129	144	163	139
Austria	2.3	1.8	2.2	2.4	129	128	65	145
Canada	4.9	4.7	5.9	7.4	127	131	113	180
Denmark	0.7	0.6	0.8	0.7	107	100	132	139
Finland	8.6	7.7	14.0	11.8	121	124	204	175
Germany, Federal Republic of	0.9	0.7	0.7	0.7	111	109	40	72
Japan	1.0	0.8	1.5	1.1	128	129	158	140
Sweden	5.3	5.8	7.2	6.9	111	106	166	127
United Kingdom	0.9	0.8	1.0	0.8	111	115	98	88
United States	1.5	1.4	1.9	1.9	121	130	131	146

Developing countries	1.4	1.2	1.9	2.0	153	159	140	155
Chile	1.7	1.4	2.2	2.3	158	134	118	161
Colombia	0.9	1.1	1.8	2.1	201	165	201	201
Republic of Korea	1.5	1.1	1.7	1.3	127	114	111	107
Turkey	1.5	1.2	1.9	2.1	126	224	129	152
	Manufacture of basic industrial chemicals except fertilizers (ISIC 3511)							
Developed market economies	1.2	1.3	2.2	2.4	124	130	234	227
Australia	0.9	0.9	1.5	1.5	111	134	217	210
Canada	1.4	1.4	2.2	2.9	134	138	175	266
Denmark	1.1	1.2	(2.0)[e]	...	115	115	(250)	...
Finland	1.2	0.9	2.2	1.4	127	115	241	180
Japan	1.2	1.1	2.5	2.4	145	150	253	259
Sweden	0.7	1.3	1.1	1.7	111	110	214	157
United Kingdom	1.7	2.0	3.2	3.5	131	137	254	216
United States	1.4	1.4	3.0	3.2	120	139	281	298
Developing countries	0.7	0.7	0.9	1.1	162	122	113	167
Chile	0.5	0.3	0.3	0.3	150	72	47	102
Colombia	1.3	1.0	1.7	1.5	137	130	114	151
Republic of Korea	0.4	0.7	0.6	1.6	198	165	179	249
	Manufacture of synthetic resins, plastic materials and man-made fibres except glass (ISIC 3513)							
Developed market economies	0.9	0.9	1.4	1.3	128	125	185	177
Australia	0.3	0.4	0.6	0.8	192	132	220	260
Austria	1.2	1.1	1.5	1.5	119	121	123	148
Canada	0.2	0.3	0.4	0.6	141	129	211	259
Denmark	0.8	1.2	0.9	1.5	105	104	125	160
Finland	0.7	1.3	0.8	1.6	114	108	118	134
Japan	1.2	0.8	3.4	1.5	131	163	346	207
Sweden	1.0	1.1	1.2	1.4	103	105	154	144
United Kingdom	1.3	1.0	2.0	1.2	130	133	195	93
United States	1.0	0.8	1.5	1.3	113	126	176	190
Developing countries	0.6	0.5	1.1	1.4	132	158	166	370
Chile	0 5	0.2	0.5	0.9	96	147	90	482
Colombia	0.2	0.5	0.4	1.5	152	173	190	330
Republic of Korea	1.2	0.7	2.4	1.7	149	154	219	297

Table VIII.9 *(continued)*

Economic grouping/selected countries	Share in total manufacturing: Employment 1970-1971	Share in total manufacturing: Employment 1979-1980	Share in total manufacturing: Value added 1970-1971	Share in total manufacturing: Value added 1979-1980	Relative skill intensity[b] 1970-1971	Relative skill intensity[b] 1979-1980	Relative skill capital intensity[c] 1970-1971	Relative skill capital intensity[c] 1979-1980
Manufacture of drugs and medicines (ISIC 3522)								
Developed market economies	0.7	0.8	1.3	1.5	112	112	242	215
Australia	0.7	0.1	1.1	1.4	102	105	225	179
Austria	0.5	0.6	0.7	0.9	111	112	135	163
Canada	0.8	0.9	1.3	1.1	110	105	216	156
Denmark	1.0	1.5	1.4	2.4	119	113	176	255
Finland	0.3	0.6	0.6	0.8	107	102	262	188
Japan	0.9	0.9	2.3	2.4	117	128	337	338
Sweden	0.6	0.9	0.9	1.3	108	119	181	160
United Kingdom	0.8	1.0	1.6	1.9	105	107	319	254
United States	0.8	0.9	1.7	1.7	126	120	325	243
Developing countries	2.0	1.7	2.9	2.3	151	164	135	164
Chile	1.7	2.1	1.8	2.5	150	168	95	106
Colombia	2.5	2.5	3.9	2.7	169	141	131	99
Republic of Korea	1.6	1.1	3.2	2.6	144	187	208	275
Turkey	2.1	0.9	2.5	1.5	139	161	107	176
Manufacture of office, computing and accounting machinery (ISIC 3825)								
Developed market economies	1.1	1.1	1.2	1.4	111	112	121	139
Canada	0.8	0.7	1.1	0.7	123	100	141	97
Germany, Federal Republic of	1.0	0.9	1.5	1.3	109	127	175	158
Japan	1.2	1.5	1.4	1.8	102	109	111	121
Sweden	1.5	1.0	1.2	1.0	101	104	68	101
United Kingdom	0.8	0.7	0.8	1.2	107	117	118	234
United States	1.2	1.9	1.4	2.2	121	116	111	121
Developing countries	0.1	0.1	0.3	0.1	138	140	107	97
Chile	0.2	0.1	0.2	0.1	123	183	75	121
Colombia	0.2	0.1	0.6	0.2	154	142	223	129
Republic of Korea	0.0	0.2	0.0	0.1	138	96	22	40

Manufacture of radio, television and communication equipment and apparatus (ISIC 3822)								
Developed market economies	3.5	3.6	3.0	3.4	98	98	73	70
Australia	2.5	1.8	2.0	1.4	105	98	63	65
Austria	1.6	2.0	1.4	1.5	91	91	86	52
Canada	3.3	2.5	2.7	2.6	102	102	57	100
Denmark	2.8	3.0	2.4	2.8	96	95	78	85
Finland	1.3	1.9	0.9	1.4	99	97	51	58
Japan	6.2	6.6	5.7	6.5	89	89	93	81
Sweden	3.9	4.4	3.2	4.3	101	103	62	92
United Kingdom	4.4	4.6	4.2	4.2	91	98	97	84
United States	5.4	6.0	4.7	5.5	110	104	70	83
Developing countries	1.4	2.7	1.3	1.8	110	113	76	75
Chile	1.7	0.5	1.7	0.1	108	116	(98)	—
Colombia	0.8	1.0	0.7	0.7	86	81	77	70
Republic of Korea	2.5	8.3	2.2	5.6	104	88	83	60
Turkey	0.4	0.8	0.4	0.9	140	168	68	95
Shipbuilding and repairing (ISIC 3841)								
Developed market economies	2.5	2.2	1.9	1.5	114	108	42	47
Australia	1.6	1.2	1.2	0.9	115	99	36	49
Canada	1.0	1.1	0.8	0.9	105	110	47	57
Denmark	6.3	5.2	4.4	3.9	106	103	23	30
Finland	3.8	4.1	3.1	3.4	111	114	54	56
Germany, Federal Republic of	1.0	0.8	0.5	0.5	110	105	7	20
Japan	1.9	1.4	2.3	1.1	140	120	106	62
Sweden	3.3	3.0	2.6	2.4	116	104	36	74
United Kingdom	2.3	2.1	1.8	1.4	114	107	35	30
United States	0.9	1.1	0.6	0.8	105	107	38	45
Developing countries	1.1	0.9	0.5	1.0	131	123	48	83
Chile	2.0	0.4	0.8	0.2	119	86	118	41
Colombia	0.4	0.3	0.2	0.5	120	103	28	38
Republic of Korea	0.9	2.0	0.5	2.3	132	135	32	110
Turkey	0.9	0.9	0.4	0.8	151	169	13	142

Table VIII.9 *(continued)*

Economic grouping/selected countries	Share in total manufacturing: Employment 1970-1971	Share in total manufacturing: Employment 1979-1980	Share in total manufacturing: Value added 1970-1971	Share in total manufacturing: Value added 1979-1980	Relative skill intensity[b] 1970-1971	Relative skill intensity[b] 1979-1980	Relative skill capital intensity[c] 1970-1971	Relative skill capital intensity[c] 1979-1980
			Manufacture of motor vehicles (ISIC 3843)					
Developed market economies	4.2	4.8	5.2	5.4	112	111	106	94
Australia	6.2	7.1	7.2	6.3	108	101	124	76
Austria	1.8	1.9	1.9	2.1	115	115	90	101
Canada	5.7	6.2	8.1	7.1	124	115	161	115
Denmark	1.2	1.3	(0.7)	. . .	100	93	(62)	. . .
Finland	1.5	1.7	1.2	1.5	105	103	56	75
Japan	5.2	6.4	6.6	7.7	112	122	134	118
Sweden	5.2	7.9	5.0	7.9	103	101	91	101
United Kingdom	6.2	5.9	5.5	5.2	119	113	56	67
United States	4.7	4.7	6.1	5.3	121	135	138	97
Developing countries	2.0	2.8	2.3	2.7	132	123	131	119
Chile	2.4	1.8	3.0	1.7	138	114	121	88
Colombia	1.9	3.1	2.2	2.1	102	121	107	86
Republic of Korea	2.1	3.0	3.2	3.1	149	132	152	88
Turkey	1.4	3.2	0.8	3.8	137	126	38	120

Source: UNIDO data base, with data supplied by the Statistical Office of the United Nations Secretariat and estimates by the UNIDO secretariat. (For qualifications concerning the data, see table VIII.1.)

[a]The nine groups are those for which data were available at the ISIC 4-digit level.

[b]Wages and salaries per employee as percentage of the same for total manufacturing.

[c]Non-wage value added per employee as percentage of the same for total manufacturing.

[d]Unweighted average for the countries listed.

[e]Not included in the average for the group, to allow intertemporal comparison.

intensities. Second, the nine groups are relatively well defined and homogeneous. They feature activities that require similar inputs of technology and skill, regardless of location. By contrast, measures of relative physical capital intensity for the groups reveal wide variations between the developing countries and the developed market economies. In this instance, the absence of a consistent relationship may reflect significant differences in the use of physical capital as well as in profitability.

Patterns of change for the last decade indicate that relative skill intensity in the nine industrial groups was stable in the developed market economies. Although the textile group (spinning, weaving and finishing) experienced a significant decline in its share of manufacturing employment and MVA, it maintained its relative position in terms of skill and capital intensity. Shipbuilding and repairing, a group that is contracting in the developed market economies, declined slightly in relative skill intensity. Basic industrial chemicals (excluding fertilizers), an expanding field of activity in the same economic grouping, reported a significant increase in relative skill intensity.

On the whole, relative skill intensity also remained stable in the developing countries considered here. That stability may not be representative of trends for the entire economic grouping, however. Spinning, weaving and finishing textiles registered a significant reduction in its share of total employment in manufacturing and an increase in its share of MVA. Relative skill intensity remained unchanged between 1970-1971 and 1979-1980 while relative physical capital intensity rose slightly. The manufacture of basic industrial chemicals (except fertilizers) is seen to be expanding in both economic groupings. In the developing countries, skill intensity in this group declined sharply, but was matched by a large increase in physical capital intensity.

The trends summarized in table VIII.8 should, ideally, be evaluated on a case-by-case basis, but such an undertaking would have been too time-consuming for the purposes of the present *Survey*.[30] Several prominent features should, however, be noted. In the Republic of Korea, for instance, where the manufacture of radio, television and communication equipment is a highly competitive and growing industry, both skill and physical capital declined significantly in intensity relative to corresponding averages for the entire manufacturing sector. This decline may be explained by the fact that while the industry basically retained its characteristic reliance on unskilled labour, productivity in other parts of the manufacturing sector grew rapidly. Data relating to wages in the motor vehicle industry also suggest interesting developments. For example, relative skill intensity increased significantly in both Japan and the United States. In Japan, that industrial group became more competitive and increased its share in both manufacturing employment and MVA.[31] In the United States, however, the same group's share in manufacturing employment stagnated while its share in MVA declined. These trends may indicate an intensification in skill in the first country, but a sheer increase in the wage bill in the second.

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[30] Individual country data are given in table VIII.9.

[31] In 1970-1971, the motor vehicles industry group accounted for 5.2 per cent of manufacturing employment and 6.6 per cent of MVA. Corresponding shares in 1979-1980 were 6.4 per cent and 7.7 per cent. See also table VIII.9.

IX

Industrial conditions in the least developed countries

In the present chapter, the industrial conditions that have prevailed in the least developed countries during the past decade are examined.[1] Progress is of paramount importance to these countries, which boast only the most limited industrial capacity and yet have the most urgent need for industrial output—particularly of basic manufactures. This need has been underscored recently by droughts and various forms of economic upheaval, thus revealing the precariousness of relying for a livelihood on the cultivation of one or two agricultural crops.

The least developed countries, whether regarded in terms of area, population, terrain, location or climate, are a diverse group. A number of them have experienced severe economic setbacks during the past 30 years. Others have escaped these setbacks; they have, in addition, been recipients of aid in the form of food or technical and financial assistance. Yet, even these latter countries have made only marginal industrial progress. Some least developed countries are extremely small, remote islands. Long and costly transportation is therefore an additional problem for their agriculturalists and industrialists. In the sub-Saharan least developed countries, severe climatic conditions during the 1980s have also exacerbated the development problem.

Largely by virtue of their poverty, and their consequent inability to attract commercial loans in any significant amount, the least developed countries are relatively free of indebtedness. Capital inflow to them, during the past 20 years or so has, for the most part, been aid. Thus, debt service as a percentage of total exports of goods and services is extremely low. In the case of Mali and Nepal, for example, it amounted to only 3.5 and 2.3 per cent respectively in 1982.[2] Other least developed countries are obliged to shoulder considerably greater burdens, however. For the 21 for which relevant data were available, the total outstanding external public debt in 1982 was $21 billion. Expressed as a percentage of GNP, the individual country debts ranged from 8 to more than 100 per cent.

The inability of many of these countries to achieve a sustained increase in real living standards over the past 20 years is illustrated by a few simple figures. Table IX.1 shows that per capita value added in agriculture (expressed in constant 1975 dollars) in the least developed countries fell by 15 per cent over the period 1965-1981. Although some increase was registered in per capita MVA—from $10 in 1965 to $13 in 1981—this represented an average increment during 1963-1981 of barely 1.8 per cent. In other developing countries, growth was considerably healthier. Over the 1963-1981 period, this group's per capita value added in agriculture grew by 0.4 per cent per year, while its MVA

[1] Countries defined as least developed are listed in the appendix to this chapter.

[2] World Bank, *World Development Report 1984* (Washington, D.C., 1984), p. 248.

Table IX.1. Per capita value added in agriculture and manufacturing (in 1975 dollars), selected years

	Least developed countries		*Other developing countries*	
Year	*Agriculture*	*Manufacturing*	*Agriculture*	*Manufacturing*
1965	84	10	93	59
1970	80	13	95	75
1975	74	14	97	94
1981	71	13	99	113

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

expanded at 4.6 per cent per year.[3] Particularly disturbing is the fact that in the least developed countries all of the improvement in MVA took place during the early years of this period. Per capita MVA in 1973-1981 actually fell by 0.4 per cent per year. (In the developing countries overall, there was also a slow-down in the growth of MVA: from 4.6 per cent per year in 1963-1981 compared to 3.4 per cent in 1973-1981; there was, however, no absolute decline.)

Individual country data are provided in table IX.2. Among the least developed countries which recorded the highest levels of per capita value added in agriculture in 1981 (at 1975 dollars) were Uganda ($191), Guinea ($128), Botswana ($104) and Guinea-Bissau ($102). For MVA, the highest achievers in 1981 were Botswana ($88), Sudan ($27) and Haiti ($24). With regard to the growth of per capita value added in agriculture, no fewer than 21 of the group of 28 countries recorded a decline in the period 1963-1981. By contrast, only 8 reported a drop in the per capita MVA growth rate during the same period.

A comparison of the sectoral averages for the least developed and other developing countries shows that between 1965 and 1981 the gap in per capita value added in agriculture widened from $9 to $28, while that for manufacturing grew from $49 to $100.[4] These figures do not, in themselves, however, suggest a growing dichotomy between the two groups of countries. The developing countries (other than the least developed) are becoming a more heterogeneous group. The impression is that while the least developed countries are bunched at one end of a spectrum, the boundary at the other end is being extended by the faster growing and more dynamic developing countries.

The agricultural sector in the least developed countries

Reference has already been made to the least developed countries' weak performance in agriculture. Crop yields have fallen and output of food and raw

[3] UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[4] UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat. All calculations are based on data in constant 1975 dollars.

Table IX.2. Growth of per capita value added in agriculture and manufacturing, 1963-1981, and per capita levels in 1981

(At constant 1975 prices)

	Agriculture			*Manufacturing*		
Country	*Value added per capita 1981 (dollars)*	*Growth rate 1963-1981 (percentage)*	*Growth rate 1973-1981 (percentage)*	*Value added per capita 1981 (dollars)*	*Growth rate 1963-1981 (percentage)*	*Growth rate 1973-1981 (percentage)*
Afghanistan	91	−1.7	−0.6	16	2.4	0.5
Bangladesh	57	−1.1	0.1	9	3.8	5.0
Benin	73	−1.5	0.1	10	−1.3	−7.0
Botswana	104	1.9	−4.6	88	9.0	14.0
Burkina Faso	51	−2.1	−0.2	18	8.2	1.5
Burundi	76	−0.8	1.3	15	8.8	2.8
Cape Verde	60	−0.3	3.4	17	3.6	1.4
Central African Republic	68	−0.6	−0.6	22	1.7	−0.7
Chad	56	−2.6	−1.8	9	0.0	−6.5
Comoros	92	−1.4	−0.3	11	−0.8	−0.8
Equatorial Guinea	46	−12.0	−18.3	5	−6.6	−18.0
Ethiopia	54	−1.0	−0.1	12	2.6	1.6
Gambia	69	−1.2	−7.1	6	−2.9	−14.5
Guinea	128	−2.3	−2.2	10	0.3	0.1
Guinea-Bissau	102	0.3	−1.1	3	3.8	1.6
Haiti	48	−1.3	−1.5	24	2.6	5.3
Lao People's Democratic Republic	47	1.2	5.1	7	−0.3	−4.3
Lesotho	40	−3.1	−2.1	9	19.9	1.4
Malawi	66	2.2	1.6	18	8.1	3.1
Mali	31	−2.1	2.3	9	1.4	1.1
Niger	101	0.0	5.0	14	1.5	0.2
Rwanda	73	2.3	1.2	20	18.8	12.7
Sierra Leone	74	−0.2	−0.5	14	1.2	−2.3
Somalia	38	−3.5	−4.2	11	8.1	−3.7
Sudan	94	−2.6	−2.2	27	−1.7	−4.8
Togo	48	−4.8	−7.8	16	−0.3	−6.5
Uganda	191	−0.7	−1.8	11	−3.7	−8.6
United Republic of Tanzania	64	0.5	0.1	9	2.1	−5.7

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis and the Statistical Office of the United Nations, with estimates by the UNIDO secretariat.

materials has contracted. Moreover, population growth has been such that per capita value added in agriculture has declined appreciably. Such trends can reverse themselves rather quickly, however; caution must be used in interpreting the relevant figures. Current patterns of farming are so inadequate that vagaries in the weather can produce far greater fluctuations in per capita agricultural output than would be the case in countries using more sophisticated patterns. In Botswana, for instance, per capita agricultural value added during the period 1965-1980 increased by 8.6 per cent per year, but during the period 1975-1981 decreased by 4.6 per cent per year. Much of the decrease reflected the dominant role of livestock in agriculture in that country, and the fact that drought and export restrictions hampered livestock raising. In fact, volatile swings in output characterize agricultural performance in most of the least developed countries.

Farm output in some least developed countries has fallen despite more intensive applications of fertilizer.[5] In the United Republic of Tanzania, for example, cereal yield fell from 0.78 tons/ha in 1969-1971 to 0.70 tons/ha in 1979-1981, despite a near doubling (to 6.1 kg/ha) of fertilizer input during the latter period.[6] By way of comparison, Japan uses nearly 90 times as much fertilizer and the yield is around 7.5 times greater.

Only a handful of least developed countries (among them Afghanistan, Bangladesh and the United Republic of Tanzania) produce any kind of fertilizer domestically, and not one produces potassic fertilizer. Of 24 countries for which data on nitrogenous fertilizers were available, 10 experienced a drop in per capita fertilizer consumption over the period 1972-1981. In some cases, the drop was so severe as to suggest that the use of fertilizer had virtually ceased. Of 23 countries for which data on phosphatic fertilizers were available, 11 experienced a drop in consumption over the same period.[7]

Deforestation is a related problem besetting many countries, including many of the least developed. Loss of forests means less available fertile farmland, greater distances to travel in search of firewood, and greater risk of floods. In some West African countries, this means that fewer meals can now be cooked because the time absorbed in gathering firewood precludes the setting of more than one fire daily.

These problems are compounded by the decline in the international trading prices of many raw materials. In 1982, roughly two-thirds of all exports from the least developed countries were raw materials or lightly processed goods. Falls in commodity prices therefore have serious consequences for these countries. The prices of many raw materials—from uranium to bananas—fell between 1976 and 1982. A number of factors have contributed to this situation, among them, as already mentioned, are climate (inadequate and unreliable rainfall) and topography (particularly desertification—the tendency for cultivated land area to be encroached upon by the desert as topsoil erodes as the result of over-farming and lack of fertilizer).

A factor of immense importance is the policy of the national agency charged with promoting the attractiveness of food production. A considerable body of data, gathered in recent years, suggests that current agricultural policy must change if food output is to increase. If raw material prices are maintained at comparatively low levels in order to assist the urban consumers, there is a danger that the agricultural sector will stagnate. A full assessment of the impact of various agricultural policies is beyond the scope of the *Survey*, but it may still be noted that there is mounting evidence to suggest that slow growth in food output is not necessarily an immutable characteristic of the least developed countries.

Manufacturing in the least developed countries

The least developed countries' share of world MVA has remained essentially unchanged—at 0.2 per cent of the world total—for the past

[5] Fertilizer is an imported commodity in most of these countries.

[6] World Bank, *op. cit.*, p. 94.

[7] UNIDO data base.

20 years.[8] Table IX.3 shows annual changes in per capita MVA growt least developed countries over the period 1963-1983. Since 1969, MVA has been negative in most years. It increased in only four years through period 1970-1983. When these trends are examined at the country lev particularly marked falls in per capita MVA can be noted. In some in the deterioration between 1975 and 1981 was equivalent to 50 per cent of the original figure. In these instances, agricultural output declined a fact which suggests that the interrelationship between manufactur agriculture may be especially important for the least developed countrie

Table IX.3. Growth of per capita MVA in the least developed countries, at constant (1975) prices, 1963-1983

(Percentage)

Year	*Increase or decrease over previous year*
1964	4.4
1965	6.5
1966	9.6
1967	4.5
1968	5.0
1969	4.6
1970	−2.9
1971	−3.9
1972	−1.7
1973	15.1
1974	0.7
1975	−0.6
1976	−1.5
1977	2.4
1978	0.9
1979	−1.8
1980	−0.4
1981	−3.8
1982[a]	−2.9
1983[a]	−0.6

Source: UNIDO data base; information supplied by the Office of Development Research and Policy Analysis, the Statistical Office of the United Nations Secretariat and the Economic Commission for Africa, with estimates by the UNIDO secretariat.

[a]Preliminary figures.

Other dimensions of this interrelationship should also be n contrast with other developing countries, a prominent characte manufacturing in the least developed countries is the sector's ve absolute size relative to levels of agricultural output. In Guinea and for instance, where agricultural output is high by the standards of ot developed countries, MVA is still less than 10 per cent of agricultu added.[9] In Botswana, on the other hand, MVA has grown so rapidly

[8]See table II.2.

[9]UNIDO data base; information supplied by the Office of Development Research Analysis and the Statistical Office of the United Nations Secretariat, with estimates by t secretariat. All calculations are based on data expressed in constant 1975 dollars.

economy has achieved a relatively balanced structure. This is largely explained, however, by the dominance of the Botswana Meat Commission in both the manufacturing sector (where it contributes more than one half of MVA) and the agricultural sector.

The small share of MVA in GDP, and the poor growth performance of manufacturing in the majority of the least developed countries, can be attributed in part to low ratios of gross capital formation to GDP. In these countries, the ratio of investment to GDP (a weighted average) was 15 per cent in 1981. In other developing countries it was 26 per cent.[10] In general, therefore, the least developed countries have an investment-to-GDP ratio roughly half that of other developing countries.

Studies of long-term change in the manufacturing sector have shown that, as countries develop and as income per capita rises, heavy industry tends to account for a growing share of MVA. Light industries, which are mostly based on agricultural inputs, or which produce textiles and clothing, tend to play a less important role as income rises, as the domestic market expands, and as economies of scale become feasible. However, as table IX.4 shows, in 15 least developed countries for which relevant data were available, light industry in 1980 accounted for the bulk of MVA—on average 77 per cent. Heavy industry accounted for the remaining 23 per cent. Corresponding figures for 1975 were little different: 79 and 21 per cent respectively. Indeed, the distribution between light and heavy industry in those countries has changed very little in the past decade.

In other developing countries, by contrast, the share of light industry was considerably lower: 41 per cent in 1980 and 44 per cent in 1975.[11] The least developed countries in which heavy industry makes a relatively significant contribution to MVA can be seen from table IX.4. In 1980, they included Bangladesh (31 per cent), Haiti (28 per cent), the United Republic of Tanzania (25 per cent) and Ethiopia (25 per cent). In most developing countries, however, including the least developed, there is a tendency towards chronic under-utilization of industrial capacity. The figures presented here, therefore, do not necessarily represent the maximum sustainable output from installed industrial capacity.

Government policy tends to have its greatest impact where heavy industry is concerned, as plants in this sub-sector are typically large-scale. Moreover, because of its economic, social and political importance, the sub-sector lends itself relatively easily to entire or at least part public ownership. In the United Republic of Tanzania, for example, the rapid build-up of heavy industry reflects government decisions to install capacity for the manufacture of intermediate products such as steel, aluminium, cables, pipes, cement, fertilizer, pulp and paper, as well as for the assembly of vehicle and farm equipment.

Detailed data on the composition of MVA could be obtained in the case of only six least developed countries.[12] Five of these reported MVA growth rates higher than the average for all least developed countries (1.8 per cent per year

[10] *Ibid.*

[11] UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[12] From the Statistical Office of the United Nations Secretariat; with estimates by the UNIDO secretariat.

Table IX.4. The contribution of light and heavy industry to manufacturing value added, in constant (1975) prices, 1975 and 1980

(Percentage)

Country	*Year*	*Light*	*Heavy*
Bangladesh	1975	76	24
	1980	69	31
Burkina Faso	1975	90	10
	1980	85	15
Burundi	1975	100	—
	1980	100	—
Central African Republic	1975	94	6
	1980	96	4
Ethiopia	1975	79	21
	1980	75	25
Gambia	1975	100	—
	1980	100	—
Guinea	1975	100	—
	1980	100	—
Haiti	1975	69	31
	1980	72	28
Mali	1975	85	15
	1980	87	13
Sierra Leone	1975	81	19
	1980	91	9
Sudan	1975	82	18
	1980	83	17
Togo	1975	91	9
	1980	88	12
Uganda	1975	81	19
	1980	88	12
United Republic of Tanzania	1975	69	31
	1980	75	25
Average for the above	1975	79	21
	1980	77	23

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

in 1963-1981). One of the highest rates, 9.0 per cent, was achieved by Botswana. Behind this figure lies a relatively concentrated handful of raw material-based plants with a high degree of foreign ownership and producing for assured export markets. These plants (which include an abattoir and engineering workshops attached to diamond, copper and nickel mines) accounted for roughly 60 per cent of total MVA in 1977. That share has since been falling, however.

Malawi is another least developed country that enjoys a relatively high MVA growth rate (8.1 per cent per year in 1963-1981). In Malawi, agro-processing is paramount, with tobacco, tea and sugar processing together accounting for around one third of all MVA. As in Botswana, however, this success has been the result of concentration in a specific field: in 1979, only 33 firms were involved in these three processing activities. In Malawi, also, parastatal organizations are involved in these activities.

With its MVA growing at an annual average of 8.1 per cent, Somalia is another high-growth-rate least developed country, although, as in several other of the faster-growing countries in this group, much of its manufacturing dynamism is dependent on performance in a small number of plants. Indications are, however, that the industrial base is broadening. Since 1978, food processing and textiles have been declining in relative importance, although in that year they still accounted for nearly 50 per cent of total MVA. The Somalian experience illustrates another approach to industrial development: public sector dominance over a rapidly growing and diversifying industrial capacity.

In Sudan, the approach is similar. Although MVA in that country declined during the period 1963-1981 (−1.7 per cent per year), its composition is relatively conventional. In 1978, food products, beverages and textiles accounted for over 90 per cent of the total. Public ownership is a significant force in these branches. In general, public enterprises in the least developed countries tend to be more capital-intensive than private ones. This may not reflect a preference for capital-intensive production on the part of the management of the enterprises, but simply differences in optimal patterns of production in different branches.

The industrial pattern in Bangladesh is much more diffuse. In 1976, the two largest industrial branches—tobacco and textiles—included over 900 registered factories. In 1983, a third of the country's MVA was derived from public enterprises; relatively few large enterprises were privately owned. The number of smaller private enterprises is comparatively large, however. In 1981/1982, textile manufacturing establishments numbered almost 1,100 and employed close to 88,000 persons. The number of handloom establishments in operation is even greater. It has been estimated that these employ between 800,000 and 1.5 million. Thus, small-scale and cottage industries provide a significant proportion of employment while public enterprises supply the bulk of the country's output.

Although MVA growth in the United Republic of Tanzania was slightly above the group average (2.1 per cent per year) in 1963-1981, it has fallen appreciably since the mid-1970s; indeed, it has been generally negative in recent years (−5.7 per cent per year). For the most part, large and medium-scale enterprises have suffered more than small-scale ones. A major factor in this regard has been recurring foreign exchange shortages, occasioned in part by the fall in coffee prices. This has led to shortages of imported parts and inputs, and, in turn, to very low levels of capacity utilization. Small-scale enterprises have tended—as much by necessity as anything else—to be less seriously affected by this problem, since their production and output-mix tend to use a higher proportion of indigenous materials.

Trade patterns in the least developed countries

In aggregate, the least developed countries are only minor participants in the world trading system. The bulk of trade—even in unprocessed goods and raw materials—is carried on among higher-income countries.[13] Nevertheless, the composition of imports to and exports from the least developed countries gives an indication of the nature of the industrialization process that is underway in those countries. Table IX.5 shows that industrially processed

Table IX.5. Least developed countries: average imports and exports of manufactures, by category, 1970-1982[a]

	1970		*1975*		*1982*	
Manufactures	*$000*	*Percentage*	*$000*	*Percentage*	*$000*	*Percentage*
Consumer non-durables						
Value of exports	459		2 496		8 207	
Value of imports	4 561		9 704		21 518	
Growth rate for exports		...		40.3		18.5
Growth rate for imports		...		16.3		12.0
Share in total imports		10.1		7.0		7.6
Supplies and intermediates						
Value of exports	10 941		18 184		27 850	
Value of imports	15 447		42 831		73 850	
Growth rate for exports		...		10.7		6.3
Growth rate for imports		...		22.6		8.1
Share in total imports		34.3		31.0		26.1
Capital goods						
Value of exports	389		1 381		3 841	
Value of imports	16 389		52 690		110 079	
Growth rate of exports		...		28.8		15.7
Growth rate of imports		...		26.3		11.1
Share in total imports		36.3		38.2		38.9
Other manufactures						
Value of exports	6 427		11 231		22 323	
Value of imports	8 690		32 830		77 292	
Growth rate for exports		...		11.8		10.3
Growth rate of imports		...		30.5		13.0
Share in total imports		19.3		23.8		27.3

Source: UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[a]Trade in manufactures, as used in these calculations, was defined by the UNIDO secretariat to approximate the range of productive activities traditionally recognized as constituting the manufacturing sector. This meant that trade data (expressed according to SITC classification) had to be selected so as to coincide with the ISIC definition of manufactering. For a list of the SITC items included, see *World industry in 1980* (United Nations publication, Sales No. E.81.II.B.3), pp. 103-108.

[13]For a number of least developed countries, no trade data were obtainable. In order to obtain estimates for those countries, data reported by their trading partners were aggregated. Thus, the imports of the world from a least developed country were regarded as that country's exports to the world. Conversely, world exports to one of those countries were regarded as that country's imports from the world.

goods account for a far greater share in imports than unprocessed ones. In 1970, their share was 89.7 per cent of all imports. By 1982, it had changed very little. This implies that the importing countries lack the capacity to do their own processing—that the bulk of their processing must be done elsewhere. In 1970, only 21 per cent of the least developed countries' exports were industrially processed goods. This proportion has increased fairly rapidly, however, amounting to 33 per cent in 1982. Countries in which particularly rapid growth in processed exports has taken place include Afghanistan, Bangladesh, Democratic Yemen, Haiti, Malawi, Niger and Togo. This trend means that, as far as export composition is concerned, the least developed countries are approaching the levels attained by other developing countries. In each of the former countries, however, the value of industrially processed exports is usually significantly less than that of imports. But in a few instances, the imbalance is not great: in 1982, industrially processed goods exported from Niger were valued at $249 million and those imported were valued at $292 million. The percentage share of industrially processed goods in total exports from and imports to the least developed countries in three selected years was as follows:[14]

Year	*Share in total exports*	*Share in total imports*
1970	20.8	88.6
1975	23.2	83.3
1982	33.4	86.0

Another way to gauge industrial progress is to look at the value, and rates of increase, of imports of manufactured goods, and compare these with corresponding export data. For the least developed countries as a group, imports of manufactures have been growing considerably faster than total exports (SITC 0-9). The result has been an increasing disparity between the foreign revenues generated and the bill for imported manufactures. In 1970, the least developed countries' imports of manufactures[15] were equivalent to 74 per cent of their total export earnings. By 1975, the proportion had exceeded 100 per cent, and by 1982 it was 128 per cent. These countries' exports, therefore, are not even paying for their imports of manufactures, let alone for all of their imports.

The situation in other developing countries has not been so disadvantageous. These countries' imports of manufactures were equivalent to 64 per cent of their total export earnings in 1982. In the same year, the principal importers of manufactured goods, i.e. those countries importing over $500 million worth (in current prices), were Bangladesh, Benin, Sudan, United Republic of Tanzania and Yemen. Some countries' imports, by contrast, amounted to barely $2 million.

Table IX.5 shows the industrial composition of imports to and exports from the least developed countries in 1970, 1975 and 1982. Capital goods and "other manufactures" were the fastest growing imports. Imports of the former, as a share of total imports of manufactured goods, reached 38.9 per cent in 1982. The shares of consumer nondurables and supplies and intermediates fell.

[14]UNIDO data base; information supplied by the Statistical Office of the United Nations Secretariat, with estimates by the UNIDO secretariat.

[15]SITC 5-8 less 68.

It is in the manufacture of capital goods that the least developed countries (like virtually all developing countries) are most deficient. In 1982, average exports of such goods amounted to only $3.8 million, out of a total for manufactured exports of $62.2 million.

A comparison of trade patterns in the least developed and other developing countries is instructive. The two groups' trade flows, measured by degree of industrial processing, shows that in the latter group the share of processed imports in all imports has been around 80 per cent since 1970. In these countries, the share of processed exports in total exports has fallen, from 41 per cent in 1970 to 20 per cent in 1982. By contrast, as noted above, the least developed countries' processed exports constituted 33 per cent of all their exports in 1982, up from 21 per cent in 1970.[16] These figures must be interpreted carefully, however. Only a few developing countries account for two thirds of the entire group's exports of manufactures. The particular, rather than the general, nature of the relationship must therefore be borne in mind.

Imports of capital goods are of particular significance as these can be expected to increase a country's productive capacity and hence its ability to amplify its output. The average value of capital goods imports by the least developed countries has grown appreciably, from $16.4 million in 1970 to $110 million in 1982 (in current dollars). The group's exports of capital goods in the latter year averaged only $3.8 million. In 1982, the largest importers of capital goods were Bangladesh ($351 million), Sudan ($579 million) and the United Republic of Tanzania ($351 million). Capital goods imports by developing countries other than the least developed represented 44-48 per cent of that group's total imports of manufactured goods, by value, over the period 1970-1982. On average, this was still somewhat above the share achieved by capital goods in the least developed countries, but the difference was not great.

Growth in industrial capacity is essential to growth in output, but other factors must also be favourable. Complementary inputs, such as electricity and spare parts, not to mention human capital in the form of trained installers and operators, as well as a consistent market for output, are necessary. An enlarged capital stock will not guarantee greater industrial output; neither is it always necessary. In countries that have a thriving informal sector, output can be increased without increasing the stock of fixed capital. Agricultural goods, derived from local materials, can be processed in the home or in small workshops and factories.

The least developed countries appear to be more closely related, through trade, to other developing countries than to developed countries. Trade among themselves has always constituted a minor portion of the total trade of the developing countries. Yet, the figures show, on average, developing countries (which may be least developed too) make far better trading partners for, and are important buyers of exports from, least developed countries. Some least developed countries, including Bhutan, Djibouti, Laos, Somalia and Sudan, do over half their export trade with other developing countries; others, e.g. Burundi and the Central African Republic, have virtually no export trade with other developing countries. In 11 of 34 least developed countries for which pertinent data were available, the proportion of exports bound for other

[16] Figures based on data provided by the Statistical Office of the United Nations Secretariat.

developing countries increased over the period 1970-1982.[17] Trade patterns show abrupt shifts in the markets for the least developed countries' exports. Developing countries absorbed 81 per cent of the Comoros Islands' total exports in 1970, for example, but virtually nothing in 1982. This instability on the part of the export markets is related to changes in the composition of exports. In the case of the Comoros Islands, a substantial decline in exports of simple manufactures and manufacturing materials (SITC 6) was coupled with an increase in food exports (SITC 0). The small absolute size of the least developed countries' exports also contributes to instability: a cancelled order or atrophied relationship with a customer can have a disproportionately large impact on aggregate trade flow figures.

Consumption of manufactured products in the least developed countries

Figures relating to apparent consumption[18] show that only in the manufacture of agriculture-related products is there any degree of self-sufficiency among the least developed countries. All products whose manufacture would require the establishment of heavy industrial plants—e.g. steel, tinplate, wire rods or pig iron—are imported. However, very few dairy products or processed food items—e.g. vegetable oils, flour, beer or soft drinks—are imported. This would appear to reflect the action of two forces. First, except in their capital cities, few countries have a distribution network that can cope with perishables. Imports of such items, therefore, are bound to be modest in scale. Second, as a certain amount of import substitution has probably taken place, some goods that were previously imported are now produced domestically. A comparison of consumption and imports of unprocessed and processed goods shows that only limited progress has been made in agro-processing. For instance, whereas raw sugar (ISIC 3118-01) is largely domestically produced in 14 countries for which data were available, refined sugar (ISIC 3118-04) is largely imported.

A number of discouraging indicators appear in the figures for apparent consumption. Of 22 least developed countries for which time-series data on wheat and flour were available, the self-sufficiency of 8 fell between 1972 and 1981. In Uganda, for example, measured apparent consumption fell from 2.42 to only 0.80 metric tons per 1,000 inhabitants.

As noted earlier, expansion in imports of capital goods does not necessarily offer a solution to the industrialization problems of the least developed countries. A characteristic that is common to all these countries is the low level of capacity utilization at which many of their plants run. This in turn contributes to abnormally high capital-output ratios. Data show that rates of capacity utilization in several least developed countries have been slipping for some years, especially in the larger plants. Agro-based plants have been confronted with particularly severe problems as farm output produced for the markets has tended to decline. Average capacity utilization rates in

[17] Based on data supplied by the Statistical Office of the United Nations Secretariat.

[18] Apparent consumption is defined as production plus imports less exports.

some of these plants has plummeted to around 60 per cent. Another factor that has contributed to this problem is the lack of foreign exchange with which to import spare parts and other essential inputs. Sometimes this situation is further complicated by restrictive import licensing laws.

An industrial characteristic that is common to most least developed countries is the tendency for industrial branches to feature one large, relatively capital-intensive plant with a number of small, under-capitalized, satellite enterprises. Very often, the large plant uses imported, capital-intensive equipment to produce goods for consumption abroad or by wealthy local customers. The small enterprises tend to use second-hand equipment, containing little imported content, to produce goods for consumption by the lower income domestic market. Examples of this formal/informal sector dichotomy abound.

A number of policy considerations attach to this type of nascent industrial structure. In particular, it is important that establishments in the public sector assist the growth of those in the informal sector—or at least do not impede that growth. The reason for this is that firms in the latter sector usually employ a large number of workers per unit of capital investment. Moreover, they often have a comparatively low capital-output ratio and are geographically dispersed in their operations. Bangladesh offers an example of a country in which large firms, including public sector firms, appear to coexist comfortably with smaller, informal ones. In Bangladesh, complementarity was a major criterion in decisions regarding the establishment of new public enterprises. In that country's textile industry, for instance, the public sector operates only plants that produce goods not readily made in small, private firms. The production of milled rice, wheat flour and other agriculture-based products is left to small, regional-level producers.

Small-scale, family-based enterprises must cope with problems that are rather different from those associated with larger plants. The former enterprises:

(a) As a rule sell their output to small, well organized groups of wholesale purchasers who pay comparatively low prices and thus reduce the sellers' ability to invest in better equipment, to buy bigger, more economical quantities of inputs, or to build warehousing facilities that would allow them to store their surpluses;

(b) Often suffer from lack of means of transporting their output. Thus, mobile merchants who are able to supply inputs to them, or to buy their output on the spot, are in an advantageous position when it comes to bargaining;

(c) Frequently have only limited or unreliable access to water and power. This means that any capital equipment they manage to buy is likely to be underutilized;

(d) Seldom can be certain of supplies of spare parts or other necessary inputs, because of foreign exchange shortages and difficulties in obtaining import licences.

The output of such enterprises is seldom recorded in full in industrial output figures as the enterprises often fail to keep records. These enterprises do, nonetheless, absorb a significant portion of the labour force, at least

occasionally. Policy decisions, therefore, must also take account of these manufacturers and processors in the informal sector.

Changes in the industrial structure of the least developed countries during the remainder of the present decade will be strongly influenced by the policy stance of the Governments concerned and the circumstances of the agricultural sector. Although data on these matters are difficult to gather, and to interpret, it would appear that a growing number of least developed countries are convinced of the need *(a)* to reform the micro-economic framework within which their firms operate, *(b)* to allow factor prices—notably wages and interest rates—to reflect more fully their true resource endowments, and *(c)* to simplify current laws and systems relating to subsidies and taxes. The adoption of such measures, apart from contributing to improved efficiency from existing investment, might encourage more subcontracting work—perhaps more labour-intensive work—from plants in more advanced developing countries.

The impact that a stronger agricultural sector would have on the industrialization efforts of the least developed countries is clear from the above. If processing plants in those countries could count on larger and more reliable flows of raw material, the utilization of that processing capacity would be increased. The unit cost of output would thus be lowered, export prospects improved, and the likelihood of having to resort to emergency programmes to import foodstuffs reduced.

The interdependence of countries is a theme that has been explored elsewhere in this *Survey*. In the context of the least developed countries, the questions that spring to mind concern the extent to which those countries, or at least some of them, have become more tightly integrated with the rest of the world. For most developing countries, the mechanisms that are most frequently cited in this regard are international trade and debt. A number of other dimensions to this relationship deserve to be investigated, however. Are the least developed countries becoming increasingly tied to other developing countries? Or are they forging links with the developed countries at least to the same extent? If ties with other developing countries are being created, to what extent are these a result of sub-contracting relationships in manufacturing? Are consistent industrial patterns to be observed in this integration? Do just a few industries tend to be the pace-makers?

Lack of data makes it almost impossible to answer these questions with any degree of precision. Although the volume of general data being gathered in the least developed countries is increasing, reliable industrial data are extremely scarce. Earlier in this chapter, however, attention was drawn to the development of certain trends among the least developed countries, and data on these trends do allow some judgements to be made concerning the question of interdependence and the least developed countries. First, with respect to trade patterns, while the evidence shows that certain least developed countries are becoming increasingly integrated with other developing countries, as trading partners, by no means all of them are doing so. Some least developed countries still do virtually all their trading with developed market economies. The fact that capital goods account for an increasing percentage of total visible imports implies growing ties with suppliers of machine tools and other capital goods manufacturers, most of whom will be located in developed countries. Second-hand capital goods may, however, account for a portion of these imports, and

some of these may come from the developing countries. Second, with respect to foreign investment, no data are available to show the extent to which the least developed countries are the sites of manufacturing or processing for foreign-based firms. Nor can the extent of subcontracting be readily ascertained, although there are known instances of foreign capital playing a major role in the growth of least developed countries' processing and manufacturing capacity. One fact that does emerge from this analysis, however, is the essentially micro-economic character of industry in the least developed countries. And this fact, in turn, suggests the need to focus on the micro-economic implications of policy reforms and related efforts aimed at establishing a broader base for interdependence.

APPENDIX

LEAST DEVELOPED COUNTRIES[a]

Afghanistan
Bangladesh
Benin
Bhutan
Botswana
Burkina Faso
Burundi
Cape Verde
Central African Republic
Chad
Comoros
Democratic Yemen
Djibouti
Equatorial Guinea
Ethiopia
Gambia
Guinea
Guinea-Bissau
Haiti
Lao People's Democratic Republic
Lesotho
Malawi
Maldives
Mali
Nepal
Niger
Rwanda
Samoa
Sao Tome and Principe
Sierra Leone
Somalia
Sudan
Togo
Uganda
United Republic of Tanzania
Yemen

[a]Grouped according to UNCTAD, *Handbook of International Trade and Development Statistics 1983* (TD/STAT.11).

X

The evolution of agro-food systems in developed market economies and developing countries

THE food industry[1] usually accounts for the largest portion of MVA in the developing countries. Although it accounts for a smaller portion in the developed market economies, it is, nevertheless, the subject of considerable attention by the Governments of those countries. It continues to play an important role within the manufacturing sector and assumes special significance in respect of such key issues as nutritional standards, self-reliance and employment. If only for those reasons, the food industry warrants close examination.

The present chapter begins with an analysis of the industry's market organization and technological progress in the developed market economies. Its growth, which has been supported by the generation of a steady flow of new, industrially processed products, is studied in light of this analysis. The chapter continues with an account of how, in the developed market economies, the diffusion of standardized food production and consumption patterns has been accomplished through trade, direct international investment and imitative national investment. It notes that, although the forces contributing to this standardized pattern are powerful, structural differences still persist. Moreover, the extent and form of the diffusion process varies widely from product to product. A typology of food products, developed according to stage of transformation, serves as a basis for the analysis.

The food industry in 20 selected developing countries and areas is also reviewed. While patterns of development are seen to fall into three distinct categories, the structure of the food industry is largely global in scope. The chapter concludes with an examination of the links between the food industry and the agricultural sector. The displacement of the traditional vegetable protein diet in many developing countries by an animal protein one is highlighted. This trend, which is closely identified with the activities of transnational corporations, has resulted in the introduction in many developing countries of a relatively sophisticated agro-food system comparable to that found in most developed countries. Many developing countries, however, are not in a position to make the structural adjustments required by this system. The experience of China is cited as a possible alternative approach. In that country, large increases in the supply of animal protein have been introduced without disruption of the structural balance of the economy.

[1]The term "food industry" as used here includes the food processing (ISIC 311/2) and beverages (ISIC 313) industries. Food refers to food and beverages.

The agro-food industry in the developed market economies

The food industry typically exhibits a slow, but steady, pace of growth. Between 1963 and 1978, total MVA in the developed market economies expanded rapidly, exceeding growth rates in the food industry. In 1973-1981, however, a period punctuated by the severe recessions of 1974-1975 and 1980-1981, the growth rate of MVA fell below that of food. The major exception to this pattern was Japan. There, growth in the food industry tended to lag behind that of other developed market economies, while the growth rate of total MVA remained consistently higher than the average.

By the early 1980s, the developed market economies accounted for about 58 per cent of the world value added in the food industry. Together, the EEC, the United States and Japan claimed about 90 per cent of the value added in the developed market economies. The following table, which is based on averages for 1977-1981, shows that in that period the EEC (excluding Greece, Ireland and Luxembourg) was the largest producer, both in terms of value added and employment.[2]

The food industry in selected developed market economies, 1977-1981

	Value added (billions of dollars)	*Number of employees (thousands)*
EEC	77.1	2 124
United States	64.5	1 540
Japan	27.3	1 060

The steady, if modest, rate of expansion in the food industry of the developed market economies is a consequence of the growth in food consumption expenditure, which itself tends to be slower than the rate of growth of total consumption expenditure.[3] The industry, however, is not always severely constrained by food consumption expenditure. For one thing, it benefits from the growth in the share of services in consumer expenditures. In Japan, for instance, the share of total food expenditure accounted for by restaurants and catering services jumped from 7 to 15 per cent between 1965 and 1975.[4] For another thing, it benefits from the fact that an increasing proportion of expenditure on food items is being devoted to industrially processed foods. In the Federal Republic of Germany, this proportion increased from 36 per cent in 1960 to 41 per cent in 1970 and 44 per cent in 1980.[5]

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[2] *Yearbook of Industrial Statistics, 1981* (United Nations publication, Sales No. E.83.XVII.5). Data converted to dollars on the basis of IMF yearly conversion rates.

[3] The growth rate of food consumption expenditure ranged between 0.5 and 2 per cent in most of the high-income OECD countries between 1968 and 1978. These values were 40 to 60 per cent lower than those found for the growth rate of total consumption expenditure. See OECD, *Comptes nationaux des pays de l'OCDE, 1961-1978* (Paris, 1980).

[4] Y. Ono, "Evolution du système alimentaire du Japon au cours des années 80" (Paris, OECD, 1982), p. 8.

[5] W. Grosskopf, "Ajustements structurels des industries alimentaires dans la République fédérale d'Allemagne" (Paris, OECD, 1982), p. 2.

The shift towards industrially processed items can only be ob high level of statistical disaggregation because it is a phenomenon ch by the differentiation and substitution of items within broad categories of food products. This feature is evident from the data for Kingdom given in table X.1. The share of different food grou household food expenditure was fairly constant between 1960 and 19 each group, however, major shifts occurred in favour of foods co larger proportion of value added or "services" (the degree of prep the food). For example, the consumption of breakfast cereals expa that of bread contracted; sugar confectionery increased, but su decreased; purchases of beef remained steady, but purchases of poultry expanded. Manufactured food items have an income elasti much higher than that of the food group to which they belong. For 1972-1977, the income elasticity for frozen vegetables in the United was estimated to be 0.75, as against 0.14 for the vegetable group a Between 1974 and 1979, the consumption of concentrated milk decreased by 37 per cent and that of milk increased by only 8 per c consumption of yoghurt and cheese rose by 19 per cent while that o rose by 30 per cent.

Table X.1. United Kingdom, 1960-1980: share of selected categories of food in total food expenditure; indices of consumption of selected food items

	1960	*1970*	*1980*
Bread and cereals[a]	13	13	13
White bread[b]	114	100	68
Breakfast cereals[b]	66	100	124
Meat and meat products[a]	27	27	28
Beef, veal[b]	118	100	97
Pork[b]	71	100	146
Poultry[b]	35	100	133
Dairy products[a]	15	15	15
Milk[b]	104	100	89
Other[b]	89	100	104
Sugar, preserves, confectionery[a]	10	9	10
Sugar[b]	105	100	66
Beverages[a]	6	6	8
Soft drinks[b]	79	100	194

Source: D. Mordue, "The food sector in the context of the U.K economy", *The Food Industry*, J. Burns, ed. (London, Heinemann, 1983), pp. 21-23

[a]Percentage of total food expenditure.

[b]Index of volume of consumption (1970 = 100).

In view of the rapidity with which the structure of indi consumption expenditures is changing, the common impression industry as a stable one supported by a steady demand requires r overall pattern may be stable, but food processing enterprises f

[1]DAFSA-Analyse, *Les industries de la surgélation en Europe* (Paris, 1980), p. 9.

adjustment problems. These problems can be attributed to a host of socio-economic factors which are tending to divert consumers away from traditional foods towards time-saving convenience foods. The factors include higher incomes, which permit the purchase of more household equipment such as deep-freezing units and micro-wave ovens; the increased participation of women in the work force; the spread of suburban housing and private transportation; and shifts in distribution channels which favour multi-product foodstores.

With the transformation of the socio-economic framework that came in the wake of the Second World War, the proportion of food expenditure devoted to industrially processed foods increased markedly. This phenomenon was manifest in all the countries that enjoyed the post-war economic boom. It was not, however, a simple consequence of growth (as measured, for example, by GNP) or the degree of female participation in economic activity. It was, and continues to be, influenced by specific national circumstances. In Japan, per capita GNP is 20 per cent higher than in the United Kingdom (1980 figures). Female participation in economic activity is also higher than in the United Kingdom: 36.1 per cent as compared to 34.3 per cent (figures for 1972-1981).[7] However, processed foods account for only 50 per cent of total food expenditure in Japan, compared to 85 per cent in the United Kingdom.[8] One possible explanation for this difference is the structure of production. Until recently, food processing in Japan was carried out in small units. In 1979, the number of persons engaged per establishment in the food industry was over seven times greater in the United Kingdom than in Japan as was the value added per establishment.[9]

Despite Japan's high level of industrialization, a complex set of circumstances have limited the degree of its industrial concentration on food processing. The experience in the United Kingdom has been different. In that country, historical circumstances have provided exceptional opportunities for the development of large industrial enterprises in the food sector. The free-trade approach that characterized agricultural and food policies since the mid-nineteenth century left the United Kingdom market open to cheap agricultural imports. This meant that, compared with that of other European countries, the share of national agricultural output in food expenditure was relatively low. However, that approach also encouraged the growth of large enterprises. Located near ports of entry, these were able to benefit fully from economies of scale.[10] As a result, the United Kingdom now has the highest share of industrially processed food in food expenditure among the developed market economies.

The experience of the United States is similar. Up to the First World War, the food market in that country was diversified at the final consumption stage, as a consequence of the multinational features of urban food patterns.

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[7] EUROSTAT, *Review 1972-1981* (Luxembourg, 1983), p. 117.

[8] Ono, *op. cit.*; D. Mordue, "The food sector in the context of the U.K. economy", *The Food Industry*, J. Burns, ed. (London, Heinemann, 1983), p. 20. For the United Kingdom, the figure includes slaughtering (70 per cent if excluded).

[9] Calculations made from data in *Yearbook of Industrial Statistics, 1981* . . . .

[10] J. Burns, "A synoptic view of the food industry", *The Food Industry*, J. Burns, ed. (London, Heinemann, 1983), pp. 10-13.

Nevertheless, the domestic market was still large enough to allow for economies of scale in semi-processed products. In the years between the world wars, food producers sought to reduce the degree of market segmentation and product specialization in the final stage, by promoting convenience foods with a high level of value added. These efforts gave rise to a radically new pattern of food consumption. Thus, by the end of the Second World War, firms in the United States had gained a position from which they could promote a pattern of food consumption to match the changing conditions of living that came with the end of the war.[11]

The experience of the United Kingdom and the United States underlines the importance of the role of suppliers in orienting consumers towards food items with a higher value added content. Developments in the food industries of these two countries in time began to be imitated in the technology and marketing strategies of other countries undergoing the same modernization process; nevertheless, the two have retained their dominant position among the developed market economies. In the mid-1970s, 48 of the 100 largest food enterprises in the developed market economies were based in the United States and accounted for 52 per cent of the developed market economies' total turnover in food expenditure. In the United Kingdom, 23 such firms claimed 22 per cent of the same turnover.[12]

Two studies, based on data for 1977, indicate that the concentration ratio, measured as the share of the largest firms (5 in the United Kingdom, 4 in the United States) in total food industry sales was high in both countries. In the United Kingdom, it was 74 per cent, as compared to 65 per cent in the manufacturing sector as a whole. A detailed analysis of 60 major food products in that country showed that the concentration ratio exceeded 70 per cent for 37 products (which together represented 62 per cent of the total sales for all products studied).[13] In the United States, the concentration ratio was 50 per cent for the branch as a whole, but ratios of more than 60 per cent were found for 17 of the 47 major food products studied.[14]

Despite differences in the size of national markets, these variations in concentration ratios can not be explained merely in terms of economies of scale. In both the United Kingdom and the United States, concentration ratios for most products are well above the optimal size which would be determined by technological norms. Moreover, they are much higher at the enterprise than at the establishment level.[15] For certain semi-processed products (e.g. sugar and vegetable oils), technological considerations have obviously been responsible for greater concentration at early stages of the processing chain. In the United Kingdom and the United States, general developmental policies have tended to

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[11] *Industry in a Changing World* (United Nations publication, Sales No. E.83.II.B.6), chapter IX.

[12] "Draft world-wide study on agro-industries" (UNIDO/ICIS.65, 1977), p. 42.

[13] B. G. Watts, "Ajustement structurel des industries alimentaires au Royaume-Uni" (Paris, OECD, 1982), pp. 25-31.

[14] J. M. Connor, "Ajustement structurel des industries alimentaires des Etats-Unis" (Paris, OECD, 1982), p. 8.

[15] J. M. Connor, "The United States food and tobacco manufacturing industries' market structure, structural change and economic performance" (Washington, D.C., United States Department of Agriculture, 1980), pp. 20-23.

favour the establishment of large firms capable of taking full advantage of the potential of economies of scale. These firms are usually also in a position to expand their markets, through mergers, and to minimize competitive pressure in fields using standardized products, through branding and aggressive marketing. Thus, technological economies of scale have often played the role of "starter" in the formation of oligopolistic structures. Yet, when certain new food products (soft drinks, breakfast cereals, chewing gum, potato chips etc.) were introduced, economies of scale were more important in marketing and sales promotion than in production. This also benefited firms operating in oligopolistic and even monopolistic market structures.

After the Second World War, these trends were reinforced through a systematic strategy of product differentiation. The strategy called for heavy investment in the creation of capacity, the mounting of effective promotion campaigns, and the ensuring of appropriate outlets for the new products. The investments in capacity and promotion were regarded as fixed production costs which served also to create a barrier against the entry of newcomers. In order to protect and expand their markets, large firms originally sought to maintain these barriers by continuously launching new products which incorporated a high share of value added at the industrial processing stage.[16] However, new food products cannot be turned out indefinitely. It became clear that it would be necessary to base the innovation strategy on forms of product substitution and product differentiation. This explains why so many firms diversified their operations to cover a variety of product lines and food categories.

The development of a new product requires a three-phase global strategy: *(a)* potential markets must be identified through careful analysis of consumers' needs, behaviour and environment (a product concept); *(b)* a prototype must be developed and tested; and *(c)* the new product must be promoted through aggressive advertising and marketing. It is a lengthy process requiring, on average, between 35 and 40 months to accomplish and demanding synergistic efforts on the part of a number of corporate teams.[17] In this process, the cost of innovation is much more closely related to marketing operations than to the level of production. Corporate growth strategies rely upon the rapid turnover of new products. In the United States, large corporations launch on average 5,000 new grocery products every year.[18] In the Federal Republic of Germany, 650 new products were launched in 1979.[19] This type of strategy requires a costly promotion effort. Patterns of consumer demand must be shaped in accordance with the pace and nature of innovation. Innovation itself requires the creative application of techniques developed in other industries or research fields (e.g. chemistry, plastic packaging, the use of colourants and additives, and biological research). The cost of such innovation is largely external to the industry—a fact that is reflected in the relative volume of R and D and advertising expenditure in the food industry of the two countries that have established the standard strategy for corporate food planning. In the United

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[16]S. Howe, "Competition and performance in food manufacturing", *The Food Industry*, J. Burns, ed. (London, Heinemann, 1983), pp. 103-107.

[17]R. S. Meyer, "Eleven stages of successful new product development", *Food Technology* (Chicago, Institute of Food Technology, July 1984), pp. 71-78.

[18]OECD, "Les industries alimentaires de l'OCDE dans les années 80" (Paris, 1983), p. 135.

[19]Grosskopf, *op. cit.*, p. 11.

States, in 1980, R and D expenditure by the food industry accounted for only 0.7 per cent of value added (against 5.7 per cent for the manufacturing industry as a whole), whereas advertising expenditure accounted for 13 per cent.[20] The proportion was much higher for specialized products such as breakfast cereals and soft drinks. In the United Kingdom in 1976-1977, the food industry's media advertising expenses were three times its R and D expenses.[21] At the same time, that country accounted for 30 per cent of the total number of industrial food research workers in the EEC.[22]

In 1980, total EEC expenditure on food R and D was 0.5 per cent of value added—about two thirds that of the United States.[23] The rising share of value added in food expenditure appears, therefore, to be a result of a strategy pursued by highly concentrated firms seeking growth through product differentiation. It is not regarded as the consequence of an increase in the quality of food consumed as incomes grow. Nor is it an automatic by-product of a country's high degree of industrialization, as demonstrated by the example of Japan. Rather, it results from the ability of firms to incorporate "services" in the industrial transformation of the product.[24]

The widening range of innovations and technical changes in the last 20 years have helped to boost the share of value added in the total food consumption of the developed market economies. One type of innovation can be linked with further extensions of industrial processing along the food chain. This has been the case in the meat industries, which have benefited from technical improvements in transport and packaging (e.g. multi-temperature vehicles, oxygen and moisture barriers, plastic films and vacuum packing). These improvements have led to a reduction in distribution costs, and particularly in the costs of transporting final products. Consequently, they have given industrial processing in large plants a competitive advantage over decentralized, handicraft-type processing. Another innovation, though not so well known, is the application of irradiation techniques to perishable food products (meat, seafood, fruit and vegetables). This technique extends the shelf-life of products through the destruction of insects and micro-organisms. Irradiation is also used in the processing of heat-sensitive foods (e.g. certain flours). Since 1970, an increasing number of products have been submitted to irradiation. These include potatoes, onions, strawberries, peppers, wheat flour, poultry and shrimps. Use of the technique, however, is constrained by regulations (in the United States, for example), by consumers' psychological resistance, by the high fixed costs of the equipment needed, and by the considerable industrial area needed to house the equipment.[25] Nevertheless,

[20] United States Bureau of the Census, *Statistical Abstract 1982-1983*, pp. 567-568, 595 and 773.

[21] Howe, *loc. cit.*, pp. 108-109.

[22] Some three quarters of these research workers in the United Kingdom were employed by private institutes and companies.

[23] Commission of the European Communities, *Food Industry in the European Economic Community* (Brussels, 1981), p. 80.

[24] A. Ashby, "The economic environment of the food industry", *The Food Industry*, J. Burns, ed. (London, Heinemann, 1983), pp. 52-53.

[25] Association Promotion Industrie Agriculture (APRIA), "Les technologies des industries agro-alimentaires. Progrès récents et perspectives" (Paris, 1981), pp. 37-52.

irradiation (sometimes used in association with freezing techniques) represents an extension of industrial techniques to new links in the food chain.

Another innovation concerns the "package"-type application of new techniques in the production of standardized industrial products. Examples of such techniques include combining ultra-high-temperature processing and aseptic packing. Aseptic packaging was originally used for the storage of long-life milk, but the 1970s saw it being increasingly applied to other products. It has many spin-off effects, such as reducing the non-industrial costs associated with energy, transport, packaging and storage. It has been progressively applied to a number of dairy products (e.g. yoghurt, cream and cheese) as well as non-dairy products (e.g. fruit juices). Its growth is closely linked with the rise of corporate-model food processing in Western Europe and Japan.[26] It is also partly attributable to the fact that in the 1970s Japanese and European food enterprises were more conscious of the need to save on energy and transport costs than their American counterparts.[27]

An innovation that has probably made the most valuable contribution to the food industry in the last 15 years aims at increasing the industrial yield of raw materials and identifying new outlets for traditional agricultural or food products through increased production of by-products with a high share of value added. An example is the outlet provided for corn products by the conversion of corn starch into high fructose corn syrup through the use of immobilized glucose isomerose. In the United States, isoglucose has been popular as a sweetener since the 1970s. At the same time, new possibilities for the utilization of corn have been opened up through the transformation of starch in ethanol. In recent years, major developments have taken place with respect to the transformation of milk, and these in turn have boosted the production of non-fat milk by-products. Caseins, caseinates and co-precipitate protein products have also become important as functional ingredients in formulated food products. In the United States in 1980, 76 million pounds of casein and caseinates were used in human foods (mainly imitation cheese and cream). Another 52 million pounds found non-food applications (mainly medical products and industrial products such as glues, paints and cleaning agents).

Whey plays a determining role in the utilization of milk by-products by food and non-food industries alike. In 1982, some 308 million pounds were used in the United States in the manufacture of animal foods. Another 476 million pounds were used in the preparation of human foods (bakery and dairy products, soups, processed meats etc.). In the last five years, new ultrafiltration techniques have opened up new possibilities for the utilization of whey protein concentrates (e.g. in the production of meat products, carbonated beverages, fruit juices, and medical and pharmaceutical products).[28] Output of whey protein concentrates in the United States, which was 35 million pounds in

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[26]Some 15 of the largest manufacturers of cartons, cups, sachets and cans are European; 4 are American. Japanese and European firms accounted for 95 per cent of the total sales of pouches in the developed market economies in 1980.

[27]See E. R. Wedral, "Overseas influence on U.S. food technology", *Food Technology*, November 1984, pp. 85-113.

[28]C. V. Morr, "Production and use of milk proteins in food", *Food Technology*, July 1984, pp. 39-48.

1982, is expected to increase to 300 million pounds by the late 1980s. The new ultrafiltration techniques have also permitted the diversification of industrial cheese products and brought down the costs associated with their manufacture.[29]

The use of soya products, as functional ingredients for human food products, is also expanding, thanks to the development of superior spinning, extrusion and steam-texturization processes. Soy protein processing is also an example of how a technique developed in another industry can find new fields of application. Four basic soya products (full-fat protein, defatted protein, concentrates and isolates) are important inputs for a number of components (baking powders, flour, milk and spun protein) used in the production of many final food products (biscuits, cakes, chocolate spreads, ice-cream, confectionery, bread, and meat products).[30]

Many of these innovations have significant implications for the structure and characteristics of the food industry in the developed market economies. Linkages between different branches are strengthened as the food industry becomes more interdependent with regard to the supply and demand of food components and ingredients. This pattern implies continuous growth *(a)* in the degree of industrial processing of basic foodstuffs, *(b)* in the share of industrially processed raw materials in the intermediate consumption of food industries, and *(c)* in the role of intermediate demand, relative to final demand, for many food items. As these new processed inputs and ingredients compete with each other as substitutes (e.g. soya and milk proteins), the firms that supply them have less control over prices than the firms that sell the final products. In an attempt to improve their position by introducing different inputs, they tend to refine the specifications and performance of fundamental properties.[31] Such innovations sometimes generate changes in production techniques, and these, in turn, spur adjustments on the part of competitors. As illustrated by the following examples, these adjustments usually have an important bearing on international trade.

(a) In the United States, an innovation designed to take advantage of domestic corn by-products has led to the promotion of isoglucose. This has had a considerable impact on the world sugar market, and in particular on that of the EEC. Two thirds of the EEC's sugar output is used by the food industry as an intermediate. This pattern could be radically altered by increased use of isoglucose. At present, EEC consumption is only half that of the United States;[32]

(b) Growth in outputs of corn starch in the United States has increased the supply of gluten feed to a point where the domestic market for animal foodstuffs has become saturated. The oversupply has resulted in an export

[29]M. Mahaut and others, "Eléments de fabrication de fromages frais par ultrafiltration", *La technique laitière*, No. 961, 1982, pp. 9-13.

[30]"Soy products in foodstuffs", *Food Processing*, October 1983, pp. 45-47.

[31]An example is the extraordinary diversification of starches, each being marketed with highly specific properties—cold-water solubility, viscosity without detectable gel-structure, delayed-action viscosity development, freeze-thaw stability etc. See R. Blanchfield, "Technological change in food manufacturing and distribution", *The Food Industry*, J. Burns, ed. (London, Heinemann, 1983), pp. 90-95.

[32]DAFSA-Analyse, *L'industrie européenne du sucre* (Paris, 1981), p. 34.

drive which is focused primarily on the EEC and Japan and which may alter those markets' sources of animal feed;

(c) In recent years, Australia, the EEC and New Zealand have developed the production of non-fat milk by-products such as casein and caseinates to the point where they meet a significant portion of world requirements. In the 1970s, as industries in the United States adjusted to the use of casein and caseinates in the formulation of many food products, American imports of those inputs increased by 50 per cent.[33]

A final type of innovation, one that is closer to the classical picture of technological change, relates to the search for economies of scale and higher productivity. Examples of this type of innovation include the widespread use of batch processes, fluidized bed processes, and microprocessor-controlled processes, all of which have led to an expansion of optimum plant size. This expansion has generally been accompanied by a reduction in the number of establishments and workers, but an increase in size of establishments, capital investment and value added per worker.

The standardization of food patterns in the developed market economies

The last 25 years have witnessed increased standardization in the pattern of food consumption and production in the developed market economies. International trade has been an important element in this process. Between 1968 and 1978, the share of food exports in domestic output increased markedly in Belgium, France, Germany, Federal Republic of, the Netherlands, the United Kingdom and the United States. Similarly, the share of imports relative to national consumption rose in Belgium, France, Italy and the Netherlands.[34] These trends were the result, mainly, of the growth in intra-EEC trade. In 1980, intra-EEC imports represented 47 per cent of total food imports, while intra-EEC exports amounted to 65 per cent of total food exports.[35] Furthermore, the EEC is a large food exporter to the rest of the world[36] and a net exporter of processed food products.[37]

The growth of intra-EEC trade reflects the progressive standardization of European food patterns. Extra-EEC trade, however, is primarily determined by specialization and comparative prices. EEC imports consist mainly of raw materials and semi-processed products such as cereals, oilseeds and animal foodstuffs. These are imported from the United States. American suppliers of

[33]United States Department of Agriculture, "U.S casein and lactalbumin imports: an economic and policy perspective", Report AGESS 810521 (Washington, D.C., 1981), pp. 15-20.

[34]OECD, "La politique alimentaire" (Paris, 1981), p. 24.

[35]Commission of the European Communities, *The Agricultural Situation in the Community: 1982 Report* (Brussels), pp. 260-261.

[36]Extra-EEC food trade represented, in 1980, 33 per cent of all OECD processed food exports. See Commission des Communautés européennes, *La compétitivité des industries de la Communauté* (Luxembourg, 1982), p. 27.

[37]In 1980 exports of the food industry were 30 per cent higher than imports of industrial food products. See Commission of the European Communities, *The Agricultural Situation . . .*, pp. 28-29.

highly processed food products, on the other hand, play only a limited role in the total food imports of the EEC. Japan is a different case, in the sense that the share of imports in its total food consumption decreased during the 1970s. However, the structure of Japanese imports has tended to shift towards a larger share of meat and animal foodstuffs imported from the United States.[38]

Besides trade, international investment has also contributed to the standardization of patterns of food production and consumption in the developed market economies. Firms based in the United States and the United Kingdom have been particularly active in this field since the early 1960s. Among the 58 largest food corporations operating in the EEC, 33 are based in one of those two countries.[39]

More recently, corporations based in continental Europe have also become major international investors. In 1980, two European multinational producers of frozen foods shared 65 per cent of the market in the United Kingdom, 55 per cent in Belgium and 60 per cent in Italy (through the joint control of a local affiliate). One of them attained 40 per cent of the market in the Federal Republic of Germany and 20 per cent in France.[40] European multinationals have also established co-operative ties in traditional products where economies of scale favour concentration.

The scope of international investment has resulted in substantial foreign participation in the food industries of most EEC countries. It has been estimated that foreign enterprises control 15 per cent of the assets of the food industry in the Federal Republic of Germany. Their share is especially high in branches producing oils and fats, processed cheese, concentrated milk and frozen products. During the 1970s, American and Swiss multinationals accounted for the lion's share of food industry investment in the Federal Republic of Germany.[41] In the Netherlands, it is reckoned that foreign enterprises account for 11 per cent of food industry sales.[42] In France, foreign participation is very high in branches producing margarine, soups, powdered coffee, biscuits and confectionery.[43] In no EEC country, however, is the foreign influence as marked as it is in Canada, where 33 per cent of food sales[44] are by foreign enterprises. In the 1970s, large European corporations developed extensive operations in the United States. In that country, however, foreign investment accounts for only 5 per cent of sales.[45]

Since 1980, two major trends have become apparent. First, a bilateral wave of investment between the United States and the EEC has involved mergers between major enterprises on both sides.[46] Second, United States and EEC

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[38]See OECD, "Problèmes des échanges agricoles" (Paris, 1982), p. 18.

[39]See J. Bombal and P. H. Chalmin, *L'agro-alimentaire* (Paris, P.U.F., 1980), p. 42.

[40]DAFSA-Analyse, *Les industries de la surgélation . . ., op. cit.*, pp. 67-88.

[41]Grosskopf, *op. cit.*, pp. 27-28.

[42]E. Klein, "Les industries alimentaires aux Pays-Bas: structures et politique des pouvoirs publics" (Paris, OECD, 1982), p. 10.

[43]B. Ewenczyk, "L'ajustement structurel des industries agricoles et alimentaires en France au cours des vingt dernières années" (Paris, OECD, 1982), p. 15.

[44]P. K. Gorecki, "L'ajustement structurel du secteur canadien de l'alimentation et des boissons" (1982, OECD), p. 14.

[45]OECD, "Les industries alimentaires de l'OCDE dans les années 80" (Paris, 1983), p. 47.

[46]*International Business Week*, September 1984, pp. 82-103.

enterprises have entered into joint ventures with large Japanese producers, thereby initiating an expansion in branded industrial food products in Japan. Imitation effects have also contributed to the diffusion process. The experience of firms in the EEC and Japan attests to the fact that when global economic conditions are favourable, local food enterprises can replicate the growth pattern of enterprises in the United States, by combining technological innovations with product marketing strategies. Table X.2 provides an overview of these trends, by product and stage of processing.

At the first stage, the share of value added in gross output is usually low, but the value added per worker is often high, owing to economies of scale and the use of labour-saving technology. Technologies and final products are generally standardized. International investment is not significant, but international trade is. And, as was noted earlier, this trade entails structural shifts which favour the growth and spread of the corn-oil and animal foodstuffs chain in the developed market economies.

At the second stage, the share of value added in gross output rises, but value added per worker generally drops below that achieved in the first stage. Technology and products are relatively unstandardized. The degree of multinational influence in the field is much lower, and international investment and trade play a less important role.

Table X.2. Food products: degree of standardization and level of internationalization among developed market economies in general, and among countries members of the EEC, in relation to the stage of transformation[a]

Products and stages of transformation	*Share of value added in gross output*	*Value added per worker*	*Degree of standardization*		*Level of internationalization*			
					Trade		*Investment*	
			Technology	*Products*	*Among developed market economies in general*	*Within the EEC*	*Among developed market economies in general*	*Within the EEC*
First stage								
Milk	1	2	3	3	1	1	1	1
Meat	1	1	3	3	2	3	1	1
Sugar	1	3	3	3	2	2	1	1
Flour	1	3	3	3	2	2	1	1
Oils and fats	1	3	3	3	2	3	1	1
Corn and oil products for animal feeding	1	3	3	3	3	3	2	1
Fruit and vegetable juices and preserves	1	1	3	3	2	3	1	2
Second stage								
Bread and flour confectionery	2	1	1	1	1	1	1	2
Meat products	2	2	2	1	1	3	1	1
Animal feedstuff	2	3	2	2	1	3	1	1
Chocolate and sugar confectionery	2	2	2	2	1	3	1	1
Dairy products	2	1	1	1	1	3	1	1

Products and stages of transformation	*Share of value added in gross output*	*Value added per worker*	*Degree of standardization*		*Level of internationalization*			
					Trade		*Investment*	
			Technology	*Products*	*Among developed market economies in general*	*Within the EEC*	*Among developed market economies in general*	*Within the EEC*
Third stage								
Frozen products	3	3	3	3	1	3	1	3
Biscuits, snacks	3	1	3	3	2	3	3	3
Highly processed dairy products	3	3	3	3	2	3	3	3
Baby and pet foods	3	3	3	3	2	3	3	3
Soups and breakfast cereals	3	3	3	3	1	3	3	3
Soft drinks	3	3	3	3	1	3	3	3
Powdered coffee	3	3	3	3	2	3	3	3
Brewery	3	3	2	2	1	3	1	2
Food ingredients	3	3	3	3	2	3	1	1

Source: J. P. Peemans, "Agro-food industries: a comparative international typology of performances and prospects", consultant paper prepared for UNIDO, January 1985.

[a]Estimates: 1 = low or very low; 2 = medium; 3 = high or very high.

At the third stage, most variables take on their highest values. The degree of standardization in technology and products is largely dependent on the level of international investment, but it is not related to the level of international trade. Increasing the share of value added, through branding and product differentiation, contributes to greater standardization of functional ingredients, packaging and technical processing.

Although the product-mix and technologies used are similar in most developed market economies, some important structural differences remain. These are attributable to many factors: the pattern of industrial organization, the general economic environment, differences in national agro-food policies, and cultural habits. All interact and contribute to the development of unique structural characteristics.

At the second stage of processing, differences in industrial organization are apparent. The result, primarily, of ingrained social and cultural habits, rather than technological backwardness, these differences contribute to the prominence of small-scale, specialized food enterprises. At the end of the 1970s, food enterprises with less than 1,000 employees accounted for 27 per cent of employment and 31 per cent of value added in the United Kingdom. At the same time, enterprises with less than 500 employees accounted for 57 per cent of employment and 59 per cent of turnover in France and 75 per cent of sales in the Federal Republic of Germany.

In addition to these distinctions in industrial organization, differences in the general economic environment can also explain national variations in structure. Food industries in the United Kingdom, for instance, have a comparatively low level of productivity (in terms of value added per worker),

despite the emphasis which that country gives to technology and product strategy. A probable explanation is the generally low level of wages. Nevertheless, the food industry is a profitable one compared with other industries in the United Kingdom.[47] Finally, structural differences between industries in the developed market economies may be due to specific policies at the national or regional level. The composition of food industry output, for example, is affected by export policies. Such policies are responsible for the large differences in the contribution of milled grain products and sugar to the value added of the food industry in the United States and in the EEC. In 1977, their shares were 12 and 7 per cent respectively in the United States, and 3 and 15 per cent respectively in the EEC.

The agro-food industry in the developing countries

In 1981, value added in the food industry of the developing countries accounted for about 16 per cent of the world total. The food, leather and petroleum industries were among the few to achieve a rate of growth during 1973-1980 that was superior to that of 1963-1973. For the developing countries as a whole, food industry growth during the 1970s roughly matched MVA growth. At the individual country level, however, this relationship was subject to the level of development. In low-income countries, the food industry grew faster than MVA in 14 out of 23 countries for which data were available; in middle-income countries, it grew faster in 8 out of 21 countries; and in high-income countries it grew faster in only 2 out of 14.[48]

Table X.3 shows some characteristics of the food industry in 20 developing countries and areas in 1975 and 1980. The picture is one of striking diversity. Per capita sales of processed food were particularly high in economies that had only modest agricultural resources of their own. These economies, however, were either oil exporters or relatively industrialized. Per capita sales were also high in three relatively industrialized Latin American countries which are also agriculturally well endowed: Brazil, Mexico and Venezuela. The share of the food industry in total MVA was less than 5 per cent in Hong Kong and Singapore and more than 20 per cent in Kenya, the Philippines and Malaysia. Value added per employee ranged from $2,500 in Indonesia to $17,300 in Singapore. One measure, however, was fairly uniform: the share of value added in gross output. With a mean value of 25.5 per cent, this was roughly the same as the average for the developed market economies. It was achieved, though, using productive structures widely different from those used in the developed market economies. These different structures can best be analysed in the light of the global food network and the interaction between the food industry and the agricultural sector.

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[47] Watts, *op. cit.*, p. 29.

[48] Low-income developing countries are defined as those that had less than $600 per capita GDP in 1978 at current prices. Comparable figures for middle-income and high-income developing countries are $600-$1,320 and more than $1,320, respectively.

Table X.3. The food industry in selected developing countries and areas: sales of processed food (1975) and characteristics of the productive process (1980)

Country or area	Per capita sales of processed food, 1975		Characteristics of productive process, 1980			
	Total population (dollars)	Urban population (dollars)	Share of MVA (percentage)	Value added per employee (thousand dollars)	Wages per employee (thousand dollars)	Value added in gross output (percentage)
Algeria	57	131	...	...	...	...
Brazil	125	211	11.7	13.4	2.0	28.8
Colombia	98	144	18.4	12.9	2.4	26.1
Egypt	56	123	17.8	...	...	...
Hong Kong	253	272	2.3	8.8	3.8	28.9
India	16	48	7.6[a]	...	..	...
Indonesia	12	29	...	2.5	0.7	23.3
Iraq	39	69	...	...	...	...
Ivory Coast	35	195	...	...	...	...
Kenya	39	197	37.9	7.8	2.2	19.5
Kuwait	402	406	...	...	...	...
Libyan Arab Jamahiriya	177	230	...	...	...	...
Malaysia	65	134	21.3[a]	11.7[a]	1.8[a]	19.0[a]
Mexico	145	246	15.5	10.3	4.2	29.7
Nigeria	19	54	...	...	...	...
Philippines	50	99	23.7	4.8[a]	0.9[a]	25.3[a]
Republic of Korea	38	69	9.1	14.8	3.7	29.6
Saudi Arabia	...	221	...	...	...	...
Singapore	232	244	4.5[b]	17.3[b]	5.0[b]	21.0[b]
Venezuela	254	317	13.7[a]	16.6	6.7	29.8
Mean values in the sample	111	172	15.3	11.0	3.0	25.5
Mean values in developed market economies	...	...	11.7	30.2	11.2	25.5

Source: *Transnational Corporations in Food and Beverage Processing* (United Nations publication, Sales No. E.81.II.A.12), tables 1-2, 1.3, 1.4 and *Handbook of Industrial Statistics 1984* (United Nations publication, Sales No. E/F/84.II.B.8).

[a] 1979.

[b] 1981.

The global food network and the structure of the food industry

By comparing national food imports against national food output, it is possible to identify three categories of developing countries and to associate certain features of the global food network with each category. The first category is comprised of countries with high per capita income and a small agricultural sector: some export oil, others export manufactures. The composition of their food imports is highly diversified, with basic staples (cereals, sugar, oils and fats) accounting for only a small share. Large sections of their population have adopted developed country patterns of food consumption. Per capita sales of processed food are relatively high, but only a small portion of them reflect domestic sources (table X.4). The disparity between total sales of processed foods and the share of the domestic industry in those sales can be attributed partly to the growing popularity of sophisticated food products (i.e. products generally regarded as part of the third stage of processing), almost all of which are imported.

Table X.4. Share of national output in food sales, and share of basic staples in food imports, selected developing countries and areas, 1975 and 1980

(Percentage)

Country or area	*Share of national output in food sales in 1975*	*Share of basic staples in total food imports in 1980*
High income, with small agricultural sector		
Hong Kong	27	20
Kuwait	27	18
Libyan Arab Jamahiriya	19	24
Saudi Arabia	39	40
Singapore	68	46
Middle income, oil exporting		
Algeria	86	59
Indonesia	83	81
Nigeria	75	59
Oil importing		
Brazil	116	75
Colombia	105	75
India	107	83
Malaysia	146	. . .
Mexico	101	79
Republic of Korea	117	91

Source: FAO, *Production Yearbook, 1980; Yearbook of International Trade Statistics, 1977* (United Nations publication, Sales No. E.78.XVII.1) and *Yearbook of International Trade Statistics, 1980* (United Nations publication, Sales No. E/F.81.XVII.13); *Transnational Corporations in Food and Beverages Processing* (United Nations publication, Sales No. E.81.II.A.12).

Although imports are the major source of supply, opportuni
domestic expansion do exist. In some of these countries, enterprises rega
being at the first stage of processing use capital-intensive technologies.
turn-key establishments which operate with the help of protecti
subsidies,[69] they produce new staples (wheat flour, meat and milk) in r
to the changing pattern of food demand. The small-scale enterprise
process traditional food staples at the second stage of processi
progressively eliminated, and a new food chain, featuring modern pr
operations and extensive distribution outlets, is created.

The second category consists of middle-income, oil-exporting co
The share of food sales in their national output is higher than in t
category. Imports are also higher than in countries at the same level of
but which lack the foreign revenue provided by oil exports. Their imp
less diversified than those in the first category, but this is changing wi
especially through the replacement of local staples by staples which a
common in developed countries. The rapid growth of income in some ex
countries (in both categories) has stimulated demand for food to such a
that local supply cannot keep up with it. As foreign exchange b
available, this problem is overcome through imports, as shown in tabie X

Table X.5. Index of food imports in selected countries and areas, 1970-198

SITC code	*Food imports*	*Total developed market economies and developing countries*	*Twenty developing countries and areas*[b]	*Saudi Arabia*	*Algeria*
011	Meat	453	1 517	4 966	—
022	Milk and cream	562	649	1 650	—
023	Butter	403	953	1 400	1 850
024	Cheese	507	8	1 540	—
041	Wheat unmilled	340	390	630	—
042	Rice	420	489	551	2 800
044	Maize unmilled	409	1 133	)	10 500
046	Wheat flour	323	436	1 150	—
048	Cereal preparations	537	621	3 500	—
054	Vegetables	378	622	1 560	1 420
061	Sugar	294	798	962	—

Source: Data in *Yearbook of International Trade Statistics, 1980* (United Nations public
No. E/F.81.XVII.13).

[a] 1970 = 100 (current dollars).

[b] As listed in table X.4.

One drawback with this pattern is that the imports tend to instil r
habits to which national producers cannot easily adjust. The average si
population in this category, however, and the rapidity with which tr
habits are being replaced by new ones, means that there is room for e
for units producing flour, meat, milk, edible oils and fats and sugar
first stage of processing). The growth of these units is generally follow

[69] A. Martens, "L'économie des pays arabes", *Economica* (Paris, 1983), chapters VI

establishment of operations at the second processing stage supplying new staples (e.g. bread and animal foodstuffs). Thus, the pressure on the traditional agro-food sub-sector to adjust to new food patterns increases as a form of "transitional dualism" arises. This is particularly true in countries where the rapid shift towards modern foods is led by consumers in upper-income brackets.

The third category is comprised exclusively of oil-importing countries. In these countries, domestic food supply often exceeds local consumption. The surplus—largely traditional products—is exported. Food imports are mainly staples, but in some countries (e.g. Malaysia and Republic of Korea) consumer preferences have been affected by the rapid pace of industrialization. This has resulted in a relatively high ratio of food imports to food output. In most countries in this category, the pattern of income distribution and the pace of economic growth play an important part in determining the import-output ratio. These countries also tend to have a high degree of self-sufficiency, but significant differences are to be observed in the structure of their food industries. In several of the larger countries, the traditional structure is dualistic: the food consumed by high-income groups is similar to that in developed countries and involves extensive local processing; the food consumed by low-income groups is based upon local staples.

Rapid industrialization has prompted a shift towards more processed, branded and sophisticated food products. Although lower income consumers continue to buy the traditional, popular staples, a new pattern of food consumption has gradually begun to emerge. Products identified as being at the third stage of processing include carbonated beverages, which have a high price/nutrient-content ratio, and wheat flour, a new, relatively low-priced staple.[50] The net result is that as producers expand operations at all stages of product transformation, the distribution of value added in the food industry becomes more diversified. New operations typically include the elementary and intermediate processing of basic, common staples, the processing of tropical foods for export, and the extensive processing of a considerable range of food items.

High rates of industrial growth are not always associated with structural dualism in the food industry. Important differences are to be noted between Latin American and Asian countries. In the Republic of Korea, where very high rates of industrial growth are associated with minimal disparities in income, the basic diet continues to include a high level of fish and vegetable protein; per capita sales of processed foods are relatively low (see table X.6). This relationship between relatively even income distribution and adherence to a traditional diet has encouraged the emergence of a dietary pattern in the Republic of Korea that is quite different to that found in, say, Brazil or Mexico.[51] In this context, the intermediate processing of traditional staples has been of great importance, for in the Republic of Korea, as in Japan, the food industry continues to be relatively labour-intensive. Outlets for more exten-

[50] A. Miroux, "Agriculture et balance des paiements au Brésil: nécessité d'ajustement et redécouverte du secteur agricole", *La documentation française*, Notes et études documentaires, No. 4675-76 (Paris, 1983), pp. 115-146.

[51] D. H. Kim and Y. J. Joo, "The food situation and policies in the Republic of Korea" (Paris, OECD, 1982), pp. 70-76.

Table X.6. Industrial output, income distribution, food sales and structure of diet, selected countries, 1975

Country	Industrial output per capita[a]	Percentage of income received by: Lowest income group (40 per cent of population)	Percentage of income received by: Highest income group (10 per cent of population)	Processed food sales per capita[a]	Nutrition (per capita): Calories	Nutrition (per capita): Total proteins per day (grams)	Nutrition (per capita): Animal proteins per day (grams)
Brazil	100	7	51	100	2 447	59	23
Mexico	120	10	41	110	2 791	72	24
Republic of Korea	82	17	27	30	2 957	80	16

Source: World Bank Development Report 1982; Transnational Corporations in Food and Beverages Processing (United Nations publication, Sales No. E.81.II.A.12); FAO, *Production Yearbook, 1982.*

[a]Index based on Brazil = 100.

sively processed products are still limited (except in the case of beverages). The growth of advanced processing operations has therefore been more constrained in Asia than in Latin America. Nevertheless, the rapid rise in real incomes has led to progressive diversification in consumption and greater intake of animal protein. These shifts have been realized through imports of new staples and the development of local units to process them.

In the Republic of Korea, the traditional food pattern survives because it is based on a balanced and diversified diet which uses improved local raw materials. The relatively equitable distribution of income, moreover, favours the diffusion of new types of food across all strata of the population. The end result is a diversified food pattern which features the integration of traditional products and new staples in the popular diet.

The interaction between the food industry and agriculture

The international diffusion of the developed countries' food patterns is placing a heavy strain upon the traditional agro-food systems of the developing countries. As consumers in the latter countries shift their preferences to new staples, and as producers in those countries adopt modern technologies, the traditional agricultural and processing units tend to be crowded out. This effect is best seen through analysis of the phenomenon that is currently affecting the agro-food system of the developing countries: the progressive substitution of a cereal-oilseed-animal-protein diet for the traditional, vegetable protein one.

The rapid expansion of the animal-protein food chain is the result of many interdependent elements: promotion by transnational corporations; pervasive international imitative effects in countries with a growing and internationally oriented middle class; policies designed to reduce food prices for urban dwellers; and the fact that—relative to other types of projects—external resources are easily available. Transnationals have played an important role in the diffusion of the chain, through their ability to co-ordinate diverse operations such as importing new staples (as inputs); transferring the

technology required to process the products (through direct investment or turn-key projects); and assisting local farmers to adjust to the production of new staples. In 1975, of the 352 transnational affiliates operating in the 20 countries and areas listed in table X.3, some 129 were active in the area of fruit, vegetables, coffee and cocoa processing; 47 in soft drinks and beer; and 176 in the cereal-oilseed-animal-protein chain.[52]

All developing countries enjoying a high rate of industrial growth face the problem of feeding a burgeoning urban population while keeping the cost of living in line with low national salaries. Some countries lack an agricultural sector sizeable enough to feed the population. Others find it difficult to expand food production on the basis of the traditional staples produced by peasant agriculture. Thus, countries that have relatively easy access to foreign exchange, through exports of oil or manufactures, or through foreign credit, have sought to solve the problem by incorporating cheap animal protein in the popular diet. In middle-income developing countries, the diffusion of the animal-protein chain takes the form of dairy products made from recomposed dry milk and of poultry meat made from imported broilers and feedstuffs. Overseas production and trade in these inputs are largely controlled by transnationals. Countries with ample foreign exchange have made costly efforts to develop local inputs to substitute for a portion of the imported products. With demand for high-quality products (e.g. fresh dairy products and beef) on the increase, capital-intensive projects have been set up to supply new staples to the food industry and fresh products to consumers. Production of these items is expanding, however, at the expense of traditional cereals. Local firms, both public and private, are involved in the processing, but they rely on sophisticated imported technology to achieve the international standards of food production they have set for themselves.[53]

In developing countries that are well endowed with agricultural resources, the diffusion of the animal-protein chain has encouraged domestic production both for local consumption and export. Whereas transnational corporations used to play a key role in initial processing, employing imported or local inputs, they have gradually been replaced by local firms.[54] Imports of the basic staples used by the domestically controlled food chains are generally increasing—especially staples for cattle feed. (In Brazil, however, while the transnationals' share in traditional food exports has diminished, their share in the animal-protein chain—which is oriented towards the domestic market—has increased considerably. This is particularly true in respect of oilseed processing.)

The diffusion of the animal-protein chain in the developing countries has had three main effects. First, it has increased the capital intensity and the productivity of agro-food operations. The initial processing of new staples is always more capital-intensive than that of traditional staples. It is soon followed by entry into more advanced processing phases, where the units

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[52] *Transnational Corporations in Food and Beverages Processing* (United Nations publication, Sales No. E.81.II.A.12).

[53] Imports, however, still account for the predominant share of products that are not extensively processed. These include animal feedstuffs.

[54] G. Arroyo and others, "Transnationales et agriculture", *Amérique latine*, No. 1, 1980, pp. 45-81.

involved also tend to be more capital-intensive than the average for the food industry. Some countries have succeeded in progressing to final processing, and have even found export markets for their products. Often, the units concerned incorporate the most advanced technological equipment and are as capital-intensive as units of their kind anywhere in the world. The global result is an increasing capital intensity of the food industry as a whole, as well as a rise in the levels of productivity which, in 1980, were between 20 and 40 per cent of those realized in the EEC.

Second, it has changed the output mix of the food sector. A salient example of such change is given in table X.7, which illustrates the rapid increase of livestock products relative to agricultural products. All the countries listed in the table, with the exception of Brazil, India and Indonesia, experienced a decrease in per capita agricultural output subsequent to 1978. By contrast, per capita output of livestock products and poultry meat increased markedly—or at least did not decrease in the same proportion.

Table X.7. Agriculture, livestock and poultry output in selected developing countries, 1972-1983

	Index of output per capita[a]							
	Agriculture			*Livestock*			*Index of total output*[a]	
	1972	*1978*	*1983*	*1972*	*1978*	*1983*	*Total meat*	*Poultry*
World	97	103	102	98	102	104	124	154
Developing countries	97	104	102	96	106	110	132	190
Brazil	96	99	110	91	105	114	143	280
Egypt	107	96	92	103	98	100	127	186
India	95	110	113	94	106	117	134	154
Indonesia	93	107	122	100	107	145	135	191
Kenya	102	99	90	108	108	106	144	145
Mexico	104	111	103	95	114	109	128	145
Nigeria	104	99	91	101	111	128	153	259
Venezuela	99	100	88	95	104	113	153	190

Source: FAO, *Monthly Bulletin of Statistics*, 1984.

[a] 1974-1976 = 100.

Third, it has led to a growing divergence between the agrarian structure and the food industry. The latter, being geared to swiftly rising demand for food in the industrial and urban sectors, has become more autonomous *vis-à-vis* the agricultural sector and more dependent on imported staples, technology and know-how. An example of this development is seen in the production of poultry meat, an integrated, even automated, industrial process that usually has its facilities in urban areas and is largely independent of peasant agriculture. This development is contributing to the demise of a food diet dominated by vegetable proteins as well as the processing of traditional staples by small-scale processors, whether rural- or urban-based. The processing of traditional staples, while characterized by low productivity levels, does make a large contribution to employment. Such processing, however, is out of phase with the rapidly changing patterns of food demand. It is, therefore, subject to severe competition from turn-key animal-protein plants.

The experience of China during the past 25 years shows that there are various possibilities for integrating peasant agriculture into the animal-protein chain, the demand for whose products is normally a consequence of rapid urban growth. Per capita output of animal protein in China is much higher than in other Asian countries with large populations. Table X.8 suggests that this is the result, primarily, of the emphasis given to meat products in China. The present pattern of meat production has been developed over a period of 25 years. It relies heavily on co-operative and peasant initiative as well as on the optimum use of local agricultural resources and wastes. It provides considerable opportunities for employment and higher incomes in rural areas. This approach is one answer to the problem of the rising demand for animal protein which is associated with rapid industrialization. It also means a strengthening of the interlinkages between the peasant economy and the industrial economy. In this sense, the Chinese experience offers what appears to be a sound alternative to the approach being adopted by most developing countries.

Table X.8. Meat output in selected developing countries, 1974-1976 and 1983

(Percentage)

	Share in total meat output							
	Beef		*Mutton*		*Pork*		*Poultry*	
Country	*1974-1976*	*1983*	*1974-1976*	*1983*	*1974-1976*	*1983*	*1974-1976*	*1983*
Brazil	60	48	2	1	21	18	16	31
China	2	2	3	3	83	83	9	9
India	22	22	46	44	7	8	12	14
Indonesia	38	30	12	11	19	17	27	38
Mexico	40	37	2	2	30	30	24	27
Nigeria	34	28	25	22	6	6	19	32

Source: FAO, *Monthly Bulletin of Statistics*, 1984.

Generally speaking, the integration of the animal-protein chain with staples processing and peasant agriculture will be one of the most urgent tasks confronting those responsible for agro-food policies in the coming years, particularly in low- and middle-income countries that have high rates of industrial growth and large populations. The possibilities to be considered may include expanding the production of local staples used for animal feeding; adapting new genetic strains and breeds to local conditions; or developing new sources of vegetable protein to offset excessive animal-protein dependency. Whatever avenue is taken, one thing is extremely important: rather than attempting to convert masses of peasants to semi-employed urban workers, the peasant economy should be incorporated into the transformation process.

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(UNIDO/IS.309)

This study outlines the methods used by UNIDO to ensure data consistency and comparability in its international analyses. It describes the practices employed for dealing with missing data as well as the procedures used to reconcile different reporting practices.

Industrial statistics for research purposes—volume II

(forthcoming)

This document contains a detailed description of the methodologies employed by UNIDO statisticians in the development of the UNIDO data base. Methods for determining data consistency and reliability are outlined. Major shortcomings in the data are summarized, as are the adjustments made to offset them. Particular reference is made to international statistics pertaining to value added, gross output, employment, and wages and salaries.

The UNIDO data base: primary sources and data base design

(UNIDO/IS.463)

This publication describes the organization of the UNIDO data base, the nature of the data involved, and the sources. The statistical orientation and priority accorded to the various sources (determined in terms of international, regional or national suppliers) is explained. Major shortcomings in the field of industrial statistics are described, together with UNIDO's approach to dealing with them.

An inventory of industrial statistics: UNIDO data base, 1985
(UNIDO/IS.474)

This study describes the coverage and types of data maintained in the UNIDO data base. It focuses on 28 industrial branches in the manufacturing sector for the period 1963-1982, giving an indication of the quality of the data available. Exceptions to the United Nations International Standard Industrial Classification of All Economic Activities are noted.

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L'industrie africaine en chiffres—vol. I: Burundi, Mali
(UNIDO/IS.474)

The document is based on previously unpublished industrial statistics, all of which where compiled as a part of a special exercise on African industry.

Africa in figures
(UNIDO/IS.517)

This detailed, statistical analysis concerns production, structural change and consumption within the manufacturing sector. Data are included for up to 28 industrial branches, as well as for a large number of specifically defined manufacturing commodities. Trade statistics for imports and exports of manufactures in selected African countries are also included.

These studies may be obtained, free of charge, by writing to the Statistics and Survey Unit, Division for Industrial Studies, UNIDO, P.O. Box 300, A-1400 Vienna, Austria.

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