RESTRUCTURING INTERDEPENDENCE ECONOMIES

PROCEEDINGS OF THE ALBENA, BULGARIA TASK FORCE MEETING (8-10 MAY 1984)

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ORGANIZATIONAL AND POLICY ISSUES OF INTERDEPENDENCE (AN INTRODUCTION)

Tibor Vasko

It is a generally accepted fact that the world has become more and more internationalized. This is evident from the ever increasing interaction of nations and nation states. These interactions are mainly in the political, economic, and cultural domains. Recently, however, concern for the natural environment has become an important issue for closer interaction.

The economic problems of the last decade, but particularly the attempts made to remedy them on a national scale, exposed the international dimension of the recent economic decline and the interdependence of national economies (Kádár in this volume). It was not always so, at least for the "big powers", as H. Kissinger (1984), pointed out for the USA:

> Economically, as late as 1950 we produced 52% of all the goods and services of the entire world. In those circumstances foreign policy was analogous to domestic policy; it was a challenge of identifying problems and then overwhelming them with resources.

No country can claim that at present.

Interdependence became an important feature of many economies in the early 1980s (and is expected to be even more so in the 1990s). Interdependence has many facets which are not easily identified, nor is it possible to understand their impact and dynamics. Yet it will be an increasingly important component of national economic policy in general and of industrial policy in particular (Ballance in this volume).

Numerous countries are finding it necessary to make interdependence the core of their economic and industrial policies, as a considerable part (often more than 50 percent) of their GNPs (GNI) is subject to foreign trade (see de Wolff in this volume). This is the case of open economies. Among these, as a specific case, are the small economies. These economies are engaged in complex economic, technological, and financial relations with other countries, the pattern of which is difficult to control nationally (Saito, Nashimiya in this volume). And yet these patterns must meet certain criteria if manageable international economic relations are to emerge. This may be the reason why the Seventh Congress of the International Economic Association selected interdependence and structural change as one of its main topics in it's 1983 Conference.

SOME SEMANTICS

Symptoms of interdependence are not always recognized and labeled by this term. In Marxist literature internationalization is often used instead of interdependence (Bogomolov, 1983). By interdependence we understand a mutual transborder involvement by economic agents located in different nation-states. Agents act in a dual transnational capacity as buyers and sellers of assets, services or rights.

There have been suggestions toward a metrics of interdependence – to measure it, for example, by the cost of avoiding interdependence. This allows for the

measurement of the symmetry of interdependence (if the cost of avoiding involvement to both actors is equal) and asymmetrical if the costs are different. To continue the semantics one can distinguish between vertical economic interdependence, (between nations with different resource-endowments) and horizontal, (when transactions are in goods of a similar kind) because of economies of scale, specialization, intra-sectoral exchanges, etc. (Dunning, 1983).

Integration is seldom seen as a proxy for interdependence, rather integration means agents interacting as if they were in the same country.

Regarding the responses to interdependence, the restructuring of a natural economy or industry is of paramount importance. The new interpretation of the term "restructuring" is explained by Hamilton (in this volume).

ORGANIZATIONS AND POLICIES

There are many well known regional institutions like the CRC, EEC, CMEA, OECD, and in specialized fields like IMF or GATT, as well as *ad hoc* or temporary organizations, all of which are in action. With the turbulent economic developments of the 1980s, these institutions are revising their roles and policies and are working on new measures (see for example, The Fast Report, 1984; Positive Adjustment Policies, 1983).

At the Thirty-Sixth session of CMEA in Budapest (June 8, 1982), the Premier Minister of the USSR, Mr. Tichonov, stressed that for an intensification of the economies of the socialist countries, it will be necessary to radically restructure production on progressive scientific and technical bases, keeping in mind the mutual *complementarity* of their economies. At about the same time President Mitterand (in Versailles) proposed a "concentrated" development of world economy, to be achieved by cooperative measures in R&D, investments, finance, and trade. These two events illustrate the importance of this topic. Thus complementarity emerges as a dual problem for interdependence, (see Pelkmans in this volume), coordination being the recommended algorithm for solving both problems.

The arsenal for making the activities more coherent consists of more impressive expressions (technical terms) than, sometimes, the real tangible results. As illustrations, (Gordon, Pelkmans, 1979), it is possible to mention:

- unification (the combination of two or more national policy structures into a common one). An example, not with overwhelming success, is the Common Agricultural Policy of Western Europe;
- coordination (internationally negotiated adaptation of domestic policy intentions to improve the impact of these policies for all participants). Coordination has many meanings and has also been mathematically formalized (for example, in the theory of multi-level multi-goal systems). It can be anticipatory (ex ante) and responsive (ex post);
- harmonization (attempts to remove inconsistencies in laws and procedures);
- consultation (helps information flows among participants and is a confidence building activity).

There are other terms used with slight differences in the meaning (concentration often used in France, orchestration, etc.). All these mechanisms have a certain political sensitivity and are sometimes (not explicitly) related to what is termed as national economic security (von Geusau, Pelkmans, 1982).

These measures are usually part of national industrial policies, but could also be used on the sectoral or corporation levels (see Pelkmans in this volume). The case in point is multinational enterprises whose activities are superimposed on the

endeavors on a national level (for case study illustrations see Dokopoulou and Hamilton in this volume).

SOME OF THE RESEARCH NEEDS

During our meeting a lively discussion on further research needs took place. Among others, the following topics were singled out:

Old Versus New Industries

A shift in the branch structure of industry is seen as a rewarding issue, it has already been widely covered in the literature. However, the knowledge obtained from this shift, which is available to policy makers, is neither conclusive or constructive, and can not be used to guarantee success in the future. Several concepts, such as diversification, leading industries, sun-rise industries, etc., though generally valid, can not easily be applied, as the many failures indicate. These concepts are the functions of the size of the economy, size of the enterprises, availability of venture capital, entrepreneurship, etc.

New Technologies and the Labor Force

As macroeconomic indicators are not responsive to individual and even less so to inventions, but rather to their wide-scale diffusion, therefore support for R&D *only* is not a sufficient policy measure to endogenously generate economic growth (see Millendorfer, Hussain in this volume). Important factors are attributed to the labor force, its qualification and mobility. Also, the availability of entrepreneurs willing and able to put new ideas into operation are seen as sine-qua-non condition as the history of several "high-tech highways" indicate. In this case many other regional issues are important, as pointed out by Hafkamp and Nijkamp, and also Forssel (in this volume).

The Role of Market Size

Even if the economies of scale under the impact of new technology deserve to be revisited in several sectors the size of the market has its importance. Here again interdependence has its influence as several commodities (steel, automobiles, ships, etc.) have, in reality, become a world commodity. This means that opportunities, and also saturation, on the market in one part of the world are felt elsewhere, upsetting the economic and monetary balance of the impacted national industries (Krelle, in this volume). The consequences of this impact depends on many factors – the size of the industry, national economy, openness of the economy, the responsiveness and innovativeness of the industry. A case in point is the Japanese TDK Corporation. It makes enough profit from magnetic materials (tapes, discs) to cover the aggregate deficit of the big five steel companies (Makino, 1985).

THE IMPACT OF INDUSTRIAL RIGIDITY

It is perhaps a general property of complex systems that they respond to any disturbance and change by activating internal mechanisms to counteract the disturbance, thus achieving a certain degree of homeostasis. This phenomenon comes into play when the changing impact of new technology hits established institutions. Some researchers make these interactions responsible for generating the long term up and down swing in economic activity. The most recent depreciation is explained as a structural crisis caused by the mismatch between the techno-economic subsystem and the socio-institutional framework. In fact we are witnessing the reversal of the former positive interaction between these two spheres (Perez-Perez 1985).

Other potentially rewarding areas singled out were (van Duijn in this volume):

- investigation of the role of the investment rate in relation to economic performance;
- the short and long term impact of protectionist measures;
- capital and labor market allocative efficiency;
- debt problems, its international, national and enterprise ramifications;
- the problem of the implementation of international anticipative versus responsive measures.

These problems are, in part, addressed in the selected papers included in this volume. Participants had a chance to hear several other interventions.

SUMMARY

It is generally acknowledged that the importance of interdependence is by far not identified in all its forms. This is also true of the knowledge necessary to devise active economic policy measures. Quite often the essence of international interdependence is circumvented by theories of foreign trade which are not always relevant (Krelle in this volume).

So the approaches to interdependence form a wide spectrum starting from active and positive acceptance, for example, Naisbitt 1982

> Instead of resisting increased economic interdependence, we should be embracing it wholeheartedly. In my view, it is our great hope for peace. If we get sufficiently interlaced economically, we will most probably *not* bomb each other off the face of the planet.

But there are those who have second thoughts about it, perhaps best illustrated by Matouk, 1979.

> Today the choice is between an attitude open to the world, with the risks which this entails, but also the opportunities which it offers, and a protectionism which, limited to the national level, can only lead to a failure to satisfy consumers who are deprived of some imported goods and obliged to change drastically their life-style, if only to reduce their consumption of energy. However, such a change, painful at present time might eventually lead to a life-style more harmonious with the ecosystem, more natural, and which ultimately guarantees more efficiently the survival of the species.

So the positions towards interdependence range from threats through challenges, to opportunities. It is the behavior of different actors that may make the difference. The policy response of each country looks for national optimum and so the sum of policies has little chance to be close to the overall optimum of the community. It is a challenge to the analysts to show what the optimum is and make the sum of individual policies as close as possible to the overall optimum. There are many indications that this optimum drifts more and more toward a global one (Bognár 1984).

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ON POLICY MAKERS AND INDUSTRY STRATEGY*

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There is general agreement that the period 1950-70 was one of exceptional economic progress in western countries, particularly in the manufacturing sector.[1] Rapid growth brought many changes in world industry. However, its full impact on the field of industrial policy has only recently emerged. This paper begins with an examination of growth-induced trends which have altered the international environment relating to industrial policy. Some consequences of these trends for the formulation of national strategies (or policy mixes) are noted and a tentative framework for characterizing national strategies is suggested. A brief survey of national strategies in two industries – steel and advanced electronics – provides the basis for some tentative generalizations.

A. THE CHANGING MAP OF WORLD INDUSTRY

Since 1950, policy makers in various capitals have witnessed a relative decline in the international role of their country's manufacturing sector. The decline was marked in the case of the US, although similar trends occurred in the UK and elsewhere. For instance, during 1963-78, the combined share of world manufacturing value added in eight western countries declined from 46 to 33 percent.[2] A different set of circumstances applies to other countries, notably Japan and West Germany. The industrial importance of both countries steadily increased. These gains were matched by a corresponding expansion in the two countries' share of world exports.

The redistribution of industrial capabilities led to modifications in the operation of a loose international framework which, heretofore, had guided policy makers' deliberations in the field of industry, trade, finance and investment. Experience suggests that the operation of such a system usually requires a powerful leader or regulator. In other words, the internationalization of economic relations will proceed more rapidly if one nation has a near monopoly of power.[3] However,

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*This paper was not presented orally at the meeting but was prepared especially as a contribution.

**The views expressed in this paper are those of the author and do not necessarily reflect those of the organization with which he is affiliated.

[1]The scope of the following discussion is limited to western countries. It pertains to the manufacturing sector in these countries and to selected industries within that sector.

[2]Figures were compiled from national accounts data, expressed in US dollars and at constant prices. Countries include Belgium, France, Luxembourg, Netherlands, Norway, Sweden, the United Kingdom and the United States. See R.Ballance and S. Sinclair, *Collapse and Survival: Industry Strategies in a Changing World* (London: George Allen and Unwin, 1983), p.14.

[3]Kindleberger has described how the UK performed this function prior to the 1930s. See C.P. Kindleberger, *The World in Depression, 1929-39* (Berkley: University of California

as the global distribution of industrial capacity has begun to converge, many policy decisions have come to be fashioned by negotiation between countries or coalitions of countries. In short, this redistribution of industrial activity makes it increasingly difficult to achieve the political consensus between countries that is necessary to deal with emerging problems.

There are other, related, reasons for the sometimes hesitant attempts to sustain the post-war network of policies, programmes and institutions.[4] The gradual spread of new industrial capacity has accentuated the importance of foreign markets and suppliers at the expense of their domestic counterparts. Under such circumstances, policy makers are faced with a greater margin of uncertainty when making decisions. These dilemmas derive from actual problems: (a) an unfamiliarity with the characteristics of foreign markets and suppliers and the inability to influence these firms through domestic policies; (b) the emergence of large tracts of competitive capacity in foreign countries, particularly in industries where adjustment pressures are already evident; (c) the fear that external suppliers may impose constraints on domestic firms by cutting deliveries, raising prices or enforcing embargos; (d) the prospect that reliance on imported capital goods may relegate domestic users to an inferior technology or lessen their ability to influence the nature of technological advances. One result has been a growing number of industry-specific disputes which often pit the US against Japan, the European Community or its individual members.

The policy consequences of realignment are re-enforced by another, more specific, type of convergence. For a wide range of manufactures, relative factor abundance in western countries has gradually become more similar. Thus, several of the traditional determinants of comparative advantage – relative differences in national endowments of capital, unskilled and skilled labour – may no longer dominate while others, such as resource endowment, may not be germane.[5] Under these circumstances the pattern of specialization in production and trade may depend heavily on factors such as non-competitive firm behavior and government intervention.

These subtle, but basic, shifts in world industry have altered both the objectives and the process of policy making in western countries. As the strength of international guidelines has waned, national differences in the choice of industry strategies have taken on added significance. Given these trends, it is perhaps appropriate to search for common threads in the national strategies. Such an exercise can be dealt with on many levels but, in any case, can not be conclusively examined in so brief a paper as this one. The following discussion suggests one rationale for generalizing about national strategies which might be useful for

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Press, 1973). Others have pointed to the similar role played by the US until mid 1970s and the resultant vacuum in international leadership thereafter. See Interfutures, *Facing the Future: Mastering the Probable and Managing the Unpredictable* (Paris: OECD, 1979), pp.77-78. Finally, Aho and Bayard have argued that the post-war changes in the international distribution of economic and political power have hampered the ability of the international trading system to deal with problems. See C.M. Aho and T.D. Bayard, "The 1980s: Twilight of the Open Trading System", *The World Economy*, December, 1982, p.399.

[4]Creation of the post-war economic system began with the Marshall Plan and included the Bretton Woods Agreement, the establishment of the IMF, the World Bank and GATT.

[5]The Ricardian influence of natural resources is of limited relevance to trade in manufactures. For instance, steel is not necessarily produced most efficiently where iron ore and coal are found, given modern transportation and the influence of market location. Similarly, the importance of Heckscher-Ohlin trade is largely confined to labour-intensive products. These aspects have been examined by William Cline, *Reciprocity: A New Approach to World Trade Policy* (Washington DC: Institute for International Economics, 1982), p.9 and pp.38-40.

analytical purposes.

B. INDUSTRY STRATEGIES IN THE MANUFACTURING SECTOR

It would be a simple process to distinguish between national strategies if each were characterized by a single or well-defined line of policy emphasis. If so, countries might be depicted as subscribing to a strategy giving an overriding emphasis to R and D and associated industries (computers, advanced electronics, aerospace) or, perhaps, a strategy of preserving sunset industries (steel, textiles and footwear). Other examples which come to mind include policy-oriented strategies reflecting the traditional dichotomy between open and closed economies, export promotion and import substitution, or a strategy of emulating technological leaders.

Unfortunately, national strategies are neither so simple nor coherent as to permit this type of generalization. First, they are seldom consistent over time and may be altered abruptly – by voters, by changes in the approach of top-level bureaucrats or by major shifts in global economic circumstances. Second, the real priorities underlying an industrial strategy are rarely obvious and are not always clearly defined even in the minds of policy makers.[6] Third, no country follows an industrial strategy which is common to the entire manufacturing sector. An emphasis on 'high-tech' industries may be pursued simultaneously with a 'defensive strategy' to delay or deter the contraction of mature industries.[7] In brief, national strategies are neither clear cut nor sufficiently broad to permit a simple characterization which is applicable to the entire manufacturing sector.

If a sector-wide interpretation of national strategies offers little basis for generalization, can more useful insights be gained by focusing on industry-specific policies and strategies? At this level of disaggregation an additional simplification would seem to be appropriate. Briefly stated, in most countries – including the technologically advanced – a large portion of total manufacturing output will probably always consist of traditional standardized activities, for example, the production of building materials, food, clothing and 'ordinary' consumer durables.[8] Transport costs, national differences in consumer preferences and declining returns to scale (e.g. for natural-resource-based products) are among the reasons why most countries produce a similar set of goods. While such industries may be the frequent subject of domestic policy debates, they are not of primary importance for the formulation of industry-specific strategies in an interdependent world. Rather, the industries which are the main focus for national strategies – and thus tend to be the focal point of international disputes – typically seem to fall into one of the following groups:

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[6] In any case, the content of national strategies can certainly not be judged from the pronouncements of a country's political leadership. For instance, President Reagan's call to "re-industrialize America" has subsequently proved to be more of a political event than a policy statement.

[7] Government intervention designed to favor one set of industries implicitly discriminates against others. Thus, policy makers may eventually find themselves under strong pressure to assist industries other than those which were initially accorded the highest priority. The result may be a national strategy which borders on the schizophrenic but, in any case, is not co-ordinated.

[8] Assar Lindbeck, 'Industrial Policy as an Issue in the Economic Environment,' *The World Economy*, December, 1981, p.393.

i) The industry is a relatively large one in terms of its capital investment and/or employment. Thus, significant and prolonged adjustment pressures (reflected in low rates of capacity utilization, depressed levels of domestic demand, rising import penetration, overinvestment, etc.) could alter the prevailing international hierarchy in the industry. The contraction of these industries, which are euphemistically known as 'mature' or 'sunset' industries, poses economic and/or political problems.

ii) The industry is a highly specialized one, often regarded as technology-intensive. In the opinion of some policy makers, international leadership in these fields (often referred to as 'sunrise' industries) depends upon "who gets there first". Once established, technological pre-eminence is thought to provide a lasting competitive advantage in international markets.

Examples of industries falling in the first category are steel, autos and, perhaps, bulk petrochemicals along with various supplier industries. The reasons for contractive pressure may include significant over-capacity, resulting from previous misjudgments about present levels of demand,[9] or the establishment of new capacity in developing countries (e.g. petroleum refining in the Middle East and Mexico and new steel mills in many developing countries). Related explanations are widespread obsolescence (as in the American steel industry) or poorly times expansion programmes which were soon undercut by new technological advances.[10] Here the major issues confronting policy makers is how to accommodate a contraction in industry size. A related, but secondary, concern is to find the means to rejuvenate the industry and to restore some measure of international competitiveness.

The prominence which policy makers attach to the second cluster of industries derives from their belief that comparative advantage may be achieved artificially. In general, any advanced country may aspire to technological leadership in at least some phase of manufacturing – especially if government intervention occurs. Moreover, technological pre-eminence in a particular phase (e.g. semiconductors and integrated circuits) may help to confer leadership in related product lines (computers, automated machine tools) and their applications (computer-aided design and computer-aided manufacture). Thus, for technology-intensive goods the argument would seem to be that comparative advantage is made, not given. National strategies to foster these types of activities are regarded warily by foreign competitors since the establishment of a pre-eminent position could affect a much wider range of industries on an international scale.

C. A TALE OF TWO INDUSTRIES

Further generalizations as to the objectives and forces that shape a national strategy are difficult without a closer look at the actual policies and strategies. Two industries – steel and advanced electronics – were chosen for this purpose. Steel is a mature industry, typical of the first group of activities noted above while advanced electronics is representative of the second group. A thorough examination of either industry is beyond the scope of this paper; instead the purpose is

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[9] A relevant example is the experience of British Steel Corporation: in 1971, the Government endorsed plans to expand capacity to almost 40 million tonnes by 1980. Ironically, 1980 began with a tripartite dispute between government, industry and labour regarding a production level of 15-16 million tonnes. See, *The Economist*, 12 April, 1980.

[10] The plight of 'mature' industries may be further complicated by rapid increases in hourly wages which outstrip the gains recorded in competitive countries.

merely to illustrate similarities and differences in national strategies as well as some of the forces and conditions that influence the choice of a strategy.

STEEL – AN AGEING INDUSTRY: Prior to the 1970s, the world steel industry's growth was steady. Bouyant domestic demand meant that producers were not plagued by prolonged contractions giving rise to problems of excess capacity, by the threat of substitutes for steel, or by declining rates of profit. The eventual transition from a rapidly growing industry to a mature one changed all this. World consumption of crude steel grew steadily until the mid 1970s and thereafter fluctuated erratically.[11]

Basic changes in long-term patterns of demand and production provided the impetus for this aging process. Because steel requirements depend on the demand for steel products, structural changes within the manufacturing sector were reflected in the industry. Today's major growth areas are telecommunications, energy, aerospace and computers. Unlike the industries that led the field during the first two thirds of the century, these new industries are not intensive users of steel. Thus, steelmakers are dependent on user industries which, themselves, are losing ground relative to overall economic activity. Other, economy-wide structural changes have had a similar effect. For instance, the service sector's share in GDP has tended to grow relative to the production of material products, and investment has given way to consumption in the expenditure of national income. Because both services and consumption are less steel-intensive than investment in the production of material goods, the industry's share in output and employment is likely to decline further.[12] The following discussion focuses on the major strategies observed in the US, the EEC and Japan developed during this period.

Defensive strategies – the US approach: The US first became a net importer of steel in 1959 during the course of a prolonged strike. Since that time a prominent policy objective has been to restrain the growth of imports. As imports rose, protectionist sentiments grew stronger and, in 1969, voluntary export restraints (VERs) were negotiated with the European Community and Japan. Although these restraints were abolished with the passage of the Trade Act of 1974, protectionist pressures soon re-emerged. The new campaign occurred in the midst of the worst recession since 1930 and thus benefited greatly from public support. There was also a change in tactics which took into account the new test for dumping contained in the Trade Act of 1974. This shift was said to be on the advice of the Carter Administration which was anxious to deflect a new drive for import quotas.[13] The American Iron and Steel Institute (AISI) played a leading role in this period. It filed a petition in 1976 charging that Japanese producers had unfairely diverted shipments of steel to the US as a result of an agreement to restrict imports to the European Community. The AISI also attempted to document charges of unfair practices and forcefully advocated the need for stronger import restraints.

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[11]Producers did not restrict their capacity expansion during this period, apparently anticipating only a brief downswing. Until 1974, the world's steel industry operated at over 90 percent of effective capacity. Afterwards, utilization rates plummeted to less than 60 percent. See Interfutures, *Facing the Future: Mastering the Probable and Managing the Unpredictable* (Paris, OECD, 1979), p.369.

[12]These contractive effects of demand have been reinforced by basic changes in production processes and, in particular, by technical advances that have dramatically reduced steelusers' requirements.

[13]H. Mueller and H. van der Ven, 'Perils in the Brussels-Washington Steel Pact 1982', *The World Economy*, November 1982, p.263.

At the height of the protectionist drive, a steel caucus of about 150 Representatives and Senators demanded that the Administration produce an effective means of import restriction by the end of 1977. Significantly, the Carter Administration introduced a trigger price mechanism (TPM) in early 1978. The mechanism set a minimum price for imports based on 'constructed costs' using Japanese data. Foreign steel could be sold in the US at prices above the minimum, but imports at prices below these levels would prompt a preliminary review to determine whether the government should launch a full-scale investigation of dumping practices. Minimum prices were periodically raised at the government's discretion. However, American steel interests remained dissatisfied with the levels of protection accorded by the TPM. They called for a two-tier system of constructed costs – one based on Japanese data and another derived from European figures. The proposal, which was not accepted, would have led to much higher trigger prices for European exporters whose costs exceeded those of Japanese producers (although their landed American prices were sometimes lower).

Firms subsequently resorted to litigation in an attempt to force the Administration to replace the TPM with a stronger form of import restraint. In 1980 US Steel Corporation filed and extensive anti-dumping petition against several European producers which led to the suspension of the TPM. The suit violated an agreement whereby the Administration had established the mechanism in return for an industry pledge not to file anti-dumping charges. After further negotiations US Steel withdrew its petition and the Administration reinstated the TPM with a 12 percent increase in the minimum prices of imports and new quantitative restrictions. In January 1982 several firms again filed anti-dumping suits and appealed for countervailing duties to equal the subsidies received by foreign competitors. This step led to a second suspension of the TPM. The accusations implicated a host of suppliers and included product categories that were new to the dispute. The legal cases affected most of the steel exported to the US by the European Community. A compromise with European suppliers was reached in October 1982 just hours before a deadline that would have brought penalties into force. Governments and industries alike agreed to a quota system, that would limit Europe's exports, on average, to 5.4 percent of the American market.

Throughout this entire period the efforts of law makers and steel producers were actively supported by the United Steelworkers Union. Because producers had traditionally offered only minimal resistance to the union's demands, the gap between steel wages and the average for manufacturing widened from 30 percent in the mid 1960s to 70 percent by 1980.[14] Viewed in this light, the union had very good reasons for endorsing the protectionist drive. All these circumstances led to a paradoxical situation in which steel producers, while offering some of the highest wages and benefits of any American industry, were appealing for government intervention to shield them from international competition.

The protectionist campaign did not proceed without opposition. At least some parts of the US bureaucracy were reluctant to endorse these measures. They were concerned with wider ranging trade relations with the Economic Community; retaliation in the form of trade restrictions on American exports of chemicals, textiles or agricultural products was feared. In contrast, representatives of steel users managed only token opposition to protectionist efforts.[15] Generally, American

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[14]K. Kawahito, 'Japanese Steel in the American Market: Conflict and Causes,' *The World Economy*, September 1981, p.248.

[15]The American Institute for Imported Steel, for example, has stressed the fact that demand for specific products, notably pipes and tubes, often exceeded domestic supply capabilities.

steel users have demonstrated a lack of unity and have failed to marshall an effective response to the industry's pressure groups. The zeal with which firms supported the protectionist campaign also varied. Several, for example, had long-term commitments to import specific types of steel that were in short supply and, as a result, were opposed to at least some aspects of the campaign. A few firms had begun to diversify – into oil refining, chemicals or activities outside the manufacturing sector – and their enthusiasm for protective measures was lukewarm.

European cartelisation and the Davignon Plan: Beginning in 1976, the EEC adopted a strategy of cartelisation which was reminiscent of the tactics followed in the 1920s.[16] The cartel was a voluntary one intended to promote market stability by fixing levels of crude steel production, minimum prices for imports and duties to prevent dumping. In return, producers were expected to reduce excess capacity with the help of cash payments for the EEC. The cartel's operation has been plagued by a continued fall in demand which contributed to a series of internal disputes. These included intra-EEC price wars and dumping allegations, objections to the public subsidies to specific steelmakers and disagreement on the need for compulsory rather than voluntary controls to enforce the cartel. An additional handicap was the heterogeneity of the European steel industry resulting from differences in (a) the extent of public ownership, (b) the degree of specialization in bulk steel, speciality steel and steel products and (c) the extent to which steel makers were integrated into the country's industrial structure.

While the disputed issues are mainly couched in national terms, the underlying problems are common to most European countries. They include the existence of considerable excess capacity and, to a lesser extent, the failure of several major producers to modernize their steel-making capacity. Moreover, the Davignon Plan faces a third difficulty which is new to the 1980s: the overall effectiveness of the strategy is greatly influenced by the EEC's changing fortunes in the 'steel war' waged against American producers. Most European producers would probably have preferred to see the continuation of the original American TPM, provided that trigger prices were not set too high. This would have allowed them access to the US market without any formal investigation of the extent to which their operations are subsidized. However, as protectionist pressures mounted in the US, voluntary export restraints (VERs) became more attractive to the Europeans. Closure of the American market would have meant that six million tonnes of steel being exported to the US would be diverted back to Europe.

A consensus strategy – the Japanese approach: In contrast the the internal differences that have plagued the European cartel, the homogeneity of the Japanese steel industry facilitated a consensus strategy. During the 1970s five producers accounted for 70 percent of Japan's output and all had similar cost structures. Although the product mix of the major firms differed, the market share of each producer was relatively constant.

The framework for consultation included the provision of monthly voluntary guidelines by MITI and weekly meetings attended by executives of the five companies and MITI officials. Many raw materials were bought through joint negotiations between the five firms and their suppliers. Investment programmes and plans for modernization were also closely co-ordinated. These tactics enabled the industry to weather the global slump in steel in the 1970s without serious cutbacks in

[16] See K.Jones, 'Forgetfulness of Things Past: Europe and the Steel Cartel,' *The World Economy*, vol. 2, no. 2, 1979, pp.139-54.

capacity. Japan soon became the world's leader in the use of continuous castings as the proportion of output accounted for by this technology rose from 20 to 80 percent between 1973 and 1983.[17]

Falling steel prices and new capacity in developing countries have subsequently led to a deterioration in the Japanese industry: in 1983, all five major steel producers reported losses for the first time in decades. Like their American counterpart, some steelmakers have proposed that their government file dumping charges against foreign exporters in Brazil, South Korea and Taiwan.[18] However, such a defensive strategy is not likely to gain wide acceptance. Unlike the Us industry which exports very little, most Japanese steelmakers are reluctant to ban imports since – unlike the US industry – they ship so much steel abroad themselves.

The internationalization of steelmaking: In comparison to other industries – consumer electronics, autos or petroleum products – steelmakers have traditionally eschewed international commitments through joint ventures, technology-swapping agreements or capacity-sharing arrangements. Recently, however, there is mounting evidence that such tactics may eventually become a dominant strategy in both Japan and the US. Despite criticism within the industry, some American firms have begun to search for foreign technical assistance leading to 'a multitude of agreements... between Japan's big five and the USA's top ten.'[19] This option also opens up the possibility for traditional steelmakers to concentrate on those product lines where they are most competitive while importing semi-finished steel from abroad.[20] The recent purchase of a modest share in Wheeling Pittsburgh by Nisshin Steel suggests another dimension to the strategy. Heretofore, foreign investors have been discouraged from similar moves by the antiquity of the US industry but American-based production has gradually become more attractive as a means of avoiding protectionist pressure in that country.

Product diversification: A strategy of product diversification reflects a desire to lessen the firm's dependence on crude steel production. One alternative is to shift into the production of higher quality steels. Another is to move downstream from crude steel, through integration, into steel-using operations that are more closely related to engineering activities. A third version, diversification into non-steel producing activities, has been observed among American firms and is tantamount to a partial exit from the steel industry.[21]

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[17]This advance yields significant reductions in energy use and other improvements in efficiency. In contrast to the Japanese situation continuous casting accounted for only 31 percent of US steel production in 1983 while, the EEC, the corresponding figure was approximately 50 percent.

[18]Wages are cited as one of the main reasons for the price advantage of new competitors. In the US, the share of wages in total costs is about 24 percent; in Japan that share is 18 percent but in South Korea the corresponding figure is 4-5 percent. Subsidies are though to be another important explanation. Estimates put these subsidies at 40 percent of production costs in Brazil and 10-20 percent in South Korea and Taiwan. *Far Eastern Economic Review*, 17 November 1983.

[19]Ballance and Sinclair, *op. cit.*, p.122.

[20]US steelmakers have recently attempted to complete such agreements with firms in Brazil but the deals have not gone through.

[21]For example, in 1980 steel operations accounted for only 11 percent of operating income at U.S. Steel. Others, notably Armco and National Steel, steadily moved out of steel as their financial position permitted. See R. Reich, 'Making Industrial Policy,' *Foreign Affairs*, Spring, 1982, pp.851-81.

The popularity of a diversification strategy reflects the consequences of the slump in demand and the rise in production costs which occurred during the 1970s. Diversification into higher quality or speciality steels offers better demand prospects and a lesser threat from competitive substitutes. Some Japanese steelmakers have followed this tactic by specializing in the production of 'high-strength' steels that compete with aluminium in the manufacture of automobiles, containers and other mass-produced items. Alternatively, producers that choose to move downstream into engineering activities are usually part of large, integrated, firms. Their steel-using operations are of a sufficient size to absorb demand fluctuations and to subsidise losses in the steel-producing activities. This arrangement works to the benefit of the firm because the engineering and metalworking phases of the operation are assured that they will obtain the types of steel required.

In conclusion, the prevailing American strategy has been a defensive one designed to control the level of imports. As the domestic market has become more fragmented – through competition from US-based mini-mills as well as foreign suppliers – a variety of policy tools have been employed to reduce the pressure to contract. The European strategy has focused on the problems of excess capacity and obsolescence while, in Japan, modernization and an increased reliance on exports helped to stave off the effects of the global slump. The European and American strategies are interrelated owing to the former group's dependence on exports. Moreover, there is mounting evidence to link the American and Japanese strategies as firms in the latter country attempt to circumvent the defensive tactics adopted in the US.

All these strategies share one common feature, however. They were not devised and implemented solely by policy makers but were assembled through negotiation involving government officials, industry representatives, trade unions and, sometimes, the importers and domestic users of steel.

ADVANCED ELECTRONICS – AN EMERGING INDUSTRY: The advanced electronics industry is defined here to include electronic applications equipment such as computers and automated machine tools as well as the main components – semiconductors and integrated circuits – used in such equipment. Beginning from a negligible base the industry has expanded rapidly and, in several countries, has overtaken consumer electronics as the predominant sub-sector in the electronics field. Thus, by 1978, the value of industrial products and components accounted for 68 percent of all electronics production in the US. The corresponding figure for the EEC was 53 percent while the share in Japan was lower but was rising rapidly.[22]

There are several reasons why governments have actively sponsored the industry's development. First, the industrial applications of advanced electronics are expected to improve greatly the reliability and quality of products. Manufacturing activities consist mainly of making materials, forming them into various shapes, joining the bits together and then assembling these parts into finished products. A product's quality and reliability are mainly dependent on the performance of these tasks – whether welding, brazing, soldering, glueing or riveting – and electronic capital goods and computer control of manufacturing processes are expected to perform more consistently than workers in this regard. Second, the cost of a manufactured product largely depends on the level of efficiency attained in the joining and assembly phases and the use of electronic capital goods is expected to lead to improvements. In general, many government officials apparently hope that new systems of electronic capital goods will eventually serve

[22]Institute of Developing Economies, *The Electronics Industry in Japan* (Tokyo: Institute for Developing Economies, 1980), p.11.

as the basis around which other industries may reorganize.

Promoting a national champion: In most western countries the state's involvement began with the development of the computer industry which was an early choice for a national champion.[23] The provision of state funds for R and D, preferences in public procurement for domestic firms, government-assisted mergers and favourable loan terms were only some of the policies employed by the governments of Europe and Japan to spur the take-off of computer firms in the late 1960s and 1970s.[24] As international competition has mounted, governments have become more generous in the provision of public funds. In March 1984 the West German Government has announced a four-year programme of $1.2 billion to assist the microelectronics, communications and computer industries by reducing risks, improving training and developing applications. Subsequently, the British government unveiled a $170 million addition to an existing programme for the same reason. And France has embarked on a five-year project costing $17.5 billion to boost competitiveness in the electronics industry.

Governments also played an indirect role in fostering the industry's development. In the US, stringent regulations on fuel economy and emission controls promise to make that country's auto industry one of the largest markets for chips and, eventually, microprocessors. More subtle forms of government intervention are typified by the Japanese Government's decision in 1965 to subsidize research on integrated circuits while simultaneously preventing US manufacturers from establishing a domestic presence before local producers were ready to compete.

The EEC has attempted to formulate an overall plan for the development of computers, microelectronics and telecommunications as well as a common policy on public procurement. Plans call for direct financial assistance to aid European firms engaged in the production of computers and microchips and indirect support through the creation of a European network for advanced communications. In addition, public procurement policies would provide for all 'qualified' EEC firms to have the opportunity to tender bids and calls for governments to allocate a small percentage of their annual equipment purchases to suppliers in other EEC countries.

A major flaw is the inability of European governments to agree on the treatment of US subsidiaries. European countries, having no domestic computer industry of their own, argue that foreign subsidiaries should qualify as home producers. In contrast, the French Government opposes the involvement of foreign subsidiaries in any EEC-wide programme. Substantial public funds are devoted to the computer and microelectronics industry, chiefly for the development of large-scale capacity to produce integrated circuits using the most advanced technologies.

In order to boost its home market for industrial robots, the Japanese Government adopted to a leasing scheme similar to that employed in the early 1960s to help fledgling computer companies. Because robots have made few inroads in most fields of manufacturing, Japanese producers have been forced to export their new inventions. Under the auspices of MITI and with the support of the Japanese Industrial Robot Association, a robot-leasing company was established in 1980. The

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[23]Ohlin defines a national champion as a new industry of advanced technology which is fostered by government and business in intense competition with similar partnerships in other countries. See G. Ohlin, 'Subsidies and Other Industrial Aids,' in *International Trade and Industrial Policies*, S.J. Warnecke (ed.), (London: Macmillan, 1978), pp.320.

[24]See G. de Carmoy, 'Subsidy Policies in Britain, France and West Germany: An Overview,' in Warnecke (ed.), *op. cit.*, pp.35-57.

Government hopes that this step will encourage more – and smaller – firms to accept automation by providing the robots to users at subsidized rates. With this financial assistance, the purchasers of sophisticated robots can depreciate 53 percent of the total cost in the first year.[25] In addition to cheap leasing, the Government has directly funded much research by the larger electrical companies and has accepted money from potential users of robots to set up research projects at government laboratories.

Joint ventures and the acquisition of foreign know-how: Their heavy dependence on American and Japanese suppliers has spurred many European governments to take more aggressive steps to promote home production in key areas of advanced electronics. This dependency is apparent in the market for computers where EEC accounts for 26 percent of world usage but only 15 percent of production in western countries. The industry's fragmented condition has consistently frustrated efforts to devise an EEC-wide strategy. Their weak position has forced various European governments and producers to look to the Japanese for technology-swapping agreements in order to withstand the American competition.

A similar pattern of dependency prevails in the field of semiconductors where firms in the EEC supply about 40 percent of the Europeans' requirements.[26] There are sound commercial reasons for European firms and governments to be concerned about the extent of dependence on foreign suppliers of components. First, there is a history of sudden shortages of key micro-electronic components and the vulnerability of users in third markets is great. Second, American and Japanese customers are thought to enjoy commercial and technological advantages because they participate extensively in the design of new semiconductor products. Finally, some Europeans are fearful that a US embargo on high technology exports will be imposed for political reasons.

Most governments carefully control the activities of foreign firms within their borders. The French strategy, designed to encourage joint ventures with the specific intent of acquiring foreign technologies, is one of the most distinctive. Because the leading French firm lacked the latest technologies to produce integrated circuits, the Government stipulated that partnerships with local firms were a precondition for American producers to manufacture in France. The American participants are expected to contribute the technology and process expertise and to train French engineers. In exchange, they are not required to put up any cash and are offered 49 percent of equity in the new ventures which receive substantial government funding. These new companies, plus the major French producers, will be the preferred suppliers of chips and circuits for the telecommunications and defense industries.

Co-operative strategies: At a time when many industrial applications are still at the conceptual stage, access to the results of R and D is crucial. Simultaneously, the heavy and continually rising costs associated with research spending can be prohibitive to all but the largest firms and most generous governments. Under these circumstances, there have been various attempts to spread the cost burden and to share the results of R and D. Two Japanese programmes were successful in pooling the resources and research interests of the public and private sector. Begun in the mid 1970s, the programmes were funded by Nippon Telegraph and

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[25] *Far Eastern Economic Review*, 4 December 1981.

[26] In 1980, two of the world's ten largest producers of semiconductors were European. By 1983, the ten largest firms were all American or Japanese. See, *The Economist*, 10 March 1984.

Telephone (NTT) and MITI, respectively, and were intended to develop new generations of advanced integrated circuits, microwave systems and computers. Engineers from NTT worked jointly with experts from large private companies that received no public funds to cover their participation costs. Instead, firms expect large orders from NTT once the programme yields results. The MITI project broke new ground by the creation of a co-operative research laboratory where some 120 researchers from five companies worked together for four years to develop 'very large-scale integrated circuits'. The project resulted in more than 1,000 new patents. Private participants are obligated to repay MITI's financial outlay if they earn income from the patents but must first convert the basic know-how into marketable products.

American attempts at collaboration are at a more incipient stage.[27] One programme, initiated in 1982, is a consortium known as Microelectronics and Computer Technology Enterprises. In addition to spreading the costs of R and D, the consortium would be a means of sharing scarce talents and of avoiding duplication of research. A helpful Justice Department removed a major obstacle by granting anti-trust clearance to the new undertaking. Another initiative is a joint venture between American firms and universities. The non-profit organization, which is sponsored by the Semiconductor Industry Association (SIA), was created to fund long-term research at universities.

There is further evidence that mounting Japanese competition has led American firms into more aggressive forms of collaboration. In the field of semiconductors and competitive position of several major suppliers has deteriorated as Japanese firms cut prices and moved into the US market. One response has been IBM's purchase of a modest stake in Intel, a producer of chips that has been particularly hard-hit by Japanese competition. The move was prompted by concern that the commercial failure of domestic suppliers would make IBM dependent on foreign producers of chips. This is only one latest in a series of joint ventures, technology exchanges and ownership agreements involving IBM, Burroughs, Digital Equipment, Texas Instruments and Sperry. Closer co-operation between producers of sophisticated electronic products and their suppliers is further suggested by the observation that "contracts for chips no longer go automatically to the lowest bidder, especially if the lowest bidder is a Japanese company."[28]

Integration strategies: A twofold integration movement is underway and is expected to continue in the future. Firms concerned with the design and production of electronic components have begun to move downstream. One attraction of vertical integration is that chip makers are able to specialize and, consequently, enjoy greater economies of scale. A second advantage is that the skills acquired in the production of chips and integrated circuits are valuable in other, more profitable, parts of the market. Despite declining profits, both American and Japanese companies have maintained semiconductor operations in the hopes of using that knowledge more profitably in downstream activities.

Integration in the opposite direction – upstream – has occurred among the users of electronic components. Computer manufacturers take up to 40 percent of all the chip makers' output. Because their operations are dependent on adequate

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[27] In Europe, concrete efforts to foster inter-European research are just beginning. Through programmes such as ESPRIT, the EEC hopes to spur co-operative research between companies of all sorts – public and private, academic and commercial. Projects in microelectronics, computerized manufacturing and advanced information technologies are scheduled to begin in May 1984.

[28] *Business Week*, 1 October 1982.

supplies, these firms have become major producers of 'captive' semiconductors for internal use. Thus, IBM has spent huge sums on research and claims to be one of the world's largest producer of semiconductors. Similar moves are being made by other users of chips and integrated circuits in the automobile industry, in consumer electronics and office equipment. The large revenues accruing to these conglomerates permit them to concentrate R and D expenditures on technology development for advanced electronics.[29] Although captive operations run the risk of failing to keep abreast of the rapidly changing state of technology, there are good reasons for the growing emphasis on in-house chip design and production. Very large-scale integration has means that virtually entire systems are implanted on a chip, leading many equipment makers to prefer in-house development in order to protect proprietary designs. Although, these new system-wide chips must be customized for specific applications, the volumes produced for each design will be low.

Defensive strategies: Under pressure from the Japanese, various parts of the American industry have turned to Washington for relief.[30] Their efforts have been complicated, however, by significant differences in the two countries' legal systems and by the far-flung nature of the industry. For instance, producers of semiconductors have long hoped for government action on their claim that Japanese firms were dumping.[31] The Justice Department initiated an investigation of US subsidiaries of six Japanese companies for possible violation of anti-trust laws. The charges included conspiring to fix the price and to limit the quantity of 64K-RAM chips exported to the US. Thus, the investigation focused on alleged efforts to steady, or even boost, prices rather than anti-dumping allegations. The approach of the Justice Department was regarded as an attempt to open a more general investigation of Japanese laws that permit industries to establish cartels, to fix prices and allocate markets and to eliminate smaller competitors within their home market. The complications introduced as a result of the international character of the industry are reflected in the reaction of the SIA to the dispute. The position of the industry association, which represents nearly 50 producers and users of chips, was ambivalent since several of its members buy chips from Japan and, therefore, benefit from the low prices. The Association's position was further complicated by the fact that the two leading producers of semiconductors, IBM and Texas Instruments, have operations in Japan but neither are members of the SIA.

D. SUMMARY AND CONCLUSIONS

The changing configuration of world industry has altered the objectives, means and guidelines for policy making. When operating in this new collegial framework, governments have found it possible – or have deemed it necessary – to assume more *dirigiste* approaches in their dealings with industry. But as the legitimacy of state intervention has gained wider acceptance, policy specialists have often found that they no longer retain the degree of independence which they once enjoyed. In fact, the growing involvement of government has created greater

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[29] Japan's diversified electronics firms are thought to devote nearly 30 percent of their sales revenues to R and D or to new plants.

[30] Defensive tactics may eventually emerge in Japan as well. Currently, MITI is drafting a law that would limit foreigners to no more than 20 percent ownership in telecommunications networks. New copyright laws on computer software are also under consideration.

[31] The unit price of one particular type of chip, the 64K-RAM, had fallen from $20 in 1980 to $5 in mid-1982. US producers regarded this development as a Japanese attempt to buy market share. However, shipments from Japan subsequently slowed down and prices stablized.

scope for influencing its decisions; there are simply more decisions to influence.

Ironically, there have been few attempts to establish the institutional arrangements needed to co-ordinate the many decisions that began to fall within the government's purview. Once the willingness to accept an enlarged mission for government became apparent, special interest groups in various industries found the dispersion of authority much to their liking.[32] When writing of the US, their growing influence prompted one observer to conclude that, "while the whole of government was certainly impervious to control by any group, the many separate parts proved to be uniquely susceptible to special-interest pressures."[33]

The existence of such groups is not unique to the policy debates of the 1970s and 1980s. However, there are several reasons to believe that policy makers must currently operate in an environment that, more than ever, is subject to pressure from interest groups within a particular industry. First, the redistribution of industrial and political influence among western countries has hampered governments' ability to resist pressures to deter or to delay the contraction of mature industries.[34] Furthermore, a convergence of factor proportions has led to the impression that comparative advantage – at least for sunrise industries – may be malleable through industrial policies.And where it is, special interest groups will redouble their efforts.[35]

One consequence of these trends is a gradual blurring of the 'public' and 'private' character of many industrial enterprises. More than ever, decisions involving pricing, production, and even public policy are arrived at through interaction between corporate strategists, government officials and pressure groups within the industry. Once the influence of forces outside the traditional confines of government is recognized, the task of accurately specifying industry-specific strategies becomes more complex. But as the evidence from the case studies suggests, non-governmental factions cannot be ignored when identifying and characterizing these strategies. Similar trends have been observed in other industries including autos, petroleum refining, machine tools, textiles and consumer electronics.[36] However, in the international sphere the choice of a national strategy seems crucial for only a select number of industries: (i) those which are

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[32]Such groups may consist of producers or producer associations, trade unions, the operators of publicly owned enterprises or others whose interests are linked to a particular industry.

[33]E.C. Ladd, 'How to Tame the Special Interest Groups,' *Fortunes*, 20 October 1980, p.66.

[34]Murrell and Olson argue that the influence of pressure groups increases with the age of the industry and that heavy industries would be more susceptible to these 'organizational rigidities' than light industries. See P. Murrell, 'The Comparative Structure of Growth in the Major Developed Capitalist Nations', *Southern Economic Journal*, April 1982 and M. Olson, *The Rise and Decline of Nations* (New Haven: Yale University Press, 1982).

[35]For these reasons, even a robust economic recovery may not serve to reduce the intensity of interest group pressure to the comparatively innocuous levels of the past.

[36]For an analysis of autos and petroleum refining, see Ballance and Sinclair, pp.79-103 and pp.160-177; the machine tools industry is analyzed in UNIDO, *Industry in a Changing World* (United Nations: sales no. E. 83,II.B.6, 1984) pp.288-302 and UNIDO, *World Non-Electrical Machinery: An Empirical Study of the Machine Tool Industry* (United Nations: sales no. E.83.II.B.5, 1984). The textile industry is discussed in R. Ballance, J. Ansari and H. Singer, *The International Economy and Industrial Development* (Harvester Press: Brighton, 1982), pp.194-205 and in I. Walter and K. Jones, 'Industrial Adjustment to Competitive Shocks: A Tale of Three Industries', paper submitted to the International Symposium on Industrial Policies for the '80s, Madrid, 5-9 May 1980. For an examination of the consumer electronics industry, see UNIDO, *Industry in a Changing World, op. cit.*, pp.304-12.

already dominant in the domestic scene and therefore determine existing international hierarchies, or (ii) those which have yet to develop but promise to alter several of these industrial hierarchies in the future. For each of these two groups there will be some repetition in strategic themes. Defensive strategies will frequently be prominent. But competitive pressure, the international diffusion of technologies, the degree of internationalization, etc. should give rise to sufficient options for other strategies to evolve and, eventually, to dominate. Perhaps a major objective of government officials should be to preserve the variety of circumstances and flexibility that would permit alternative strategies to emerge.

MACRO-ECONOMIC MEASURES TO IMPLEMENT STRUCTURAL CHANGE

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1. Introduction

This paper has a modest aim: to discuss the role of national macro-economic measures in the process of the industrial restructuring of interdependent economies.

Modesty is called for for a number of reasons. Firstly, macro-economic measures are not the only way to tackle the restructuring problem industrial economies are facing - other types of measures (e.g. those usually summarized under the heading of 'industrial policy') might perhaps be far more important and appropriate. Secondly, supranational measures might be preferable to national ones, but the former are not discussed here. Thirdly, this paper is a discussion paper, and nothing but a discussion paper. It does not give a thorough and detailed analysis of the relation between macro policy measures and industrial restructuring, but rather attempts to provide a framework for a discussion of some of the issues involved.

2. Perspectives for the industrialized world - structural tendencies

In my view, the recession of the early 1980s - which in most countries of the industrialized world was the longest and most serious recession of the post-World War II era - has marked the end of almost ten years of generally slow growth. In the terminology of long-wave theory (cf. Van Duijn [1983]), this period can be considered the depression phase of the long wave. The main characteristics of such a period are: demand saturation in most former growth industries, a lack of new growth industries of sufficient size, overaccumulation of capital stock, modest productivity gains, a low utilization rate of productive resources and an accumulation of government debt.

Depression periods are the end of an era. They force economies into new directions. That, in fact, has been the one positive effect of the recent 1980-82 recession: the shedding of labour and the reduction of excess capacity have brought about a mental change among industrialists, labour unions and governments. I would say that economic decision-makers are more forward-looking than they have ever been during the past ten years. Industrial restructuring is not just talked about - it is being implemented now.

In this world in transition, a number of tendencies are developing which I think will be dominant tendencies in the years to come. Without pretending that it is complete, I would argue that the following list presents a number

of important characteristics of the economic environment during the remainder of the 1980s:

A. Low inflation
B. Structurally increasing factor productivity
C. A greater emphasis on quality control
D. A rather rapid diffusion of product and process innovation
E. A 'make'-orientation rather than a 'distribute'-orientation
F. Greater production process flexibility
G. A redirection from mass-production towards individualized production
H. Industrial concentration through unification of homogeneous units rather than through diversification.

It should be noted that all these changes mark distinct breaks from the recent past. A number of them exemplify rediscoveries of orientations pursued a number of decades ago; others are new in that they may become characteristics of highly-advanced industrial societies.
Let me briefly elaborate each of these tendencies:

A. Low inflation

In the face of high real interest rates and accelerating inflation, many economists are not convinced that an era of low inflation lies ahead of us. My argument would be, however, that all structural determinants of inflation point at average rates in the industrialized countries, which are more comparable to the rates prevailing in the 1950s and early 1960s than to those of the inflationary 1970s. These structural determinants include:

- demand-supply conditions in labour markets
- demand-supply conditions in commodity markets
- the relative size of the government sector.

B. Structurally increasing factor productivity

'Factor productivity' is meant to include all production factors: not just labour, but also capital and raw materials. There are various reasons why factor productivity can be expected to go up:

- technological innovation (notably the application of micro-electronics) is already improving efficiency in a number of sectors; its impact will widen in the years ahead;

- with the baby-boom generation getting older, the labour force will become a more experienced one;
- scarcities of raw materials in the early 1970s are now forcing producers and users of raw materials to make a more efficient use of them; the productivity revolution which occurred in postwar agriculture may be succeeded by a similar revolution in raw material usage.

C. A greater emphasis on quality control

Slow growth in the past decade has forced producers to put greater emphasis on controlling and improving the quality of products. In general, it could be agreed that wealth increases in the years ahead are more likely to come from better quality products than from a larger quantity of products. Consumption increases in the highly-developed societies are restricted by the one scarcity economists cannot escape, viz. the fixed amount of time consumers have. Even a continued decrease in the length of the workweek will not solve that problem.

D. A rather rapid diffusion of product and process innovations

During the mid-1970s it was observed that the process of technological innovation had slowed down. Since then, however, many developments have occurred which are now beginning to bear fruit. In retrospect it will become evident that many innovations actually took place in the 1970s, whose impact, however, was not noticeable until the 1980s. Innovations often have a long introduction phase; only when they enter the (rapid) diffusion phase does their growth start to have an impact on the economy as a whole. In the remainder of the 1980s we are likely to see a repitition of the early postwar experience: strong growth in 'new' industries, based on innovations which were introduced some ten to fifteen years before.

E. A 'make'-orientation rather than a 'distribute'-orientation

In the course of a long-wave upswing a shift in emphasis from production problems to distributional problems is generally noticed. When economic growth comes to be taken for granted, the distribution of it among classes of the population, among regions and sectors is considered a more pressing issue. Now a reversal of priorities is noticeable. Once again, the increase of national wealth is considered more important than attaining the proper distribution of existing wealth. In other words: priorities on the efficiency-equity trade-off are shifting towards more efficiency.

F. Greater production process flexibility

With the increased emphasis on efficiency, it is becoming more important for producers to create greater flexibility in the organization of their production processes. There is a tendency to lengthen the number of operating hours of machinery, which is accomplished by abolishing fixed work hours and instead operating with various shifts. This tendency is in accordance with a development towards shorter workweeks per worker.
Greater flexibility is also accomplished by reducing labour market rigidity in general, viz. by reducing the number of tenured positions and by liberalizing rules and regulations for hiring workers.

G. A redirection from mass-production towards individualized production

One of the positive aspects of the introduction of micro-electronics in the production process is that it allows for greater flexibility in product design, without driving up the cost of production to an excessive degree. There is also a tendency among consumers to demand individualized products and services. One of the consequences of this tendency will also be that production units will become smaller, either through the break-up of existing plants into smaller components, or through the creation of new small and medium-sized firms.

H. Industrial concentration through unification of homogeneous units rather than through diversification

The tendency described here may seen to run counter to the one discussed under G. However, the two are quite compatible. By concentration through unification, I refer to the nature of corporate mergers, which is likely to be different from the one in the 1960s and 1970s, when larger corporations were created through diversification, i.e. by bringing together, in one holding company, various unrelated entities with the purpose of spreading product and industry risk. Acquisitions in these years were also made to accomplish sales growth when the product package of the acquiring company did not provide much growth any more. Recent corporate acquisitions have been of a different nature. They combine firms which are active in the same area, and are made to strengthen the potential for technological innovation in that area.

3. Perspectives for the industrialized world - short cycles and long cycles

Actual economic developments always reflect long-term structural tendencies as well as short-run cyclical and one-time accidental changes. In practice, it is very difficult to separate these forces. What may seem to be a favourable structural development could turn out to be the effect of a temporary cyclical upturn. Recessionary forces, on the other hand, could easily give the impression that a favourable structural tendency is not a tendency after all.

The present economic upturn provides a case in point. My view is that the industrialized world is in a recovery phase, which is not just cyclical, but - more importantly - structural. I expect this phase to continue through the rest of the 1980s. The tendencies described in the previous section will, therefore, not be temporary changes, but more fundamental ones.

Even so, it is not to be expected that the gradual improvement of economic conditions, along with the restructuring processes which are occurring at present, will continue in an uninterrupted way during the coming years. More precisely, some form of economic slowdown is likely to develop around 1986. At present, economic signals point at a rather mild slowdown, not comparable to the severe recessions of 1974/75 and 1980/82. Yet it will be recognized as a slowdown, and as such it could be seen by many as a breakdown of the favourable tendencies described above. The point I should like to make here is that structural processes under way now will only be temporarily interrupted by a downturn of the short cycle.

I should emphasize that the word 'structural', as used here, is not meant to refer to tendencies which will persist for decades. Economic structures change over time, but these changes themselves will induce economic agents to adjust their behaviour. To illustrate this statement: a high rate of technological innovation in a particular phase will by itself reduce the rate in a subsequent stage of economic development, as more and more producers will turn their attention to existing growers rather than to the development of even more new products and processes. In that respect, I view the process of economic development as a very 'Schumpeterian' one.

4. Policy responses: export-oriented policies

Structural change can be accomplished in many ways: through macro-economic measures, through sector-specific measures and through micro-economic policies.

It is probably fair to say that macro-economic policy was the dominant type of policy during the years of high growth. During recent years, however, the emphasis has shifted to micro-measures, as many economists feel that macro-economic policy is an inappropriate instrument for accomplishing structural change. Thus the increasing popularity of the micro approach is very much related to the phase of economic development we are in. In years of rapid growth, the macro economy is the appropriate level of interference; during years of recession and depression, when structural adjustments have to be made, it is necessary to descend to the micro-level in order to directly influence the behaviour of economic decision-makers. In terms of economic theory: Keynesian economics had its heyday during the 1960s. Recently we have seen economists turning their attention to the micro-economic notions of classical economics.

Despite this shift from macro to micro, in this paper I will restrict myself to a discussion of macro-measures. While their importance and effectiveness may have been overestimated in the past, they should not be underestimated today. Also, traditional macro-economic measures taken by one country may have a considerable impact on other countries, and a discussion of macro-measures thus allows us to illustrate the interdependence of national economies.

At present, it would seem that macro-policies as conducted by various nations can be separated in two categories:

- those emphasizing the role of the export-oriented sector of the economy;
- those emphasizing the domestic sector.

In simple demand models, export demand (E) is one of the 'basic' expenditure components, together with government expenditure (G) and investment outlays (I). An increase in each of these components has a multiplier-effect on the economy, the size of the multiplier depending on the savings rate, the tax rate and the rate of imports.

Export-oriented policies have traditionally been an important tool for small economies. The smaller an economy, the more open it usually is. In a country such as Belgium, for instance, export demand exceeds domestic consumption, and a promotion of exports will have an enormous impact on the national economy. In a large country such as the United States, on the other hand, export demand accounts for less than one-fifth of private consumption, and

for that reason alone, domestic policies will have a far greater importance than export-oriented policies.

It is understandable, therefore, that small countries tend to emphasize export promotion more than large ones do. They have various macro-economic measures at their disposal, the most important of which are:

A. Currency devaluation;

B. Subsidies to export industries;

C. Cost control in order to increase price-competitiveness.

From a national perspective, countries deal with the 'rest of the world'; if we take a systems view, however, somebody's exports must be somebody else's imports. Gains made by one country, become losses absorbed by other countries. If all countries in the system subsidize their shipyards, nobody gains and all citizens in all countries end up paying for ships. If all countries control wages in order to increase price-competitiveness, again nobody gains. For the system as a whole, therefore, export-oriented policies could turn out to be a zero-sum game. This is especially true in a system of countries comparable in size.

This is not to say that there can be no 'system' justifications for export-oriented policies by individual countries:

1. a country's competitiveness may have deteriorated over time, e.g. due to excessive wage cost increases; cost control may be warranted if a country is to regain its former relative cost position;
2. a higher rate of inflation than the 'system rate' will put pressure on a country's currency; a devaluation is a means to correct the imbalance, provided the devaluation is followed up by measures to keep domestic inflation in check;
3. an 'infant industry' may need temporary support in order to establish its position on export markets.

In all three cases, the justification for export-oriented policies comes from the fact that temporary imbalances exist, which need correction. The search for permanent export gains, at the expense of other countries' positions, may well start a process of action and reaction, from which nobody gains.

In the real world, systems of countries usually do not consist of countries of equal size. The industrialized world has a small number of large countries, and a large number of small countries, whose exports are often oriented towards one or two of the large industrial powers. In those instances, the volume of trade between 'small' and 'large' has a far greater impact on the

economy of the small country than on the economy of the large one. This difference in relative importance could provide another justification for the pursuance of export-oriented policies by small countries. If conducted successfully, their relative benefit is likely to be far greater than the losses imposed on the large country. Even so, actual practice has shown that even large countries with low imports/GNP-ratios may feel threatened by the growth in imported goods and services and retaliate.

Another factor which determines the international trade flows is the stage of development of countries and the production structure associated with a particular stage. The history of industrialization has produced a sequence of product groups which countries go through as they move along their life cycle of development: from textiles to steel, shipbuilding, automobiles and eventually micro-electronics. The existing differences in stage of development produces a trade pattern in which the bilateral trade relations between two countries can be greatly imbalanced, without giving rise to corrective measures.

The recognition that the world consists of countries which are at different stages of development, and which specialize in different product groups, leads to the view that international trade for the world as a whole is - and should be - a positive-sum game. Gains from international trade are the result of specialization. They are accomplished by combining national markets into larger, international ones. For some products, markets have already become world markets. In the current phase of industrial restructuring, gains can be made by creating large international markets for products which are in the early phases of their life cycles. This problem is especially urgent for the countries of Europe, which lack a large national market of sufficient size. Creating a large market for technologically-advanced products, however, requires supranational, rather than national policies.

5. Policy responses: domestic-oriented policies

In the previous section I have argued that export-oriented policies can in some cases be justified as attempts to correct imbalances which have arisen in previous years. The imbalances are imbalances with respect to other countries. But in an entirely closed economy, too, the production structure

changes and may become imbalanced. In fact, industrial restructuring is nothing but the search for a new balance: between production and sales, between growing industries and maturing industries, between demand for labour and supply of labour, etc.

Closed economies or relatively closed economies have to solve their imbalances through domestic measures. Again, these measures can be directed at the macro-level, the meso-level and the micro-level of the economy. I will restrict myself to the macro-measures. But before getting to the policy issue, it is necessary to specify the type of imbalances which are typical for a long-wave downswing - or, if one likes: industrial restructuring phase. The following would seem to be of importance:

1) Wage increases which, for a number of years, have tended to outpace productivity increases;
2) a change in the life-cycle profile of industries: towards an over-abundance of older industries and a relative lack of younger industries;
3) a tendency towards institutional rigidity;
4) a relative increase in the size of debt;
5) a growing tax burden, signalling a relative reduction of the size of the private sector;
6) an increase in the consumption-investment ratio, indicating in fact a shortening of the time-horizon of society.

Nearly every industrial society has to cope with one or more of these problems. It is also fair to say that they are being addressed now, whether through active policy measures or through the mere fact that imbalances in themselves are causing reactions by economic decision-makers. That is to say: the parameters of economic systems are not fixed. They change over time, in response to structural developments. In fact: long-wave theory is built on the premise that economic systems contain endogenous corrective mechanisms. Even without the insertion of an exogenous policy-maker into the system, structural adjustments will take place.

But we could go one step further by noting that governments are not exogenous themselves. They too react to imbalances when they appear to be 'structural' rather than temporary deviations from a balanced growth path. Considering the well-known lags in economic policy (recognition lag, implementation lag, economic-impact lag) it is understandable that a transition phase is inevitable before restructuring policies start to have an effect on the structure of the economy.

The point is, however, that - regardless of the interdependence between economies - no single country can afford not to put its own economy in order. No country can solely rely on external forces to bring about structural adjustment, if the domestic economy is an imbalanced one. That this is true can be amply illustrated by the recent developments of the various European economies, some of which have taken major steps in the restructuring process, others of which are lagging behind. When - to give an example - government debt has become excessive, sooner or later the size of this debt has to be reduced, regardless of whether the world economy is recovering or not.
The main consolation at this point in time comes from the fact that this condition is now widely recognized as a pressing one. While most of the smaller countries do look at exports as one way to alleviate their problems, they all recognize that increases in exports alone cannot do the trick.
Macro-economic policies can speed up the process of adjustment in a number of ways:

- by gradually reducing the size of the government budget deficit to the size of the structural savings surplus of the private sector of the economy;
- by measures which encourage savings in the private sector; these will include tax incentives, but also policies aimed at controlling inflation;
- by government investment outlays, aimed at improving the industrial and social infrastructure of the economy;
- by implementing measures which increase the flexibility of the economic process (i.e. through deregulation);
- by reducing the overall tax burden, while shifting the emphasis from direct taxation to indirect taxation.

The impact of domestic-oriented macro-economic policy measures should not be exaggerated. As stated above, I view them as means to speed up a process of adjustment, which may be taking place already. Only when it comes to controlling its own expenditures, can a government act autonomously. Other expenditure components, however, can only be influenced in an indirect way. Investment outlays are a case in point. Here the position of a stable political environment may do more than attempts at fine-tuning through investment premiums. Other examples are wage and price controls. In their extreme application, i.e. through freezes, they have a history of being only temporarily effective, often unleashing new inflationary forces after the freeze has

ended. Wage controls only work to the extent that all parties involved - workers, firm management, government - share the desire to keep wage changes in line with the development of other economic variables, such as productivity.

This latter comment points at the importance of commonly shared goals in a national economy. Historically, periods of economic progress have usually been periods of social harmony, at the national level, but often also at the international level. They may be intangibles in quantitative economic analysis; industrial restructuring, however, cannot be accomplished without conditions such as 'social harmony' being met.

6. Conclusion

The subject of this contribution has been the role of macro-economic policies in the process of industrial restructuring in a world of economic interdependence. By restricting the discussion to macro-policies, important tools and measures of restructuring policy have remained untouched. The most far-reaching category of these would seem to be those policy measures which require cooperation between nations, and which can, therefore, be labelled as being supranational in character.

Yet it was also emphasized that supranational measures cannot take away the need for countries to correct imbalances which have arisen within national economies. National restructuring policies are indispensable. Interdependent as industrial economies may be, they cannot solely rely on the outside world to cure their problems. While a rising tide raises all ships, history shows us that the domestic conditions of countries can vary greatly at a particular point in time.

Similarly, export-oriented policies can only go some way towards solving the problem of industrial restructuring. Small, open economies are, of course, dependent on the development of world trade. For them, the pressure to correct imbalances vis-à-vis other countries is greatest. But this is the same as saying that their openness will force them to tackle the restructuring problem even quicker and with greater intensity than less open economies must do. For export-oriented policies only tend to be effective if they are matched by domestic measures. Also, export-oriented policies conducted by all countries in a system of small and medium-sized economies (as is the case

in Europe), may turn out to be a zero-sum game. Here, the need for cooperation at the supranational level presents itself again.

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INDUSTRIAL RESTRUCTURING: AN INTERNATIONAL PROBLEM

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Abstract

The transition from growth to stagnation in the international economy has made industrial restructuring more essential, yet harder to achieve. Competition between the industrialized countries is changing the pattern of their comparative advantages, shifting industrial location within the North, a trend supported by the activities of multinational enterprises. This is more important than competition from less developed countries in most industries. While current trends indicate more specialization of industrialized countries in high-skill, capital- and knowlege-intensive industries and of newly industrializing and developing countries on labour-intensive and raw material-intensive industries, this trend is not necessarily inevitable or desirable.

THE TRANSFORMED WORLD INDUSTRIAL ENVIRONMENT

The phrase 'industrial restructuring' has come into frequent use only very recently, partially displacing terms,

common earlier, such as industrial 'change', 'adaptation' and 'adjustment'. These latter imply relatively small, smooth, spontaneous, even slow, alterations in manufacturing products, processes and places, and in materials procurement or marketing, as industrial organizations respond - perhaps 'passively' as decision-takers - to stresses from the economic, social and political environment which threaten their continued, efficient or profitable operations. 'Restructuring'[1] suggests the adoption of more conscious and 'active' strategies by organizations and governments, as decision-makers, to rearrange, reorganize and redirect industrial activities more fundamentally to create new structures and patterns. It implies deliberate and concerted effort to shift resources in particular ways between types of activity, sectors or places, to obviate, remove or forestall environmental stresses. This change in terminology is rooted in the late 1960s/early 1970s' watershed between two distinctive global economic eras.

Growth 1950-1970

Once post-Second World War reconstruction was complete (c. 1950), established industrial core regions in northeast America, northwest Europe, north Italy, south and southeast Honshu - joined by industrializing socialist countries in Eastern Europe (Hamilton, 1968, 1970) - began to experience nearly 20 years of 'industrial boom almost without precedent' (OECD, 1983, p.14). Several factors combined to bring this about; major improvements in transport and communications; progressive removal of national and international barriers to liberalize flows of capital, technology and trade, especially within the capitalist world; the setting-up of arrangements to stabilize currency exchange rates and trade; rearmament; and the rise and spread of multinational enterprise (LINGE and HAMILTON, 1981).

Growth also facilitated relatively smooth and quite rapid changes by firms in the structure of manufacturing employment

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1 According to the 1982 Supplement to the Oxford English Dictionary the first recorded use in the English language of the word 're-structure' was by K.S. Lashley in L.A. Jeffress, Cerebral Mechanisms in Behaviour, 1958.

in the industrialized countries, though state planning achieved restructuring in Eastern Europe and the USSR. Overall, numbers of jobs in labour-intensive industries (such as textiles, clothing or shoes) began to stagnate or disappear while those in capital/raw material-intensive industries (e.g. metallurgy, chemicals) and in capital/machinery-intensive industries (e.g. vehicles, appliances, electrical/electronics) expanded rapidly, though important differences occurred in the pace and scale of change between countries. Qualitative shifts raised labour productivity in most manufacturing activities as firms introduced mass-production in their industrial facilities; all industries became less 'labour-intensive' and more 'capital-intensive' whether they produced clothes, steel or cars.

Broadly, however, this was either not detected or not recognized at the time as a 'restructuring' problem, mainly for three sets of reasons:

1. Demographic. Rapid expansion in the demand for labour confronted a deficit of people of working age which had been caused by altered demographic behaviour in the 1930s depression - delayed marriages and restricted births - and by the decimating effects on population of the Second World War. Labour markets in industrialized regions would have been very severely strained had it not been for:

   (a) the increasing participation rates of women in the labour force; and

   (b) large scale migrations of workers, both

      (i) from rural areas (especially in the socialist countries) and, in the USA, from the 'Deep South' or Gulf sunbelt states; and

      (ii) immigration of ethnic minorities from the 'South', from the Gulf of Mexico into the USA, and from the Caribbean, Mediterranean and Asia into Western Europe.

Women and imigrants filled the unskilled jobs, so releasing indigenous male workers to move between occupations and locations to the semi-skilled and skilled jobs being generated in new growth industries and in the expanding non-manufacturing functions in all industries. External labour supplies thus helped industrial 'restructuring' seem like 'change' or 'adjustment' and, in any case, were part of deliberate policy to maintain stable profit rates for capital and lower labour costs. Had international migration been restricted, relocation of labour-intensive industries to LDCs might have begun earlier, speeding up restructuring in developed countries into capital-intensive production methods.

2. Politico-economic. Decolonialization after 1946 led to the formation of 100 newly independent countries. Many sought industrial development despite the enormous ranges in their size, real sovereign power, historical experience, social organization and natural resources. Industrialization of the world's less developed countries and regions became the problem that preoccupied both research and policymaking during the UN 'decades of development' (1960-80). And, for historic politico-economic reasons, and the legacy of possibilism in geography, there were large numbers of geographers about with research experience and interest in Third World countries; with some important exceptions, industrialized countries attracted little interest until the late 1960s.

3. Research and Policy. Elaboration and diffusion of Perrouxian ideas in the late 1950s concerning the creation of growth and development poles were greatly accelerated by various UN organizations and international conferences. Such an apparently authoritative global seal of approval easily convinced policymakers in many countries that growth or development poles offered a mechanism by which, in effect, polarization of Myrdalian processes of cumulative causation (MYRDAL, 1957) could

be diverted, transferred or relocated from industrialized to less developed countries to implement the development desired (for a recent discussion see DALY, 1983); growth poles were seen as a method of greatly accelerating the advent of 'polarization reversal' that HIRSCHMAN (1958) had predicted would eventually occur.

Stagnation and Recession 1970-1985

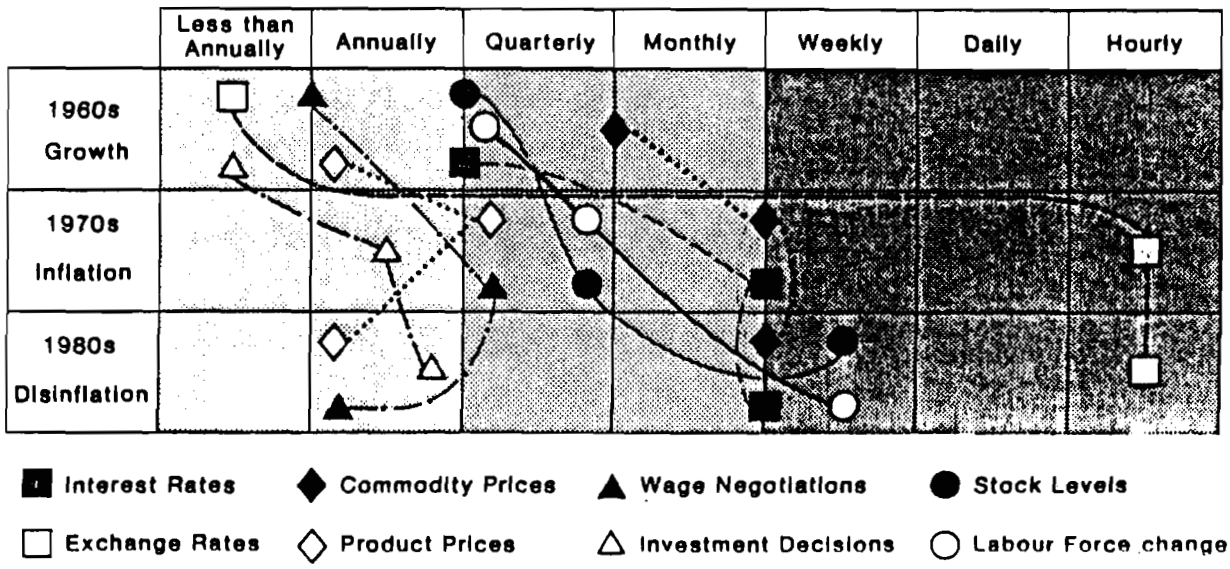
A wide range of forces shape industrial structures and their dynamics at any geographic scale of analysis. The traditional classification of factors by origin into internal (i.e. national, e.g. demand, competitiveness, investment) and external (i.e. international, e.g. competition, commodity markets) is only satisfactory insofar as it recognizes:

(a) significant regional variations in economic and social conditions within many countries;

(b) very close interaction of internal and external factors, with a distinctive strengthening of the international impulses and components in recent years with particularly marked trends towards 'globalism' in transport and communications, technology, and capital markets related to:

(c) the increased importance of firm-specific transnational environments created within larger multinational enterprises able to internalize and manipulate a range of local, national and international conditions.

Since 1970 the world economic environment has been destabilized (Figure 1): more frequent changes in currency exchange, interest rates and commodity prices have led industrial organizations to make decisions at shortening intervals with respect to changes in investment, stocks, wages and labour requirements. These trends were being built up or their preconditions were being created already in the 1960s. Seven trends in the economic, political and social environment converged and intensified to make restructuring a global necessity for industrial organizations by the late 1970s:



Source: ECONOMIST 24.9.1983

Figure 1. The De-stabilization of the World Economic Environment since 1960

First, the slowdown in economic growth was worldwide, although most marked in the OECD countries (which accounted for 80 per cent of the non-Communist world's industrial output in 1982) in which growth in GDP dropped from an annual average of 5 to 6 per cent (1963-73) to 2½ (1973-8) and less than 1 per cent (1979-82). Depressed markets introduced greater uncertainty; reduced world trade in materials and manufactures; delayed investments; and severely curtailed demand for certain capital good, especially transport, building, mining and factory equipment (e.g. ships, vehicles, machinery, machine tools) and hence for steeel.

Second, higher inflation rates have had far-reaching effects. Profits or accumulation have been squeezed, though differentially between industries, at best throwing industrial enterprises into greater dependency on outside capital borrowing (so enhancing the role and power of the banking sector) or at worst indebtedness or bankruptcy. High interest rates have made capital expensive, delaying modernization, hindering competitivess; in shrinking markets this has meant surplus capacity and hastened plant closures, rationalization or mergers, especially in capital-intensive industries (e.g. steel, shipbuilding) and in some industries with big research-and-development (R & D) commitments (e.g. chemicals, vehicles) or long investment lead times (e.g. mineral extraction). Similarly, inflation has raised labour costs, pricing some labour-intensive operations out of the industrialized countries (encouraging their relocation by firms in countries with cheap labour) and stimulating automation to reduce labour intensity in other operations retained by firms at home.

Third, increased international monetary instability has taken two major forms:

(i) The transition from fixed to floating currency exchange rates - intended to reflect real national differentials in prices and costs more closely and quickly (and so encourage adjustment of national industrial structures to changes in comparative costs) - in fact led to prolonged 'over-shooting' (under- or over-valuation) of exchange rates.

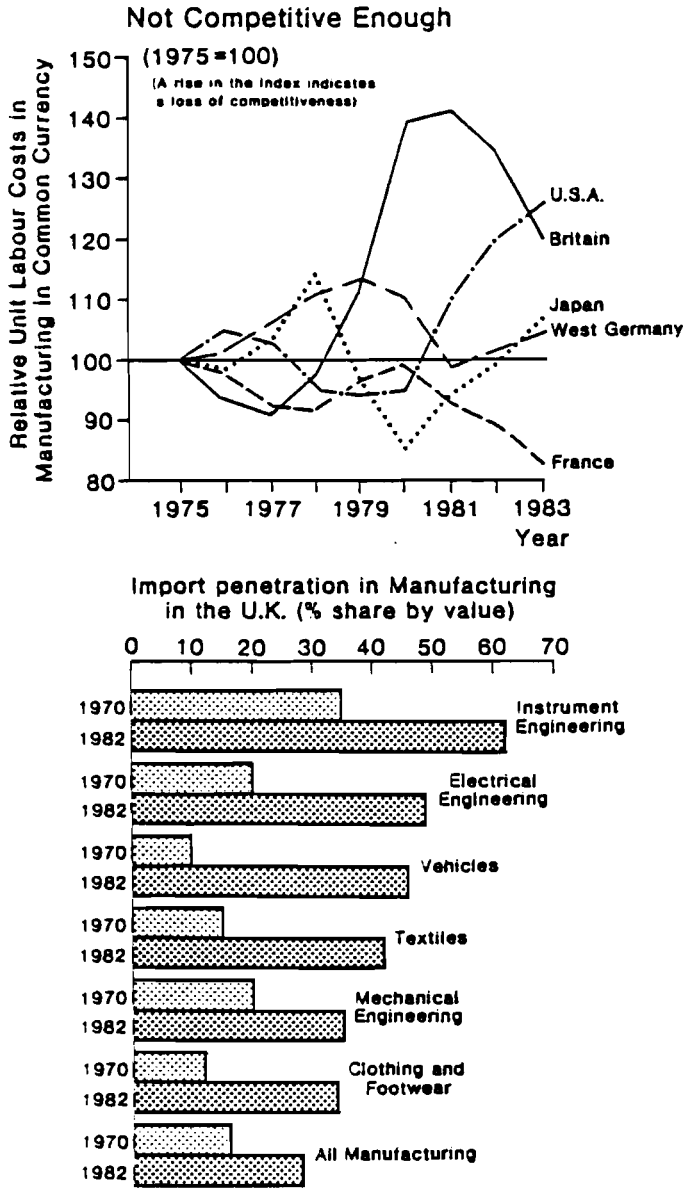
Under-Valuation of the D-mark, Swiss franc and Japanese yen has probably prolonged industrial exports from, and hence industrial production in, West Germany, Switzerland and Japan at various times in the 1970s and early 1980s. Over-valuation of the currencies of oil- or gas-producers such as the Netherlands, Norway and the UK, has contributed to weakened competitiveness, among other factors, and has hastened their 'de-industrialization' following severe import penetration of manufactures (Figure 2).

(ii) Huge petrodollar surpluses created after 1974 in the OPEC countries initially helped to finance industrialization in newly-industrializing countries (NICs) and large-scale technology transfers to Eastern Europe and the USSR. In 1980 such recycling had led to the deep indebtedness of some countries (e.g. Brazil, Mexico, Poland, Romania, Yugoslavia), with the result that:

> the demands of debt servicing and repayment are causing these countries ... to expand their sales to solvent markets. This increases competition in OECD and third-country markets without necessarily creating a corresponding increase in outlets in the selling countries, given their limited absorption capacity (and) potential solvency constraints ... (OECD, 1983, p.22).

Fourth, the rise of new human values. The growth era sowed the seeds of an upsurge in human demands for (a) protection of environment and (b) improved welfare and working conditions. Although (a) has often raised some industrial costs through the need to install expensive recycling, filtering or purification equipment, both (a) and (b) have created markets for new products such as filters, leisure and sports equipment, or medical machinery.

Fifth, innovation and technological change. Although stagnation and recession discouraged R & D, inflation combined with shrinking markets after 1974 made firms in many industries make technological changes to cut costs. Escalating energy costs induced energy-saving innovations and their wider



Source:ECONOMIST 12.11.1983; IMF; CSO; CBI.

Figure 2. Forces in the De-industrialization of the U.K.

manufacture, e.g. in engines for all forms of transport, in heating equipment or energy-intensive processes; it also encouraged more compact or lighter products to save on energy-intensive materials with feedback effects reducing demand, for instance, steel. Rising labour costs stimulated introduction of automation and robotics in factories and warehouses and computerization in the office. These inflationary trends and soaring capital costs seem to be hastening the 'in-filling' of the innovation trough between Kondratiev long waves as electromechanical technologies are phased out and replaced by microelectronics which yield big cost savings in energy, labour, capital and very flexible production systems. Sharpening competition between firms located in industrialized countries and from the NICs and socialist countries in standardized manufactures, is necessitating innovation in the 'North' of more sophisticated consumer durable, intermediate and capital goods often incorporating new or improved materials.

Sixth, political volatility. Figures on world trade in manufactures suggest that East-West detente and OPEC unity provided stable environments which enabled manufacturers in Western Europe, North America and Japan during the 1970s to cushion some effects of recession by diverting capital and consumers goods to CMEA and OPEC countries. Since 1979, however, escalating military activity in many parts of the world has both cut back such markets and deflected investment to meet expanded demand for weapons, armaments and space-technology. It is unclear how far improved relations between OECD countries and the Chinese People's Republic, and any stable policy within the latter for imported technology, can or will compensate for reduced business with the CMEA.

Seventh, increasing international competition has arisen from: past trade liberalization which enormously expanded trade of the Hecksher-Ohlin type based on factor endowments; industrialization in many countries; and the recent stagnation of world markets. It has often been aided by state intervention in production subsidies for exports or vigorous export-orientated policies in some industrialized and newly industrializing countries (LINGE and HAMILTON, 1981).

THE CHALLENGES OF RESTRUCTURING INDUSTRY

Paradoxically, a reawakening of the geographer's interest in industry has occurred when advanced economies appear to be becoming 'post-industrial' following relative and, increasingly absolute decline in manufacturing. The foregoing trends shaping industrial structure are stimulus enough to such revived research interest, yet other reasons of a practical nature are no less compelling. Industrial geography has been reborn in a new guise because of the awareness of its wider production-system and welfare implications in a world which has reached an industrial 'crossroads' (HAMILTON and LINGE, 1983).

The decisions to be made at the crossroads are for enterprises, governments and people to choose which direction lest the direction be chosen for them. Not to restructure industry could mean manufacturing suicide, but the choice of what kind of restructuring, why, how, and how fast, presents enormous challenges and will involve high economic, political and social risks. The most critical problem in the non-Communist world is that it is firms that are restructuring in their own interest to survive; and as a result of world economic de-stabilization (Figure 1) and intense competition in stagnant markets, they are making more drastic decisions more frequently and involving major investment and labour force changes which can sharply alter the fortune of people living in particular cities and regions.

Industrialized Countries

Employment appears to be the most intractable problem in these countries, where current market conditions and the introduction of job-replacing technologies to raise labour productivity and lower costs has made manufacturing (and related or dependent non-manufacturing) the major source of unemployment creation amongst unskilled and semi-skilled workers (Figure 3). Whereas in the 1963-1973 decade most advanced OECD countries boasted unemployment rates of 1-2½ per cent, most today suffer rates of 7½-15 per cent. An overall result - used by some to identify

SCOTLAND'S JOBS (000's)

	1970	1975	1982
Oil and Mining	39	34	44
Manufacturing	708	676	463
Services	1049	1125	1224
Total Employees	2058	2084	1931
Unemployed	91	88	318

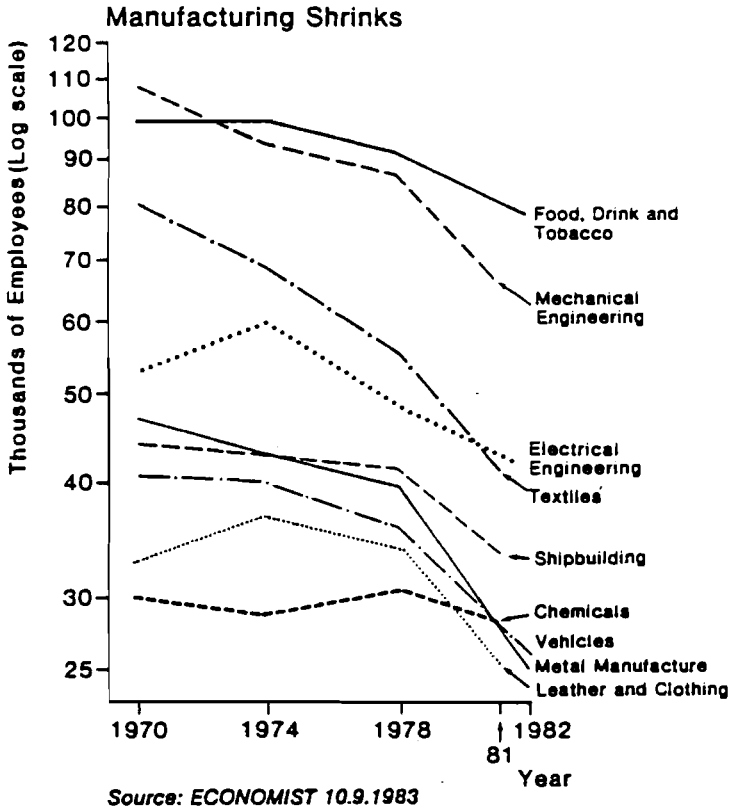


Figure 3. Job Losses in Manufacturing and Employment Change in Scotland, 1970-1982

the arrival of the 'post-industrial era' - is that manufacturing in the 15 most industrialized OECD countries[2] in 1982 generated only 15-32 per cent of their GDP and 18-33 per cent of their employment compared with 25-42 and 25-40 per cent respectively in 1960. The new wave of technologies will almost certainly not create much new 'compensatory' employment in the short or medium term; indeed, their job-replacing capabilties in the factory, warehouse and office could be devasting. Services will become still more important in these countries than they are today, partly because new manufactures - though actually to be produced by numerically-controlled machines and robots - will require far more 'knowledge-intensive' inputs, after-sales servicing and application-adaptation than the present generation of industrial products. The danger is that the current wave of service expansion into profitable but low-paid activities will contract the per capita market for manufactures in industrialized countries, contributing to further de-industrialization in some of them (e.g. the U.K.).

Less-Developed Countries (LDCs)

These face quite different problems. Despite two 'decades of development' and the Lima Declaration (1974) for the creation of a 'new international economic order', little of the world's industry is located in the LDCs. As far as one can establish, in 1982 17 industrialized OECD countries produced 56 per cent of the world's industrial output, the CMEA 30 per cent, and the LDCs only 14 per cent. Almost half of the latter, however, was concentrated in six NICs. Except for the 'city states' of Hong Kong and Singapore (Figure 4), and localized areas in Brazil, Mexico, Taiwan and Korea, manufacturing has hardly provided more than a very marginal solution to the Third World's problems of unemployment, underemployment and poverty. Indeed, dependency on the international banks has certainly increased the latter as the LDCs have had to pay high interest rates on large per capita foreign debts; and in 1983 these repayments to banks in developed countries began to exceed capital receipts as a whole. Often,

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2 These countries include the USA, Japan, Canada, West Germany, France, United Kingdom, Italy, Austria, Belgium, Luxembourg, Denmark, Netherlands, Norway and Sweden. (Data were unavailable for Switzerland: see OECD, 1983, pp.178-180).

indebtedness should not be blamed on manufacturing per se but rather, on the increased dependency of industrial firms in general on banks for capital and on the type of industrialization experienced in many LDCs:

(1) the large, capital-intensive, resource-extractive/ refining operations that create few jobs and drain away materials for the overseas addition of high value; and

(2) small, usually sub-optimal, often technologically-outdated and mainly assembly operations set up to supply restricted LDC markets at high cost under the 'protective umbrella' of national import-substitution policies but which usually involve substantial overseas backward linkages; although this industrial activity tends to be labour-intensive, and hence has traditionally been viewed as more 'appropriate' to LDCs, it generates limited value added and jobs are thus low-paid.

It is a moot point, however, whether LDCs might not be better off had their governments encourged multinationals - or at least not been so hostile to them - and attracted better capability to repay capital transferred than they now have.

Some LDCs - especially the Southeast and East Asian NICs - underline the relevance of this latter point for, since the late 1960s, they have attracted substantial sections of the labour-intensive lines of production priced out of North America, Western Europe and Japan, especially in the textile, clothing, shoes, plastic-goods, electrical and electronics (Figure 4) industries (see HAMILTON and LINGE, 1981, chapters 1, 7, 13, 14, 15; HAMILTON and LINGE, chapter 19). This might be the beginning of a long-term cumulative industrial relocation trend as the world 'economic equator' moves southward and eastward; and as intermediate and capital-goods' industries are also attracted to the LDCs by the advantages of much cheaper labour in proximity to NICs with expanding regional markets. And it could augur 'better' (if not 'well') for employment prospects in more (though clearly not all) LDCs, though further de-industrialization would

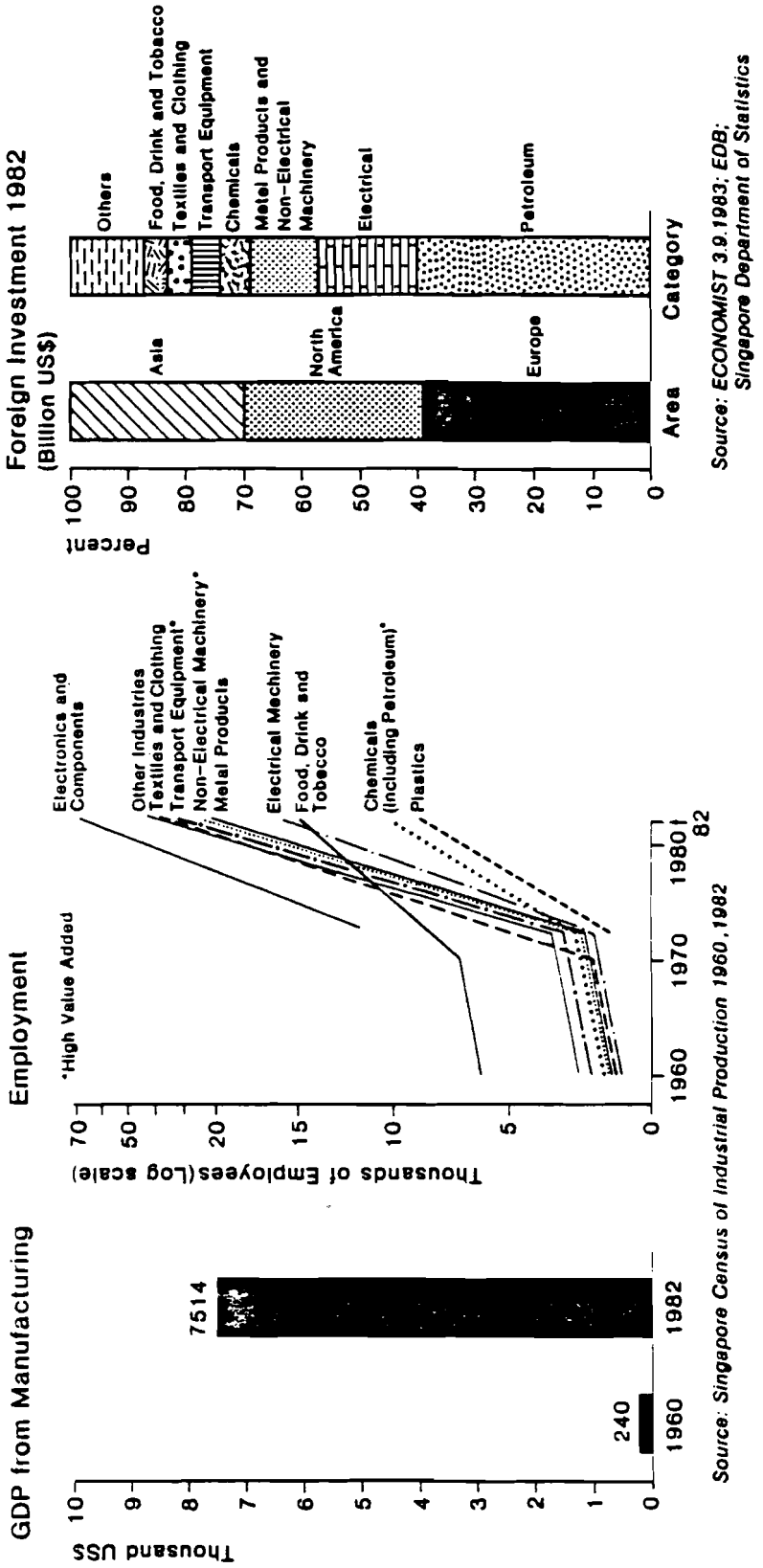


Figure 4. The Industrialization of Singapore 1960-1982 and the Importance of Investments by Foreign-owned Multinational Firms

occur in the advanced economies. Yet it could be that the days of industrial relocation to cheap labour locations in NICs and LDCs are numbered by the rate of the innovation, adoption and diffusion of the new technologies in industrialized countries. For a considerable period into the 1990s the early stages of the product cycle connected with the new and sophisticated labour-replacing technologies will possibly reconcentrate industry in, or 're-industrialize', the older industrialized countries and their regions. So manufacturing could not continue to hold out significant job-creating prospects in either LDCs or NICs.

Relationships between technological change and employment are complex and should not ignore productivity, value creation or social satisfaction. A spin-off of the rise in concern for the quality of environment and life in the early 1970s was the campaign to halt capital-intensive projects in LDCs and base development on more 'appropriate' (usually labour-intensive) technologies. These latter may undoubtedly serve social needs in that they involve small-scale operations and can thus preserve family and community structures (rather than commuting, migration and urbanization linked to large industries breaking up such structures). But 'appropriate technology' is of dubious economic utility: high labour intensity means low value added, low surplus value creation, and thus stunts accumulation for development (EMMANUEL, 1982). This is an argument in support of early adoption of up-to-date techniques of production in the LDCs to generate high productivity and accumulation. The problems of accomplishing this are many:

(a) modern technologies are mostly controlled by multinational enterprises headquartered outside the LDCs and reluctant to lose that control either as a matter of principle or because it might shorten the product cycle too rapidly for their own 'comfort' or for the welfare of developed country workers and government;

(b) few LDCs possess the politico-economic bargaining power to prise up-to-date technologies out of multinational firms (or in some cases governments) based in the North, unless those organizations perceive clear advantages in yielding them;

(c) even if LDCs obtain the technology, they may be unable to retain a significant part of the earnings, and profits or royalties and these will flow out to the industrialized world; and

(d) up-to-date technologies may create a few jobs directly, at least in relation to LDC employment needs, although the job multiplier effects will depend on the success of the LDCs in bargaining to retain a significant part of the profits within their territories.

Centrally-managed and socialist economies. These were able to achieve substantial industrialization insulated in large measure until the 1979s from growing global economic inter-dependencies. Once they began to import OECD technology, the small East European economies in particular became partially locked into international capital and product markets. This exposed several problems impinging on their need for industrial restructuring:

(a) comparatively labour-intensive industry of all kinds, a legacy of the so-called 'extensive' industrialization during the acute capital scarcities of the 1950s;

(b) this and a tendency for many industrial plants to produce ranges of finished products (and their components) in relatively small batches offset the efficiency that could potentially come from their larger scale of operation (cf. many OECD industries);

(c) relative dominance of industrial structures by 'traditional' industries such as steel and electro-mechanical products with insufficient production of consumers' or electronics-based goods; and

(d) continued duplication of industrial products between CMEA member countries despite substantial progress towards rationalization, specialization and integration in their industrial systems since 1965, and collaborative R & D with respect to newer technologies.

For a time in the 1970s, the centrally-managed economies were able to offer 'intermediate technologies' or cheaper standarized manufactures to the LDCs, sometimes in conjunction with Western firms (GUTMAN and ARKWRIGHT, 1981) and to pay for their own Western technology imports by 'compensation trade' and 'intermediate technology' trade came in for severe competition in price and quality from the NICs; and governments have found their planning and institutional structures too rigid to cope with the challenges of contemporary economic change.

RECENT TRENDS

Clearly, then, the needs and capabilities for industrial restructuring vary between the four groups of countries outlined - the industrialized OECD, the CMEA, the NICs and the LDCs. The extent and character of industrial problems and prospects, however, differ between countries within these groups. Variations in the rates, directions and timing of manufacturing change between all OECD countries since 1970 illustrate this: relatively sustained growth in the European periphery (Ireland, Mediterranean countries) at least until 1980; quite rapid pulling out of the short 1973-75 and 1979-82 recessions in the USA and Canada; considerable growth in Japan after 1975; longer depression in western Europe, though with the EEC 'Six' and Austria recovering up to 1980 when recession began to hit West Germany and France again; sustained decline in Australia, Norway, Switzerland and especially the UK.

These differences are outward expressions of variations between countries in adjustment and restructure to aggregate world market trends. Such processes are in the hands of multinational firms, governments and indigenous firms. In the industrialized countries this very broadly means some combination of:

(a) success or failure of firms or state organizations to rationalize, modernize or close down facilities in six groups of industries which, according to CEPII (1980), suffered from contraction in world aggregate demand which, by 1978, was 13-30 percentage

points below the 'line of cyclical peaks' of 1960s demand, i.e. building materials, metals (including steel), engineering products, wood and paper, chemicals, textiles and clothing;(for illustration see Table 1) and

(b) success or failure of organization to introduce, develop and expand those industries whose products were in rising demand, particularly all products making use of electronics applications (intermediate goods, e.g. components; capital goods, e.g. data-processing and telecommunications equipment; electronically-controlled consumer goods, etc.), organic chemicals, plastics and pharmaceuticals.

International Competition: Some Myths and Realities

These processes in advanced countries have been influenced by the increasing competitive strength of at least some NICs in some industrial sectors. But this should not be exaggerated for much of the restructuring in the North - closures, rationalization, new facilities - has been and is being carried out by multinational enterprises. Contrary to popular belief, their major operations are in the North and it is there that they are inter-linked by most intra-firm (international) trade in manufactures.

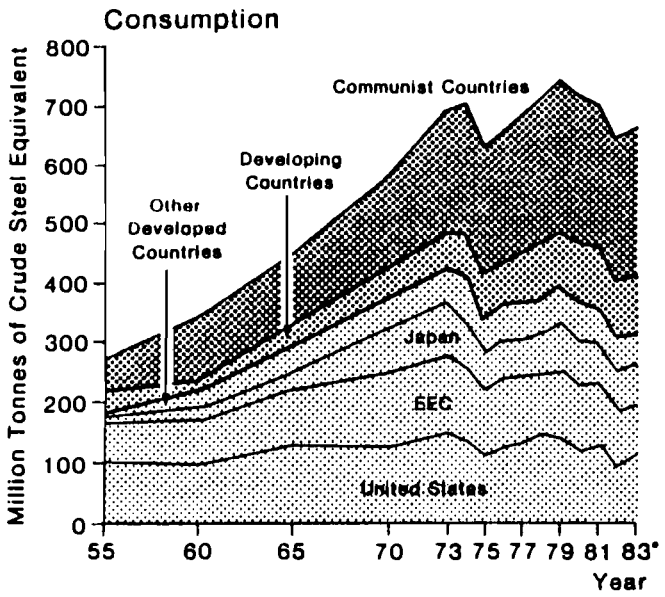
The increasing participation of the NICs in the international trade displays several facets: their penetration of developed-country markets in a widening range of products; the entry of new producers and competitors; and the growth of markets in the NICs for plants and equipment manufactured in industrialized countries:

> It is not so much that the emergence of new competitors has impeded industrial development in the developed countries; on the contrary it has been stimulated. Rather, this competition has increasingly affected the OECD area's industrial structure via shifts in comparative advantage. There is, therefore, the need for adjustment, the cost (including the social cost) of which may be high for some countries, industries and/or regions (OECD, 1983, p.31).

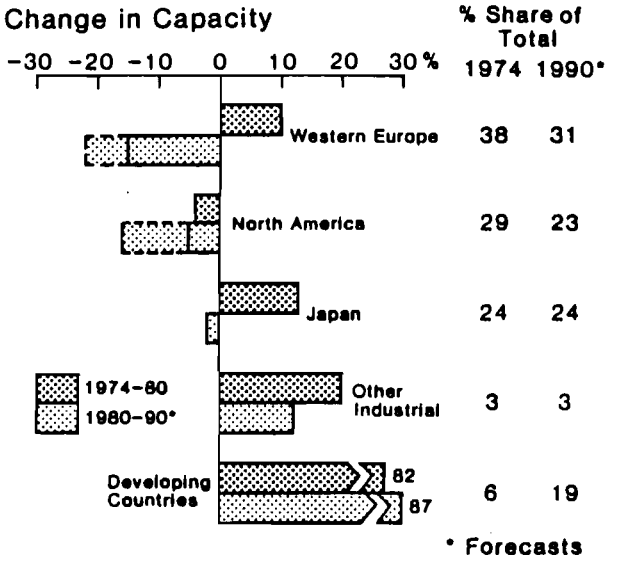
Industrialization in NICs and some LDCs in aggregate, though not necessarily in individual countries, has passed through three stages to date:

Table 1. Restructuring by U.K. chemicals corporations: a response to chronic overcapacity in West European plastic production, 1983/1984

Corporation	Restructuring processes: Plant closures	New plant opening	Swapping	Known/planned job impacts
Shell	1 petrochemicals and plastics plant, Carrington (N.W. England)			−1,000
		ethylene, Mossmoran (Scotland)		+ 200?
British Petroleum (B.P.)	3 plants: chlorine ethylene dichloride vinyl chloride monomer, Baglan Bay (S. Wales)			− 500
	3 PVC plants, Barry (South Wales)			− 600
		1 PVC plant, Barry ⟶ (S. Wales)	I.C.I.	+ 150?
Imperial Chemical Industries (I.C.I.)	1 polyethyline plant, Wilton (N.E England)			− 700
		1 polythylene ⟶	B.P.	+ 150?



Source: ECONOMIST 1.10.1983; IISI



Source: ECONOMIST 8.10.1983; IISI, 1983 Annual Report

Figure 5. Global Shifts in the Location of the Steel Industry, 1955-1990

(1) import substitution of simple manufactures, mainly by developing textile and metal industries, to create conditions from which to begin to pay off overseas debts followed by:

(2) export of manufactures with a high content of either cheap unskilled labour (e.g. clothing, shoes) or local materials (e.g. non-ferrous metals) and then:

(3) development of industries requiring more skills, capital and relatively modern techniques; this also involved the relocation of the relatively labour-intensive segments of the production chains of multi-national corporations from their home countries. Industrialization in Singapore illustrates this (Figure 4).

Each of these stages has involved an increasing scale and complexity of manufactured exports from industrialized countries, though the latter have not shared equally in this process (e.g. Japan, West Germany and the USA have been far more successful than the UK).

This progression can be related to the stages of economic development (ROSTOW, 1959); but it is, of course, most often cited as support for the product life cycle model in which, as the skilled labour content in a product decreases with standardization of production techniques, the comparative advantage shifts from locations in more advanced to those in less developed countries. However, because there are very many LDCs with abundant labour, only some will be able to share in this process. They will be the countries with the best international transport access, greatest political stability, most adept labour, strong or supportive government industrialization policies and hence those most favourably regarded by international bankers (LINGE and HAMILTON, 1981).

Except for Iran and Nigeria in the earlier 1970s, the above three stages do not typify the oil-rich OPEC countries, where very recent industrial construction is heavily concentrated in the downstream processing of oil and gas into refined products

and various chemicals or in energy-intensive metallurgy such as alumina-aluminium production. This generally reflects the shifting comparative advantage in energy costs to countries which which, in the case of the Middle Eastern OPEC countries, do not have significant labour reserves (or therefore labour advantages).

Intensified international trade in manufactures is revealing that the advanced economies may suffer comparative disadvantages and rising production costs in industries with mature technologies (in which labour costs are thus significant - textiles, clothing, woodworking, leather, footwear, rubber, plastics and some electrical equipment) and in industries dependent on scarce or costly natural resources. The closure of an increasing number of oil refineries and chemicals plants in coastal areas of Western Europe, for instance, reflects the shift of cost advantages to the Middle East and Singapore (though expanding Asian markets are more critical for the latter). Shutdown in older European and American steel industries express a similar shift southwards and eastwards in advantages to the materials sources in Latin America, the socialist countries and Asia (Figure 5).

The rapidity with which changes like this are occurring in vehicles, chemicals and petrochemicals in particular reflects the dominance of these industries by large multinational corporations more able and willing to restructure and relocate, in part by "swapping" facilities between themselves to achieve rationalization, lower costs and remove surplus capacity. In the U.S. economy, merger activity as a means to restructuring by firms seems, since 1979, to be producing the 'fourth great merger wave' since 1895. Adjustment in steel, which is largely state-owned, has been slower; it has, too, in labour-intensive sectors where small family firms unable (or unwilling) to borrow capital to restructure but having access to immigrant labour and can (often illegally) continue to operate using "sweated labour" conditions. The industrialized OECD countries, however, will retain their major advantages in knowledge- and skill-intensive industries, in part supported by the needs of multinational firms in these activities.

Nevertheless, there is evidence that at least five factors can slow down the locational shift of advantages from industrialized countries to the NICs and LDCs:

(a) increased protectionism in some developed countries (e.g. EEC in the form of quotas) to reduce or restrict import penetration which might cause problems of contraction in highly localized or labour-intensive industries; but experience tends to show that protection does not work in the long-term and merely makes the need for future closure or rationalization more drastic; an example is the U.K. textile industry, in which jobs declined between 1970 and 1982 and production declined by 4.5 per cent yearly (1973-81).

(b) for a time, certainly in the 1960s and early 1970s, regional-aid policies by governments, particularly in the EEC and EFTA countries, retained branch plant operations with higher labour intensities in the countries concerned, albeit involving an interregional shift from core metropolitan-industrial to peripheral areas, so slowing down overseas relocation to NICs and LDCs. Availability of cheaper rural and non-unionized labour, and plentiful land, in these regions has tended to have the same effect (e.g. Italian Mezzogiorno; U.S. sunbelt states); but it can similarly delay (or introduce the need for later) drastic adjustment (e.g. Figure 3).

(c) management innovation, rationalization, modernization/automation, and specialization on high quality products with a high demand-income elasticity and low demand-price elasticity, have enabled developed countries to improve, maintain or lose less even of the labour-intensive or materials-intensive activities than might have been expected (e.g. introduction of special steel-reinforced rubber conveyor belts in Akron, or special alloys production in Pittsburgh, U.S.A.);

(d) that few NICs have been able to attract industries requiring more advanced know-how and higher skills (mainly in South-East and East Asia and Latin America) is not due only to the comparative advantages of their local (often metropolitan) environments. It also results from real or perceived political instability, hostility or military conflict - widespread in many other countries of Central and Caribbean America, Africa, the Middle East, and South-East Asia - which deters both multinational industrial corporations from seeking to establish facilities and international banks from being prepared to finance projects there; and

(e) some large West European firms have been able to continue to supply LDC markets with capital and consumer goods from their home-country base by cooperating in various ways with enterprises located in Eastern Europe which can offer them components or intermediate products at low cost (GUTMAN and ARKWRIGHT, 1981; LINGE and HAMILTON, 1981).

These aspects help to explain further the persistence of the overwhelming industrial dominance of the North throughout the 1970s. Clear evidence of this is the rise in the trade surplus on OECD-produced manufactures with the LDCs from US$ 37.7 billion in 1973 to US$ 121 billion in 1978, though OPEC countries, which accounted for a third of the 1973 surplus, took more than half of the surplus in 1978. By contrast, industrial progress in some non-oil producing NICs is demonstrated by the fact that in the same period the share of electrical engineering products in total LDC-manufactured exports rose from 24 to 35 per cent. Such a trend seems to express very clearly the locational shift in comparative advantage to the Third World for the output of products nearing the end of their life cycle.

Much publicity is given to the effects of import penetration of products from LDCs on employment in the older industrialized countries. This is often misplaced. BALASSA (1979) demonstrated that 1.5 million net jobs in industry had been created in the

industrialized countries by 1976 as a result of trade in manufactures with LDCs. Such change involved major adjustments and restructuring, redeployment of workers and resources between firms and industries. In absolute terms the trade created 520,000 new jobs cf. 370,000 job losses in the U.S.A., about 1 million new industrial jobs cf. 290,000 job losses in the EEC, and 570,000 new jobs cf. 70,000 losses in Japan. These average net increases in industry employment resulted because, in aggregate, manufactured exports to the Third World rose faster than imports, so offsetting the higher labour intensity of job loss per unit value of imports (cf. the job gain per unit value of exports). Such trends bear out at international level what much growth pole development achieved at regional level - greater growth in developed areas. But gains and losses are usually in different areas within countries, posing spatial adjustment and restructuring problems.

BALASSA's work shows that the industries hardest hit by competition from LDCs are those employing highest proportion of unskilled and female labour and localized in less industrialized, inner-city or other industrially declining areas. Thus trade with LDCs had caused more job losses than gains in 6 industry groups in the U.S.A. by 1976: textiles, clothing, timber products, furniture, rubber and plastic goods, leather and footwear; in 4 of them in the EEC and in 2 of them in Japan. Such differences reflect a combination of industrial 'maturity' and competitiveness of the 3 respective areas. By the early 1980s, however, the most advanced NICs, especially Korea (LINGE and HAMILTON, 1981, pp.23-35) and Singapore (Figure 4) had sped up their industrialization sufficiently to begin competing with the industrialized countries in high value-added and more capital-intensive products (e.g. ships, machinery), so that more industry groups are likely to show a shift from net gains to net losses of jobs from trade in manufactures with LDCs.

Yet, it is competition from within the industrialized world, and especially from Japan with its huge manufactures trade surplus with the U.S.A. and Western Europe, which combines with productivity gains from management and technology innovations

and changing market conditions in the industrialized world to create more net job losses in manufacturing in the older industrialized countries - and hence to redistribute manufacturing jobs in the North - than does trade with LDCs.

TOWARDS 2000

Recession has made industrial restructuring a greater necessity for regions and nations, but at the same time more difficult for them to achieve. Increased foreign trade impacts on industrial structures everywhere inevitably require definitive change in the international division of labour. Specialization by firms in industrialized nations on up-market, high value-added, knowledge-intensive products incorporating advanced technology and substantial labour skill is becoming more pronounced, especially in a wide range of capital goods, chemicals and sophisticated consumers' goods. Meanwhile, enterprises located in, or relocated to, LDCs exhibit increasing penetration of world markets in mass-produced standardized goods.

Such an evolving pattern of international division of labour is neither inevitable nor desirable. It is not inevitable because vigorous government policies in some countries (e.g. Korea) demonstrate that LDCs can become NICs which develop quite advanced capital-intensive industries capable of low cost, good quality output. It is not desirable because it maintains or widens the economic gap in value-added between North and South.

The Need for Realism: Technology vs. Jobs

Even so, current trends indicate that the industrialized countries should expect their firms in labour-intensive industries to contract substantially; so too will steel, shipbuilding and vehicles enterprises or divisions as both cost and market advantages shift relatively to the NICs and LDCs. Firms in developed countries poor in energy resources, or with high-cost energy resources, will suffer significant disadvantages in all metallurgical fields, paper, basic chemicals, petrochemicals and non-metallic minerals while those in resource-rich countries

such as Australia or Canada, and some areas in Latin America and the Middle East, may be expected to expand such industries. Nevertheless, as firms make technological changes in various industries and production stages at differential rates there will be more (and a different pattern of) spatial separation within industries between the stages located in industrialized, and those located in developing countries than at present. It might be expected, for instance, that while more basic ferrous and non-ferrous production will become localized in the NICs and LDCs, the demand for sophisticated capital equipment for use in the factories of the future, in undersea developments and in space technology will require special metals and alloys to be produced in the advanced economies.

The task of government is seen by many businessmen to be to create the conditions for industrial organization to adjust and restructure by promoting the widest possible technological progress and applications. The community, on the other hand, may see the tasks of businessmen in partnerships with government as fostering dialogue, cooperation and the creation of conditions for a smoother human experience in coping with restructuring for a new society. Undoubtedly electronics and microelectronics will enter the management, R & D, manufacturing processes, transport, warehousing and uses of the products of more enterprises and industries (e.g. data-processing, robotics, new chemicals and energy) and to strengthen the competitive position of their older industries (e.g. textiles, shoes, electrical products, vehicles, metals) currently experiencing severer LDC and socialist-country competition, surplus capacity or the threat of it in the near future.

Technological innovation, application and adoption, however, generally require large, and rising, investments. At present the very high profitability of information-processing is stimulus enough to the rapid growth of business machinery, computer and microelectronics industries as technology is applied, often in 'learning' fashion, to cope with the explosion of data and information. Labour-substituting office automation will be further encouraged by the present high labour intensity of more

routine administration functions in most economic activities. High profits mean high rates of entry, especially in the U.S.A., where new firm foundation is now running at double the rate of the 1960s. But the huge costs of developing some new industries - especially robotics, biotechnology, aerospace and lasers - are forcing competing firms and governments to collaborate in joint R & D and co-production on an intercontinental scale. This is involving a marked trend towards integration of operations between facilities located in North America, Western Europe and Japan.

If investment in technological innovation in the still large metal, engineering and consumer goods industries is allowed to flag in the industrialized countries - for reasons of depressed demand, squeezed profit margins, or government 'non-interventionist' or monetarist unwillingness to support long-term technological progress - then the life cycles of present products and their methods of manufacture could be prolonged and give LDCs greater opportunities to expand their penetration of world manufacturing. Continued recession would also force more firms headquartered in developed countries to merge, rationalize at home and to relocate production in LDCs with lower labour costs if they are to survive in the world market. Indeed, currently the world's motor vehicle manufacturers are engaged in a massive global "reshuffle" with every region, country and corporation competing fiercely to place itself among 'the winners', with countries such as the U.K. under threat of very substantial 'flight' by multinationals like Ford, G.M. and Peugeot-Citroen, while other countries like Spain or Brazil can attract new specialized capacities from these firms (Figure 6). Because LDC markets would also become relatively more important, governments of LDCs - insofar as bankers could be persuaded to provide credits and loans to them or to the relocating firms - would be able to insist more forcefully on the technology transfers they require to industrialize (further). And this might better sustain North-South trade in manufactures. Undoubtedly these trends will have differential impacts amongst both developed and developing countries.

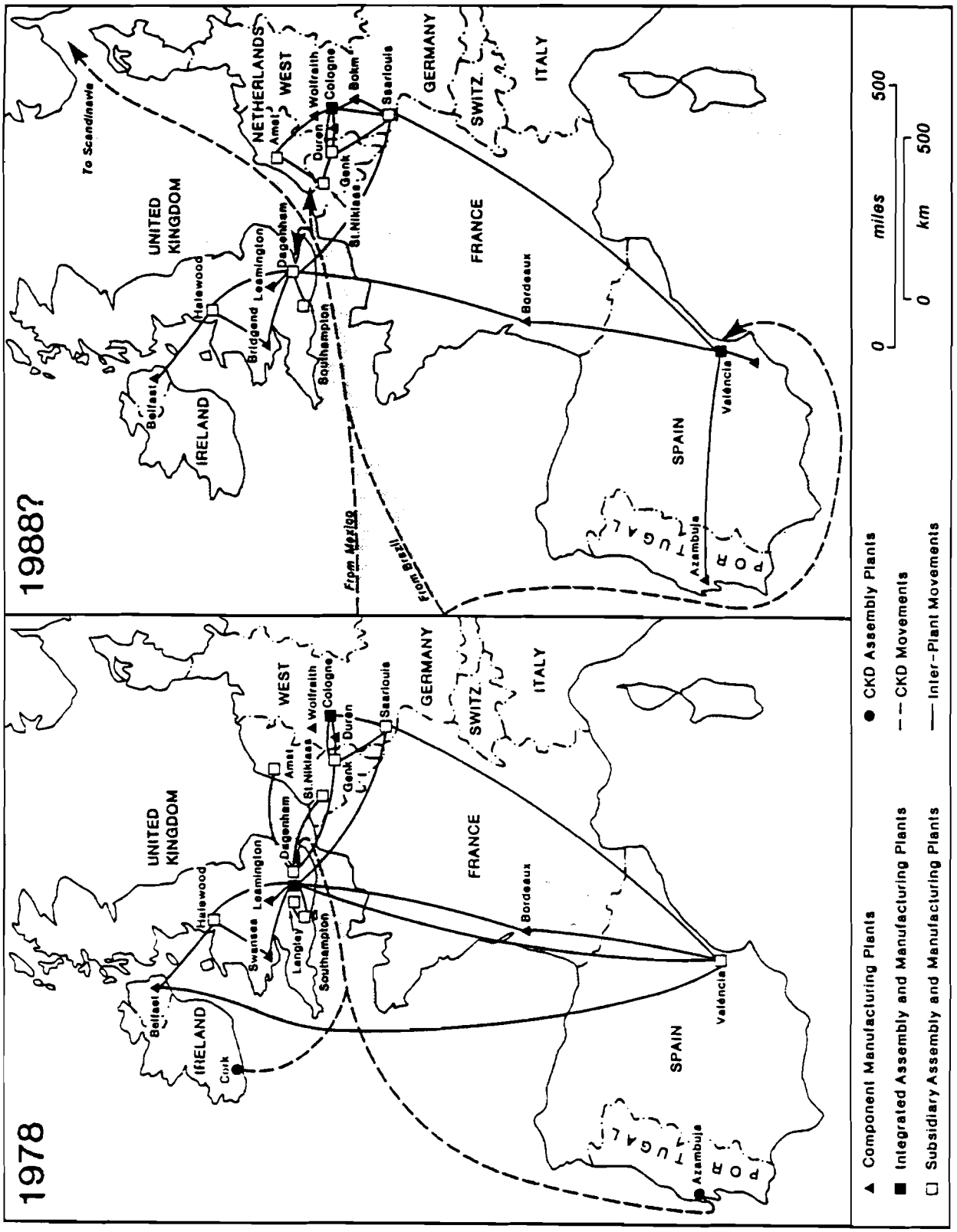


Figure 6. International Restructuring by a U.S. Multinational in Europe (Ford Motor Corporation)

Even if sufficient capital is forthcoming for wide technological change, it is not expected to generate many net jobs in manufacturing in developed countries in the 1990s. Full automation and robotization could probably sustain present (even peak 1970s) levels of manufacturing activity (though composed differently) while reducing the proportion of the labour force working in manufacturing in many advanced countries by the year 2000 to the current levels of employment in agriculture in those countries (c. 2-15 per cent). This is not surprising, despite the OECD (1983, p.149) prediction of considerable industrial employment expansion in Australia, Canada and Japan and a 'moderate' increase in the U.S.A. in the 1980s. For one thing, there will be time and sector leads and lags in technology impacts on job loss and job gain. For another, significant geographic shifts are likely to occur in the location of industrial jobs within the developed world (as well as between it and developing countries), particularly with the possible strengthening of the Pacific-centred, and concomitant weakening of the North Atlantic-centered, manufacturing 'belts'.

Integral parts of this process are the phenomenal development and restructuring of Japanese industry and the rapid 'de-industrialization' of the U.K. The latter was induced by a legacy of poor manufacturing competitiveness and exacerbated after 1978 by an overvalued currency and by government monetarism which claimed average net job losses of 1,000 per day in the 1979-82 period. Despite a sustained 1982-84 level of more than 3 million unemployed (a rate of 13 per cent), the U.K. currently has record manufactured exports and rising output due to relative international improvements in productivity and competitiveness from technological modernization. The U.K. experience warns against expecting much net job creation from manufacturing in developed countries. Moreover, similar and intensified efforts being made in most countries in the North to raise productivity may tend in the long term to neutralize the benefits of such gains in individual countries, to re-establish pre-existing (i.e. early 1970s) international productivity differentials (though at a much higher, capital-intensive level) and thus to contribute to further industrial

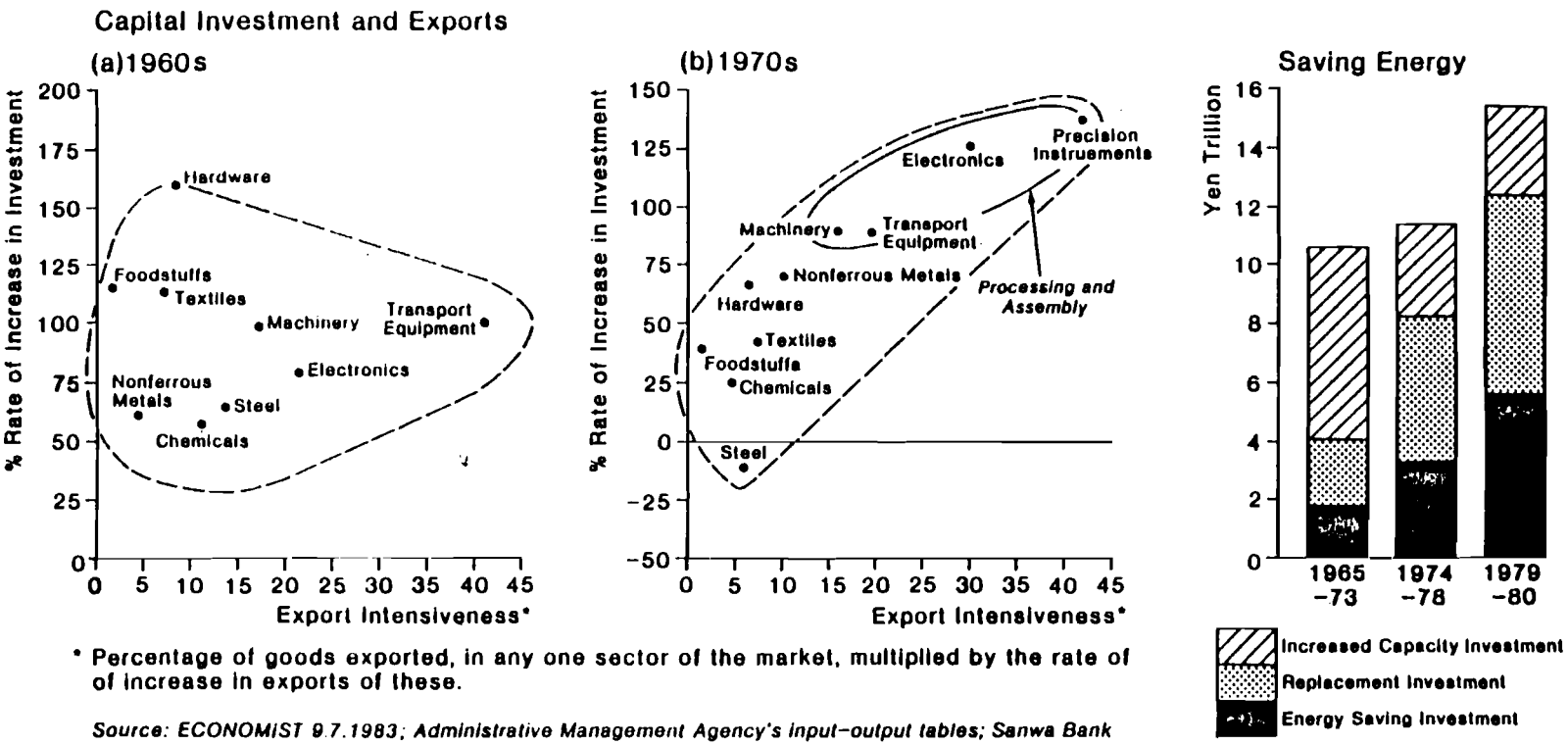
redistribution (concentration) in favour of the more competitive industrialized countries. This is what Japan, on the other hand, is achieving through high investment in restructuring (Figure 7). Not without reason, then, the OECD (1983, p.151) concludes that 'the very nature of competition makes any net growth in industrial employment very hypothetical'.

Market Constraints

Market conditions are thus crucial to the processes and patterns of industrial restructuring into the 21st century, Evolution to a highly populous world with high incomes for all, permitting growth-induced adjustment in the manner of the 1960s, is very unlikely. Indeed, market trends are complex, predictions confusing. Wide variations in national experience are likely, leading to sharper economic differentiations both within and between the First, Second and Third Worlds. Even the broad generalizations on market conditions and international trade seem to be inconclusive:

(1) Indebtedness or failure to attract capital could seriously limit the ability of many LDCs and some socialist economies to purchase capital goods for further industrialization, so stunting their manufacturing development and having serious feedback effects on firms in industrialized countries where competition and restructuring in the production of such goods will be fiercer. Latin America's current import squeeze illustrates this (The Economist Newspaper, October 1, 1983).

(2) Such a scenario could be modified by another market trend. United States and United Kingdom experience is showing an increasing tendency for the mass consumer market in industrialized countries to become polarized. This is resulting from the displacement of the more 'middle-income' distribution of manufacturing jobs (when industry was a mass employer of labour) both by higher-paid business-service and industrial R & D or management jobs and by burgeoning lower-paid



* Percentage of goods exported, in any one sector of the market, multiplied by the rate of of increase in exports of these.

Source: ECONOMIST 9.7.1983; Administrative Management Agency's input-output tables; Sanwa Bank

Figure 7. The Leader in Restructuring: How Japan Keeps ahead of Competition

retailing service jobs, a trend deepened at the lower-income end by unemployment, 'de-unionization' and ageing population. Such 'market-splitting' could confine restructuring in the operations of firms in developed countries to the up-market, high-value industrial products while shaking out larger segments of their production chains of standardized manufactures to locations in LDCs whence low labour costs would still permit manufacturers to supply the demand for cheap goods from the growing body of the lower-paid unemployed and retired in the industrialized countries.

Again, however, the pattern varies: West Germany, for instance, still obtains a much higher proportion of GDP from, and employment in, manufacturing and hence polarization is expected to be less than in the U.K. or U.S.A. with positive effects on the country's market attractiveness.

(3) Stronger state industrialization policies in some LDCs might involve greater protecionism to foster import substitution, so modifying (1) above, but many LDCs suffer severe home market constraints imposed by economic dualism and by social and political polarization - as the Brazilian experience testifies. Other LDCs may alter their industrial structures to exploit market trends outlined in (2) above, but this requires further trade liberalization on the part of developed countries.

(4) Emphasis on North-South interaction in international trade tends to obscure the potential for greater international division of labour <u>within</u> the South. Limitation on Third World industrialization set out in (1) above could be partially circumvented by transfers of lower-priced, 'more appropriate' technology, but it requires much more inter-LDC cooperation. Clearly such developments could strengthen the industrial role of the NICs in the global system, stimulate more

LDCs to become NICs, and put pressure on industrialized countries through competition to restructure faster. Yet pressure on organizations there to restructure does not only emanate from economic sources.

(5) East-West power struggles make military and space spending very powerful forces in the functional and spatial pattern of industrial change. The course this takes can have untold consequences for the greater sharing or concentration of global manufacturing.

WHAT IS TO BE DONE?

Industrial restructuring undoubtedly requires a much improved international environment of peace and greater cooperation, understanding and stability, particularly if it is to be orderly and to benefit the world at large through more productive deployment of resources. Significant institutional change is necessary in East and West to achieve this. Restructuring demands far more vision and leadership by governments in consortia if it is not to be merely the result of the will of multinational firms, cut-throat competition, nationalism or militarism. Currently there is a very real danger that the governments of the industrialized OECD countries are stimulating (or allowing) the restructuring by their firms in the same industrial directions, so creating the pre-conditions for devasting future competition between them in a range of new generation industrial products. The 'micro-chip wars' of the early 1980s should warn us that satisfying world demand in new products may require far fewer manufacturers and facilities operating economically than, say, the current manufacturers of 'world cars' (though fewer of them will be needed in future, too).

Restructuring, therefore, should be channelled, with enlightened government stimulus, in several parallel directions, with very careful attention being paid to the detailed potentials for, and dynamics of, international specialization, cooperation and complementarity. Key amongst these directions must be

efforts to: develop, diversify and use more efficiently all natural resources, especially energy and metals; improve the productivity, and greatly raise the social utility and environmental quality of capital goods; innovate and use a variety of new technologies with far greater commitment to non-military, cultural, educational, medical and scientific uses; and to bring the location of industry more into line with the geographic distribution of natural and human resources, involving more equitable sharing of value added between countries at different stages of economic and social development. The roots of the restructuring problem lie in making governments and productive enterprises, especially multinational enterprises, socially and internationally more responsible; otherwise restructuring will create problems for the many in the interests of the power and profit of the few.

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STRUCTURAL CHANGES IN THE WORLD ECONOMY

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I. THE ISSUE

The long-term trends of post-war international economic development had discontinued by the mid-seventies. International realities of the last ten years have revealed that growth rates cannot be considered as yardsticks of economic performance, economic dynamism has increasingly become a function of structural transformation of the rate of structural adjustment.

Emerging new patterns of international development are of a global nature, and do not stem from and cannot be interpreted with the traditional business cycles but reflect cumulative and complex structural changes in the world economy. The accelerating structural transformation of the world economy has been increasingly affecting the external conditions of development for the majority of the nation states, created new challenges for and requires new responses from economic theory and development strategy.

Naturally not all the challenges of the eighties are of a structural nature. On the other hand, the process of international structural transformation is a multidimensional one, it is motivated not only by economic but also social, political, technological and strategic driving forces.

This short paper strives to underline the most important new structural changes which created new conditions for the socio-economic development of the majority of the nation states.

1. Changes in the international supply-demand conditions are a primary factor in structural transformation. On the *demand* side changes in income level, relative prices, technological progress, target system are fellow travelers of long-term economic growth. Structural changes in international demand can be characterized by a diminishing specific use of energy, raw materials, semi-products of the modern growth process. In high income countries a relative saturation on the market of the traditional nondurable and many durable consumer goods does not provide for economic dynamism in the present industrial structures. Dynamism of demand has been shifting to technology sensitive new products and services.

Though changes in international demand are far from being inconsequential, new international challenges have been and will be more vigorous on the supply side. In the seventies supply constraints and supply security conscious strategical responses emerged in the energy economy. Increasing oligopolization on the markets of modern technologies, increasing relative importance of the technology factor in the modern growth process, as well as strengthening strategic considerations in the international technology transfers, explain the rising constraints on the market of up-to-date technologies.

On the other hand, the rapid expansion and uncoordinated character of postwar industrialization created excess capacities in the production of primary goods, semi-products, light-industrial and durable consumer goods, and vehicles. Postwar industrialization in Eastern Europe, Southern Europe and the Third World has concentrated considerable on the traditional growth industries, whiie many European (OECD) countries have lagged behind in streamlining their industrial structures. As a consequence an international *oversupply* of a structural kind emerged by the seventies on the international and national markets of most traditional industries. This oversupply generated sharp competition, unfavorable dynamism of prices, structural unemployment and adjustment tensions.

2. The increasingly visible consequences of an international structural oversupply are sectorally correlated to the considerable *regional or geographic* shifts of economic dynamism. In the production of many price-sensitive light industrial goods, energy-intensive semi-products and labor-intensive semi-products and labor-intensive as well as technologicaliy more mature durabie consumer goods, comparative advantages shift rapidly towards late-comer industrial exporters, and recently newly industrializing developing countries. This sectoral and subsectoral dimension apart from geographic shifts in economic dynamism, and gradually in gravity centers, are also motivated by the above-the-average iong-term economic dynamism of the Far East, the western part of the USA, as well as the Eastern Siberian parts of the Soviet Union. The previously Europe - and Atlantic-centric international economic dynamism is increasingly giving way to a Pacific-centric international growth process. The great Pacific area, where the political and economic interests of four international powers meet in a direct geographic neighborhood, affects increasingly the patterns and conditions of international growth. At the same time institutional rigidities and target systems in Europe, political tensions as well as price patterns in the Near and Middle-East, endowment problems in Africa represent serious obstacles to the objectivity necessary for an adjustment process.

3. Economic history has revealed that the driving forces as well as their relative importance and consequences are subject to changes in time. Structural challenges induce responses, behavioral adjustments of economic agents and as a result of these responses may fade away or modify. International income distribution tends to show a close correlation with the relative importance of hierarchy of the various growth factors. During the quarter of century following the end of the Second World War it was the labor, during the seventies the energy which indicated the relatively highest international appreciation, highest price dynamics and represented the most important channel in the *international income redistribution.* As countries felt the result of increasing over supply on the international labor and energy markets and the growing demand for capital and technology, the bargaining positions as well as incomes of the capital and technology owners were increased considerably. At present and in the foreseeable future the owners of these factors realize extra incomes and growth stimulants in international relations.

Periods of high capital costs require the priorization of the income-earning capacities of the enterprises and nation-states as compared to the distribution-centric previous approaches. Capital-importing countries, facing very soft capital constraints in the seventies, are compelled to apply very severe criteria and curbs as far as capital-intensive development projects are concerned. Rising costs of capital, the high level of structural unemployment, and the diminished bargaining power of labor tend to affect adversely the international economic positions of countries exporting capital-intensive products without favorable capital endowment, labor-intensive products containing high inputs of not specially qualified labor.

4. International patterns of structural transformation raise in a modified way and relevance the *size* issue in international growth and trade. Small-sized countries and microeconomic units have been traditionally compelled on a rather narrow specialization in order to improve their income earning capacities. Postwar industrial growth has increased gradually the share of economies of scale-sensitive industrial activities where big countries and big organizations enjoy organizational advantages. The gradual structural worsening of the small countries' positions was partly compensated by the growing miniaturization of modern technologies diminishing the specific costs of small scale production.

Experiences of the last 5-10 years reveal that the relevance of the size issue has increasingly been linked to the growing importance of the ***organizational bargaining power*** in the economic process. During the last twenty years the role of the state has radically increased in the centralization and redistribution of the national income in all countries. As a consequence of stronger and frequently dominating government presence in economic life costs, wages, prices, incomes, interests, etc. reflect not only impacts of market mechanisms but increasingly interests and pressures of political parties, regional or religious interest groups having the relatively biggest organizational bargaining power. Similarly, the last twenty years registered the highest expansion of the big transnational corporations relying not only on market but power mechanisms as well. Finally, from the beginning of the seventies strategical considerations, "economic weapons", penetrated the international flows of products, technologies and capitals, much more than ever before.

In an international context, where organizational bargaining power affects a widening range of economic processes, the relative positions of small enterprises and countries, "ceteris paribus", tend to deteriorate. It is not by chance that the growth rates, equilibrium positions, incremental capital-output ratios of the small OECD countries during the last decade were in most cases less favorable than the OECD average, their relative positions deteriorated on the markets of the power sensitive engineering products.

Increasing losses due to insufficient economic size and organizational bargaining power leave different options for the small countries:

- evacuation of the more power-sensitive fields of the international and domestic economy and an ever growing specialization in activities less affected by the consequences of organizational power,
- concentration of the resources on some activities and building up organizational power congiomerates enjoying considerable market positions and bargaining power,
- lasting coexistence with and toleration of the higher economic costs of the uneven bargaining power.

II. THE APPROACH

1. New, long-term patterns of international economic growth reflect the increased importance and more rapidly changing impacts of exogeneous factors in the development process. Economic thinking, modeling activities, economic policies not recognizing or reflecting adequately the increased importance of exogeneous factors and changing global conditions of growth cannot cope adequately with the new development issues either. Externally vulnerable or rather sensitive national economies have no rational alternative to a quick and intensive adjustment to changed international realities and have to consider correspondingly their theoretical and economic policy approaches. National economic therapies, although unavoidable and objectively necessary, can, however, be rather

expensive in social terms, if they are not supported by an improvement of global cooperation. Small economic units without economic hinterland find it particularly difficult to compensate for the losses of increased international fluctuations, rapidly changing prices, costs, interests, exchange rates, etc. If international cooperation is regulated purely by market impacts, relative adjustment costs are higher in smaller countries. On the other hand, increasing the presence of organizational bargaining power in the international division of labor affects also negatively development patterns and chances of small economies. International markets and division of labor regulated by a global cooperation, international standard rules of the game based on a consensus of the nation-states creates the relatively best conditions for the healthy and socially less expensive development and structural transformation of the small countries.

2. In the present international organizational set-up more than one forum (GATT, UNCTAD, etc.) has been shaped to analyze and handle problems connected with international trade flows. Urgent financial problems are handled, although not with a global character and perfect solutions by the IMF and the banking world. It is not unjustified to reckon with a ripening recognition that an intensive international division of labor increasingly needs the creation of an international central-bank (or equivalent forms of financial and stability cooperation) regulating international liquidity problems. Disequilibria in trade and financial flows, however, reflect structural issues, the proper consideration and handling of which has not as yet found a proper *international institutional* forum. The lack of adequate research capacities, early warning systems, cooperation with respect to structural transformation and adjustment policies has contributed in many countries and on a world scale to parallel developments, to the emergence of scarcity phenomena and international oversupply as well as the concomitant disequilibria, excess capacities, and the high social-political costs of economic development.

The reduction and elimination as far as possible of the present international structural disorders, losses and tensions is in the interests of all countries and is becoming a more and more urgent requirement at the given stage of the international growth and division of labor. The handling of international structural issues or the elimination of a highly important missing link in the chain of international organizations suggests the creation of an international forum (organization) for *research, information-exchange, consultation* and in a later stage *harmonization* on development decisions affecting medium or long-term patterns of investments, production, specialization, markets, etc.

3. It is needless to emphasize that adequate research activities with a scientific basis can also be considered as a prerequisite for this new type of international cooperation. A larger-scale international research would be necessary on the *patterns, causes and consequences of international structural transformation, as well as the experiences of the adjustment processes and strategies* in order to identify the most important present and future structural challenges and the most convenient responses.

When shaping the character of such a research one has to consider that pure theory always has a limited capacity to reflect accurately human and organizational behavior. Changed realities of our present urge certain reconsiderations in traditional economic theories, both market and planning theories. The diminishing relevance of traditional economic theory and the growing need of its reconsideration are due to:

- changes in the relative importance, functions of the driving forces of economic development,

- the increasing interrelations of economic and non-economic (institutional, political, cultural, social, etc.) factors in the development process,
- the growing interactions between the interdependence of national economies.

Under these circumstances the aforementioned research should not rely on previous theoretical assumptions, but rather on the analysis of socio-economic processes. From this constraint it follows that such a research project cannot aspire to developing a comprehensive new economic theory, but concentrates on such lasting structural changes, interrelations of economic and non-economic spheres which might be instrumental in understanding and managing better the development process in the nation-state, as well as on a world scale. Correspondingly, such a project has to be *future oriented*, *interdisciplinary*, and *implementation-centric* in the broader sense.

A successful research would not result in new theoretical models, but would contribute, in a modest way, to a quicker *adaptation of economic thinking* to the changed and future realities, as well as to the emergence of a conceptual framework, which would promote the healthy restructuring of international relations and also the development of a less conflictive but more dynamic system of cooperation among nation-states.

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MARKET INTEGRATION AND INDUSTRIAL AUTONOMY,
the case of the European Community

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In an increasingly thightly knit world economy the dynamics of the international division of labour will make itself felt more and more upon the participating economic agents. This straightforward statement is on the lips of every statesman nowadays irrespective of the country's continent, level of development, size or socio-economic system. Paying lipservice to the exigencies of permanent exposure to what continues to be a highly dynamic set of shifting and emerging product and process cycles with varying relative prices and changing leadership in export growth, however, usually forms the introduction to a staunch defense of the country's political preference to be in control of its industrial 'destiny'. Lots of reasons are advanced to justify industrial autonomy. Prominent among them are national security (especially in bigger countries), the level and/or skill-profile of employment, the export position, the 'dependence' (in other words, the import share in apparent domestic consumption; actual or potential) in certain products, or, indeed, more indirect but also highly valued goals such as rapid income growth and technological or 'economic' leadership in the world. An even more extensive series of instruments are employed, including inter alia, imperative planning on a national basis, public procurement, public R & D programmes, public investment aid, public enterpreneurship in a national market environment, public incentives for affiliates of or joint ventures with multinationals, export aid, various price- or volume related import restrictions, direct investment controls, public sector regulation, international long term supply contracts, specialisation agreements, R & D cooperation among firms and countries or among countries, international production agreements, tied development aid and reciprocal purchasing in international defense contracts, as well as more indirect instruments such as patenting laws and procedures, and anti-trust policies (with discretion for exceptions).

Therefore, I entertain not hope whatsoever that a general treatment of the international inconsistencies can be fruitfully developed beyond what is already known from the literature on international economic interdependence, and the policy conflicts it tends to generate 1).

In delimiting the subset of countries to a small and fairly homogeneous group (in terms of the economic system prevailing, and also, at least largely, in terms of the level of development), one might try to come to grips with the multi-variate nature of the tension between international market integration and national industrial

autonomy. The European Community in a subset that meets these criteria. More important, however, is the ambitious and unique extent to which EC Member States have committed themselves to integrate their product markets, thereby constraining not only legally and politically but also economically via the behaviour of producers, traders and consumers, the range of policy measures and the modes of implementation with respect to national industrial policy. Indeed, put simply, the EC has Communitarian product markets and national industrial policies. It can therefore serve as an example par excellence to study a spectrum of policy instruments all aiming to reconcile legitimate concerns about national industrial autonomy with market integration. Finally, the EC provides an interesting experience industrial cooperation aiming at a hoped-for joint benefit of improved competitiveness in world markets.

The purpose of the paper is to analyse how the EC copes with the multiple conflicts that arise from a unified internal EC product market and the absence of the unified industrial policy (in other words a desire for national industrial autonomy). I shall deal both with legal and political means of co-operation on the one hand and managing the conflict potential on the other hand. I shall present a bird's eye view of a variety of policy instruments that the EC has, either exclusively or jointly with the Member States themselves, in particular positive co-ordination (steel), negative co-ordination (the surveillance of national aid to industry), harmonization (matters of the so-called internal market), and unification (trade policy). In the final part I shall address the problem of how to make offensive industrial policies of the Member States consistent, whether by negative co-ordination or by joint programmes. Although EC arrangements are undoubtedly more ambitious than the set of understandings and agreements that could possibly be reached in GATT, ECE, UNIDO, UNCTAD, or between the EC and other regional grouping or indeed within Comecon, it is hoped that they provide insights in the strengths and weaknesses of those negotiated international agreements that might be thought feasible ones in the current process of international restructuring.

1. Market integration in the Community

With the possible exception of the economic relations between Canada and the United States, there seems to be no economic grouping in the world economy that has achieved a degree of market integration as advanced as that of the European Community. This holds for market integration "from below" (i.e. by the market participants, through their economic activities as traders, consumers, investors, etc.) as well as for market integration "from above" (i.e. by negative and positive measures of EC and national public authorities).

A few indicators may serve as useful reminders of how large the so called 'Internal (product) Market' of the EC looms in the economies of the Member States. Total intra-EC exports in 1982 amounted to $ 325 billion (% of world trade), of which $ 205 billion was in manufactured products. The weighted EC average of intra-EC trade in manufactured products (exports plus imports) per head of the active working population for 1980 was (3126ECU) , which provides a rough approximation of the great stake everyone in industry has in industrial market integration. Also in the ranking order of foreign markets the EC looms much larger for every Member State than any other country or group market: in 1980 the EC took approx. 50% of all EC industrial exports, whereas EFTA (as a whole) took only 12.6%, OPEC 8.2%, the USA 6% and all others even less. In 1980, 17.4% of EC industrial production (not counting Greece, here) was exported to other EC countries, up from 11% in 1970. In addition it ought not be forgotten that intra-EC cross-frontier direct investments have become substantial in the Community (Pelkmans, 1983), implying other means and modes of market integration, not always visible in trade flows. Finally it should be observed that intra-EC services trade is growing rapidly, and a number of such services are actually complimentary to trade in industrial products.

In such a configuration it will be clear that mutual sensitivity about economic activity in one another's markets is greatly heightened. Although still falling short of the virtually complete market integration that characterizes the intra-USA economy, it is nonetheless becoming increasingly artificial to view "national" markets in the EC as separate entities. This is particularly so because the actual pervasiveness of interpenetration is even greater than the mere trade flows can indicate, because price and non-price competition extends to the same or

substitute goods that are traded domestically. In terms of market behaviour of economic agents, what determines the extent of market integration is the competitive conduct of enterprises, traders and consumers over the entire range of so called 'tradeables' (i.e. imports, and their domestic substitutes, and exports, and their domestic substitutes), which implies a magnification of the influence of intra EC trade.

Market integration 'from above' (for industrial products) is also rather advanced. Excluding some technical complications in transport, industrial market integration is achieved by three general sets of policies (the so called Internal Market measures, Competition Policy and Trade Policy) and one amalgam of specifically 'industrial' policy tools (let us call this the Community's Industrial Policy; however, it does not really compare with the Member States' industrial policies). The four domains are distinct only up to a degree; it is impossible and indeed misleading to disentangle them entirely.

The EEC (1957) and ECSC (1951) Treaties aim to achieve genuine product market integration. The Spaak report (1956), laying the foundation for the EEC Treaty, even spoke of the "fusion" of markets, a metaphor leaving no doubt whatsoever of the disappearance of 'economic frontiers' between the originally 'national' markets. This great ambition has not fully been achieved, however, despite the strong political commitments of Member States and the uniquely powerful integrative instruments the Treaty and subsequent case law of the European Court have provided. Genuine product market integration will be hindered by two types of national public interventions, those at borders and those in the domestic economy. The range, nature and intensity of such interventions will differ among countries according to the role the state has been assigned in the economy. The fact that the EC is first of all a customs union (in the sense, defined by GATT, art. 24) and hence can be expected to remove intra-EC tariffs and quota's is a necessary but (very) insufficient condition to realize one EC market. Genuine product market integration requires two demanding conditions:

- product must enjoy full and free market access
- the (national) public influence on competitive conditions ought to be approximately uniform.

Contrary to what is sometimes claimed, it is not at all necessary to abolish government intervention in the Member States and return to a 19th century type

'nightwatch' state for market integration to come about. Product markets may be influenced, controlled or ex post corrected; what is required is the uniformity of such interventions over the entire EC so that the competitive conditions for producers, traders and consumers - though deviating from free market arrangements - are everywhere alike and do not discriminate in the opportunities offered.

A comprehensive scheme of the Community's approach to product market integration is provided in Table 1 (see p. 6) (the rather special provisions of the ECSC Treaty have been left out here, because they apply only to coal and steel). Although there are elements of trade policy (4.2) and competition policy (8.1; 10) included in Table 1, a complete view can only be obtained by considering the full scope of these two common policies. The complexity of this EC market 'regime' is a consequence of the fact that the Community comprises 'mixed economies", having a strong tendency to intervene nationally and reassert influence on market outcomes for socio-political reasons. The overall aim of EC market integration is inconsistent with an independent reassertion of national market interventions, so that the Community must (and does) play a role in all ten of the policy areas distinguished for the purpose of this Table. The EC does so, however, with different degrees of stringency (and success).

The upshot is that product market integration - no matter how far it has advanced by 1984 - still leaves ample room for national policies attempting to engender a more favourable performance for their industry. It is important to understand that all national policy-makers in the EC usually recognize a number of EC constraints - both legal and economic - in their search for 'industrial autonomy'. But the "borderline" beyond which their national policy discretion begins is energetically defended. And where the "borderline" is hazy, they attempt to shift it to their discretionary advantage. Where problems of industrial restructuring are particularly pressing, however, the recognition of EC legitimacy can be severely challenged, and inconsistencies may actually endanger the market integration achieved.

Table 1
Towards EC product market integration 'from above'

I. Intra-EC Market access - financial physical

1. tariffs: abolished

2. other charges: prohibited (or at costprice)

3. VAT:
   - 3.1 indirect tax systems are harmonized (into VAT)
   - 3.2 tax base still differs (exemptions; excises)
   - 3.3 duties; rates differ

4. quotas
   - 4.1 ordinary quotas abolished
   - 4.2 trade deflection controls authorized (ex. art. 115)

5. measures equivalent effect to quotas
   - 5.1 prohibited with exceptions (health, public order; industrial property)
   - 5.2 harmonization of technical product specifications (incomplete)
     or
     judicial review (Cassis de Dyon and Dassonville law cases)

6. exceptions outside the normal reach of a customs union:
   - \- exchange controls; safeguards (still existing)
   - \- transport (regulated sector)
     + \+ rationing
     + \+ no cabotage

II. Uniform Public Influence (only micro)

7. regulated sectors
   - 7.1 EC regulated (positive integr.): CAP only
   - 7.2 liberalisation only (without pos. integr.): transport

8. industrial policy
   - 8.1 public aid: EC prohibition (except R & D) but no common EC aid
   - 8.2 public procurement policy: formal liberalisation

9. regional policy
   aid, EC surveillance, but permitted

10. public firms
    - 10.1 public firms, general: see 8.1
    - 10.2 'entrusted' undertakings: public regulation, plus monopoly, plus public ownership

2. Positive coordination: the case of steel

As defined in earlier work (Pelkmans, 1979, p. 116), coordination among countries "involves the internationally negotiated adaptation of domestic policy intentions in order to improve the final impact of these policies for all participants. Policy coordination is concerned with the effectiveness of national policies that are potentially inconsistent in their objectives or conflicting in their instruments." Thus, the final impact of a coordinated policy is not likely to be better than the envisaged policy outcome in case the country would have been fully autonomous and would have had its own, but it will constitute an improvement over the actual outcome of the policy, had it been implemented in the interdependent system, with the inimical chain of negative policy feedbacks by other countries due to follow. Coordination is a functional response to the recognition of interdependence.

Especially (but not only) in mixed economies with representative systems of government, functional responses entailing domestically painful concessions to other countries are hard to come by. Domestic narrow constituency politics, or occasionally even the broader electoral politics militate against the 'dictates' of international accomodation over the back of specific national interest groups, without worrying about the overall economic 'welfare' especially beyond the very short run. The political-institutional framework for economic policy coordination therefore has to be a strong one, especially when it is concerned with the highly sensitive problem of industrial restructuring. Because it is only when industrial restructuring is no longer solved 'invisibl'y by the market - although that still happens much more than the political 'noise' in the media would make us believe - but guided, aided or controlled by the national government, that international coordination is most needed and, alas, thereby much more difficult to realize.

The European Coal and Steel Community Treaty enables the use of unprecedented powers for international economic coordination, and is probably the strongest institutional machinery for industrial restructuring in a context of international market interdependence. Curiously enough, this does NOT mean that the ECSC is basically interventionist. Art. 5, ECSC, stipulates that the 'Community shall carry out its task . . . with a limited measure of intervention' whilst art. 2, ECSC speaks of the bringing about of 'conditions which will of themselves ensure the most

rational distribution of production at the highest possible level of productivity' (emphasis added). The Treaty is plain in prohibiting national public subsidies to coal and steel (art 4,c, ECSC). The crux is that, as art. 5 puts it, "only when circumstances so require" a direct influence upon production or the market can be exerted. However, in the more important competences it is Council of Ministers (rather than the supranational Commission 2)) that is indispensable for the decision to take legal force. This renders the ECSC management of the steel crisis a case of positive coordination: coordination among ten national Ministers holding the industry portfolio it surely is in the sense defined above; positive in the sense that one transcends the mere removal of unilaterally introduced inconsistencies ('negative coordination') and agrees about common measures what to do.

The ECSC steel crisis persists now for nine years. It started out as a price collapse in the first half of 1975, after an exceptionally good 1974. The sequence is important because investments in new capacity, coming on stream in the late 1970's, have frequently been defended with the prospects of the year 1974 as the basis for the decision. Oligopolistic industries with large economies of scale (i.e. large fixed physical capital costs) and fairly homogeneous products tend to show an extremely volatile market pricing picture. Of course this is exacerbated if enterprises (modern or old; high cost or low cost; land based or coastal based) invest in new capacity on the basis of a record year of supply with record high prices, still apart from a host of other factors. These other factors included that the EC's export position in simple steel products came to be eroded due to rise of steel production in the NIC's and that its export position in specialty steels (especially in the US) came to be threatened by the Solomon plan (with an ingenious coupling of trigger prices and dumping procedurers) and later by plain protectionism. Moreover the small but rising EC imports of steel only added to the problem.

In 1975 and 1976 the EC Commission decided to take a series of 'soft' measures to increase the 'transparency' of the market (compulsory provision of figures for monthly supply, forecasted supply and employment figures) so as to preempt new waves of uncoordinated decisions by enterprises based on simple extrapolation of short run trends and on 'Cournot behaviour' (i.e. ignoring oligopolistic interdependence by assuming that one's own entrepreneurial decision will not ignite other firms to change their course). The measures did not suffice. The price

collapse caused severe losses and employment started to fall rapidly; however, in a few EC countries capacity was still coming on stream in highly modern coastal plants. The older plants were usually inefficient and concentrated in regions that were either relatively poor (Wallonia in Belgium) or relatively strongly oriented to heavy industries (Ruhr area in Germany; Saar area in Germany; Lorraine in France; mid-England zones; Liguria area in Italy). Closures were considered socially and regionally impossible; yet, reconversion and rationalisation would be very expensive in these old industrial areas while still requiring substantial reductions in manpower. Meanwhile, national government tried to gain time by covering the (heavy) losses of the nationalized firms without being very firm in asking capacity reductions in return. In the ECSC context all hoped for better prices soon, and betted on exports. And what is crucial for an insight in the potential of positive coordination, every national industry minister refused to be first in pursuing capacity reduction, fearful for the market share of 'his' firms after the crisis would be over. One might also put it differently: every minister hoped that a sufficient number of his colleagues would be prepared or forced to impose capacity reductions at home so that he would be spared the political and social agony. This strategic 'free rider' behaviour cannot, of course, be overcome by measures improving the information about market trends and forecasts. The upshot was a continuation of depressed prices without any prospect of a return to the production levels of 1974 (in millions tons: 1974: 156; 1975: 126; 1976:134; 1977: 126).

In the course of 1976 a series of more far-reaching <u>but voluntary</u> measures were implemented by the EC Commission. They included a more stringent application of art. 54, ECSC, the announcement of (non-binding) target prices and the request to the steel firms to reduce supplies voluntarily (the beginning of the Eurofer recession cartel, under EC supervision). Art. 54, ECSC, contains powers for the EC Commission to influence the <u>financing</u> of (individual firms') investment programmes, in accordance with the periodically drawn up 'general objectives' of the EC steel industry (ex. art. 46, ECSC). It is not possible for the Commission to block the investment but it can block subsidies (and use heavy fines as sanctions; since the ECSC has a modest taxing power from which scrapping and social programmes are paid, the fines can be affected immediately) and refuse ECSC loans or reduce the grant element in them. In a period of heavy losses this power is a considerable one. Moreover, these decisions must be published and hence will influence the coordination negotiations.

Agian, the 1976 package did not suffice. Prices were not kept at the target levels (due to large discounts), voluntary supply reduction in the Eurofer cartel did not work (due to pressures to increase capacity utilisation and so curb losses) and some governments went ahead in financing both the losses and the new capacity coming on stream (due to heavy social pressures). In mid-1977 the first minimum prices had to be imposed, extended to more (simple) steel products in late 1977. As a consequence a quantitative import regime had to be established 3), connected in early 1978 with 'trigger prices' and a more strict anti-dumping surveillance 4). Also the social programme for retraining of workers was strengthened. This package eased the tensions a little, prices improved marginally and EC supplies increased both in 1978 and 1979 (although remaining far below the 1974 level (1979: 140 million ton). Moreover, 1979 was a mini-boom and was bound to be followed by a renewed shrinkage of demand (if only because of the macroeconomic restraints imposed by president Carter and Federal Reserve chairman Volcker). Alas, the second oil crisis made things drastically worse, especially because EC governments were no longer willing to provide accomodating monetary financing: the recession turned into something like a depression. EC steel production fell by 10% within a year. That it did not fall more was due to reckless national subsidizing of stocks that were, in fact, not saleable. New capacity had now come on stream (in France and Italy), loss coverage and other subsidies had reached very high levels (despite the prohibition in art. 4, ECSC !!), employment continued to fall, and the EC export position eroded further in the light of rapid output increases in the NICs (and steady volumes in Eastern Europe). The 'general objectives' as a set of forecasts had to be revised downwards time and again; the gap between EC steel capacity and its anticipated outlets widened year after year. The 'immanent crisis' (art. 61.b, ECSC), being the basis of the Davignon package of 1978, had turned into a 'manifest crisis' (art. 58, ECSC). An even stronger form of positive coordination had become inescapable.

Art. 58 empowers the Commission to impose production quota's. In fact, it introduces a publicly authorized cartel, with extensive enforcement powers, with a view to overcome the 'manifest crisis'. The production quota's are in force since late 1980 after months of haggling in the Council. Particularly Germany had two problems: it had great inhibitions to give up a market-based mechanism of allocation, and, it protested against the actual allotment of quota's. The second question arose from the fact that Germany - as the only country - had anticipated

some of the capacity reductions that (in abstract) all governments agreed were badly necessary. It insisted that quota's should not 'freeze' the present market shares but take into consideration the adjustment already carried out. It also insisted that price competition was 'most unfair' (despite the minimum prices) because some EC Member States subsidized the steel firms so heavily that their market shares would never been so high (cost ineffective as these firms were), had these aids not enabled the firms to reduce the prices to prescribed levels. Of course, the 'free riders' (the others) were under such domestic pressures that they could not yield. Another problem was caused by the so called 'Bresciani', a group of small steel firms in Brescia (It.) that specialized in particular, non-heavy steels and were highly efficient. They were not in the Eurofer cartel as it was in their interest not to freeze their (increasing) market share.

From this discussion it should be clear that positive coordination - imperfect, and much too slow as it was - only worked in the end because mutual interests (i.e. also the fear of damage, upon refusing agreement) and strong powers of enforcements were both present. Concessions had to be made, and, in the final analysis, were made. The Commission has never hesitated to levy heavy fines if firms surpassed their assigned production quota's, and it has threatened to cut future quota's in case of renewed defiance.

However, it took another two years before basic agreement could be reached on an overall programme of renationalization and restructuring. The Council finally decided to pursue a capacity reduction of approx. 30 million tons (which is still barely sufficient to obtain a capacity utilisation that will bring profits), a country and enterprise breakdown of these reductions (that is, what plant closures, where!), a ECSC Subsidy Code (saying that no public aid can be given after 1 Janurai 1986, while all aids are conditional and must be approved before 1984), a new set of minimum prices coupled to ex ante deposits (so as to enable a rapid fining system) and extra financial means for social measures. The external trade policy measures have been maintained with some changes. Unfortunately, the only strong export product of the ECSC (specialty steels) has been subjected by the US to volume protection in the form of a fixed US market share.

Now that the Member States are actually implementing the coordinated measures, resistance increases even further. It is improbable that the Subsidy Code will

remain undamaged, but otherwise governments have held firm, especially with respect to capacity reductions. Nonetheless, this should not only be attributed to ECSC powers but also, to some extent, to the enormous drag of public money that the steel crisis has given rise to. The budgetary pressures inside Member States, and the secundary negative effects on the rest of the economy, has greatly helped the positive coordination process.

The conclusion is that there is little reason to expect positive coordination to be the appropriate means for international management of restructuring conflicts. The requirements in terms of institutional powers and mutual economic interests, are so demanding that it can only succeed in a unique uset-up such as the EC, or perhaps with the support of substantial side-payments (by whom?) to suppress free riding and align domestic decisions to a coordinated package.

3. Negative coordination: EC surveillance of national aids

The negative coordination of national industrial policies and regulations comprises all action, appropriate under the EEC Treaty, to render the influence of national public agents on industrial activity and structure consistent with the Internal Market and the Competition Regime. The coordination function is essentially reactive or preventive; reading the EEC Treaty one would not normally expect a Community design of industrial structure to underlie it. Public subsidies can be justified on the basis of allocative or redistributive arguments. If market failures cause prices to convey the 'wrong' signals, or, prevent the product market from coming into being (public goods being undersupplied), public aid can be employed to improve the allocation of resources and realize higher output with greater satisfaction of preferences. Such subsidies aimed at the improved functioning of market mechanisms are not subject to EC surveillance. Art. 92.1, EEC, contains a general prohibition of any public aid ". . . which distorts or threatens to distort competition . . .", which is precisely the opposite effect of such subsidies (when property implemented).

Subsidies can also be justified on redistributive grounds, or on the latter combined with allocative reasons. Art. 92.2 EEC recognizes explicitly the following three redistributive aids: (non-discriminatory) "aid having a social character, granted to

individual consumers", aids in case of natural disasters, and aids for areas suffering from the division of Germany. The combination of redistributive and allocative reasons is especially of importance for regional policies. On the supply side it may be necessary to employ (relatively more) public aids for infrastructure and certain public services as well as financial incentives for industrial establishments to compensate for locational disadvantages before allocation could be said to be spatially optimal. On the demand side, redistribution may be necessary - through the aggregate tax and social security system, and perhaps even by offering specific advantages as well - for positive externalities (such as availability of various skills and private services) to be generated, so as to maintain competitiveness vis-à-vis firms benefitting from agglomeration externalities elsewhere. Both types of aids are not distortive, subject to the proviso that the measure of compensation is not excessive (which is an elusive proviso in policy practice).

Art. 92.3, EEC, recognizes that "aid to promote the economic development of areas where the standard of living is abnormally low or where there is serious underemployment" as subsidies that may be compatible with the common market. Hence, coordination aims at a proper implementation of what, in principle, is permitted. The EEC Treaty (art. 92.3.(c)) even allows distortive regional aids ". . . to facilitate the development of certain economic activities or of certain economic areas", subject to the discretionary policy condition that such aid does not adversely affect trading conditions to an extent contrary to the common interest". Clearly, EC surveillance needs to be based on an explicit regional policy at Community level before this condition can be appropriately imposed.

Public aids are much more difficult to justify when market failures are absent, because they create distortions that would otherwise not exist. In mixed economies with representative government and fairly inflexible labour markets, (national) public aids to industry are frequently defended on social grounds -often combined with regional concentration of unemployment - or with budgetary - political reasons (when it is financially indifferent to pay subsidies or unemployment allowances, the former are preferred as they boost employment figures).

These arguments are economically misleading, as they are based on partial and short-run analysis. Moreover, they ignore that they are normally inconsistent with the notion of competition in a Community-wide Internal Market.

If a firm or sector in a Member State is inefficient, markets will tend to convey signals such as a falling market share and/or falling profits. The salutory effect of competition from apparently more efficient firms is precisely that it forces the inefficient ones to reduce their X-inefficiencies, change their product mix and take other managerial measures, or otherwise be eliminated. The threat of negative growth or bankruptcy of private firms is the linchpin of competition: microeconomically, it ensures that the drive for more efficiency and innovation in dynamic firms is a stimulus that will be rewarded (if others react later, or not at all); macroeconomically, it ensures that the waste of resources is kept to a minimum, hence resulting in higher output. Public aids to noncompetitive firms frustrates the basic incentive of competition and causes a waste of resources. These arguments hold irrespective of whether one refers to so-called 'domestic' aids or export subsidies: the former could impede a firm from another EC country to build up a higher market share in the country giving aid, the latter enables larger market shares elsewhere that are not solely based on the firm's internal efficiency and marketing performance. Furthermore, non-aided firms (say, in other EC countries) could understandably ask for 'matching' aid or border protection which would lead to additional waste of resources (while neutralizing the effects of the initial aids) as well as a stepwise destruction of the Internal Market.

The arguments cannot be saved by reference to (structural) unemployment. If unemployment is structural and substantial, public aids to one firm in one country must imply a reduction of the turnover of other firms in that country and in other EC Member States that would have been achieved without the aid. It might also induce such low prices as to endanger profit margins of other firms necessary for replacement investment, for R & D, or indeed for expansion (expecting to consolidate or increase market shares). In this sense, unemployment is shifted to other firms, possibly in other Member States.

The EEC Treaty (art. 92.1) prohibits aids precisely on these grounds, that is, when a (threat of) distortion of competition arises and the aid ". . . affects trade between Member States". As noted above, the prohibition is not absolute, not even when aid can be considered to be distortive but in the latter case the 'common interest' of the EC should be overriding or a 'serious disturbance in the economy of a Member State' ought to be the reason for aid. Unfortunately, the actual implementation of negative industrial aid coordination has proved to be problematic.

General aid programmes are not specifically mentioned, ex art. 93, as possible exceptions to the rule, ex art. 92, 1, of incompatibility with the EC Treaty. But it is not a priori clear that they would always distort competition in such a way as to be "incompatible with the common market", as the language of art. 92,1 has it. This implies that the Commission has to exercise discretionary power which is far from easy in this politically sensitive domain. The Commission's position, rejecting a number of national aid schemes, has been endorsed by the Court in the Philip Morris case **5)**. That position is as follows: "state aids are in principle incompatible with the common market. The discretionary power of the Commission should only be exercised when the aids proposed by Member States contribute to the achievement of the Community objectives and interest set out in Art. 92 (3) EEC. The national interest of a Member State or the benefits obtained by the recipient of aid in contributing to the national interest do not by themselves justify the positive exercise of the Commission's discretionary powers" (emphasis added) **6)**.

As to national regional aids, the competences of the Commission do not allow interference with the precise sectoral distribution of aid, once a regional programme has been agreed in Brussels. Given the frequent overlap between sectoral and regional problems cumulation can occur that may have distortive effects.

For sectoral aid, guidance and negative coordination has been farthest developed during the 1970s. Sectoral aid has to be selective, temporary and degressive over time. Purely conserving aid, proping up firms without reference to restructuring or reconversion programmes has to be abolished. In sectors with adjustment problems, aid ought not to have capacity increasing effect (of course, this does not apply to dynamic, innovative sectors). Also, aid ought not to hinder structural industrial change (EC, 1972).

Thus on paper negative aid coordination in the EC appears to aim to facilitate rationalisation processes in industry. Aid is strictly conceived so as to strengthen the adaptive capacity of firms and lower the tangible and intangible social costs of transition. Therefore the problem of a possible distortion of competition, both for non-assisted firms in the country and for users and consumers would seem to be bearable. But the practical implementation over the 1970s has proved to be quite different.

First, in three sectors (shipbuilding, synthetic fibres and steel) serious structural overcapacities have led to a policy to facilitate weathering crises, rather than imposing rationalisation. In some measure it is accepted, for instance, that current operation costs of firms in these crisis sectors are reduced by aid. In shipbuilding a build-and-scrap programme was blocked in 1980.

It follows that it is difficult in the socio-political practice of the EC to implement negative coordination for sectors in genuine trouble. As rationalisation occurs slowly through the market (natural mobility of workers out of a sector; induced job search elsewhere because of a lack of confidence in the crisis sector; mergers; technical wearing out of physical capital), governments hope that this will yield such slimming so as to reduce aid in a future cyclical upswing. But due to insufficient differentiation of wages with respect to sectors and skills, and reduced geographical mobility (especially for social reasons and housing problems), the natural sectoral rate of job change has tended to fall. And the prolonged recessionary circumstances have rendered induced job search much more difficult. The upshot has been that 'crisis aid' has taken on a life of its own, largely exempt from the negative coordination criteria mentioned above. It has led to permanent distortions and to tendencies of 'aid matching' among countries, restricting the expansion of the more efficient firms. Note for instance that between 1975 and 1980 some *f* 40 Billion of national aid to steel firms has been disbursed (!) despite a complete prohibition in the ECSC Treaty. Important aid receivers that are subject to the EEC regime include cars, shipbuilding, textiles and aircraft.

Of course the Commission is well aware of the problem. For instance, in 1982 it warned against an emerging "aid mentality" (EC, 1982, p. 111), "i.e. that firms, when they get into difficulties, turn immediately to the State for assistance rather than rely on their own resources and efforts to overcome their difficulties. This aid mentality is nurtured particularly in cases where they see their competitors receiving aids in other Member States and consequently feel that they have a right and a need to receive aid themselves". The Commission has also developed three guidelines for aid in (industrial) crisis sectors: (1) national aid must not lead to the export of unemployment to the rest of the EC; (2) aids must bring about the restoration of the health of the firm(s) within a "reasonable" period of time; (3) aids should be "transparent", so that they can be controlled, (EC, 1982; p. 114). The first two guidelines, if faithfully applied, must lead to capacity reduction in crisis sectors.

A second problem with negative aid coordination is the weak political legitimacy of the Commission when it opposes aid. Although it has the ultimate stick of recourse to the Court of Justice, it has no carrot in the form of less distortive Community aid or significant EC procurement and it suffers from a lack of political authority in requiring timely and accurate notification enabling complete and ex ante evaluation. All too frequently notification is late and all too rarely is it detailed and accurate enough. One had the impression, especially after the mid-1970's that Member States did this on purpose so as to postpone the actual adjustment to Community criteria as long as possible **7)**.

In the twelve years from 1970 to 1981 inclusive, the EC Commission's annual total of investigations of cases of State aids increased from 21 (1971) to 142 (1981); the three-year moving average increased with 412% (71/73 to 79/81). Until 1981, however there were conspiciously few formal negative decisions (a total of 21 over 11 year), which could mean that the Commission had to yield under political pressures, or, that the member country changed its laws or provisions ex post. On this crucially different interpretation, no statistics have ever been presented. The impression is that the Commission has become more stringent after 1978, and especially after 1980. Infringement procedures were opened (aid form either 'settled' or formally forbidden) with an average of 12 a year between 1970-78. Thereafter, the annual figures differ markedly: 1979-54; 1980-33; 1981-62; 1982-129 (with 13 negative decisions formally published) **8)**.

As a general supposition it seems reasonable to maintain that - although any genuine coordination is politically ambitious - negative coordination is relatively easy. After all, 'thou shall not' rules leave scope for domestic autonomy, 'thou shalt' rules do not. The EC form of negative cooridnation would seem to be a favourable case because the aspect of negotiated adaptation (in the Council of Ministers) is only relevant to distortive public aids where a "Community interest" has to be defined and operational criteria established. Usually this does not happen on a case by case basis (which would greatly impair the effectiveness ofthe coordination by having to indulge in ad hoc package deals). Once such EC interests have been defined. it is the Commission (and, if necessary, the European Court) that can implement the policy, even against the public stance of the national government in question.

Despite the at times doubtful political legitimacy of the Commission's implementation, there is no question that the negative coordination in the EC has succeeded in reconciling the achieved market integration with a sufficient measure of national industrial policy autonomy to stabilize the European Community. Whether the infinitely weaker GATT code on subsidies could ever accomplish a similar result among the developed, market-oriented countries seems unlikely. What ought to be the appropriate mechanism in cases of very different levels of developments or different socio-economic systems, is an even harder question: if domestic interventions are far-reaching, how can they be made consitent in such a way that market access is not or not greatly impaired during the process of restructuring?

4. Harmonization

Harmonisation comprises efforts to remove inconsistencies in laws and governmental procedures hindering or distorting trade among interdependent economies. There are negative and positive aspects to harmonisation, analogous to those in coordination, but it is not useful to treat them separately since they tend to be substitutes.

Harmonisation is a highly technical mode of cooperation, yet, this property need neither imply the absence of important economic effects nor the lack of politicisation. In any event, harmonisation is much more suitable for worldwide application than various other forms of Communtiy regulatory collaboration, be it that the ambition and scope is likely to be more modest.

Discussing harmonisation in the EC must be done in a truncated form given the mere scale of the many attempts ongoing. Moreover, harmonisation is also a 'buzzword' in the Brussels parlance: rather than referring to the meaning as given above, it is employed loosely for anything cooperative that, in soothing disputes or mitigating conflicting attitudes, may create more 'harmony'. As interdependent, interventionist economies cannot but maintain relationships of permanent negotiation, overall 'harmony' serves as a crucial asset of diplomatic goodwill generating the confidence and willpower to overcome differences in policies. Also, art. 2, EEC, mentions the "harmonious development of activities" among Member

States as a key objective, a phrase that obviously can be used with a great many diplomatic twists. While recognizing the value of all this (and noting that the need for this asset is at least as great in wider international negotiations), I shall merely deal very briefly with a narrow concept of harmonization.

Apart from the harmonization of statistics and of legal techniques, the EC has displayed activities on two fronts: first, on the harmonisation of indirect tax systems among Member States and second on the harmonization of technical product regulations, norms, standards and performance tests. In the period of the EC of Six, the Member States decided to switch to the value-added system (=VAT) of indirect taxation, although only France used this system. In doing so, they greatly facilitated the (comparison of) calculations of the tax burden in consumer prices and in the prices of complex intermediate goods as well as reducing the frontier 'nuisance'. With due recognition of the comprehensive administrative success, it is still true that differences in national VAT duties have to be formally cleared at borders. At present the EC is attempting to copy the Benelux example of tax clearance, not at the border, but at the origin and destination of the good. For problems of international industrial restructuring this elaborate harmonisation is hardly worth the trouble.

Harmonisation of technical specifications, however, acquires an increasing importance in the Community's industrial strategy, and is also relevant worldwide in a number of cases. If technical specifications of products are legally compulsory in one country, they will affect the 'physical market access' for imports from any other source, irrespective whether products from that source will have free financial access (i.e. EC products, and usually EFTA industrial pruducts as well) or have to overcome a tariff barrier. 'Physical market access' is free if the physical properties of the product do not have to be different for domestic production and for export. In the EC there are three alternative ways to realize free 'physical market access': unificiaton (i.e. the imposition of uniformity, via art. 235, EEC, or derived legislation), harmonisation (i.e. ensuring sufficient compatibility to obviate border controls) and judicial review by the European Court with respect to the legality of national specifications that block or hinder intra-EC trade. Unification is rare, although parallel Community options (for instance, in patents and trade marks) come to be viewed as useful and acceptable alternatives. Harmonisation and judicial review are explicitly linked by the Commission and the Court.

Harmonisation (ex. art. 100, EEC on 'approximation' of national laws) implies a negotiated core or range of specifications (thereby excluding other possibilities) that is formalized in a so called EC 'directive', obliging Member States to insert this core or range in their own laws without, however, prescribing the operationalisation or inforcement methods. Crucial is that harmonization prevents a Member State from relying on art. 36, EEC, that permits to exercise border controls on trade for such reasons as health, public morality, public policy (in a restrictive sense, but it does include 'justified' consumer protection, for instance) and public security. If products do not fall under a harmonisation directive, country-wise product specifications are prohibited, ex. art. 30, EEC (on so called measures having equivalent effects to quota's), except when the Court accepts their validity, following art. 36, EEC. However, the burden of proof is on the Member State, and at any rate, the measure should never be more restrictive (for trade) than is necessary for (proportional to) the purpose of the regulation **9)**. The rather severe judicial review by the Court has forced Member Sates to be a little more forthcoming in the tardy harmonization process.

The combination of harmonization and judical review is a robust stabilizer of market integration in the European Community. This stands in sharp contrast with the rising tide of non-tariff protectionism and the erosion of physical market access now that product regulation has been greatly intensified over the globe (think of food laws, environmental laws, anti-danger prescriptions). What is, more over, of special importance for industrial restructuring is the question of technical norms and standards, since they play a dominant role in advanced and new industries. Although the International Standards Organisation (ISO) tries to obtain agreement about worldwide standards, the bulk of them in the EC derive from three sources:

- European standardization institutes (CEN and CENELEC)
- national standardization institutes
- non-codified industrial norms

The first one gains in importance now that the EC Commission has decided to delegate the harmonization of technical industrial standards to them rather than to the luggish EC machinery. A CEN/CENELEC standard is normally adopted in EC directives. The last one does not give rise to border protection but it implies that foreign sellers have no chance if norms are decided by national industry. In new products - especially intermediate goods and in case of technological changes of

existing products -, investments in R & D, and in production lines may be wasted, or at least misspecified, if markets cannot be penetrated due to national norms. In computers, telecom switching and terminal equipment, car components, aircraft components, certain new consumer electronics (video-recorder; compact disc), biotechnology, components for numerical controlled machine tools or robots, the setting of standards and norsm can be decisive for the competitiveness of a firm's product in the short run, and for the market position in the longer run.

If restructuring is going to shift resources out of low value-added, comparative disadvantageous lines of industry to advanced and new industries to strengthen the future export position of the country (and the Community) in question, flexible modes of harmonization are indispensable for success.

5. Unification: the not-so-common trade policy

Unification is defined as the combination of two or more national policy structures into a common one, backed by some form of sanctions. Unification is, of course, highly ambitious. To be successful at unification the loyalty to cooperate must not only be positive in spirit but indeed also self-denying in character. It assumes that certain policy areas can be separated from the national government without a loss of effectiveness, in other words, it implies a fundamental transfer of political responsibility that must not be undermined by the national competences in functionally linked policy domains. This seems an almost prohibitive barrier for modern nation-states, the EC countries included, as they have a strong inclination to maintain their own power and reassert themselves.

The present author does not suggest that unification could ever be a feasible solution for international compatibility problems in industrial restructuring. Rather, I have chosen the strongest form of policy cooperation in the EC and hope to show that the internationally most conflictual instance of restructuring policy - trade policy - has exceptionally strong tendencies to remain national (in part) so as to be responsive to national desires of industrial autonomy. If this is correct it does not augur well for the international compatibility of industrial restructuring programmes among countries that do not have such far-reaching degrees of commitment to a common cause.

As art. 113, EEC, states ". . . the common commercial policy shall be based on uniform principles" and the implementation is a Community matter. The EC has therefore exclusive powers in the common trade policy; the Member States have effectively transferred them and cannot claim concurrent or parallel competences. But there is a trap here that is of great economic importance. Although EC powers are exclusive once transferred, it is all but obvious what powers actually have been transferred. Without necessarily being exhaustive, art. 113.1 lists changes in tariff rates, the conclusion of tariff and trade agreements, the achievement of uniformity in measures of liberalization, export policy and anti-dumping or countervailing duties as falling under uniform principles. But the respective degrees of liberalization need not be equal in the EC, as a careful reading of art. 111.5 shows, and have not been equal in practice. This has the curious consequence that a safeguard clause (art. 115, first para.) is inserted, causing intra-Community border interventions and origin-controls in order to prevent trade deflection arising from differential access to Member States' markets for identical third country imports. Fragile pre-federalism and a powerful political economy of sectoral pressures generate this ambiguous attitude that, while buying off domestic tensions for the national politician, has an eroding effect on the ability of the EC to use its commercial power and to avoid further problems in the Internal Market. The unhappy choice then becomes that between the erosion of intra-EC free trade and the erosion of EC free trade with the rest of the world. Where trade policy, or subsidiary instruments such as trade credits, are instrumental to foreign policy aims, the problem is further compounded. Disparities in economic foreign policy instruments are bound to have repercussions on market integration -whether through trade deflection or (further) distortions of competitive conditions - and hence have to be constrained.

In sketchy form the Community's trade policy looks as follows today:

a) there is a common external tariff (as indeed GATT, art. 24 requires) and all the (many) exceptions are joint exceptions with identical implication. The more important cases include 71 so called Lomé-Convention countries (African, Caribbean and Pacific, or ACP countries) that have tariff-free access in industrial goods, the EFTA countries (Nordic countries, Austria, Switzerland and Portugal) that have an industrial free trade area with the EC, all Mediterranean countries except Albania that have - varying -preferential

access for industrial products, and, finally, all less developed countries, having a measure of preference in the EC's Generalized System of Preferences (that is less generous than the Lomé regime).

So, who actually pays the common tariff duties? Well, only the non-European OECD countries, most (not all) of the Comecon countries, South Africa and Taiwan. At any rate, EC tariff duties are low to very low, with hardly any exceptions.

b) Where there is volume protection the picture drastically changes. Although national quota's have been abolished (with the curious exception of German coal quota), new forms of volume protection have arisen at the Member State level in various appearances and for many products.

Usually this volume protection is highly informal, building on a technique first invented by US senators late 1956 (when confronted with a flood of Japanese clothing imports and refusing to defy GATT rules that, in 1955, had been further elaborated under US leadership) and taken over in 1957 by the US administration. The idea is that the formal trade liberalization is an irrefutable commitment so that partial, selective and informal methods ought to be found to "reconcile" the national goal of protection with the maintenance of an international trading order. This is what 'voluntary export restraints' are all about.

Now, in the EC, it is by nature impossible to transfer the formal competence of countries to the Commission when there is only a higly informal exchange of deterrence through threats and a promise to curb exports by the source country. The cleavage between disposing of a formal common trade policy competence and having the actual powers of negotiation and implementation (the national customs!) has caused resurgent frictions in the EC's trade policy for reasons of industrial restructuring, or, frequently, for reason of a refusal to adjust to the emerging comparative disadvantages.

In addition, the Council and the Commission together can formally authorize a particular Member State to install temporary protection in a particular product vis-à-vis a particular exporting country (the ar. 115, EEC, procedure, as stated above). Usually these are cases where there is a threat of injury due to so called 'market disruption' - a sudden flood of imports at much lower prices that leaves no time for adjustment, rationalization and restructuring **10).**

The last few years the Community is slowly trying the regain the 'commonness' of trade policy, also in questions of formal and informal volume protection. This move tends to be at the expense of the market access of emerging industrial exporters, especially the NICs.

The textiles and clothing sector is the big sector where border protection has become overwhelmingly quantitative. Preceded by the Short-term (1961) and Long-term Cotton Textile Arrangement (1962), three Multi-Fibre Arrangements have now been concluded (resp. 1973, 1977 and 1981) with an ever-increasing number of semi- or newly industrialized countries. Also the coverage of 'fibre'-products has continuously been extended while the rate of permitted import volume growth has been reduced in 1977. The US and the EC differ in their emphasis of tariff protection and this creates a greater EC incentive to employ stringent quantitative limits in the four-yearly MFA negotiations. In addition, the EC has felt it necessary to impose quota's per Member State in view of the different speeds (and willingness) to adjust to textiles and clothing import competition. This is based on art. 115, EEC, enabling national measures to prevent trade deflection in cases where national commercial policies still vary. However, the legality of the national quota is in doubt, because, in textiles and clothing the Community negotiates the MFA. Hence, a possible set of national quota's can, at best, be a guideline for negotiations among the Ten, before agreeing to the MFA. It seems legally incorrect to use them as a justification for national origin controls at the border, ex art. 115.

Since overall EC quota's (and their annual growth rate) are negotiated between the EC and (some 30) individual exporters of the Third World and Southern Europe the upshot is a long list of quota's per year per product per exporting country, broken down for 10 Member States. With 126 product groups under the EC interpretation of the MFA, (say) 30 suppliers and 8 internal quota's (Benelux counting for one), the maximum number of quota's could be more than 30 000 per year! Since many product groups are not in the highest class of sensitivity, no internal (or sometimes not even EC-wide) quota's are established, although there are strict monitoring schemes in case they show a too high import growth rate. Nonetheless, at present the EC has several thousands (!) of Member-State-specific textile and clothing quota's, rendering the internal 'free customs union' in this sector ridiculous, whilst punishing industrial achievements of LDC's.

Also Japan has been subjected to selective but increasing volume protection. Most of this protection is still imposed by EC Member States. A common commercial volume-policy vis-à-vis Japan is only slowly coming into existence, starting from the first Multi-Fibre-Arrangement (1973) and the common 'monitoring' of EC imports of cars, tools and t.v. sets decided in 1981. Precisely in (certain) textiles and (all) clothing, however, Japan has turned from a net exporter to a net importer in the course of the 1970's. The Community has subsequently liberalized the import of Japanese textiles and clothing (except certain natural silks). On 12 Februari 1983 Japan agreed to restrain the exports of video-recorders and large t.v. tubes to the EC to negotiated volumes while accepting unspecified restraints for ten other products, including cars, certain robots and t.v. sets. This further step to a joint commercial policy vis-à-vis Japan appeared only possible in a protectionist context.

In certain industrial products, 'voluntary export restraints' had been negotiated already before, whether among the Member State and Japan, among a Member State's group of firms and Japanese exporters or among the four 'parties' with various mixtures of (legal) government involvement on either side. The 'imbroglio" in motor cars is probably untypical but certainly telling (Bronckers, 1982). Italy appears to have a miniscule quota of 2200 Japanese cars per year (under 'automatic' approval of the EC), France has made it known by extremely informal methods that it would never accept a Japanese share of French car consumption of more than 3% (and has applied ingenious 'waiting' procedures in French harbours), Great Britain has an unpublished 'voluntary restraint' agreement between the British Society of Motor Manufacturers and the Japanese Automobile Manufacturers Association that is widely said to contain an 11% market-share ceiling, while Germany and the Benelux have obtained (different) voluntary export restraints, with an ill-defined role of the German government, resp. the Benelux governments in unison. Finally, Greece and Ireland have special transitory provisions and Denmark has no volume car protection. Given such divergent policies, and the big interests behind them, virtually any thinkable common policy of volume car protection vis-à-vis Japan would entail substantial (consumer, producer and labour) adjustment costs for several Member States. Hence, a common policy beyond the vague agreement of 1983 is a remote possibility and could only be realized in a heavy-weight package-deal.

As repeatedly stressed before, divergent national trade policies imply that the Internal Market of the EC will be disrupted because trade deflection through more liberal Member countries has to be prevented for the national volume protection to be effective. Under heavy political pressure the Commission is frequently forced to grant permission, ex art. 115 EEC, despite the dubious legal nature of some such approvals, and despite the dangerous erosion of the core of the Community's achievements: free access of all products, circulating in the EC within the union borders, to all domestic markets of Member countries.

Quantitative border protection has increasingly become a form of industrial policy. It aims to reduce or regulate the speed of adjustment of domestic EC industry to socially or politically tolerable levels in the importing country. For the EC it creates difficulties because speeds of adjustments differ among Member States and the assignment of alternative instruments to deal with industrial adjustment between the Community and national tier of Government causes additional problems.

National governments - being constrained by the negative aid coordination of the EC Commission, and the Court of Justice - and national pressure groups - seeking relief from import competition so as to maintain or restore expected income levels and safeguard as much employment as possible - are tempted to seize upon every means available to retard or avoid adjustment to world market conditions. In this context it is worthy of note that for domestic pressure groups common protection has a property that public aid does not have.

The point is that if national aid would be properly coordinated by the EC, aid would be temporary, degressive over time and would not tend to hinder structural industrial change. On the other hand, if quantitative protectionist instruments have to bring relief to EC industries with adjustment problems, the Community is competent to provide that relief, but it has traditionally refrained from monitoring the industry's effort to adjust, restructure or reconvert. The logic behind this lack of conditionality is that competition among EC firms and mutual access to the markets of Member States cannot be distorted by a common commercial policy. In other words, the trade policy is not looked at as an industrial policy though it is one. As a consequence, the competences to make the industrial policy, implicit in the trade policy, consistent with negative aid coordination are lacking.

The failure to make trade protection conditional upon sectoral adjustment will tend to lead to adjustment delays or to additional pressures to protect the level of production, income and employment. This would conserve the inefficiencies calling for adjustment. It may well induce a rapid dispersion of the practice to other sectors or products, leading to ossified structures behind Community shelters.

One might conceive, in theory, that the EC Council would adopt border protection in a similar fashion as adjustment aid: (say) volume protection would not only be limited in time, but would be degressively severe over time as well and their renewal would be dependent on internal adjustment. Hopes to see this happen should not be set too high! A closer look to the Multi-Fibre Agreement may exemplify the point. The Long Term Arrangement on Cotton Textiles (1962) and the First Multi-Fibre Agreement (1973) differ in the range of products covered and the number of export countries (both being considerably greater in the latter case), but do not differ essentially with respect to purpose. The objective was to reduce import growth rates so as to render the speed of adjustment socially acceptable. It was explicitly stated that the temporary protection should bring the necessary relief to implement adjustment (despite the evident increase in the scope of protection). By the time of the Second Multi-Fibre Agreement (end 1977), the scope in terms of products and countries was further increased while its nature had become much more restrictive. The Third Multi-Fibre Agreement has continued the previous one without any improvement. This raises doubts about the expressed objective - its 'revealed' objective seems to come much closer to a desired level of production by EC producers. A recent document (EC, 1980, p. 1a) confirms this: "In the case of textile products imports with a particularly high penetration rate . . . the objective, subscribed to by the Commission and all Member States, consists in the realization, for the entire duration (of the MFA II), of stablization of the penetration rates . . . so that Community producers may expect a reasonable share of the market".

Of course, one of the serious problems of the EC textiles and clothing industry consists in the continuous, sizeable job losses. But this has at least as much, if not more, to do with stagnation of exports in third markets (due to NIC competition), for which protection does not help, with factor substitution (which may only in part be attributed to import pressures) and with demand stagnation.

It is clear from experience that neither the EC Commission nor the Council is in a position to implement active surveillance over adjustment in the textiles and clothing industry and make the Fourth Multi-Fibre Agreement believably conditional upon it. By its nature, border protection can serve the desired social pace of transformation by regulating import pressures, but it is incapable of securing structural objectives. At the same time, the necessary instruments for the structural objectives - such as rationalization, reconversion - should become an integral element of EC trade policy.

6. Industrial strategy without power and purse

One of the more worrying aspects of today's ongoing industrial restructuring policies is the marked similarity of industrial strategies in many OECD countries, and increasingly of other countries as well. Every government seems to rush to be in the forefront of the 'big four' industries of the future: informatics (i.e. telecom, tied in with dataprocessing and other information technology), robotics, microelectronics and biotechnology. Only slowly observers begin to realize that the possible incompatibilities could well lead to serious restructuring conflicts later.

The concern of the EC at present is the more immediate one of removing the inconsistencies among the Ten, preventing a wasteful overlap of R & D programmes and realizing a truly open and integrated "home" market (that, in advanced industries, is surely not always the case) so as to reap the indispensable economies of scale while facilitating the recoupment of development costs.

Ever since the Colonna Memorandum (EC, 1970) there have been recurrent efforts by the EC Commission, and the European Parliament, to implement an EC strategy in advanced industries and advanced technologies. Irrespective of the economic merits of such strategies, it ought to be acknowledged that effective EC initiatives in this domain have to overcome enormous problems. No positive competences exist, while a negative surveillance of state aids in advanced sectors would be controversial, to say the least. Moreover, several advanced industries have strong links with - some are even dominated by - the defence industries which are exempted in the EEC Treaty (art. 223). Finally, national governments frequently

are engaged in national strategies for their 'own' advanced industries, whether for chauvinistic or security reasons, having led to exceptionally strong vested interests -amalgamating public and private ones - in resisting Europeanization.

During the early 1980's the emphasis in the Commission's industrial strategy for the EC has decisively shifted away from worrying too much about coordination of aid in traditional or declining industries to extensive documentation of the EC industry's declining competitiveness in the world market, especially in advanced industries, and the subsequent attempts to get a series of ambitious programmes accepted. Aid coordination by no means decreased in intensity - quite the contrary, as shown before - but the Commission gave strategic prominence to an awareness campaign and boldly pushed for R&D programmes and a few other measures.

The case for subsidization entails an informed judgement, not only of the risk and degree of uncertainty of a particular R&D effort, but also of the 'patentability' of the future product and the (in)sufficiency of the private means of appropriation. It will be clear that this judgement is difficult and must reckon with a larger margin of error. The question then is whether public agents can be expected to have a better judgement than private suppliers of risk capital, and if they have not, why public agents would decide to subsidize where private agents refuse to lend. In the EC context, the further question is whether joint subsidization is necessarily better than 'competitive subsidization' in different Member States. This question might well be answered in the affirmative as it is known that R&D competition can be wasteful and lead to suboptimal solutions.

There is also a cost component in public subsidies to advanced technologies and R&D. Once governments have decided to provide decisive R&D subsidies, it can sometimes be arbitrary, if not reckless, to stop subsidizing in the event of cost rises due to miscalculation or longer duration of testing.

This argument is even more important in case the EC would engage in joint international programmes for advanced products, although the inefficiencies that would tend to arise would likely be greater in joint production than in joint R&D. The nature of international programmes is such that they imply multi-annual commitments, negotiated by all partners (governments, or backed by their governments), usually for a unique venture for which cost comparisons are

difficult. Overmanning, cumbersome and elaborate administrations, and overpayment of personnel may be the consequence. In common production programmes, the problem is that all partners wish to share in much, if not all, of the technology, which reduces the potential for the division of labour (Hartley, 1982; 1983), while also desiring 'national' variants in certain cases of defence technology. Hochmuth (1974), in his detailed study of public international agencies developing advanced weaponry, airplanes and satellites, points out the inefficiencies, caused by the lack of hierarchy (due to conflicting national interests) and the ad hoc, that is, finite life of the common ventures.

Larger financial entry barriers need not be a problem for well-functioning capital markets, but, in the EC, financial capital markets are segregated: the national markets are usually fairly thin. Individually, they exhibit substantial openness vis-à-vis the Eurocapital market, but this market trades only bonds (no corporate stock is floated) and tends to be selective and risk-averse. Here there is a definite case to organize a common European securities market, with the possibility to float stock over the entire Community. For risky projects, requiring large financing, a Community-wide securities market might bring off - at least, in a number of cases - what would be difficult in national stock markets. The reason is that a sufficient number of portfolio holders, desiring only a very small share of risky, high-yield stock, have to be found to raise enough funds for product development and introduction on the market. For small yet risky initiatives, the Community tries to stimulate a 'venture capital market' to promote innovation and to facilitate new entry.

Of course, one ought not exaggerate the failures of the capital markets in the EC. A refusal to finance loss-making initiatives can hardly be attributed to a market failure. Programmes like the (British/French) Concorde and the European Airbus consortium have in effect been subsidized with enormous sums running into several billion ECU! The first one has been a technical success but a commercial failure, while the second is commercially fairly successful but at very high sunk costs that are de facto written off. Is not this a case of government failure?

Large-scale economies represent a forceful argument for liberalization of national markets in advanced industrial products in the EC. The theoretical option of the world market is rarely an appropriate alternative since few important markets

outside the EC are truly open. Nonetheless, the practical obstacles in a transition to a common market in advanced products -with EC-wide rather than national public procurement - should not be underestimated. A well-known example is the Airbus programme where a US engine was (and is) used while, at the same time, British Rolls-Royce engines were heavily imported by US aircraft firms. The still dominant position of the US air carriers industry on the world market implied, for a foreseeable period at least, a larger, and relatively secure, outlet for Rolls-Royce than an insecure and merely European, and merely civilian, project to build a family of three or four carriers for commercial use, in the face of tough US competition. The later success of Airbus with its first two types of airplane might help to foster a demand growing to minimum efficient scale, with costs possibly coming down over the learning curve as well, rendering it a comparable option to the major US firms (at least, in civilian aircraft production).

During 1982 and 1983 the Community slowly came to the realization that the competitiveness in the 'newer' industries was unsatisfactory and worsening. It has meanwhile agreed upon a number of R&D programmes in advanced industries, the largest initiative of which is the ESPRIT project in information technology (a five-year programme of ECU 1 400 million, co-sponsored and co-managed with industry itself). There are also modest programmes in biotechnology, metal engineering and 'basic technology'. There is also insistence to come to EC standards and norms in biotechnology before production processes have really become mature.

The problems of realizing a true EC product market - rather than promoting product development - in advanced sectors have hardly begun to be tackled. The role of public procurement in advanced industries such as defence technology, telecom, new transport equipment and large turbines for electricity firms should be fundamentally altered. The European Council of heads of state and government recommended in 1983 to open public telecom markets by reciprocal buying between pairs of EC Member States up to 10% of the annual demand. Of course this is an encouraging political signal but with little economic significance, yet.

In 1983 the question has arisen whether advanced industries could obtain EC infant industry protection. The case at issue was the 'compact disc', a Philips invention that had been licensed to Sony. It appeared that the first stages of commercialization and search for large-scale production - early in the product

cycle - took longer than anticipated, and longer than the Japanese competition needed to start exporting to the EC (at higher prices, though). The major economic argument for infant industry protection was that the compact disc was an infant mass consumption good in need of a grace period during which the producer would move over a 'learning curve' to extremely competitive costs, given the size of the EC market. Getting over the usual consumer resistance would take a few years whereafter the infancy would be a thing of the past. However, free access for a licensee's exports to the EC would jeopardize the realization of a cumulative 'learning' output and might frustrate the recoupment of the R&D expenditure for a genuine European innovation.

In principle, this argument can be correct. If indeed the negative slope of the learning curve does not become negligible too soon, it can be decisive who is first on a big market like the EC. The argument acquired particular force because EC production of the video-cassette recorders (also a Philips invention with slower commercialization than the Japanese competitor) suffered greatly in 1980-1982 from a flood of imports from Japan, inducing the EC to 'impose' a "voluntary" export restraint on the (Japanese) product to guarantee a 20% market share for EC producers.

On the other hand, the argument has speculative elements, because nobody can predict the learning curve for a new product. The EC decision to raise the tariff for compact discs (temporarily) from 9% to 19% is nonetheless a breakthrough in the use of trade protection for industrial policy. One suspects that, above all, it is a political signal to Japanese trade policy-makers, rather than a 'scientific' infant industry tariff. Nevertheless, it sets the precedence that the EC is capable and prepared to employ its trade policy to promote industrial innovation and facilitate the first years of marketing.

Altogether, the Community's policy for advanced industries does not look very impressive. There is a lot of consultation, some ad hoc cooperation, an occasionally well-funded programme, and here and there the use of existing policies (trade; competition) to foster particular ventures in high tech. The EC has not really succeeded in genuinely opening up its own internal market for all advanced products, implying that the restructuring shift to high tech is still a national decision!

7. Final remarks

The strong inclination of countries to shift some of the costs of industrial restructuring to foreigners, and to foreclose a number of domestic business opportunities for foreign competitors has certainly not subsided in the EC with the maturing of the Community. As shown, it is difficult, even with an armory of cooperative policies, supported by an authoritative common Court and, sometimes, common funds, to achieve compatible industrial reconversion among the Member States.

If there is one lesson to be learnt from the EC experience it is that there are two conditions for effective cooperation in this domain: mutual economic interdependence ought to be so strong that "free rider" behaviour carries severe costs (hence, cooperative gaming is a serious alternative option, with positive incentives), and, the underlying institutional (or constitutional, nearly) assignment of economic policy competences ought to be such that countries are constrained in their freedom of interpreting and implementating the negotiated outcomes in their own way (hence, assignments to the common level of decision-making, or direct delegation to a supranational organ ought to be of material importance). Each of the two conditions are necessary ones; only together are they sufficient.

The first one is occasionally fulfilled outside the EC as well (EC/US trade and monetary nexus is a good case) but then the lack of the second threatens to cause instability and conflict, unless a permanent system of conflict management can be installed (as indeed it operates between the US and the EC - highly informally). Between the NICs and the EC, or between Comecon countries and the EC, even the first is lacking.

The only long run trump card that the NICs and the Comecon countries have is that the EC's industrial trade surplus with them is rapidly dwindling, which renders 'market access' to the NICs and to Comecon countries a negotiable issue. Indeed this could open a sound route for restructuring. The problem is how to create an institutional regime that can guarantee sufficient stability for such a long run industrial restructuring to be carried out.

NOTES

1) See, for instance, Gordon and Pelkmans (1979), Keohane and Nye (1977), Cooper (1968), etc..

2) In the ECSC case traditionally called the 'High Authority', but being exactly the same group of Commissioners as for the EEC and Euratom.

3) Although the ECSC (in contrast to the EEC) has no common-external trade policy in times of normalcy, art. 57, art. 71 and art. 74, ECSC, together with a judgement of the European Court of Justice in 1978 empower the Community to take such trade policy measures as to effectuate internal measures with respect to prices and supply volumes.

4) The so-called Solomon plan in the US and the (first) Davignonplan in the EC installed (coordinated) minimum import prices, below which automatically a case of dumping would be considered proven. These 'trigger prices' were the lowest cost-prices for steel known on the world market (usually Japanese or certain EC plants cost-prices).

5) Case 730/79; European Court Reports, 1980, p. 2687.

6) EC, 1981, p. 151.

7) See Chard and Macmillan, 1979. In 1980 the EC Commission went so far as to issue a Communication to the Member States' governments, stating that "Cases of non-notification or late notification ... have ceased to be isolated. Indeed, the extent of the tendency ... would appear in some cases to indicate the possible existence of a general decision not to respect the provisions in question". Official Journal, 30 Sept. 1980; no. C 252/2.

8) All data from EC, 1983, p. 113. The figures exclude aids in agriculture and transport.

9) More extensive legal treatment is in Oliver (1982) and Mattera (1983). The reader is also referred to a less technical digression in Pelkmans (1984, ch. 6).

10) Like art. 19, GATT, except that the GATT procedure comprises more safeguards for the exporting country.

11) See Keesing and Wolf (1981) and OECD (1979, Annex II).

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ENVIRONMENTAL ECONOMIC ANALYSIS IN INTERACTING REGIONS

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1. INTRODUCTION

Post-war advances in computer technology have favoured the introduction and use of computer-based decision and choice models in the area of both micro- and macro-economics. This trend has been favoured by two circumstances: 1) the enormous progress made in designing and implementing operational models based on advanced mathematical, statistical and econometric tools, and 2) the potential offered by modern computer software allowing the researcher to deal with complex and large-scale systems.

This development has exerted a deep-going impact on decision analysis. Decision analysis aims at judging a range of feasible options on the basis of a set of relevant evaluation criteria so as to eliminate less desirable options and to identify the most favourable alternative(s). In macro-economic decision analysis, however, the research is usually confronted with intruiging problems such as: a macro-economic system usually displays a multidimensional complexity, so that an integrated view is very hard to obtain; the system is influenced by multiple (formal and informal) actors with conflicting priorities and interests, so that an unambiguous macro-economic welfare criterion is lacking; there is a wide variety of diverse regions in a national system each of them interacting with the nation as a whole and with the other regions.

These considerations lead us to the specification of the following requirements for an integrated macro-economic model for decision analysis:

- The model should - in addition to (socio-)economic components - also include environmental and energy components so as to allow one to study the system at hand from an integrated viewpoint.
- The model should also incorporate the objectives set forth by

(formal and informal) actors so as to do justice to the existence of diverging interests in society (leading to multiple objective analysis).

- The model should also encompass dimensions in order to take account of the regional diversity of a complex national system.

These requirements imply a plea for an integrated multiobjective national-regional model. This paper aims at presenting such a model for integrated economic-environmental-energy policy analysis in The Netherlands. Section 2 will describe some general methodological features of such a model. Next, in Section 3 a plea will be made in favour of interactive decision analysis in order to provide a method for conflict resolution. Then in Section 4, a conceptual version of a so-called Triple Layer Model will be presented, followed by a specification of an operational model in Section 5. Further details and empirical results will be discussed in Sections 5 and 6, respectively.

2. INTEGRATED MACRO-ECONOMIC POLICY MODELS

A complete macro-economic policy model provides a stylised and consistent picture of (a part of) a complex reality. In general, economic, environmental and socio-political models may be regarded as images of the real world created by model-builders. Models used in policy analysis should be able to present the boundaries within which policy decisions are to be made, the tradeoffs inherent in choosing alternative solutions, the impacts of policy measures on a set of relevant policy targets, possibilities for a communication between experts (or planners) and decision makers, and the sensitivity for changes in the spatial scale, the time horizon or the level of measurement of variables. Such methodological conditions are hardly fulfilled in modelling practice, so that the determination and the judgement of the unique optimal state of the system is fraught with difficulties. Consequently, many conventional programming approaches have only a limited validity in the practice of policy analysis. That is also the reason why - instead of optimality analyses - impact analyses, effectiveness analyses, decision support analyses and strategic decision analyses have received increasing attention in recent years. In such analyses, much emphasis is placed on the effects of policy objectives and policy instruments, the role of conflict management and the meaning of compromise principles.

Another reason explaining why many conventional programming models have only a limited relevance in policy analysis is the fact that such models are usually based on a set of stringent assumptions, such as: the existence of one known decision maker, complete information on all relevant objectives and instruments, perfect insight into the impact of policy measures on socio-economic objectives, absence of equity problems and of spatial or social spillover effects, a stable (often linear) structure of the economy, and so forth. It is conceivable that these notions are especially relevant in an integrated economic, environmental, energy and regional policy analysis (see also Issaev et al. 1982).

Integrated economic-environmental-energy modelling has become increasingly complicated over the last decade. Systems theoretic concepts, optimal control models, game-theoretic approaches and multidisciplinary analyses have become necessary tools for economic-environmental-energy analyses. There is a strong tendency towards a more coherent and integrated analysis, in which economic, environmental, energy and regional aspects are brought together in one consistent framework (see Laksmanan and Nijkamp 1980). This need for integrated modelling is mainly caused by the fact that the post-war economic growth paradigm intertwined with technology, scientific and educational progress and rising population numbers, has overlooked inter alia the social and ecological dimensions of this process and hence has led to a serious threat for the man-made and natural environment. This development can not only be observed in the developed countries, but also in the Third World countries, especially in those areas where a rapid industrial expansion is not accompanied by sufficient monetary resources for environmental protection and pollution abatement. Integrated planning and policy models provide essentially some necessary means to restore the balance in favour of more emphasis on environmental dimensions (cf. also Guldman and Shefer 1981).

As environmental and energy policy analysis usually takes place in a complex field with conflicting goals, various social interests, multiple decision groups and power structures, this analysis should necessarily take account of the multidimensional nature of the environment and energy problems (see Nijkamp 1980). It is clear, that a broader, socially-oriented view of policy analysis requires an integrative framework for judging alternative policy options. This will, in general, imply that - instead of optimisation of the systems outcomes -

the attention has to be focussed on providing a rational basis for the policy decisions regarding the system, among others, by revealing conflicts among objectives or groups, or assessing tradeoffs among different choice options, by gauging the distribution aspects of policy measures, by identifying efficient solutions and by designing appropriate and relevant methods and procedures for policy evaluation and for compromise strategies. The current interest in interactive multiobjective decision models shows clearly such new trends in designing and employing modern tools for environmental policy making (see also Hafkamp and Nijkamp 1982a and Hafkamp 1983).

The foregoing remarks lead us to the specification of the following requirements on a relevant integrated policy analysis (see also Nijkamp and Spronk 1983):

- appropriate and reliable assessment of relevant impacts of policy measures or exogenous changes
- complete representation of the policy areas concerned (including its feasible decision space)
- multidimensional representation of the diverse components or modules of the system at hand
- flexible adjustment of the policy analysis to new information or new circumstances
- comprehensible presentation of the results to responsible decision makers or actors
- appropriate use of available data (including qualitative data)
- consideration of equity aspects and spillover effects
- treatment of tradeoffs and conflicts inherent in the choice problem at hand
- use of learning strategies and decision aid tools in a communication between all participants involved in the policy problem at hand
- integrated approach with much attention paid to compromise procedures and institutional dilemmas
- emphasis on 'satisficer' principles rather than on 'optimiser' principles.

In the remaining part of the present paper we will make an attempt at developing an integrated approach to regional-economic-environmental-energy policy analysis by using the so-called Triple-Layer Model (TLM) (see Hafkamp and Nijkamp 1982b). It will be shown that recently developed interactive (integrated economic-environmental-energy) policy

models appear to provide a promising perspective for an integrated multiple objective policy analysis. Two elements are central in such approaches, viz. efficient (or Pareto) solutions for conflicting objectives and interactive strategies among analysts and policy makers. In this regard, it will also be demonstrated that multi-regional input-output analysis is a necessary part of a meaningful and consistent framework for the abovementioned approach.

3. INTERACTIVE MULTIOBJECTIVE PROGRAMMING MODELS

In recent years much work has been undertaken to formulate operational optimisation procedures for problems with multiple objectives (see among others, Keeney and Raiffa 1976; Cohon 1979; Rietveld 1980; and Nijkamp and Spronk 1981). At present, there is a whole spectrum of different multiobjective methods available, both in the field of continuous programming analysis (see, e.g. Nijkamp 1979) and in the field of discrete plan and project evaluation methods (see e.g. Voogd 1983). It should be noted however, that many of these procedures have not been specifically designed for macro-economic decision making. The usefulness of these diverse methods and procedures for macro-economic policy analysis very much depends on the way macro-oriented priorities and conflicts can be taken into account. With respect to this issue, it may be meaningful to distinguish these methods and procedures according to the information available on the decision maker's preferences (see, e.g. Hwang and Masud 1979). Three cases may then be distinguished: 1) full information, 2) limited information, and 3) no information. Especially in the case of limited or zero information, interactive procedures may be very helpful. Many problems in an integrated policy analysis do not require an unambiguous solution that represents once and for all the optimal state of the system concerned: compromise strategies appear to prevail. In the light of the process character of many decision problems, an interactive policy analysis may therefore be a reasonable and operational approach. This approach is usually composed of a series of steps based on a systematic exchange of information (based on computer experiments) between decision makers and analysts. Such interactive approaches are normally characterised by the following pair of steps:

- the analysts propose meaningful and feasible (trial) solutions on the basis of a well-defined compromise procedure.
- the decision makers respond to each (trial) sclution by indicating

in which respect (i.e., in regard to which effects) the proposed compromise is still unsatisfactory (given their views on minimum achievement levels, aspiration levels, etc.).

These pairs of steps are then successively repeated until after a series of computer experiments, a final satisfactory compromise solution has been identified. As mentioned before, a large number of interactive models has recently been developed (see among other, Rietveld 1980 and Spronk 1981). Interactive policy analyses based on multiobjective programming methods have already demonstrated their meaning in various policy problems, also in a macro-economic context. They may be regarded as having many significant advantages compared with traditional methods (see Nijkamp and Spronk 1981).

In the present paper, only one specific type of interactive policy methods will dealt with, viz. the method of displaced ideals (see Zeleny 1976 and Nijkamp 1980). It is a method which needs no explicit prior information on tradeoffs between targets expressed by decision makers in the procedure. If they are offered a feasible (and efficient) solution to the multiobjective problem, they only need to choose an objective which has to be improved in value in the next iteration of the procedure. This tentative compromise solution is determined on the basis of a reference solution (the 'ideal' point), which is regarded here as the points on the main diagonal of the payoff matrix associated with the multiple objective problem. Figure 1 provides a concise presentation of the stages of this interactive optimisation procedure.

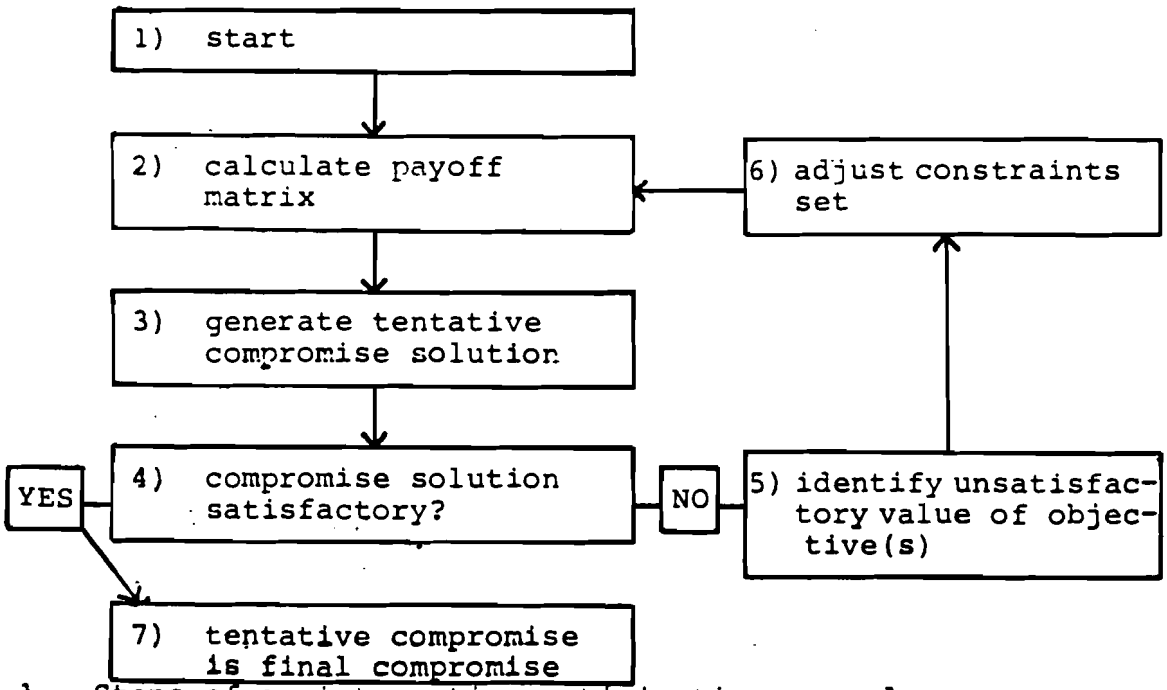

Figure 1. Steps of an interactive optimisation procedure.

More details regarding this method can be found in Hafkamp and Nijkamp (1982b) and Hafkamp (1983). This procedure can also be directly related to scenario analysis for macro-economic policy making. A scenario is a consistent set of prospective values of plans, goals, instruments and exogenous circumstances. Both single and compound may be dealt with. Choices among different scenarios may also be generated by means of the abovementioned multiobjective methods.

4. A CONCEPTUAL TRIPLE-LAYER MODEL (TLM)

TLM is a model of a spatial system where economic, environmental and socio-political aspects are integrated. The spatial element implies that the system is analysed at the level of regions interacting with the national level. Consequently, TLM is a national-regional economic environmental model. TLM is a result of projecting a complex reality on three mutually interacting parallel layers:

- an economic layer
- an employment layer
- an environment layer.

Several aspects of a complex and multidimensional system can thus be depicted in various submodels, according to their respective different aspects and consequences.

The design strategy of TLM implies a three stage procedure, where first a simple model is constructed, so as to depict the triple layer structure and to delineate the scope and detail of the model (see also Hafkamp 1983). The second step of the design procedure is the construction of a conceptual triple layer model and is described in the present section; the third step assembling the operational triple later model, is dealt with in the next section.

The conceptual model presented here is a multi-regional model of an economy where economic, socio-political and environmental aspects of a society are of main importance. Public decision making and planning in such a spatial system will be analysed in a way analogous to allocation mechanisms in formalised economies with public goods and external effects (see also Ruys 1975). We shall explicitly deal with (groups of) individuals belonging to a certain region of the spatial system and to a certain interest group (e.g., environmentalists,

labour unions).

Conceptually, the model has the following structure. The spatial system consists of a set of regions:

$$\bar{R} = (1, 2, \ldots, R) \tag{1}$$

The individuals within the spatial system are denoted by:

$$\bar{I} = (1, \ldots\ldots\ldots\ldots I) \tag{2}$$

The set of individuals in a region is written as:

$$\bar{I}_r = (1_r, 2_r, \ldots I_r) \quad r \in \bar{R}) \tag{3}$$

where $I_r \cap I_{r'} = \emptyset$ for $r \neq r'$ and $\bigcup_{r=1}^{R} \bar{I}_r = \bar{I}$.

The elements which are of importance for individual decision making are regional income, employment and environmental quality. As notation of attainable outcomes in the system, we adopt:

$$\left.\begin{aligned} s_r &= (y_r, l_r, z_r) \quad , \quad r \in R \\ s &= (s_1, s_2, \ldots, s_R) \\ s &\in S \ ; \ S \text{ is compact and convex} \end{aligned}\right] \tag{4}$$

s is an R-tuple of vectors describing the state of the entire spatial system. $\underline{s}_r$ is a vector describing the state of the system for region r, where

y_r denotes regional income
l_r denotes regional employment
z_r denotes regional environmental quality .

Various policy mixes (combinations of regional economic policy, environmental policy, and labour market policy) enable a central authority to 'control' the spatial system so as to reach, in principle, any situation which is reflected by an element of S.

Individuals in a region have a 'consumption' set which is denoted as;

$$X = \{\underline{x} \mid \underline{x} = (y,l,z) \in R_+^3\} \tag{5}$$

As mentioned above, we may distinguish different interest groups. There are various ways of incorporating such groups in individual welfare functions. Here we suppose the existence of twice differentiable, concave individual welfare functions:

$$w_{i_r}(\underline{x}_r) \quad i_r \in \bar{I}_r \tag{6}$$

Thus, the welfare position of an individual in region r is only determined by income, employment and environmental quality in region r.

In addition, a choice set of C is defined that serves as the basis for individuals to decide which objective is the most urgent one and hence should be raised first:

$$C = \{\underline{c}_{i_r} \in R^3 \mid \underline{c}_{i_r} = (a_1, a_2, a_3) \wedge a_j, \sum_{j=1}^{3} a_j \in (0, 1), j=1,2,3\} \tag{7}$$

(7) means that during each state of the choice process not all objectives can be improved simultaneously, but that only one objective can be increased in value (in other words, a_j is a zero-one variable). The spatial system composed of individuals can now concisely be characterised by:

$$EE = \{\bar{R}, \bar{I}_r, S, (X_r, w_{i_r}, C)\} \tag{8}$$

Spatial system EE can - from the point of view of individuals - be regarded as an economy with external effects only. The set of Pareto-optimal states PO in this system can now be defined as:

$$PO = \{s \in S \mid \exists r \in \bar{R}, \exists i_r \in \bar{I}_r : w_{i_r}(\underline{s}'r) > w_{i_r}(\underline{s}_r) \rightarrow s' \in S \quad \vee$$

$$\{\exists r \in \bar{R}, \exists j_r \in \bar{I}_r : w_{j_r}(\underline{s}'r) < w_{j_r}(\underline{s}_r)\} \tag{9}$$

It should be noted that Pareto-optimality is an efficiency criterion rather than an equilibrium criterion. The set of Pareto-optimal solutions is also known as the set of efficient or non-dominated solutions.

The presence of different interest groups that want to maximise respectively regional income, employment and environmental quality makes it impossible to identify one single overall best solution. Consequently, formally a multidecision maker, multiobjective problem has to be solved so as to achieve a state of the system that is a compromise for the conflicting interests among groups.

This can be done by using the interactive method based on displaced ideals which was described in Section 3. However, this method does not specify a decision rule for identifying a 'most urgent' objective if there are many decision makers involved. This lack may be overcome

by using a voting procedure based on a majority rule. The preference relationships should be interpreted as 'tacit preferences' (preferences of which decision makers themselves are not explicitly and entirely aware).

The steps of the interactive compromise procedure are already contained in Figure 1. The selection itself of an unsatisfactory value of an objective takes place choosing a 'most unsatisfactory' level of an objective by means of a democratic voting procedure, so that a central authority has to count the votes concerning the most unsatisfactory objectives and next adjust the constraint set accordingly.

A more detailed description of the way a TLM is coupled with an interactive multiobjective procedure is contained in Hafkamp and Nijkamp 1982a.

5. AN OPERATIONAL TRIPLE-LAYER MODEL (TLM)

The operational TLM is composed of three submodels - one for each layer - : an economic, an employment and an environmental submodel. A detailed discussion of all equations, variables and data of these submodels can be found in Hafkamp (1983). In this section we only discuss the main lines of the various submodels.

The economic submodel compromises a national-regional economic model of the Dutch economy. It is the result of coupling the so-called Secmon model (see Driehuis 1978) with a multiregional input-output model of five Dutch regions. Various goal variables are included in this submodel: inflation, current and capital accounts and economic growth). Policy instruments are: taxes and public expenditure, monetary instruments, exchange rate, wage and price control and labour market policy. Economic actors are: households, firms, government and other agents.

The relationships between the components of the economic submodel are described by means of 10 modules:

- production (based on input-output tables);
- final demand (consumption, investment, public expenditure and exports);
- imports (final products, raw materials and manufacturing inputs);

- production capacity;
- labour market;
- wages and prices;
- income;
- government expenditure;
- social insurances;
- monetary systems.

The employment submodel analyses primarily the demand for labour at both a regional and sectoral level. For the time being, the supply side of the labour market is considered as exogenously determined by demographic and social developments. It would be worthwhile however, to include more detailed information on demographic developments, education and training endogenously in the model.

The environmental submodel describes three aspects of environmental quality:

1. Emission of air pollutants caused by:
   a. combustion of fossil fuels;
   b. process emissions, etc.
2. Concentration of air pollutants (via diffusion)
3. Reduction of emission by:
   a. saving energy, selective growth, etc.;
   b. alternative choices of energy sources;
   c. anti-pollution technology.

Pollution of water and soil is not taken into account here, nor is any attention paid to the phenomenon of synergetic effects. The following pollution categories are taken into account: sulphur dioxide, nitrogen oxides and dust particles.

The choice of energy source also has an important influence on the emission of air pollutants. For example: SO_2 emissions in The Netherlands decreased drastically after a large-scale introduction of natural gas, but since a switch back to coal or oil took place, a drastic increase occurred. Especially the shift of electricity producers from natural gas to oil, coal or nuclear energy and the further exploration and introduction of alternative energy sources (solar energy, wind, etc.) are of great importance to environmental quality.

The way in which the components of these three modules are linked is

represented in Figure 2.

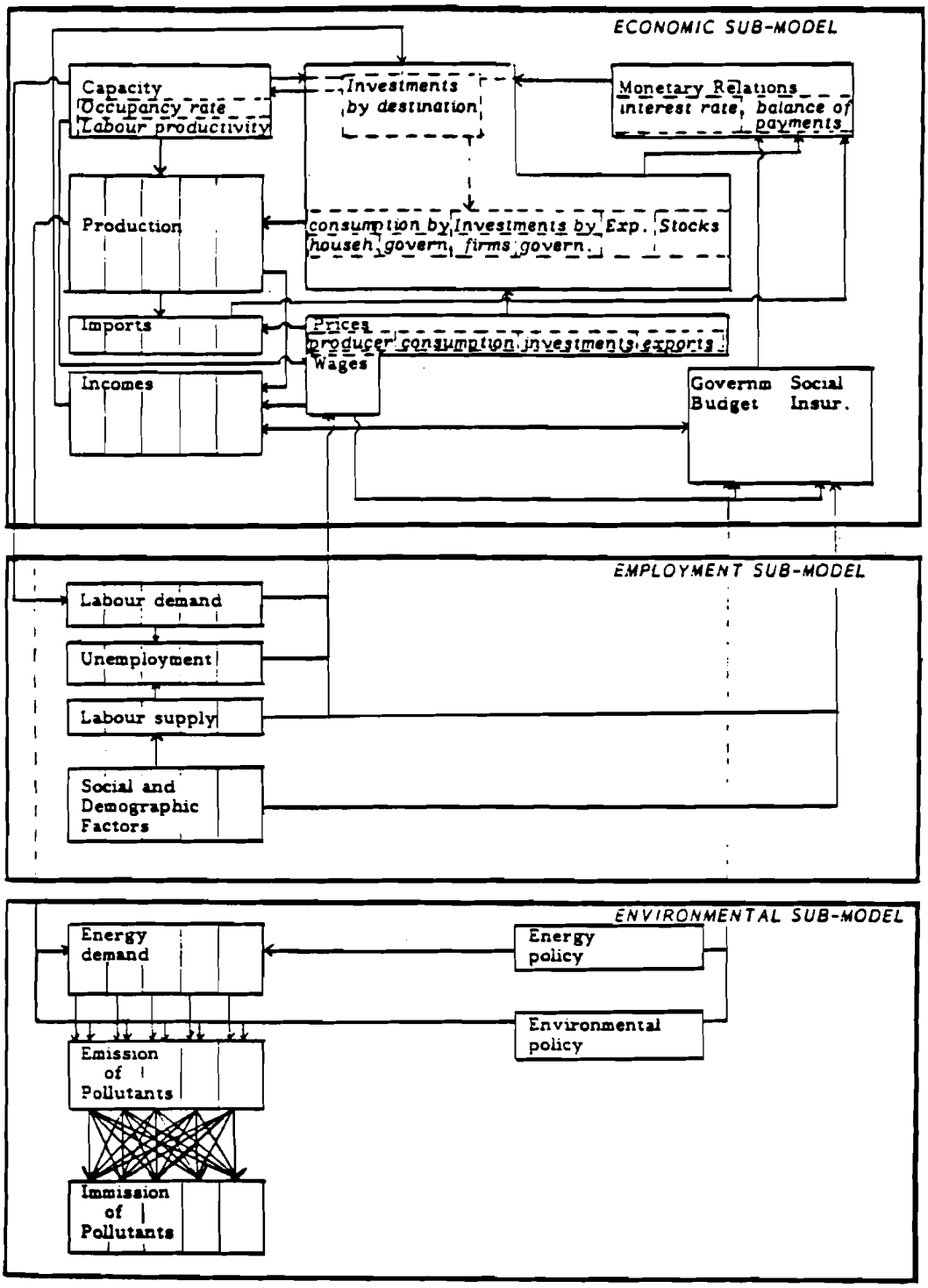

Figure 2. Representation of the Triple Layer Model and its submodels

6. INTERACTIVE MULTIOBJECTIVE PROGRAMMING WITH THE TRIPLE LAYER MODEL

Implementing the operational triple layer model of Section 5 has presented us with a number of computational problems. Solving vector optimisation problems of this size asks for powerful optimisation routines.

In this section, we will apply the interactive compromise procedure introduced in Section 3, to the operational version of TLM. While applying the interactive compromise procedure to the conceptual version of TLM focusses on choice aspects for individuals and on coordination aspects as to public decision making, its application to the operational version is primarily concerned with controlling the procedure itself and understanding the results obtained.

The model is comprised of five regions (see Appendix, Figure A1), with three objectives in each region - income, employment and environmental quality. This means that the compromise procedure produces compromises between regional interests as well as between objectives at the regional level. Therefore, a multitude of versions of the procedure could be designed so as to reflect a variety of institutional arrangements under which socio-economic decision making takes place. These institutional arrangements may imply that a single authority, viz. central government, is the single decision maker. They may also imply that decision making is entirely left to regional planners, whose decisions, votes, wishes and actions are added up only at the central level. Various intermediate arrangements are possible as well, and can be described as multilevel decision making procedures (see in particular, Rietveld 1981).

The basic version of the procedure implies separate optimisation of all 5x3 objectives at every iteration, while a choice can be made in the procedure between fast convergence ($\emptyset=1$; this parameter will later be discussed) and slow convergence ($\emptyset<1$)). Simplified versions of the procedure, optimising separate objectives only at the national level in each iteration and adjusting the constraint set for objectives at the national or regional level, are described in Hafkamp (1983).

Since the Triple Layer Model has approximately 500 endogenous variables, it would be very inconvenient to present the results of each

simulation run for all such variables. Throughout this section, we shall express the values of objective variables as index numbers. As a base for these index numbers, a feasible solution for the model is used which is found by setting all instrument variables at a fixed, zero value. The solution which results is found in the interior of the solution set (i.e., it is not an efficient solution). This base solution is given in Table 1.

Table 1

Basic model solution obtained by fixing all policy instruments at zero values

	Var	Solution
National		
income[1]	y_N	125572
employment[2]	l_N	3244
env. qual.[3]	z_N	1033
Region 1		
income	y_1	12653
employment	l_1	298
env. qual.	z_1	1301
Region 2		
income	y_2	19433
employment	l_2	561
env. qual.	z_2	1448
Region 3		
income	y_3	28473
employment	l_3	797
env. qual.	z_3	2228
Region 4		
income	y_4	31396
employment	l_4	748
env. qual.	z_4	1687
Region 5		
income	y_5	33615
employment	l_5	837
env. qual.	z_5	3633

1) millions of Dutch guilders in prices of 1973
2) millions of man years in firms
3) thousands of tons of 'composite pollutants'

In order to demonstrate the interactive compromise procedure we will now discuss it step by step - using figure 1 as a guideline - for several consecutive iterations.

1. Start

The problem is prepared for multiobjective optimisation using a computed optimisation package. In this case the APEX optimisation package (by CDC) was used.

The selection of unsatisfactory values of objectives is to be done by the decision makers themselves. For example, they may follow a negotiation procedure if they are regional planners. If they are inhabitants of the regional system, they may use a voting procedure, or any intermediate between negotiating and voting. For the sake of presentation, we will assume some possible outcome of a negotiating or voting procedure to be given.

The interactive compromise procedure thus carried out only provides a tentative scenario for a simulation experiment in multiobjective decision making. The convergence speed parameter is fixed at a value of $\emptyset = 0.50$.

Iteration I

2. Calculate payoff matrix

The payoff matrix is found by optimising consecutively all 15 objectives. Every single optimisation of these objectives leads to one column of the payoff matrix, which is shown in Table 2.

3. Generate tentative compromise solution

In order to generate the tentative compromise solution, it is necessary to identify in the payoff matrix the maximum and minimum value for each objective. This leads to the first and second column of Table 3. The compromise solution is now found by minimising a standardised distance function which measures the distance between feasible solutions and the ideal, but infeasible maximum solution which is given in the first column of table 3.

$$\min d = \left| \frac{127 - y_1}{127 - 95} \right| + \left| \frac{116 - l_1}{116 - 110} \right| + \left| \frac{117 - z_1}{117 - 81} \right| \quad \cdots \left| \frac{127 - y_5}{127 - 94} \right| + \left| \frac{117 - l_5}{117 - 110} \right| + \left| \frac{120 - z_5}{120 - 71} \right| \tag{10}$$

Table 2

Payoff matrix of iteration 1. Separate optimisation of objectives: income, employment and environmental quality at a regional level

		max y_1	max l_1	max z_1	max y_2	max l_2	max z_2	max y_3	max l_3	max z_3	max y_4	max l_4	max z_4	max y_5	max l_5	max z_5
Region 1																
income	y_1	127	116	95	118	116	118	112	118	120	116	116	120	104	116	119
employm.	l_1	115	116	114	116	116	112	114	116	111	115	116	110	110	116	110
env.qu.	z_1	84	81	117	96	81	98	83	81	96	96	81	98	82	81	98
Region 2																
income	y_2	128	131	132	133	131	99	127	132	131	126	131	130	111	132	133
employm.	l_2	115	115	114	115	116	112	114	115	111	115	115	110	109	115	110
env.qu.	z_2	86	74	83	80	74	113	73	74	83	90	74	83	81	74	83
Region 3																
income	y_3	117	120	117	117	120	118	122	119	91	116	120	115	103	120	118
employm.	l_3	116	116	115	116	116	113	115	117	112	116	116	111	110	116	110
env.qu.	z_3	88	78	88	88	78	88	72	78	116	88	78	89	89	78	89
Region 4																
income	y_4	120	122	122	120	122	123	119	122	123	127	122	94	111	122	120
employm.	l_4	115	115	113	115	115	112	114	115	110	115	115	109	109	115	109
env.qu.	z_4	88	77	85	90	77	84	77	77	85	82	77	114	89	77	91
Region 5																
income	y_5	119	118	119	120	118	119	116	118	120	120	118	120	127	118	94
employm.	l_5	116	117	115	116	117	113	115	117	112	116	117	111	110	117	110
env.qu.	z_5	111	89	109	109	89	110	86	89	107	109	89	109	71	89	120

Iteration 1		
Region	Objective to be Improved	
1	income	y_1
2	environmental quality	z_2
3	income	y_3
4	income	y_4
5	environmental quality	y_5

6. Adjust constraints set

At this point in the first iteration, the constraints set is adjusted in such a way that in the next iteration the compromise values for the objectives selected under the previous step (5) will be higher than the actual compromise values given in Table 3. The general formulation of raising lower bounds of objectives can be written:

$$x^{l,i+1} = x^{L,i} + \emptyset(x^{C,i} - x^{L,i}); \ \emptyset \in (0,1) \qquad (11)$$

where:

$x_{L,i}$ lower bound on objective x in iteration i
$x_{C,i}$ compromise value of objective x in iteration i
$\emptyset$ parameter denoting convergence speed

The convergence speed parameter is to be set at the start of the interactive procedure. A high convergence speed ($\emptyset$=1) implies that from one iteration to the next large improvements are found for objectives selected at step 5, while a final compromise may be reached in relatively few iterations, as relatively strong constraints are added in each iteration. For the present application of the procedure the convergence parameter was set at .50. Consequently, the following lower bounds for objectives were added to the constraint set:

$$y_1^{L,2} = 95 + 0+50\ (117-95) = 106\ *$$
$$z_2^{L,2} = 73 + 0.50\ (88-73) = 80.5$$
$$y_3^{L,2} = 91 + 0.50\ (115-91) = 103$$
$$y_4^{L,2} = 99 + 0.50\ (118-99) = 106$$
$$z_5^{L,2} = 71 + 0.50\ (94+71) = 82.5$$

* This calculation of lower bounds is illustrative only. Rounded off figures were used.

Minimisation of (10) leads to the compromise solution which is the third column of Table 3.

Table 3

Iteration 1. Compromise solution, ideal and least ideal solutions for regional objectives

		solutions		
		maximum	minimum	compromise
Region 1				
income	y_1	127	95	117
employment	l_1	116	110	115
env. qual.	z_1	117	81	108
Region 2				
income	y_2	113	99	131
employment	l_2	116	109	115
env. qual.	z_2	113	73	88
Region 3				
income	y_3	112	91	115
employment	l_3	117	110	116
env. qual.	z_3	116	72	95
Region 4				
income	y_4	127	94	118
employment	l_4	115	109	115
env. qual.	z_4	114	77	96
Region 5				
income	y_5	127	94	122
employment	l_5	117	110	116
env. qual.	z_5	120	71	94

A more illustrative representation of the results compromised in Table 3 is the diagram of Figure 3. Such diagrams can be more easily interpreted by decision makers. We will use them for the discussion of the other compromise solutions.

4. Compromise solution satisfactory?

As discussed in step I of this procedure, we did not have actual voting results on compromise solutions reached. Instead we assumed possible outcomes of such procedures. At this point we assumed that, NO, the compromise solution of the first iteration was not satisfactory.

5. Identify unsatisfactory values of objectives

We assumed the following regional objectives to be most urgently improved:

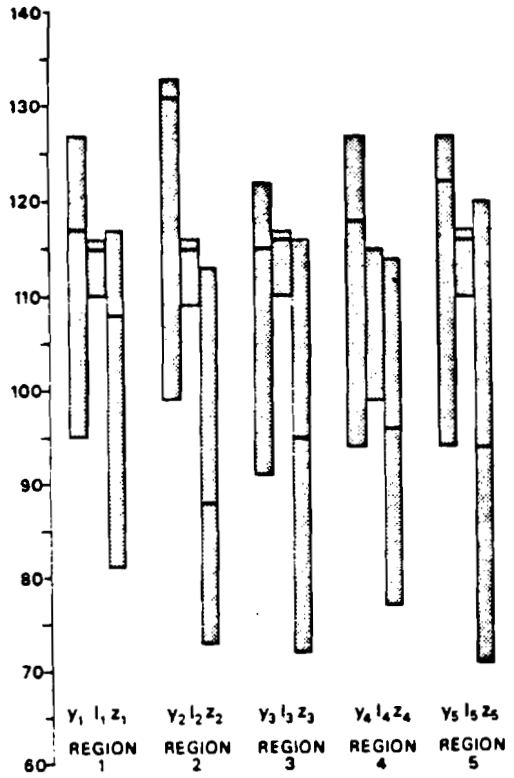

Figure 3. Compromise solution of Iteration 1, between minimum and maximum values for regional objectives

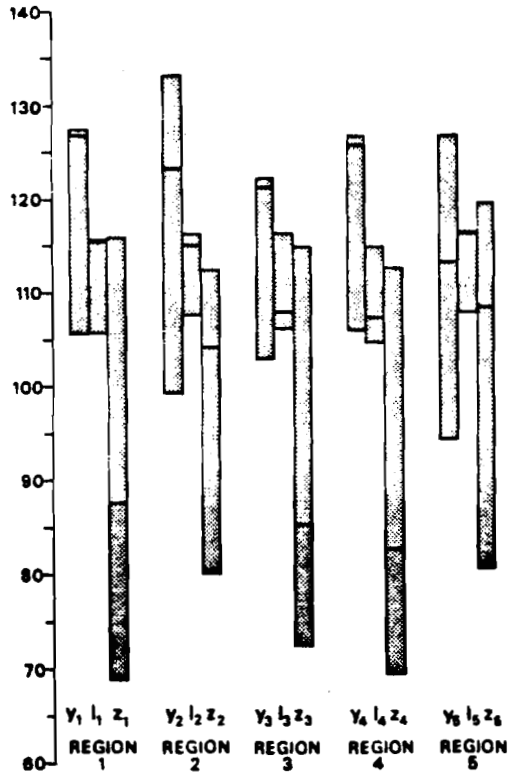

Figure 4. Compromise solution of Iteration 2, between minimum and maximum values for regional objectives

Iteration 2

2. Calculate payoff matrix

The payoff matrix is, again found by optimising consecutively all 15 objectives. The differences between this payoff matrix and the previous one are enturely due to the fact that the lower bounds derived in step 6 of the previous iteration were added to the constraints set.

3) Generate tentative compromise solution

The second compromise solution is found by minimising the standardised distance between the unfeasible ideal solution (diagonal elements of the new payoff matrix) and the adjusted constraints set. Figure 4, which is based on these outcomes, can be used to evaluate the changes which occurred due to the unsatisfactory values of objectives identifed in steps of the previous iteration.

The compromise values for regional objectives in iterations 1 and 2 give a rough approximation of the existing tradeoffs in the operational version of TLM, the most noticeable being those between regional income and environmental quality: An improvement of one percent in environmental quality of regions 1, 1, and 5, roughly leads to a 0.5 percent loss of regional income. Regional employment appears to be quite invariant under the choices made, because employment policy can be carried out independently from policies that aim for either economic growth or environmental quality (both of which have favourable impacts on employment).

The compromise solution of the first iteration caused the choice of priority in region 1 to move to regional income. As a result, the compromise solution of the second iteration shows that regional income was increased by 8.5 percent. Along with this increase of income came a sharp decrease of the environmental quality indicator by more than 18 percent. It is clear that those people who represent environmental quality, will be even more convinced of their choice for environmental quality. There may be a considerable number of people wanting an increase of regional income after the first iteration, but find their desires over-fulfilled: the increase of income is too sharp, while the decrease of environmental quality is too steep. This may result in a general tendency to support the environmental interest in the second iteration.

In region 2 a reverse tradeoff was chosen. The first iteration indicated that there was strong support for environmental quality. The actual outcome, an 18 percent improvement of the environmental quality indicator against a more than 6 percent decrease of income, may be very satisfactory to the core of the environmentalists but, to many, this may be an 'over-exchange'. In this region, the tendency may be to support the objective of regional income in the second iteration.

In regions 3 and 4, the choice for regional income resulted in a six percent improvement of income which is paid off by a decrease of environmental quality of over 10 percent. This choice situation is equivalent to that of region 1. In region 5 a situation has arisen which is comparable to that in region 2. A choice for a better environment results in a strong improvement of the environmental quality indicator by 15 percent which is accompanied by a seven percent decrease in regional income.

4. Compromise solution satisfactory?

Assume the second compromise solution is not satisfactory.

5. Identify unsatisfactory values of objection

The discussion of the compromise solution at step 3 allows us to assume the following objectives as 'most unsatisfactory' at the regional level:

Iteration 2		
Region	Objective to be improved	
1	environmental quality	z_1
2	environmental quality	z_2
3	environmental quality	z_3
4	environmental quality	z_4
5	income	y_5

6. Adjust constraints set

The constraints set is now adjusted in the same manner as in the previous iteration. New lower bounds, to be added to the constraints sets are:

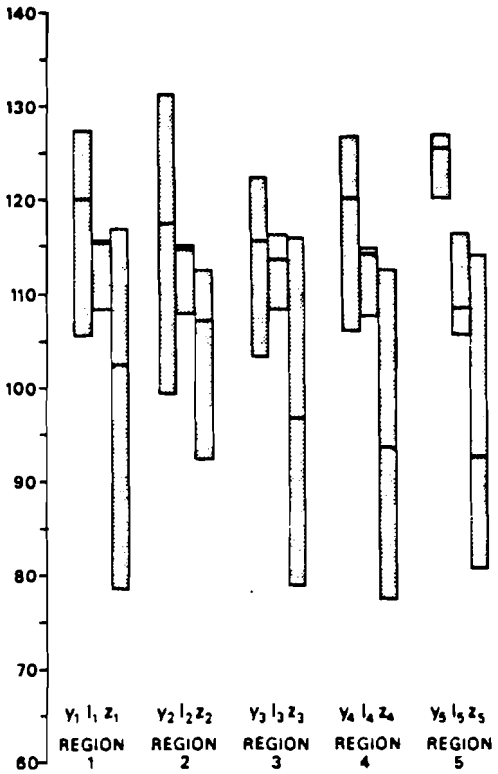

Figure 5. Compromise solution of Iteration 3, between minimum and maximum values for regional objectives

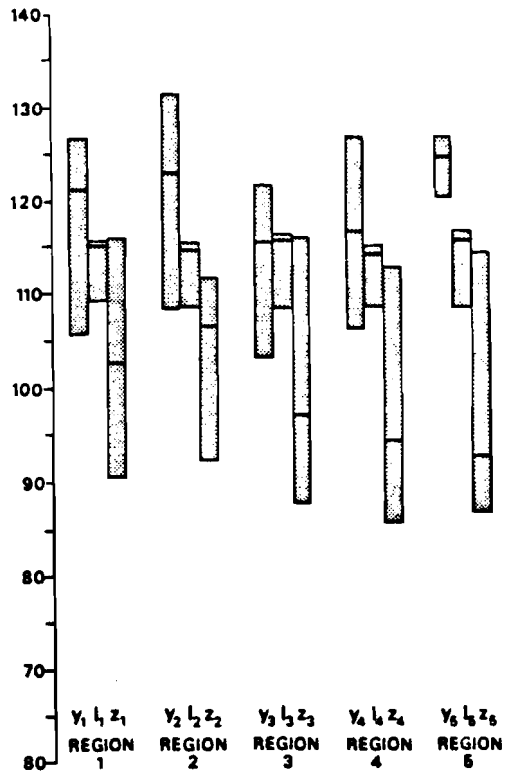

Figure 6. Compromise solutions of Iteration 4, between minimum and maximum values of regional objectives

$$z_1^{L,2} = 78$$
$$z_2^{L,2} = 92$$
$$z_3^{L,2} = 79$$
$$z_4^{L,2} = 77$$
$$z_5^{L,2} = 120$$

Iteration 3

2. Calculate payoff matrix

The payoff matrix is derived in a analogous way to that of the previous iterations, taking into account the lower bounds on objectives which were raised in step 6 of the previous iteration.

3. Generate tentative compromise solution

Generation of the third compromise colution is analogous to that in the previous iteration. The diagram of Figure 5 represents these outcomes.

4. Compromise solution satisfactory?

In order to demonstrate the procedure to its full extent we again assume that NO, the third compromise is not satisfactory.

5. Identify unsatisfactory values of objectives

We assume that environmental quality is to be raised in regions 1, 3, 4, and 5. In region 2 an improvement of income is assumed to be necessary.

6. Adjust constraints set

For the objectives selected in the previous step of this iteration, lower bounds are adjusted according to the procedure described in step 6 of the first iteration.

Iteration 4

2. Calculate payoff matrix

The fourth payoff matrix is again calculated in a straightforward way.

3. Generate tentative compromise solution

The fourth compromise solution resulting from the new payoff matrix was to draw the diagram in Figure 6. Clearly, from the third to the fourth iteration, the adjustment of the constraints set by imposing

new lower bounds on selected objectives has induced only marginal changes.

5. Compromise solution satisfactory?

Assume YES; of course, the procedure can easily be continued through a number of more iterations. However, we shall not do so.

7. Tentative compromise is final compromise

Clearly from iteration to iteration the interactive decision making procedure not only gives information to the decision makers on the actual tradeoffs between objectives (as inherent to the model), but also allows the analysts to deduce, from the choices of (groups of) individuals, the actual preferences. However, in order to arrive at an accurate assessment of these preferences, it would be necessary to carry out the procedure over a large number of iterations.

7. CONCLUDING REMARKS

The interactive multiobjective approaches to integrated economic-environmental decision making in a spatial system presented and illustrated in the previous sections, have several advantages over traditional approaches:

- They reflect the process character of complex economic-environmental policy problems; they constitute learning aids for policy makers as well as for modellers.
- They emphasise an active role of policy makers in specifying and solving choice problems, inter alia by making policy objectives and tradeoffs more explicit.
- They are able to take into account the variety and the conflicting nature of policy options or criteria without requiring a priori specification of weights.
- They provide an integrative framework for eliminating less relevant alternatives and for choosing consistent compromise solutions.

The simulation experiments of Section 6 indicate that it is possible to adapt the interactive compromise procedure to varying institutional arrangements, even to multilevel decision making procedures in which a national and regional level are distinguished.

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STRUCTURAL CHANGES IN WORLD ECONOMY: REGIONAL ISSUES AND CONSEQUENCES

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STRUCTURAL CHANGES IN WORLD ECONOMY: REGIONAL ISSUES AND CONSEQUENCES

1. Introduction

Economists, in their studies about world-wide economic situation generally agree that one of the main points of gravity are investigations on atructural changes - their necessity and consequences. The overall structure of an economy determines the way it develops. That is why emphasis is laid upon structural change in order to find an appropriate one.

In this paper we describe the mechanisms of structural changes which were found by structural analysis on a wide basis of empirical data. By structural changes we understand the changes in the structure of branches and technology in developing as well as industrially developed countries and, in connection with this, changes in the international division of labour. The principle item of the issue consists of measurement models for different measures of the qualification of labour in both, the home economy and the international trade. These measurements are based on empirical calculations of the marginal productivity of labour of different categories. The following is a short introduction to the way these calculations have been carried out and also to the results obtained.

2. Formal Prior Condition

2.1 Remarks Concerning the Method

Our inquiries are based on a wide field of empirical data which include not only conventional economical variables, but also relevant data exceeding the frame of economical variables in its narrower sense. One major effort at STUDIA as far as mathematical and formal studies are concerned can be explained with what the Frankfurt School of Statistics (Flaskemper) called 'adequation'. This term refers to the quantification of theoretical variables by the use of the available statistical data. For this one has to develop a sophisticated model suiting the theoretical terms of economical science like the one that led to the quantification of labour as introduced further. A second endeavour consists of

the further development of multivariate analysis as will be explained on examples of main-plain analysis and cluster inversion. Measurement models and the new application of multivariate analysis help to structure the empirical data in a way which enables to deduct heuristic hypotheses for the development of theories. These theories can then be formalized in the conventional way.

Our efforts for structuring data in a formal mathematical and theoretical frame is higher than that of other approaches, whereas modesty is persued as far as high sophisticated formalizations of theories, that are not sufficiently verified in an empirical way, are concerned. The high formal and mathematical investment within the empirical foundation of theories is worthwhile in so far, as prognoses which were based on it later proved valid as will be shown in the following.

2.2 The Marginal Productivity

'Marginal Productivity' is a term often used in economic theory. The Study Group for International Analysis has widely applied this term in an empirical way and has obtained a new understanding of the mechanisms of structural changes[1].

The starting point is a General Production function where beside capital and labour an indicator reflecting the educational attainment[2] is also taken into consideration:

$$Y = p\, L^{\alpha}\, C^{\beta}\, e^{kB/L} \qquad (1)$$

where

Y ... value added

p ... efficiency parameter

L ... number of employees

C ... capital stock

B ... educational attainment indicator

$\alpha, \beta, k,$ are the parameters and $b = B/L$

1) 'Future Structural Changes in Austrian Industry', STUDIA-report to UNIDO, 1979.

2) Education is distinguished from other production factors by being introduced in an exponential function. Exaggeration of the marginal productivity of capital is avoided by the application of the production factor education. For more see: 'Materielle und Immaterielle Faktoren der Entwicklung - Ansätze zu einer allgemeinen Produktionsfunktion', Zeitschrift für Nationalökonomie, 31, p.81-120, 1971.

The partial derivation of equation (1) with respect to the factor labour (L) gives:

$$\frac{\partial Y}{\partial L} = \frac{Y}{L} (\alpha - kb) = y (\alpha - kb) \qquad (2)$$

The partial derivation with respect to the factor education gives:

$$\frac{\partial Y}{\partial B} = \frac{Y}{L} \cdot k = yk \qquad (3)$$

Assuming $\frac{B}{L}$ = constant, i.e. $\frac{\partial B}{\partial L} = 0$ we again have

$$\frac{\partial Y}{\partial L(B)} = \frac{Y}{L} \cdot \alpha = y\alpha \qquad (4)$$

We can interpret the mathematical terms as follows:

$\frac{\partial Y}{\partial L}$ - marginal productivity of labour without the consideration of education (related to 'skill')

$\frac{\partial Y}{\partial B}$ - marginal productivity of education (related to 'social information processing')

$\frac{\partial Y}{\partial L(B)}$ - 'total marginal productivity of labour' which also depends on the education (related to the 'quality of labour')

The concept of marginal productivities with all its mathematical background can be used for each industrial sector by estimating sectoral production functions[3]. If marginal productivity of labour in one sector is higher than that of another sector, then we can say that each extra employee brings more value added in the first sector when compared to the second sector. In this sence one can define marginal productivities in different sectors of industry as the qualification of labour in respective sector.

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[3] Millendorfer, J. and Ch. Gaspari: 'Consideration on Sectoral Growth in the Manufacturing Industry', UNIDO-paper, ID-WG. 160/10, 1973.

2.3 Qualification Indices of Domestic Industry and Foreign Trade

Basing on this we can construct two different qualification indices:

i) the average qualification of labour index (Q_1) for a country or a region calculated according to the formula:

$$Q_1 = \frac{1}{L} \sum_{i=1}^{n} w_i L_i \qquad (5)$$

where:

L_i is the number of employee in the sector i and L is the total number of employee in all sectors of the industry.

w_i is the weight of sector i reflecting the marginal productivity of labour of that sector.

n is the number of sectors.

ii) the qualification — balance of foreign trade index (Q_2) relating to the performance of a country in international trade[4]:

$$Q_2 = \frac{\sum_{i=1}^{n} w_i p_i}{\sum_{i=1}^{n} w_i q_i} : \frac{\sum_{i=1}^{n} p_i}{\sum_{i=1}^{n} q_i} \qquad (6)$$

where:

p_i and q_i are the value of exports and imports respectively for the sectors i

w_i is the weight of sector i reflecting the marginal productivity of labour of that sector.

n is the number of sectors.

High values of Q_1 and Q_2 indicate high qualification of labour in industry as well as better position in international market. Q_1 increases with the increase of value added in highly qualified sectors while Q_2 increases with relative increase of export of highly qualified goods over import of these goods.

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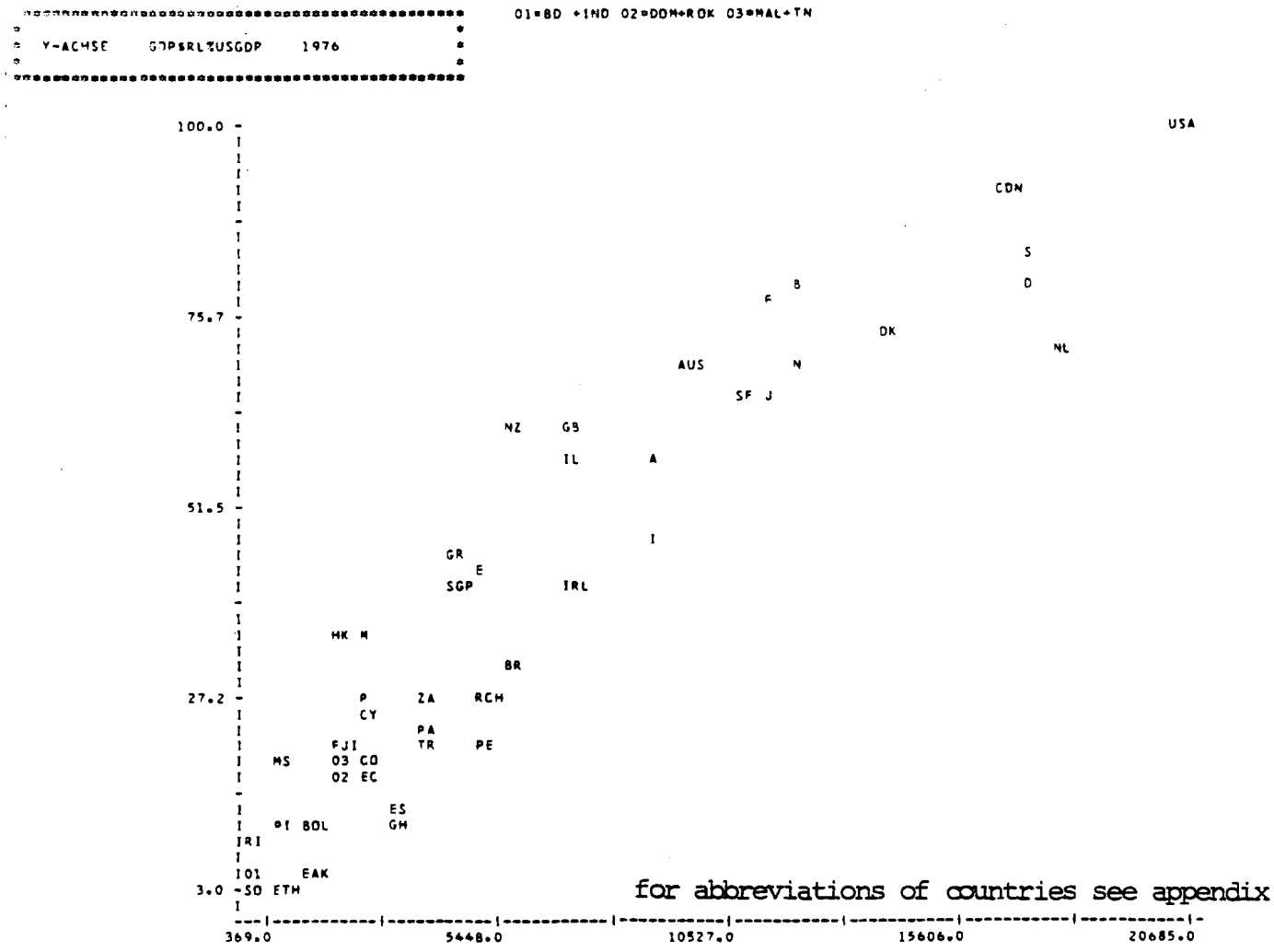
4) for details see Stüve, M.: 'The Qualification of the Balance of Trade', STUDIA Working Paper Nr. 4/1984.

The values of Q_1 and Q_2 have been calculated for all countries according to the three categories: total labour, labour of the higher educated and labour without higher education. These qualifications have been used for a world wide comparison of countries together with other variables. Furthermore a regional study of Austria has been accomplished applying the average qualification of labour of the different federal states calculated by the marginal productivities[5].

3. Results of Investigations with Qualification of Labour Index

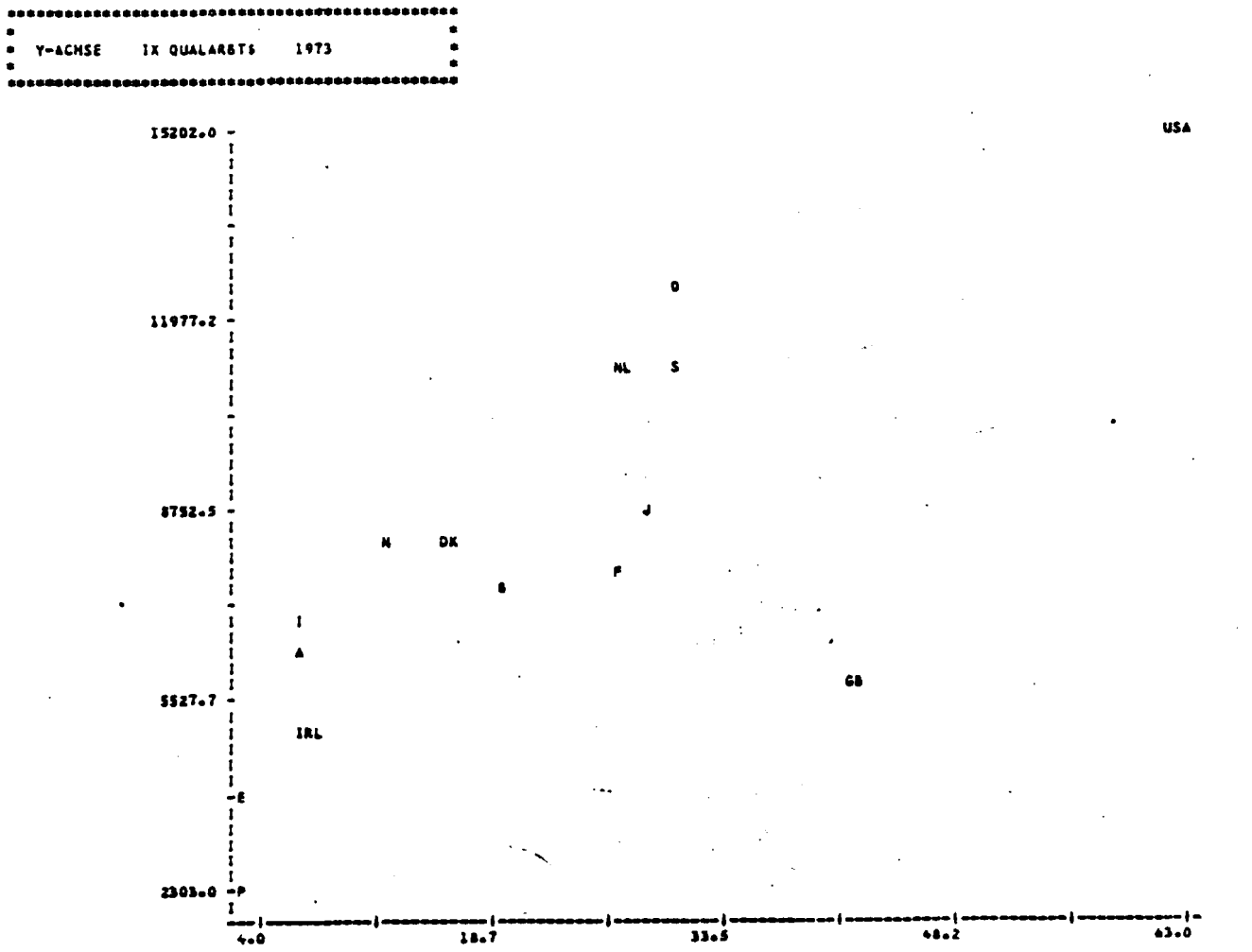
In a world wide comparison of countries we found, as expected, a distinct correlation between average qualification of labour and GDP per capita (see diagram 1).



Diagr.1: Qualification of labour index against real GDP per capita

[5] Millendorfer, J.: 'Kranke Riesen - Gesunde Zwerge?'. STUDIA, Laxenburg, 1983.

We can also note a strong correlation between the qualification index and expenditures on research with a time lag of several years (diagram 2). This proves empirically the well known theory of production cycle, according to which - to express it in our terms - a high qualification of labour relates itself to the early period in the production cycle, whereas a low qualification is connected with the later period of this cycle reflecting the stage of routine technology.

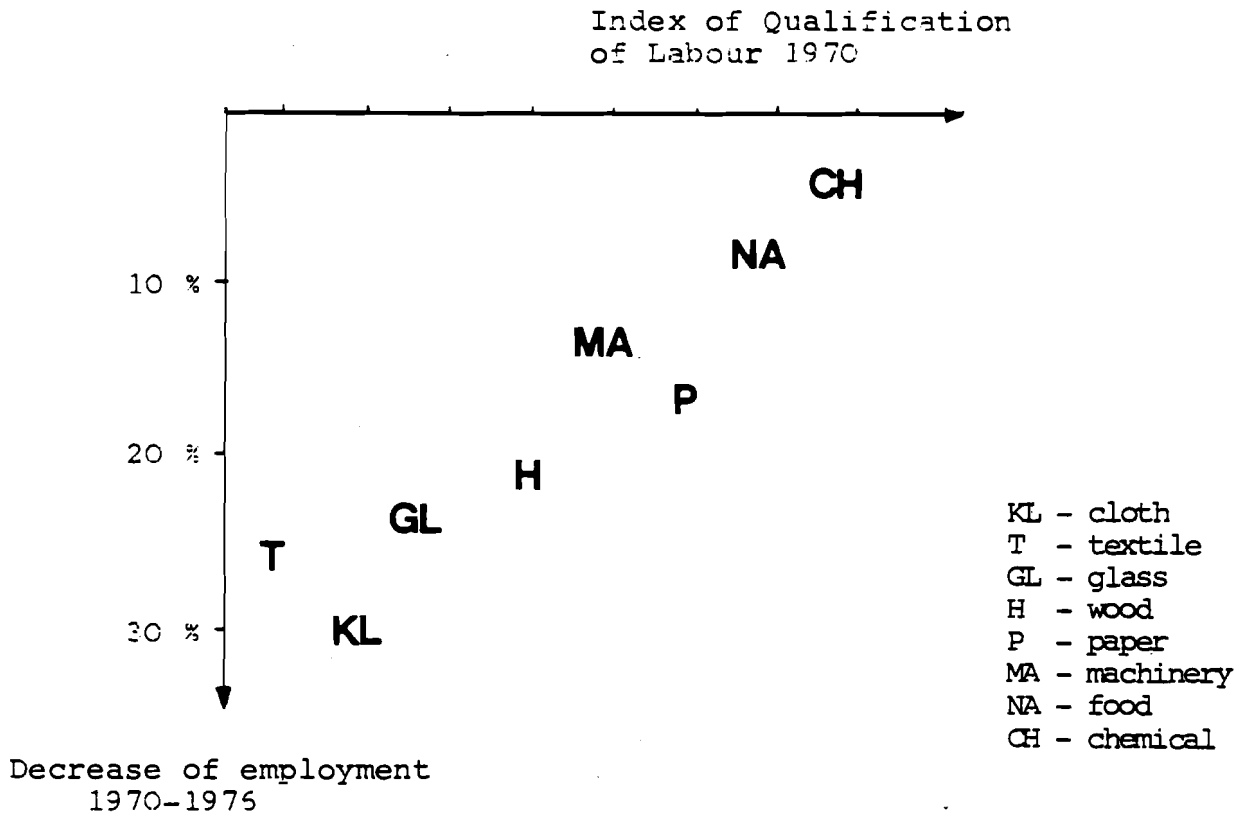


Diag.2: Per capita expenditure on research against qualification of labour

There is one exception in the diagram 2, which is Great Britain. Applying historical data one can explain, why research expenses by themselves are not sufficient to describe the innovation development: Great Britain has been successful in the 19th century on the basis of the technology of that time, which depended on steam power, coal and gas. Being tied up to the successes of the past they adapted the new technology of electricity only in a moderate way. The extend, to which they changed in 1929 towards the new technology, defined - as

it did in other countries, too - the technical development of the next decades. The delay in undertaking necessary structural change due to impression of the successes in the past have compelled England, to be far away from the leading economic position, although it has the greatest research expenses in Europe. The reason of worse performance during last decade of mining countries can be a very similar one. Their dependancy and faith in mineral resources was a constraint to adapt necessary structural changes. To sum up one can say, that the qualification of labour is dependend on the position in the production cycle, which itself is defined not only by the research efforts, but also by the historical development of technology.

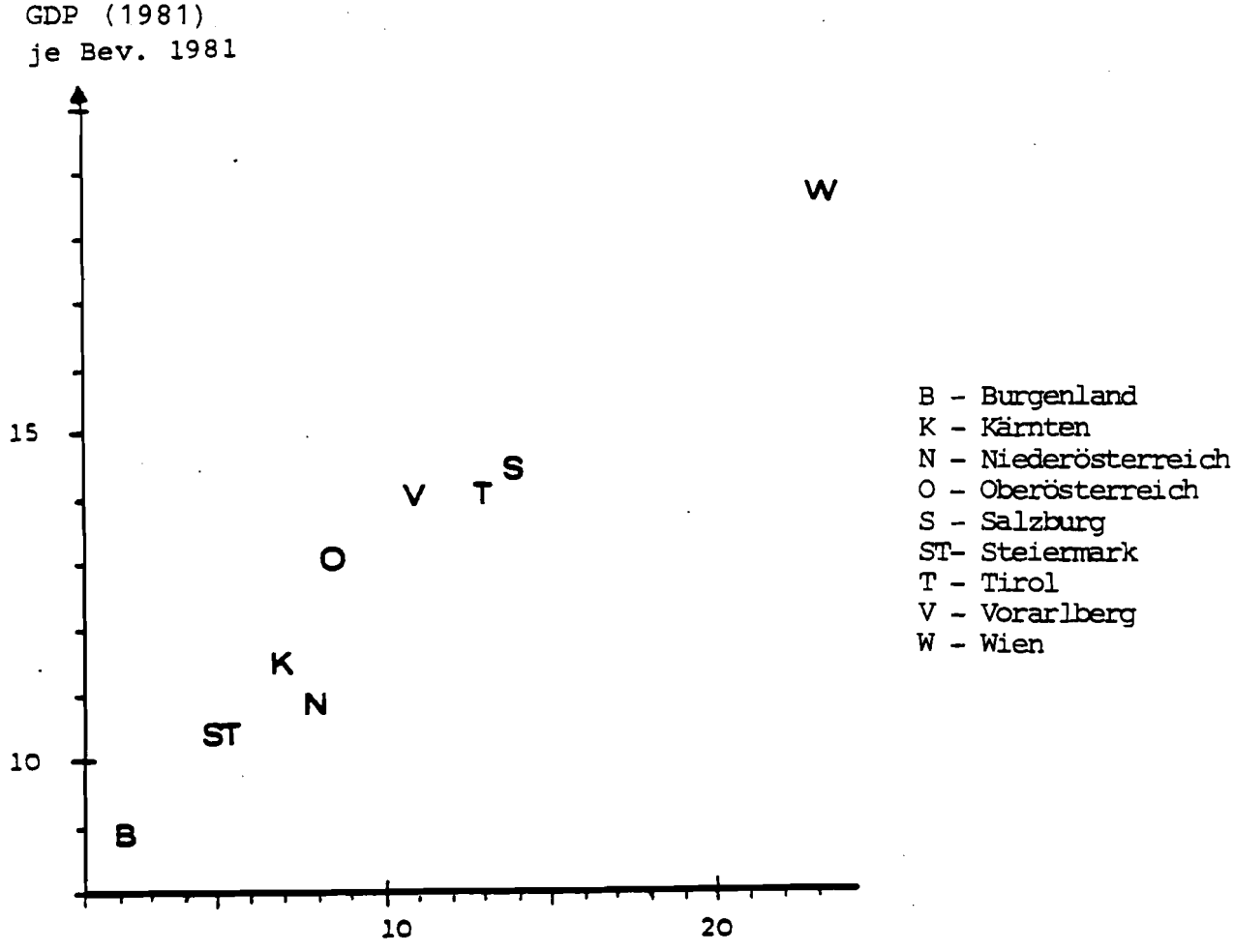
From the studies we have already carried out it follows that the structure of sectors of industrial countries changes in the way that sectors with low qualification of labour are excluded. Employment rate and production in different sectors decreases according to the decreasing value of the qualification index. A prognosis about development of swiss manufacturing sectors made by STUDIA based on this theoretical framework was fully verified. This is illustrated in the diagram 3.



Diag.3: The abscissa is the forecasts of development of employment for Swiss industry basing on qualification of labour and published in 'Konturen einer zukünftigen Industrieförderung! Wirtschaftsberichte Nr. 6/1975, pp.5-13, while the ordinate is the actual development of employment as shown in Schweizerische Bankgesellschaft published 1977 in: Wirtschaftsnotizen, July 1977.

This result leads to an understanding of the fact, that since the midseventies capital intensity, though formerly a successful approach, is no more a sufficient strategy for competition in industrialized countries. And it is qualification of labour which accrue in importance and significance for competetive strength and thus has become decisive criterion of structural change.

The arguments based on the marginal productivity of total labour become even more valid, if we apply the marginal productivity of higher education. In a regional study of Austria we calculated the average qualification of labour in different regions. This was done for all three type of qualification of measures mentioned above. This comparison of the federal countries of Austria showed - apart from expected results like the close connection of marginal productivity and wages in industry - one unexpected result: The GDP per capita of federal states, most strongly correlates with the marginal productivity of social information processing (see diagram 4).



Diag.4: Qualification of labour of social information processing against gross domestic product of Austrian federal countries.

The information-intensive labour before and after the actual act of production serves as a process of communication and learning both within the firms and in the external environment of firms. The result can be understood in that way, that these external processes of communication and learning have a positive effect on the whole region. The external communication of social information processing thus becomes decisive for the regional development due to a social process of learning, whereas a high qualification of skill, though connected with a high average industrial productivity, does not seem to contribute so strongly to the development of a region.

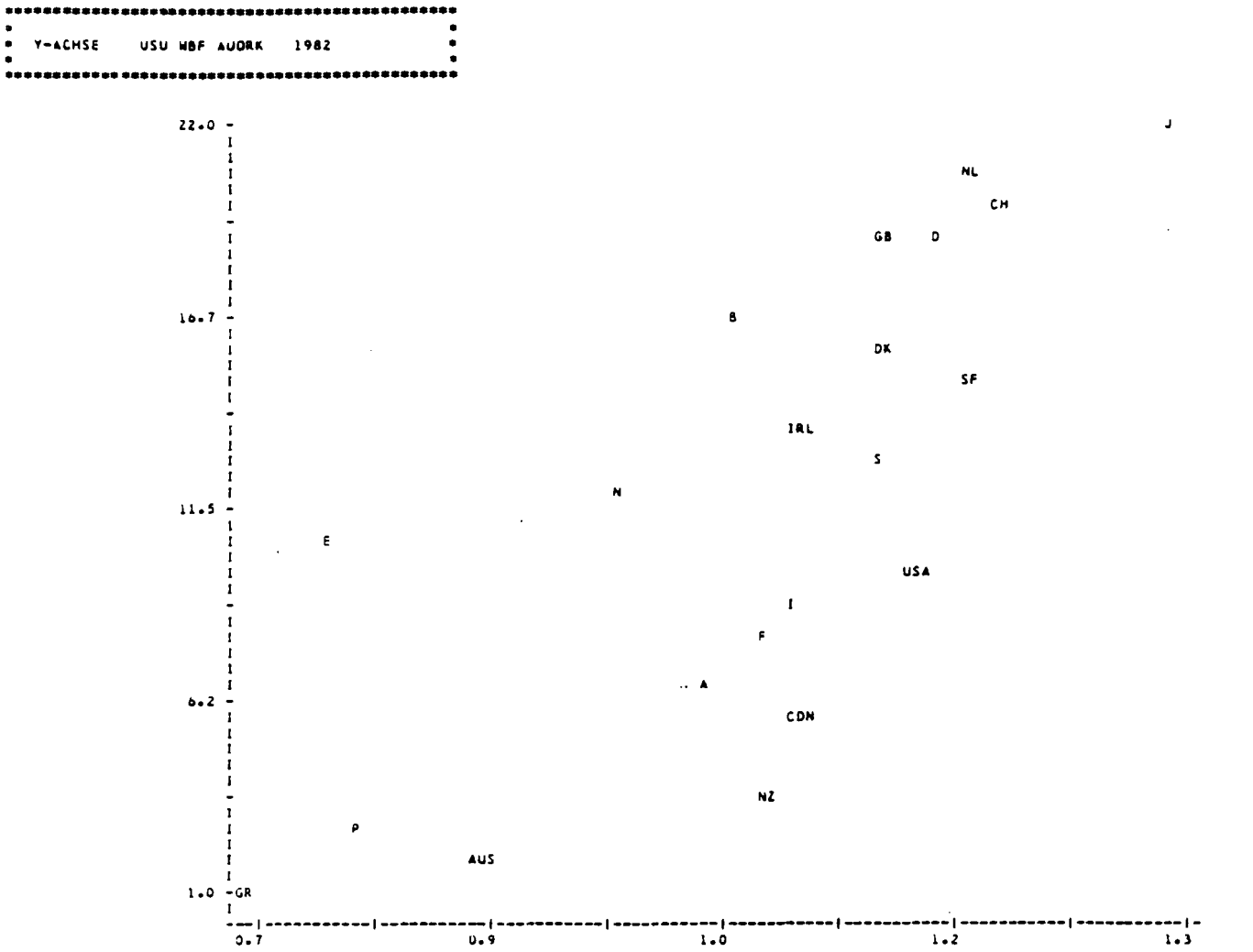
This leads to consequences as far as developmental strategies are concerned. If for example multinational firms establish factories with high technologies and high wages in a developing country, this will according to our results have no significant positive effects on the development of a region - apart from the common effects in the field of demand -, as long as social information processing stays outside the reach of the society in an isolation from sorroundings in the host country.

A cross-section comparison of all countries since the seventies shows that in 1973 developing countries possessed a lower qualification of labour than industrial countries, though the best developed developing countries and the least developed industrial countries somewhat mergeinto each other.

For 1979 however due to lack of data for some threshold countries, at present, it can not be confirmed if there is an increasing gap which divides industrial and developing countries as far as qualification of labour is concerned: The international division of labour however more and more causes industrial countries to specialize in technologies with high qualified labour, whereas developing countries specialize in technologies with lower qualification of labour. Both, the hypotheses of convergence and divergence become confirmed in a certain way, since developing countries accelerate their process of industrialization (convergence), though they have to specialize in technologies with a low qualification of labour, by which the gap between them and the industrial countries may increase (divergence). This gap is not so much determined by the diverging level of the technological niveau within a sector, but by the structure of sectors.

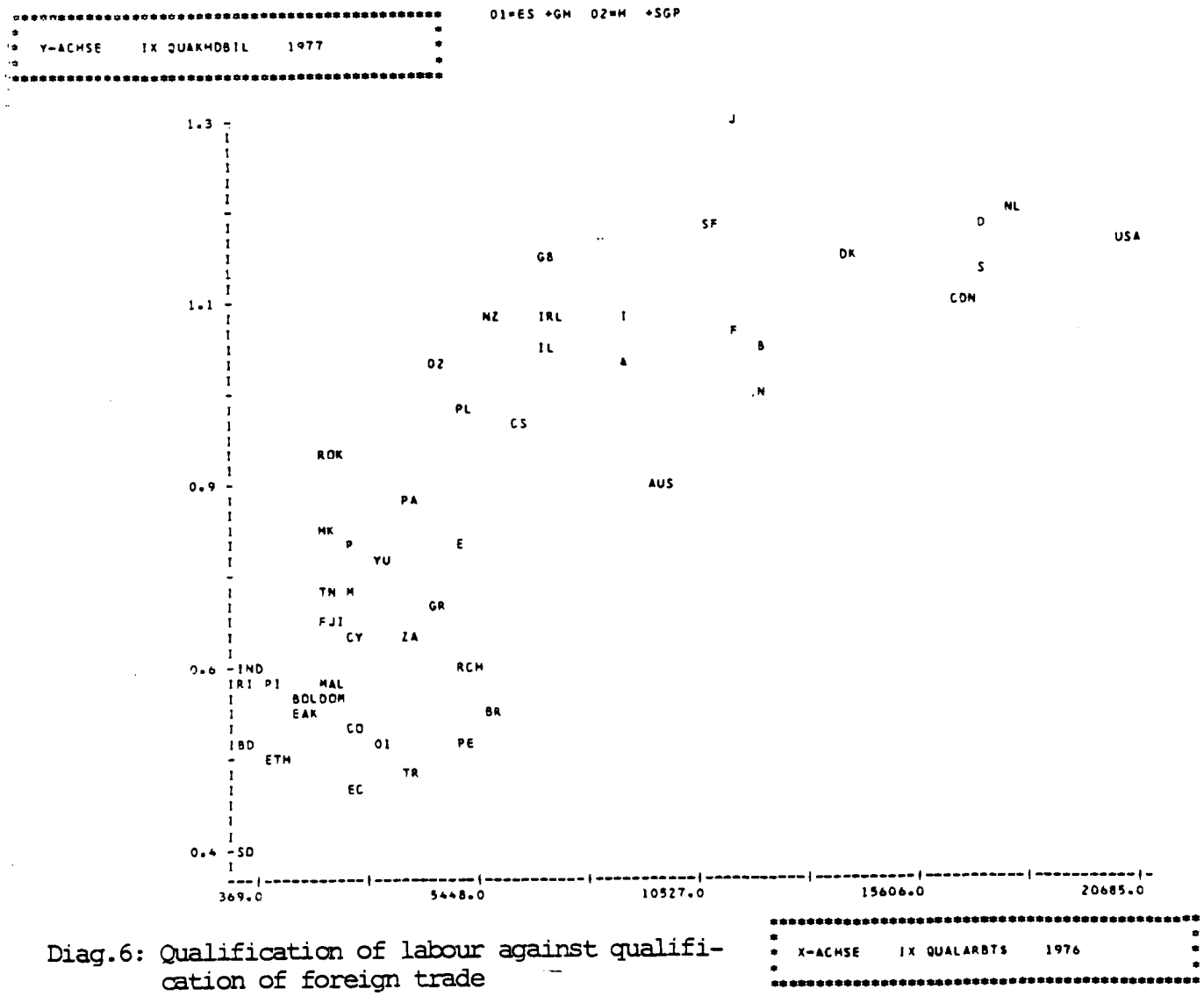
4. Results of Investigations with Qualification — Balance of Foreign Trade

The explanatory value of this measure is very high. This measure logically correlates well with terms of trade of respective countries. But possibilities of its application is much more than that of terms of trade. Qualification — Balance is connected with qualities that promise to be successful in long run. It is thus positively correlated with such variables as foreign orientation (diagram 5) and innovation (Internationale Wirtschaft, January 1983) as well as investment ratio, insurance data etc. It seems meaningful to concentrate on the following diagrams.



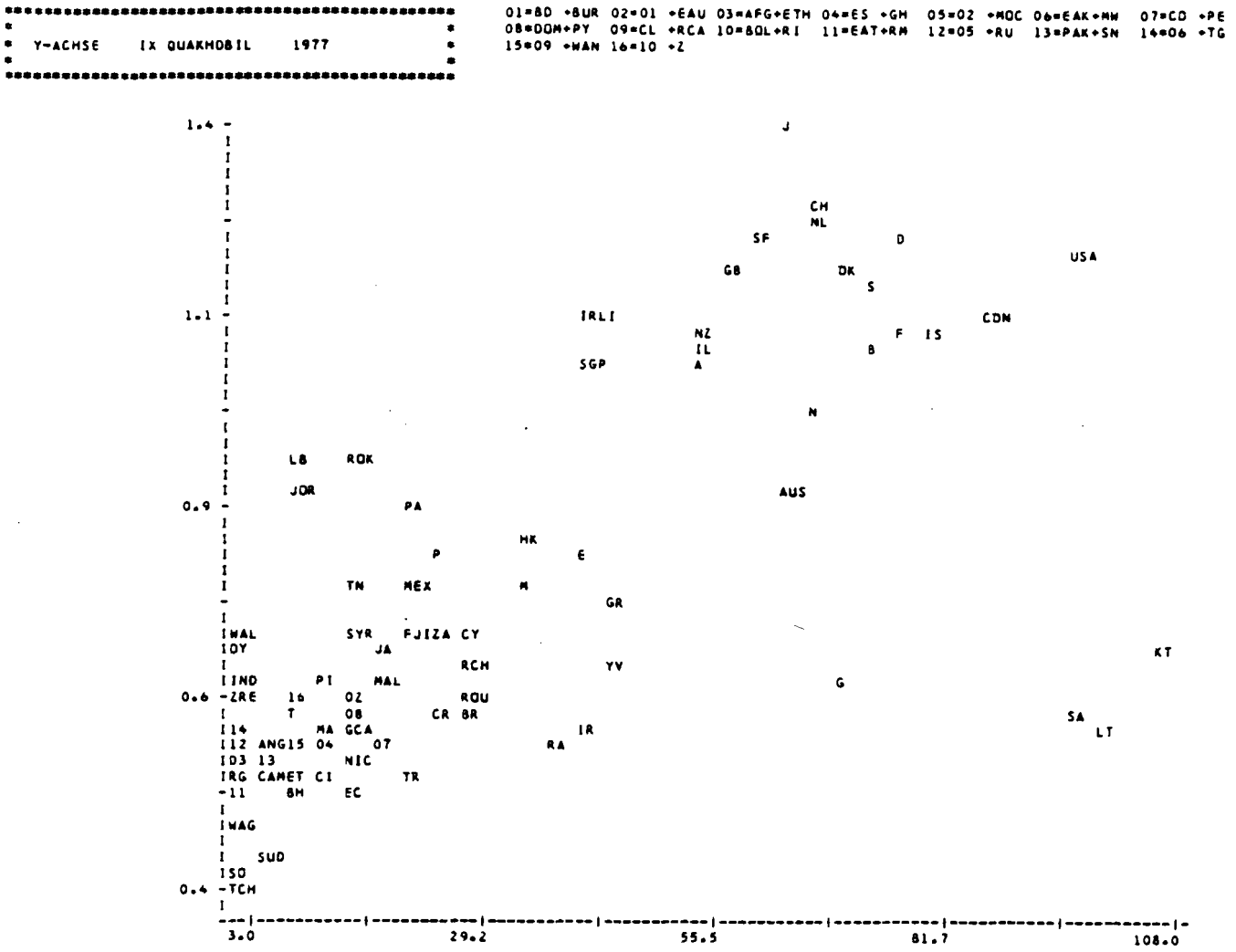
Diag.5: Qualification — balance of foreign trade against foreign orientation

Diagram between both of these qualification measures (labour and foreign trade) shows (diagram 6) quite distinctly the bottle neck for the developing countries.



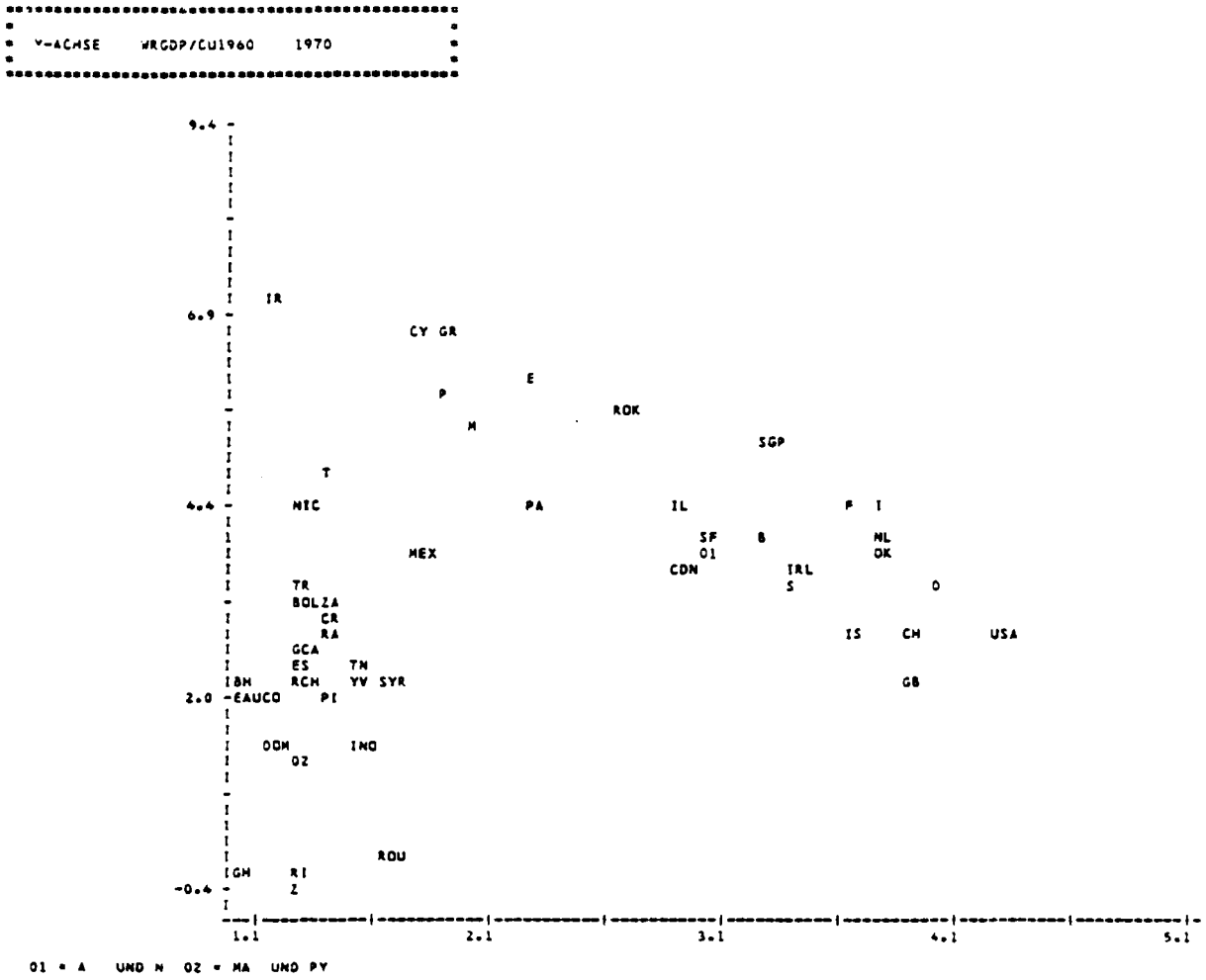
Diag.6: Qualification of labour against qualification of foreign trade

It is their lower position in international division of labour that ultimately hampers development process and even be responsible for any gap between the industrialized and developing countries (see diagramm 7).



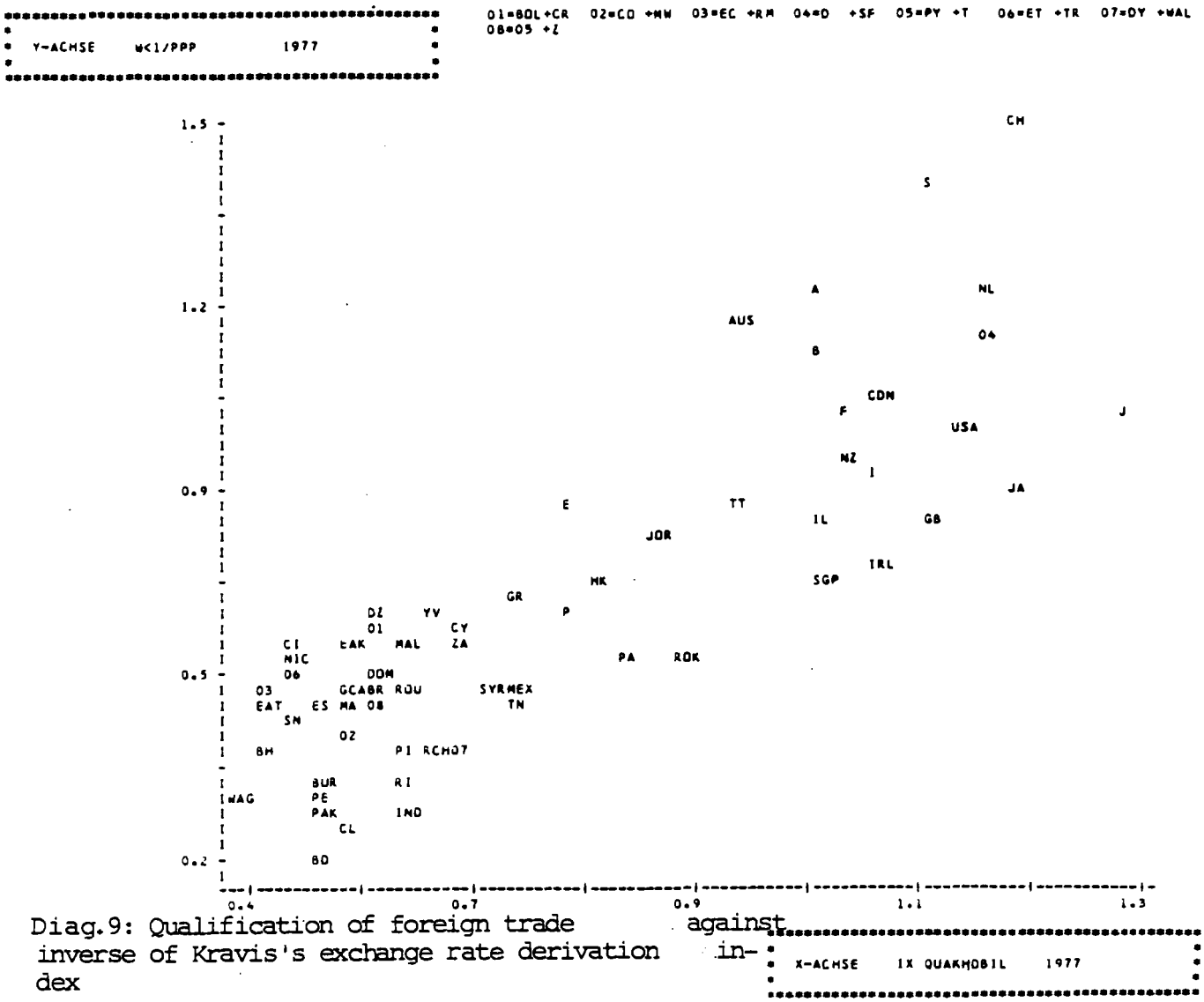
Diag.7: Real per capita GDP against qualification of foreign trade

As far as international division of labour is concerned a special form of the qualification-balance of foreign trade is highly interesting: measurements obtained with the marginal productivity of social information processing. One can understand these measurements to be indicators of the so-called 'brain export'. Comparing these measurements with growth rates, they show a remarkable pattern indicating that the industrial countries with low growth rates more and more incline to 'brain exports', whereas developing countries occupy a low position as expected. This can be read from diagram 8.



Diag.8: Qualification of foreign trade based on social information processing against growth rate of per capita GDP

The observation of the qualification-balance of foreign trade having a strong correlation with the purchasing power parities, calculated originally by Kravis under a project of the world-Bank and also by OECD is of basic theoretical interest (compare diagram 9).



Diag.9: Qualification of foreign trade against inverse of Kravis's exchange rate derivation index

After we had obtained such a high correlation in just this special context, it could even be improved by adding further variables, which correspond with the conventional theory of exchange rates: capital flow, additional income by rents in oil exports, development aid and others. The R^2 of a multiple regression with a sample of 70 countries equals 0.94. The variable with the highest explanatory power is the qualification-balance of foreign trade. If we omit the monetary variables and just examine the context given by the qualification of trade and purchasing power parities, we can for the present and before starting to examine the theoretical monetary context on the whole, estimate the practical importance of the new observation.

If the balance of payments is in equilibrium one can deduce, that ceteris paribus a country has to provide more efforts in regard to its exports comparing to imports, the less qualified its labour is[6]. Naturally the unequal relation of working time contained in exports and imports given with an equilibrium of the balance of payments signifies disadvantages for developing countries, which easily come through in a deficit of the balance of payments or a shortage of imported goods, which can lead also to obstructions in production processes, if imported goods are preconditions for the industrial production. Trials to overcome these difficulties by establishing a more efficient and higher qualified exporting industry however can lead to a new dilemma, that of a 'dualistic' economy. Economies structured in that way bring into opposition exporting sectors relatively well equipped and highly developed to the rest of the economy which is poorly equipped and low developed, the home population remaining undersupplied with the most necessary goods. According to the recent state of knowledge these difficulties may be overcome only by an equilibrium of extensive growth (by increased input of factors), intensive growth (by increased efficiency of the factor input) and monetary growth which is based on improving exchange relations and follows the mechanisms outlined in this paper. The first two components can be obtained and examined by the general production function[7]. The monetary component has just been described. Concepts of how to overcome the difficulties mentioned above will not immediately result from the new perceptions. These however will hopefully contribute to the improvement of the fundaments that will support a development of new concepts.

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6) This problem has so far not been treated in cross-sections, but in the temporal development, i.e. with respect to the change of exchange relations called the terms of trade. Difficulties are rendered by strong short-term oscillations of prices, which impede the empirical and therefore also the theoretical inquiry into long-term mechanisms of the process of exchange. In the discussion dealing with terms of trade the argument of 'exploitation' occasionally is brought up, which Galtung tried to bring into action by help of an index of exploitation. Its set up is too simple (ratio of exported raw materials together with agricultural products and imported processed goods) and doesn't lead to applicable results (Canada for example belongs to the group of 'exploited' countries).

7) see footnote 2. We just concluded a new estimation of the general production function as well as a calculation of the extensive and intensive growth for all countries. The parameters of the general production function thereby stay, generally speaking, the same as in the estimation 14 years ago. The efficiency zones, as expected, show little changes. The extensive and intensive growth rates are determinated in a different way. The latter are strongly connected with 'soft variables', (a publication concerning this topic is being prepared).

5. Current Studies

5.1 General Remarks

The current study is applied to a combination of conventional economic variables and so-called 'soft variables', which describe values, patterns of behaviour and organizational forms, in order to find determinants of the structural change. Examples for soft variables are the motivation indices of David McClelland and Geert Hofstede. They in particular show clearly and understandably connections with economic variables, but so do also the indicators of price distortions and state influence which are published by The World Bank. It is not without interest, that even today a developing country's former belonging to a special colonial power is of quantitative economic significance[8]. Furthermore differences of developmental mechanisms between home economies and foreign trade for the wider regions, like Latin America, South-East Asia and the arabic Orient, can be analysed. The essential points of these inquiries are the empiric perception of the laws of structural change with the help of sophisticated measurement models and the establishment of theories only on the basis of the complex mechanisms obtained in this empirical way. This way it is guaranteed that the measurement models of these inquiries and the mathematical models for formal presentation have a close and valid connection with reality. The relation to the empirical reality is furthermore secured by continuous discussions of the current results with experts in practice. (In our case, with Austrian trade delegates).

The following introduces some present results of these inquiries. Apart from the measurement models mentioned above new methods of multivariate analysis have been applied, first and foremost the mainplane analysis and the cluster inversion. These methods structure the abundance of empirical data in a way, which makes possible theoretical interpretations. Since other disciplines like the empirical research in medicine and biology are following similar tasks, it is not surprising, that in those fields similar methods have been developed by authors, we are in communication with.

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8) A paper concerning this matter is now being prepared by Ch. Horrix of the STUDIA.

5.2 Main-Plane-Analysis

In a quite new field where there is no mature theory, we have to be careful in deriving hypothesis from empirical data. The best way to cope with this difficulty is a redundancy in a wealth of empirical observations. Here a difficult question arises: How to handle the mass of data? STUDIA developed a new formal method of multivariate analysis, the Main-Plane-Analysis, which facilitates the theory-building on a large empirical data base[9]. The results of M-P-Analysis plotted graphically show clearer the relationships between hard and soft variables. Long arrows represent variables which are explained with a high correlation by the eigenvectors of the plane. If two long vectors are parallel then they are correlated. Three long non parallel vectors are in a multiregressional relationship. Short vectors have bigger residuals to be explained by variables usually not in the plane. Knowing this formal relationships it is possible to derive from the main-plane heuristic hypothesis with a high probability not to be falsified in detailed investigations. On this basis interesting mechanisms between soft and hard variables were found.

There are different main-planes which are related to certain issues: One main plane is related to the issue policy and social psychology, another to the issue of economy and institutional structures etc. The investigation of the relationship between the main planes needs special studies on the basis of canonical correlations. These studies show the interrelations of the different issues[10].

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9) M-P-Analysis can be described from two approaches, factor analysis and Cholesky-factorization. Factor analysis and M-P-Analysis are looking for (n-k) dimensional spaces in the n-space. M-P-Analysis limits the dimension (n-k) to 2 or 3 and is looking for different 2-or 3-dimensional spaces. Each space respectively main-plane explains a subgroup of the whole sample of variables. This subgroups and the interrelations of samples in it can be understood as issues, it means as subproblems. Cholesky-factorization transforms the correlation matrix to find sub-matrices along the diagonal of a matrix, while M-P-Analysis does not transform the whole correlation matrix but calculates the eigen values of subgroups of interdependent variables. Advantages of M-P-Analysis: The results plotted graphically stimulate theory-building; a very flexible step-by-step approach in a dialogue with the computer; well defined levels of significance.

10) For details see W. Baaske: 'Main Plane Analysis - Simple Structures in a Wealth of Variables', in: J. Millendorfer: 'Kranke Riesen-Gesunde Zwerge?', STUDIA, Laxenburg, 1983.

5.3 Cluster Inversion

The essential point of main plane analysis as opposed to factor analysis and the biplot method[11] is, that it systematically selects groups of variables according to the criterion of a maximum of linear dependency. A second method that STUDIA has developed is also based on a systematic selection of variable: the so-called cluster inversion.

The cluster analysis known so far, to describe it in a simple way, divides a sample, with respect to some set of variables, into subgroups such that subgroups are homogeneous within but different among themselves. means the task is to find homogeneous subgroups basing on given set of variables.

Cluster inversion reverses this approach and it starts from given subgroups of a sample, and look for variables which in consequence lead to these subgroups. This method is currently applied by STUDIA to examine structural changes, e.g. to define characteristic difference between regional groups like Latin America, countries in North Africa and South East Asia. One can apply variables obtained by cluster inversion also to a mainplain analysis. The result of such a combination of cluster inversion and main plane analysis is illustrated by diagram 10.

Diagram 10 illustrates main plane of variables that classify, respectively discriminate the region of Latin America, the countries of the Middle East and North Africa. The variables are partly of democraphic nature like birth-rates, death-rates, male-female ratios, urbanisation etc. Others are monetary variables like e.g. money circulation per GDP, money supply per currency reserves etc. Still others consists of conventional economical variables like growth rate of trade as percentage of GDP, ratio of private and govt. consumption and others. With the help of mainplain analysis we currently examine which variables, relevant for the structural changes, lie in this mainplain. By this the differences of driving and retarding forces for structural changes in Latin America and in countries of the Middle East in North Africa can be investigated.

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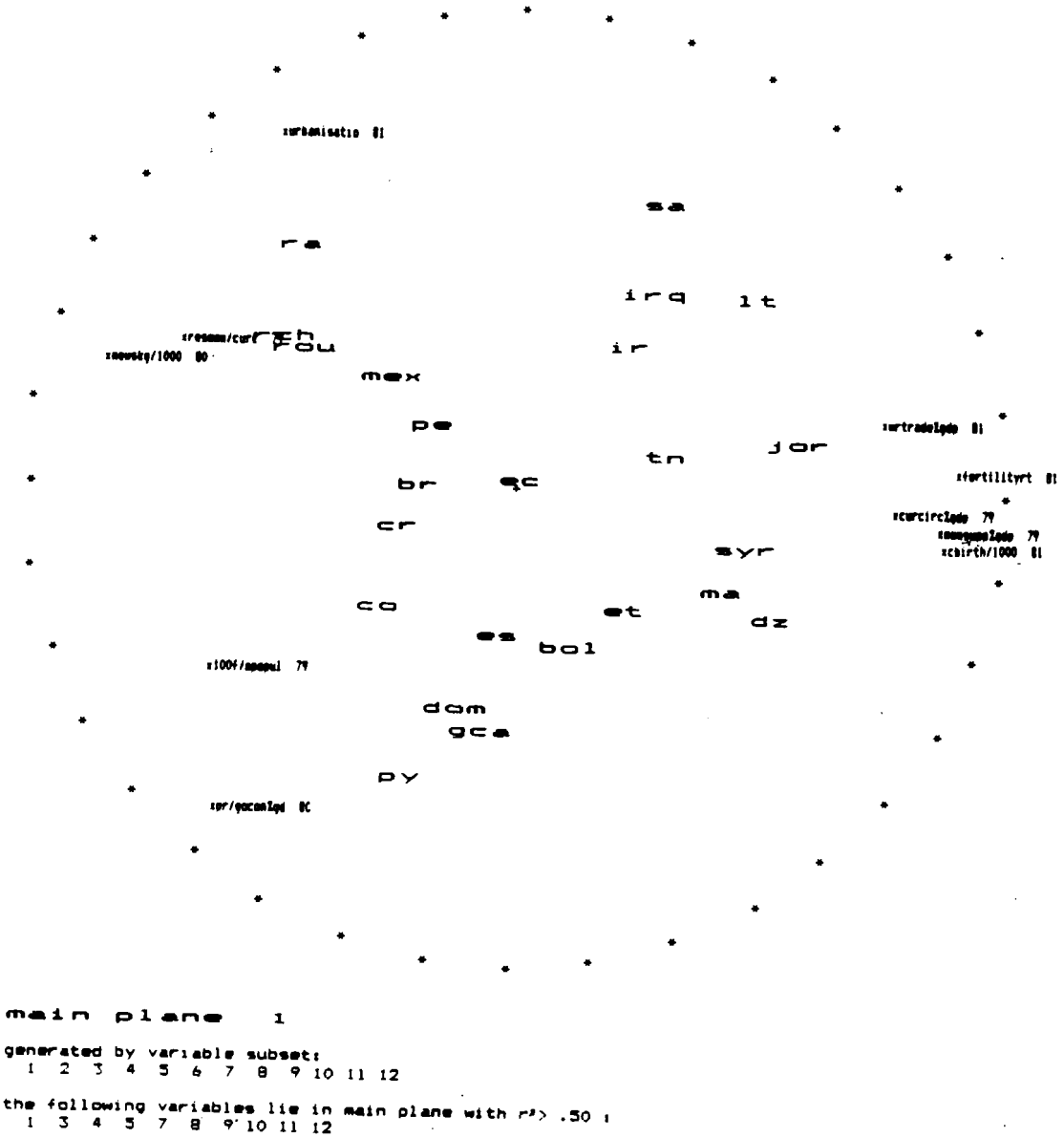
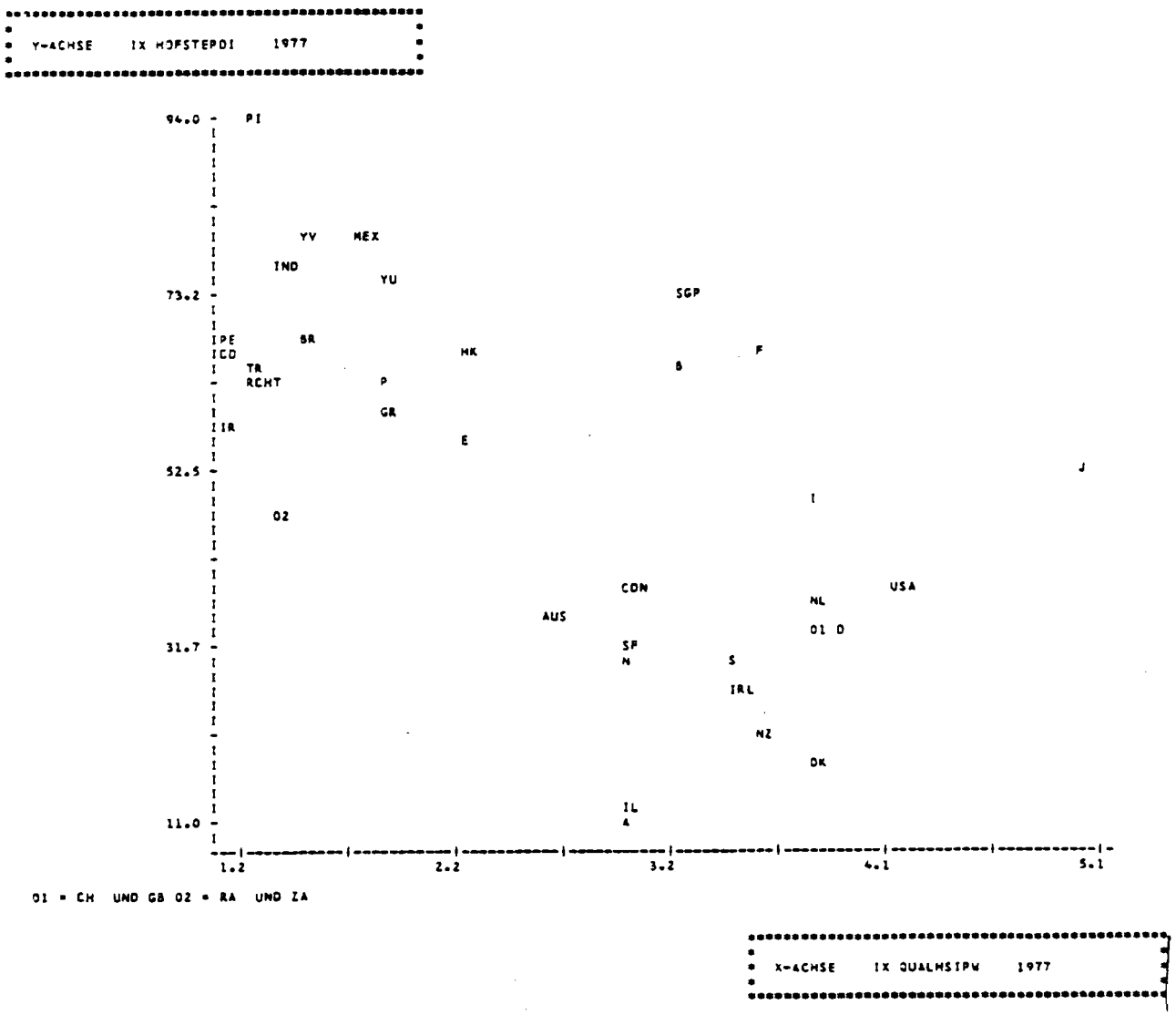
11) see: K.R.Gabriel, G.Rave and E.Weber: 'Graphische Darstellungen von Matrizen durch das Biplot', EDV in Medizin und Biologie 1/1976.



diagr.10: The main plane of variables classifying the Latin American and Arabien countries as two different groups

We also can investigate which variables signify typical differences that exist between industrial and developing countries. We then find that not only economical variables explain these differences, but also the so-called 'soft variables', measurements that do not suit immediately to the notion of economical measurements but are of economical relevance. Specially the motivation factors measured by Geert Hofstede show great significance. In diagram 11 we show the relation of the qualification of exports and imports according to information intensive

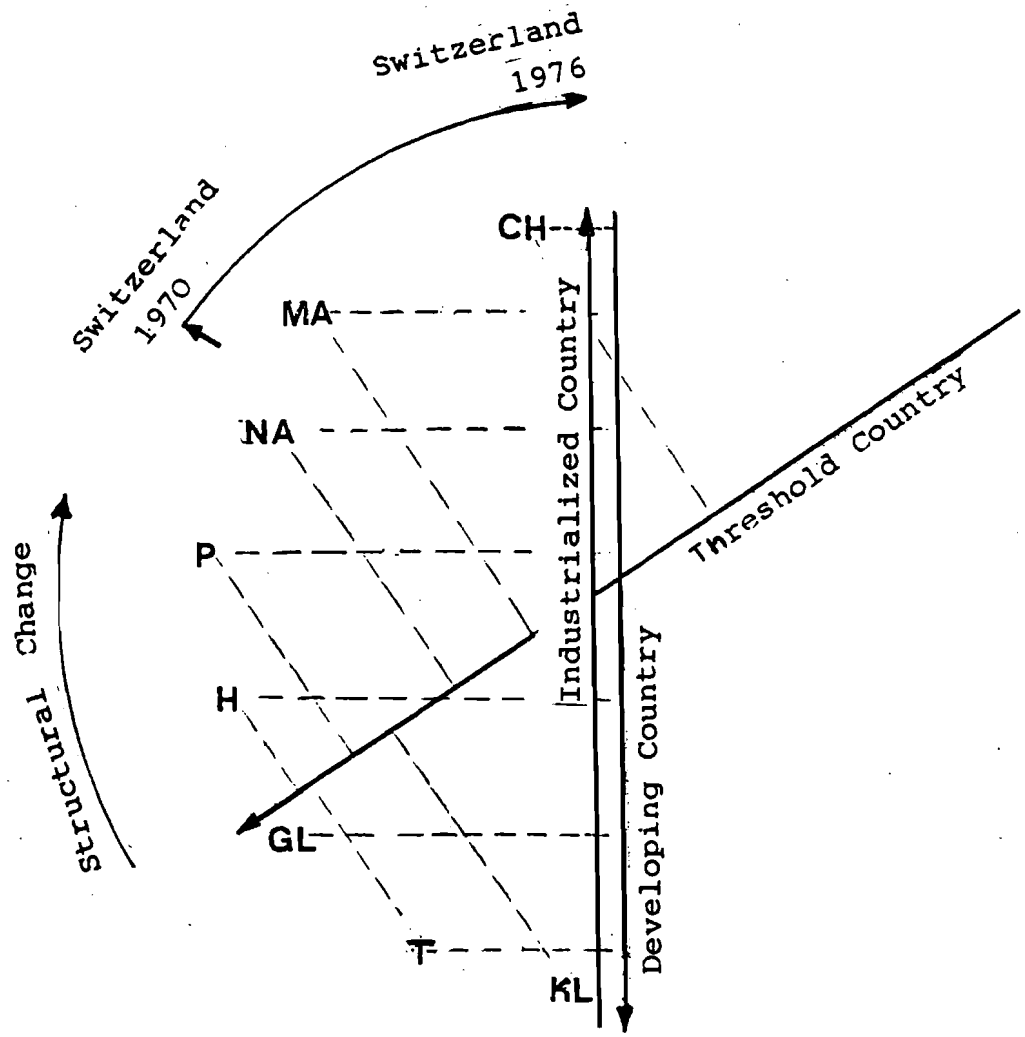
labour ('brain export') and motivation factor: 'power-distance' according to Geert Hofstede. Industrial countries and developing countries form a cluster. The group of countries that have a higher 'brain export' has a lower average power-distance-index, i.e. a lower distance between the hierarchical levels. This gives weight to the thesis, that a more efficient social information processing needs a somewhat more cooperative way of leadership than is applied in the old patriachical style. These belong to the driving and retarding forces of structural change, since they influence the possibility to specialize on 'brain-export' in the international division of labour.



Diag.11: Balance - Qualification of foreign trade based on social information processing and power-distance-index of Hofstede reflecting distances between hierarchical levels.

5.4 Mainplane Reflecting the Structural Change

Empirical investigations, which STUDIA has made into the structure of sectors of all countries have proved the fact, that developing countries specialize in low labour-qualified sectors, whereas industrial nations specialize in qualified labour sectors. We can describe this structural change by the help of a mainplane. If we order the sectors according to the qualification of labour (see diagram 3), we can represent the situation of developing countries, threshold-countries as well as industrial countries according to the structure of sectors in a mainplane, in which the different sectors are fixed. This has been illustrated in diagram 12



Diag.12: Mainplane reflecting the structural change

The deviation of a country's structure of sectors from the average structure of all countries can be found by projection of the sectors onto the variable that represents the country. The projection of sectors onto the variable of an industrial country shows a structure in which highly qualified sectors dominate. In case of developing countries low qualified sectors dominate. Threshold countries have a structure of sectors, in which not only low qualified sectors but also medium qualified sectors have a bigger share. Structural change is demonstrated in the mainplane by turning the vector of a country in the clockwise direction[12]. The speed of structural change is signified by the speed of the angle. The structural change of Switzerland, presented in diagram 3 corresponds with the turning of the vector of Switzerland in the mainplane described above. This turning on the other hand corresponds with the changes of the above mentioned variable 'qualification of labour' of this very stretch of time.

The structural change in industrial countries which can be represented by turning the vectors in the mainplane of structural change goes together with a contraction of the sectors with low-qualified labour and constancy or growth of the sectors with high-qualified labour. Inquiries in which countries have been compared show, that in some industrial countries certain sectors deviate from this rule. This can be explained by protectionism in these sectors, mainly steel and motor-car industry. The deviations can be considered to be measurements of protectionism. In developing countries sectors with low-qualified labour grow, whereas the highly qualified sectors are not yet developed. Threshold countries which have advanced relatively far, record the highest growth in sectors of medium-qualified labour. Here also we can find deviations which signify a structural policy below the optimum. The sectors with the highest and lowest qualification define the greatest difference of growth within the sectors, with opposite signs in industrial and developing countries. Threshold countries may not have differences of growth rates in these extreme sectors: low qualified sectors may still be growing, while sectors with a high qualification have already started to grow.

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12) The turning of vectors in a mainplane has been described for a different contentional application in J. Millendorfer: 'Long Waves in a Larger Context', Proceedings of the conference 'Long Waves, Depressionsand Innovations, Florence, Oct. 1983.

The mainplane of structural change can be applied to show the temporal development of a country as well as signify the differences of countries in a cross-section. Due to the individual deviation of a country's development from the general rule, which depends on the cross-section of countries, there will be differences between the mainplanes which describe the structure of single countries. These differences refer to the differences of countries regarding their individual process of development. A structural mainplane of a country thus enables the understanding of a country's situation within the structural change at one glance.

The problem of 'driving and retarding forces of structural change can now be understood in the way, that in multivariate analysis such variables are gathered that explain the change of the angle. One measurement explaining this change is the variable 'total qualification of labour of a country', mentioned above. We posses an abundance of single observations tending in this direction which need yet to be integrated into a general theory.

6. Recapitulation and Outlook

The empirical application of the wellknown term of marginal productivity renders possible to develop new measurements of the qualification of labour in home economy and foreign trade. By help of these measurements phenomena that are known in a qualitative way, like the rise of a qualification gap between industrial and developing countries, can be represented quantitatively and new perceptions referring to the structural change can be obtained. These cover obstructions of innovation by fixation on technologies which have been successful in the past, mechanisms of regional development as well as a new set up for the comprehension of exchange relations in foreign trade. The measurements derived from the marginal productivities thus show to be a key variable to comprehend mechanisms of structural change.

Beyond the indicators connected with the marginal productivity of labour, new formal methods which are mainly applied to the investigation of 'driving and retarding forces of structural change' proved very successful. The complex connections of this topic can be struc-

tured by these new methods, especially that of mainplane analysis and the cluster inversion, in such a way as to find - according to the simplifying principles in the economy of thinking - access to possibilities of theoretical interpretation. It has already become clear that apart from the conventional economic variables,so-called 'soft variables' as structures of motivation, behavioural patterns and forms of organisation essentially contribute to a classification of 'driving and retarding'forces of structural change.

APPENDIX

Abbriviations of Countries

A : Austria
ADN: Yemen Democratic
AFG: Afghanistan
AL : Albania
ANG: Angola
AUS: Australia
B : Belgium-Luxenburg
BD : Bangladesh
BG : Bulgaria
BH : Honduras
BOL: Bolivia
BR : Brazil
BRN: Bahrain
BUR: Burma
C : Cuba
CAM: Un.Rep.of Cameroon
CDN: Canada
CH : Switzerland
CHI: China P.R.
CI : Ivory Coast
CL : Sri Lanka
CO : Colombia
CR : Costa Rica
CS : Czechoslovakia
CY : Cyprus
D : Germany, Fed.Rep.of
DDR: German Dem.Rep.
DK : Denmark
DKO: Korea Dem.Rep.
DOM: Dominican Rep.
DY : Benin
DZ : Algeria
E : Spain
EAK: Kenya
EAT: Un.Rep.of Tanzania
EAU: Uganda
EC : Ecuador
ES : El Salvador
ET : Egypt
ETH: Ethiopia
F : France
FJ : Fiji
G : Gabon
GB : United Kingdom
GCA: Guatemala
GH : Ghana
GR : Greece
H : Hungary
HK : Hong Kong
HV : Upper Volta
I : Italy
IL : Israel
IND: India
IR : Iran
IRL: Ireland
IRQ: Iraq
IS : Iceland
J : Japan
JA : Jamaica
JOR: Jordan
K : Cambodia
KT : Kuwait
LAO: Laos
LB : Liberia
LIB: Lebanon
LSA: Lesotho
LT : Libyan Arab.Jamahiriya
M : Malta
MA : Marocco
MAC: Macao
MAL: Malaysia
MEX: Mexico
MO : Mongolia
MOC: Mozambique
MW : Malawi
N : Norway
NEP: Nepal
NGU: Papua New Guinea
NIC: Nicaragua
NIG: Niger
NL : Netherlands
NZ : New Zealand
OMA: Oman
P : Portugal
PA : Panama
PAK: Pakistan
PE : Peru
PI : Philipines
PL : Poland
PY : Paraguay
Q : Quatar
RA : Argentina
RC : Taiwan
RCA: Central African.Rep.
RCB: Congo
RCH: Chile
RG : Guinea
RGB: Guinea-Bissau
RH : Haiti
RI : Indonesia
RIM: Mauritania
RM : Madagaskar
RMM: Mali
RO : Romania
ROK: Korea Rep.of
ROU: Uruguay
RU : Burundi
RWA: Rwanda
S : Sweden
SA : Saudi Arabia
SF : Finland
SGP: Singapore
SN : Senegal
SO : Somalia
SU : USSR
SUD: Sudan

SYR: Syrian Arab.Rep.
T : Thailand
TCH: Chad
TG : Togo
TN : Tunisia
TR : Turkey
TT : Trinidad, Tobago
UAE: United Arab.Emirates
USA: USA
VN : Viet Nam

WAG: Gambia
WAL: Sierra Leone
WAN: Nigeria
YAR: Yemen
YU : Yugoslavia
YV : Venezuela
Z : Zambia
ZA : South Africa
ZRE: Zaire
ZW : Zimbabwe

INTERDEPENDENCES BETWEEN THE ECONOMIES OF THE NORDIC COUNTRIES

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1. TRADE BETWEEN THE NORDIC COUNTRIES

Nordic countries (Denmark, Finland, Norway and Sweden) are small and rather open economies. Their share of the world trade is only 5 percent. Hence it is usual to think that the conditions of world trade determine the development of these economies while their own effects on the world economy are small. However, there are close links through trade flows of certain commodities between Nordic countries as well as between these and other countries. Nordic countries also compete with each other in the markets of the Third World Countries. Interdependence between the economies of Nordic countries is thus rather strong.

Bilateral trade flows can be considered as channels through which economic impacts move from one country to another. These impacts may be due to economic growth, development of economic structures, different kind of disequilibrium, and economic policy measures. They have direct effects and repercussions, which cause feedback from the importing country to the economy of the country from which such developments emanate.

The changes in industrial structure due to changes in the commodity composition of foreign trade are important development trends in most economies today and in future. The adjustment process of industrial structure affects foreign trade and strengthens or weakens change in the comparative advantage of national economies or generally in the international division of labor. Their study implies that industries and trade flows are taken into consideration at a disaggregated level.

Exports and imports are responsible for between 25-30 percent of GDP in the Nordic countries. In intra-Nordic trade the share of imports in total trade varies between 16 and 27 percent and of exports between 15 and 24 percent (Thage and Jakobsen, 1983).

There are considerable variations between shares of commodities exported to the other Nordic countries. Primary products have a rather big share in total Nordic exports. It involves gas and crude oil (Norway), ores (Sweden), food (Denmark), wood products and paper (Finland, Norway and Sweden), iron and other metals (Sweden, Norway). These commodities are traded only little between the Nordic countries (10 percent), whilst manufactured commodities tend to dominate intra-Nordic trade (30 percent).

Table 1. Distribution of Nordic foreign trade by country 1981 (current prices)

	Denmark		Finland		Norway		Sweden	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
1 Denmark	--	--	3.3	2.2	4.1	6.1	7.8	6.2
2 Finland	2.1	3.7	--	--	1.8	4.4	6.5	6.6
3 Norway	6.2	4.3	4.7	2.5	--	--	9.6	6.1
4 Sweden	11.5	12.0	13.4	11.3	9.0	16.4	--	--
1-4 Nordic countries	19.8	20.1	21.4	16.0	14.9	26.9	23.9	18.9
5 UK	13.6	11.9	10.7	8.1	40.0	13.6	10.0	12.0
6 FRG	16.7	18.6	9.1	12.1	17.9	14.7	11.3	16.2
7 Other EEC countries	15.0	16.8	12.1	10.1	8.8	11.9	17.4	14.3
8 USA, Japan, Canada	8.9	12.7	5.0	11.8	5.1	17.7	8.3	12.5
9 Other OECD countries	6.1	4.4	4.5	4.4	3.4	4.9	7.9	5.8
10 Eastern Europe	1.8	3.7	26.5	26.5	1.4	2.6	3.7	4.4
11 OPEC countries	5.7	3.3	4.4	5.8	2.0	1.7	7.0	9.3
12 Other countries	12.3	8.7	6.5	5.2	6.5	6.1	10.6	6.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2. Exports 1981 from the Nordic countries. Current Prices. Million US Dollars

Commodity	Total	Export share (%) to the other Nordic countries
Non-electric machinery	9551	21
Paper and Paper products	6695	11
Food products	5630	12
Crude oil	5413	3
Electric machinery	3991	26
Motor vehicles	3982	21
Iron and steel	3197	24
Other chemicals and plastic products	3029	31
Ships, oil rigs, etc.	2945	15
Petroleum products	2874	54
Other commodities	28780	23
Total	76087	20

2. ECONOMIC DEVELOPMENT IN THE NORDIC COUNTRIES

This description is based on a recently made comparative study on Economic Growth in a Nordic Perspective (DOR, Sekretariatet, Copenhagen, ETLA, Helsinki; IFF, Copenhagen; IUI, Stockholm; IOI, Bergen).

Sweden was industrially the most advanced of the Nordic countries in the 1950s. Finland was least advanced (measured according to the per capita output of the manufacturing sector) but its manufacturing output has increased nearly twice as much as that of the other Nordic countries during the 30 postwar years.

Even after the first oil crises Finland managed to surge ahead of the OECD average. Denmark came close to the OECD average but Norway and Sweden came behind (oil and gas production is excluded from manufacturing output.

Finland's export earnings are obtained more from basic industries (such as forest industries) than is the case for other Nordic countries. The share of engineering industries increases constantly. Denmark's exports are based on agriculture, food industries and specialized engineering. Norway has its manufacturing base in the production and exploiting of hydroelectric power. Sweden's base lies in diversified engineering industries and it also has substantial activity in crude steel and forest industries. Denmark, Finland and Sweden have been shifting away from their dependence on raw materials and basic industries.

Their dependence on an internationally competitive manufacturing sector is increasing. Norway is becoming increasingly dependent on its oil and gas production (50 percent of commodity exports). Nordic countries have built large public service producing sectors (especially health, education, transport). Their share of GDP lies above the OECD average. These countries also have internationally high transfer payments from the public sector, which became prominent during the 70s. Capital spending patterns changed substantially in each country during the 70s.

Norway has invested considerably in oil-related activities. The long-run problem is to transform its oil wealth into a more diversified industrial structure. The "crowding out effect" makes transformation difficult.

Table 3. Nordic production structures in 1980

	Denmark	Finland	Norway	Sweden	Nordic economy	OECD Europe	U.S.
1) GDP, billion $	66.2	50.1	57.4	123.4	297.1	3 507.8	2 598.9
2) Inhabitants, million	5.1	4.8	4.1	8.3	22.3	394.2	227.7
3) GDP, Nordic share, per cent	22	17	19	42	100		
4) GDP, per capita, $	12 929	10 479	14 045	14 851	13 076	8 899	11 416
5) GDP, per capita average = 100	99	80	111	114	100	68	87
6) Contribution to GDP per cent							
a) Agriculture, forestry, fishing, mining and quarrying	5	10	20**	4			5
b) Manufacturing	19	29	16	24			24
c) Electricity, construction	8	11	11	11			7
d) Trade, transport financing, etc.	46	37	38	35			45
e) Health, education, transport and other public infrastructure activities*	13	12	8	11			—
f) Public service production, incl. (e)	22	15	14	25			13

* The figure for Denmark is included in d)
** of which 15 percentage points are in oil and gas

Source: OECD, National Accounts

Finland is undergoing a transformation process from dependence on basic industries to the development of engineering. Sweden went through this process earlier.

Sweden has, at one and the same time, both crisis industries (basic industries) subsidized by government, which have been prevented by policy makers from closing down, and other industries that have flourished or come to life (the technological and commercial base has expanded strongly).

Denmark has a broad base of sophisticated but rather small firms in expanding markets, moving the industrial structure away from its original dependence on agriculturally related products.

The adjustment needs in the manufacturing industry are greater in Norway and Sweden than in Denmark and Finland. Traditional export industries are located in stagnating markets are are subsidized considerably. But these countries have the wealth to do it. Danish and Finnish industry, at least to some extent, and a part of Swedish industry have succeeded well in their post-oil crisis structural adjustment. In Denmark and Sweden a significant reorientation of technologies and of markets for existing firms occurred. In Finland adjustments have been made within existing industries.

All the Nordic countries except Finland have reduced their investment ratios in manufacturing relative to the OECD average since the first oil crises. This is partly explained by the shift from the basic industries to more sophisticated and less hardware-intensive industries, at least in Denmark and Sweden.

In their growth strategies, Denmark and Finland have emphasized more than have Norway and Sweden, economic growth in the long term at the cost of a higher rate of open unemployment in the short term. Norway and Sweden have kept their unemployment rate low by subsidizing production in industries weakened by crisis.

Three policy strategies may be observed in industrial policy and allocation efficiency:

1. Wage and salary equalization with a consequent inability of the labor market to move labor by wage signals.
2. Designing the structure of industrial support programs.
3. Switching the consumption pattern towards less import-intensive consumption.

A natural question is now whether there is a local Nordic policy solution. The prospects for growth in the international market are only very small. Can coordinated Nordic macro demand management create the desired local effects in the Nordic countries?

A return to broad-based economic growth in manufacturing is currently not to be expected in Norway and Sweden, should world demand happen to switch on to a faster growth path than can be assumed. This suggests that Nordic macro demand management alone is not efficient enough for these two countries. Denmark and Finland have a slightly better outlook for the future.

Inefficiencies in the allocation processes and slow international market growth may be considered as causes for Nordic economic stagnation. The Nordic countries today face strong competition in international markets. The future development of markets is difficult to predict.

Flexibility in structural adjustment is therefore necessary. The Nordic labor market allows free movement between countries but the Nordic capital markets are more regulated than in most industrialized countries. This may have led to an inflexibility of structural adjustment and lower intra-Nordic industrial cooperation. The regulated Nordic capital markets may have a built-in bias in the allocation process. Regulation to some extent may prevent intra-Nordic specialization and division of labor and direct industrial cooperation with non-Nordic countries. On the other hand the loosening of the regulation of capital markets may lead to unexpected disturbances in national economies and to missed opportunities for making national economic policy. Analyses and studies should be done that take into consideration close links between the Nordic economies.

NORDHAND MODEL SYSTEM[1]

The NORDHAND model system consists of four national models and a trade model. All the national models are different in structure and classification. Similar characteristics are the use of disaggregation of production activity and the use of an input-output framework as a core of the model. The trade model links national models together. Classifications and estimates used in the trade model for commodities and countries must be adjusted with classifications and estimates of imports and exports of the national models when the whole system is used for analyses. This adjustment system is described by Figure 1.[2]

National models are at first used to estimate imports demanded by national economies. Exports are then either exogenously evaluated or calculated by the models if they have export functions. These estimates include intra-Nordic exports and exports to other countries. The iterative process in the trade model

[1]The model system is described in greater detail by Forssell and Kärrymäki,1984.

[2]Paal Sand and Gunnar Sollie, Technical description of the NORDHAND Model System. Paper presented to the Input-Output Task Force Meeting, IIASA, Laxenburg, Austria, 29 September-1 October 1983.

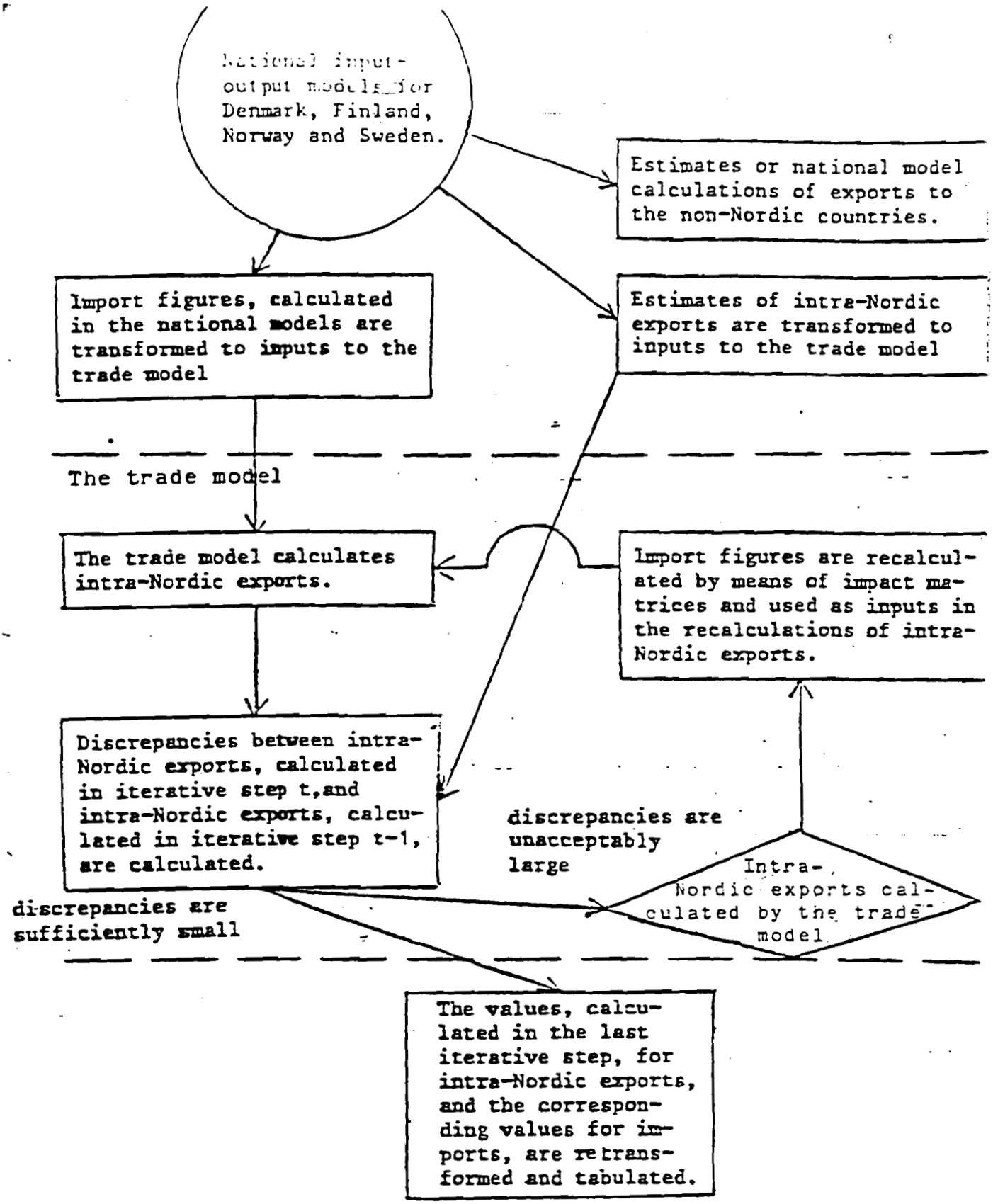

Figure 1: The NORDHAND Model System

is started using import figures estimated by the national models. The trade model calculates intra-Nordic exports and these estimates are compared with those originally used in the national models.

When discrepancies are unacceptably large, the estimates of intra-Nordic exports calculated by the trade model are used for recalculating imports by the national models. These figures are substituted for those used in the preceding iterative step. The iterative process continues until discrepancies between the estimates of the trade model and the national model for intra-Nordic exports are sufficiently small.

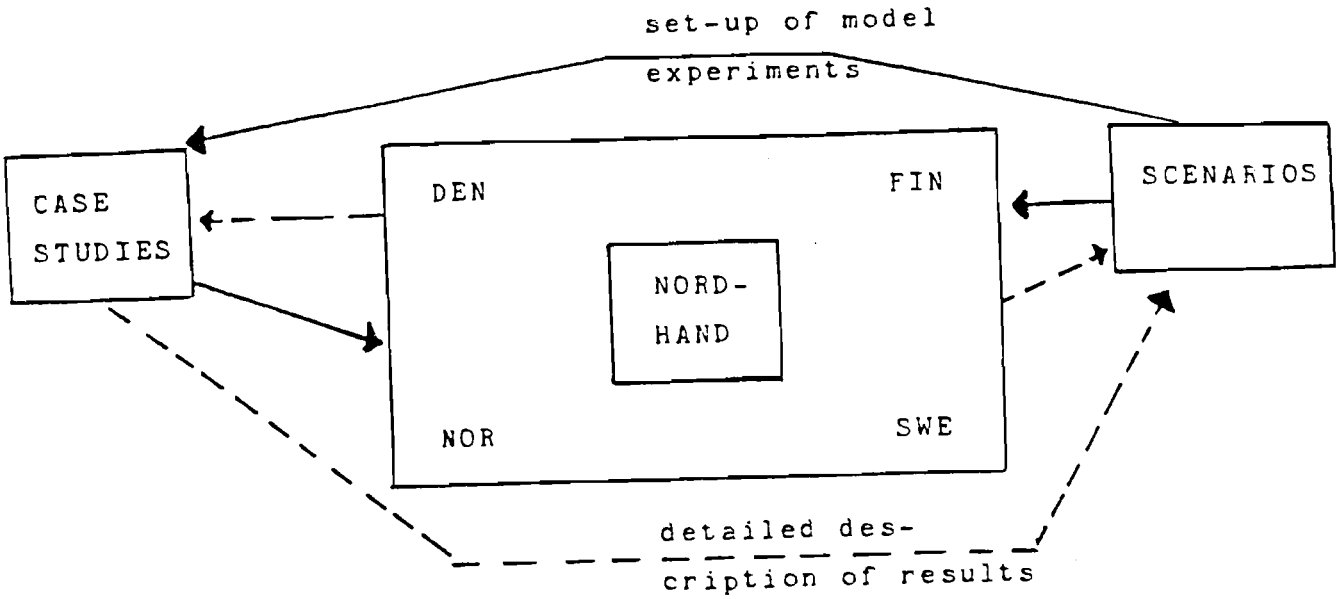

Figure 2: Scenario analysis in NORDHAND Model. The broken line describes the results of model calculations, the continuous line shows the specific assumptions and exogenous factors in each analysis.

Figure 2 includes three techniques that can be integrated in a multi-country–multi-commodity model system: economic modeling, case studies and scenario analysis. The scenarios form a super structure of the system. In scenarios the researchers or national economic decision makers, planners, etc., can express their neutral, conflicting or normative opinions about the future development of the whole economy or some specific sectors. In connection with a detailed model system the outcomes of different assumptions can be compared both at aggregate and disaggregated levels.

Some important areas of application for the NORDHAND model system are listed below:

a) The analysis and prognosis of the effects on the development of world economy of the structural changes in intra-Nordic trade under different assumptions.

b) Simulation of the effects on foreign trade flows due to various policy measures in one or more of the Nordic countries.

The trade model described here is the first version of the NORDHAND model system. It is a pure quantity model and it includes only the bilateral trade flows between Nordic countries while the rest of the world is treated as a whole. The Model system is planned to be expanded along the following lines:

a) The market share functions and price relations are incorporated in the trade model.

b) The treatment of the rest of the world is developed further in order to make the model system more comprehensive.

c) The national models are harmonized in order to get a simultaneous solution of the trade model and all national models.

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GROWTH AND TECHNOLOGY: INTERDEPENDENCE BETWEEN TAIWAN AND JAPAN

Mitsuo Saito and Ryoichi Nishimiya

1. INTRODUCTION

It is well known that Japan enjoyed a very high rate of economic growth during the 1960s; the average annual growth rate of GNP was about 10 percent. Within a period of twenty years Japan rose from being a developing country where the per capita GDP was 462 US dollars in 1960 to a developed country with a per capita GDP of 8,627 US dollars in 1979. It is interesting to note that high economic growth of this sort has recently also occurred in several other East and Southeast Asian countries, such as Hong Kong, Singapore, South Korea, and Taiwan. As shown in **Table 1**, the average annual growth rate of real GDP of these newly industrialized countries (NICs) was 8.8 to 10.4 percent before the oil crisis, and even after the oil crisis it was 7.3 to 9.6 percent; only in the case of Japan was it significantly lower (3.6 percent). It is important to note that all these countries have the following three features in common:

(1) They are relatively poor in natural resources, such as oil, coal, and metal ores. This implies that the advantage of natural resources is not a necessary precondition for high economic growth.

TABLE 1. The Growth of GDP of East and Southeast Asian Countries, 1960–73.

	Average growth rate of real GDP (%)		Per capita GDP (US dollars)		Per capita GDP (percentage of US value)	
	1960–73	1973–79	1960	1973	1960	1973
Hong Kong	9.0	8.6	348	3809	12.4	35.3
Japan	10.2	3.6	462	8627	16.5	80.1
Korea, Republic of	8.8	9.6	150	1613	5.4	15.0
Singapore	10.0	7.3	430	3829	15.3	35.5
Taiwan	10.4	8.3	153	1868	5.5	17.3

(2) They are open to foreign countries, in the sense that they are able to freely introduce scientific knowledge and techniques, and to import and export goods and services.

(3) They can draw upon abundant and well-disciplined labor forces.

One might argue that these three features have enabled the countries concerned to realize high economic growth through two mechanisms: borrowed technology on the supply side and wide foreign markets on the demand side.[1] It is quite natural that the rate of technical progress will be much faster in a country that introduces existing technology from abroad than in one that is exploring it for the first time. In a developing country, the level of technology can be high due to imported or borrowed technology, while the wage level remains very low. If a developing country succeeds in introducing foreign high technology for the production of a given commodity, e.g. a textile, and in acquiring a certain level of capacity for producing the commodity using this technology, its production costs will be very low compared with those in a developed country where the wage level may typically be ten times as high as in the developing country. The foreign demand for the low-price commodity from the developing country will be very

[1] S. Kuznets emphasizes "the existence of a technological backlog, the exploitation of which could generate accelerated advance elsewhere" in discussing conditions for strong economic performance in an LDC. He also writes that "given the power of modern technology and effectiveness of modern trade ties, the potential growth of an LDC should only moderately be constrained by scarcity of natural resources, or by scale problems because of smallness of the internal markets." S. Kuznets, *Modern Economic Growth and the Less Developed Countries*, a paper presented at the Conference on Experiences and Lessons of Economic Development in Taiwan, held in Taipei in December, 1981.

strong. Keeping pace with the increase in production capacity for the commodity, exports will continue to grow very rapidly, until the wage level of the developing country approaches that in the developed country. This sort of rapid growth in export demand will continue to be a strong driving force behind the economic growth of the developing country. It is true that this pattern, which has been discerned very generally in the so-called NICs during the last twenty years, has very important policy implications for development strategy. But several negative aspects must also be noted: social and economic maladjustments accompanying very rapid industrialization, environmental deterioration, and trade frictions due to the rapid growth in the exports from developing countries to the developed ones.

An example of the last type of problem arose between Japan and the United States during the 1960s and 1970s because of the rapid expansion in Japanese exports of textiles, steel, electronic appliances, and cars. Recently, similar trade frictions have arisen between Japan and Taiwan, and between Japan and South Korea.

The main purpose of this study is to make an econometric analysis of the underlying pattern of high economic growth. More specifically, we attempt to make a quantitative assessment of the contribution of borrowed technology to the recent rapid growth of the Taiwanese economy, and also to analyze quantitatively the recent trade friction between Taiwan and Japan. The procedure followed is first to construct an econometric model of Taiwan, then to make a comparison of growth patterns between Taiwan and Japan on the basis of econometric models of both economies,[2] and finally to study the trade friction between the two countries by linking together the two econometric models through export and import functions. Section 2 describes the main features of the econometric model of Taiwan, and discusses the implications of its estimated results. Section 3 is devoted to testing the explanatory power of the model for the past performance of the Taiwanese economy and examining its dynamic properties. Section 4 links the Taiwanese and Japanese models and then tests the explanatory power of the linked models and examines their dynamic properties. Finally, Section 5 presents a simulation study

[2]The econometric model of Japan is described in a companion IIASA Working Paper, *The Causes of the High Economic Growth of Japan* , published in 1985 by the International Institute for Applied Systems Analysis, Laxenburg, Austria.

of the impact of technological progress within one country on the economic performance of other countries as well as the impacts on the domestic economy.

2. MAIN FEATURES OF THE TAIWANESE MODEL

The model is essentially an annual aggregative model of the Keynesian type, whose sample period is 1960–81. The equations and variables of the estimated model are listed in the Appendix. In general, the method of estimation is ordinary least squares. $\bar{R}^2$ is the measure of goodness of fit adjusted for degrees of freedom; and D.W. is the Durbin–Watson statistic. The figure in parentheses below each regression coefficient indicates its t-value. Some of the equations are estimated by the Cochrane–Orcutt iterative method, where ρ is the serial correlation coefficient of the first order in error terms.

The first important characteristic of the model is the disaggregation of exports and imports, which enables us to deal with the trade relationship between Taiwan and Japan. Imports are then disaggregated into imports from Japan and those from countries other than Japan. Imports from Japan are further disaggregated into six items: (1) food and agricultural products, (2) chemicals, (3) textiles, (4) metals, (5) machinery, and (6) others. These imports are mainly explained in terms of the GDP of Taiwan, relative prices, and the level of capacity output of Taiwan (see eqs. (2.1) to (2.6)) The level of capacity output, representing the effect of import substitution, is calculated from the estimated production function, as explained below.

Imports from countries other than Japan are disaggregated into (1) fuels and (2) nonfuels. These are also explained in terms of the GDP of Taiwan and relative prices (eqs. (2.11) and (2.12)). There is a slight statistical discrepancy between the sum of disaggregated imports from Japan and the total import from Japan, *MGJPMO*, since the former is based on MITI trade statistics from Japan and the latter on trade statistics from Taiwan. The two figures are intercorrelated through a statistical equation (eq. (2.19)). The sum of commodity imports from Japan and nonfuel commodity imports from countries other than Japan is the total nonfuel commodity import, $MO \cdot PMO$, (eq. (2.18)), and the total commodity import and service imports add up to the imports of goods and services derived from the national income account, M, (eq. (2.14)).

Commodity exports are also disaggregated into exports to Japan and those to countries other than Japan. Exports to Japan are further disaggregated into (1) food and agricultural products, (2) chemicals, (3) machinery, and (4) others. The main explanatory variables for such exports are the GNP of Japan, relative prices, and the level of the capacity output of Taiwan (eqs. (2.7) to (2.10)). The second of these variables is introduced to take into account the fact that the capacity level may impose limits on the maximum amount of Taiwanese exports. A greater part of item (4) is textiles. Therefore, in the estimation of eq. (2.10) we used an estimate of 0.64 for the long-run elasticity of exports of this item with respect to the GNP of Japan; this estimate is the result of the calculation 1.26 × 0.79 × 0.64, where 1.26 and 0.79 are, respectively, estimates of the elasticity of consumer demand for textiles with respect to total consumption and the elasticity of total consumption with respect to personal disposable income, both of which were obtained from a cross-section study, and 0.64 is the ratio of personal disposable income to GNP.

Exports to countries other than Japan are explained in terms of the world trade index, relative prices, and the level of capacity output of Taiwan (eq. (2.13)). In the same way as for imports, eqs. (2.21) to (2.24) are identities and statistical discrepancy equations, by which individual export items add up to exports of goods and services derived from the national income account, X.

The second significant feature of the model is the system of price equations that relates the growth of exports and imports to the cost structure of domestic Taiwanese products. Corresponding to the disaggregation of imports, industry as a whole is disaggregated into eight industries: (1) primary, (2) food, (3) textiles, (4) chemicals, (5) petrochemicals, (6) metals, (7) machinery, and (8) construction, utilities, and services.

Using the framework of input–output analysis, we may write the price–cost relationship of industry i as:

$$P_i = \sum_{j=1}^{8} A(j,i)\cdot P_j + D(i)\cdot PI + LC(i)\cdot W + T(i)\cdot P_i + S(i)\cdot P_i \qquad \text{(A.1)}$$

Here P_i, W, and PI are, respectively, the price for industry i, the wage index, and the deflator for investment goods; $A(j,i)$, $LC(i)$, $D(i)$, $T(i)$, and $S(i)$ are material input coefficients, labor input coefficients, the depreciation ratio, the indirect tax

ratio, and the surplus ratio, respectively. The coefficients, which represent the technical and institutional structure of each industry, are adopted from the Taiwanese input–output table for 1976. By solving each equation with respect to P_i, we may express the price of domestic product i as a function of the prices of other products and the wage:

$$P_iD = \Big(\sum_{\substack{j=1 \\ j\neq i}}^{8} A(j,i)\cdot P_j + D(i)\cdot PI\Big) \,/\, (1 - A(i,i) - T(i) - S(i))$$

$$+ (LC(i)\cdot W) \,/\, (1 - A(i,i) - T(i) - S(i)), \qquad \text{(A.2)}$$

where P_iD is the price of the domestic product. This equation implies that the cost of product i consists of two parts: the nonwage part (the first term on the right-hand side) and the wage part (the second term). Let us denote the former by P_iIO, as shown in eq. (4.2). The elasticity of P_iD with respect to P_iIO in the base year, when $P_i = 1.0$, is calculated as

$$\Big(\sum_{\substack{j=1 \\ j\neq i}}^{8} A(j,i) + D(i)\Big) \,/\, (1 - A(i,i) - T(i) - S(i)) \qquad \text{(A.3)}$$

In eqs. (4.3), (4.6), (4.7), (4.9), and (4.10) the coefficient of $\ln P_iIO$ is set at the value given by formula (A.3) from the 1976 input–output table. On the other hand, taking into account the distinct declining trend in $LC(i)$, we introduced the reciprocal of the labor productivity of industry as a whole into eqs. (4.3) to (4.10) as a variable representing the secular movement of the labor input coefficient of industry i. In this procedure we assume that there exists a stable relationship between the growth rates of labor productivity in industry as a whole and in the individual industry i.

The price as a cost item, or the purchasers' price, P_i, will be defined as a weighted average of the prices of the domestic product, P_iD, and the price of imported goods, P_iM (eq. (4.1)). The latter is also defined as a weighted average of the import price from Japan, $PMJ_i\cdot RATE$, and the import prices from countries other than Japan, PME and PMO (eqs. (4.27) to (4.34)).

The deflators of individual components of final demands, *PC*, etc., are related to a variable defined as a weighted average of the individual industry prices, *PCIO*, etc. (eqs. (4.12) to (4.16)), where the weight is calculated from the relative share of each industry's output in the relevant final demand (eq. (4.11)).

Export prices, PX_i, are explained in terms of the price of the industry corresponding to each export item (eqs. (4.17) to (4.20)). Import prices from Japan, PMJ_i, are determined by the wholesale price index of industry as a whole in US dollar terms, *PWHIJ·RATJ* (eqs. (4.21) to (4.26)); we assume that there exists a stable relationship between the trend of the price for industry as a whole and those for individual industries. Under the same assumption, the wholesale price index for each individual industry is related to that of industry as a whole (eqs. (J.1) to (J.4)).

The third important feature of the model is that the supply side of the economy is represented by a production function of the CES type:

$$GDPM = [\delta_1(T \cdot L)^{-\vartheta} + \delta_2 KIF^{-\vartheta} + \delta_3 ME^{-\vartheta} + \delta_4 MO^{-\vartheta}]^{-1/\vartheta} \qquad \text{(A.4)}$$

where an output variable, *GDPM*, is the total supply, i.e., GDP plus imports, and L, *KIF*, *ME*, and *MO* are labor input, capital stock, fuel imports, and other imports, respectively; δ_i and ϑ are parameters and the elasticity of substitution is $1/(1+\vartheta)$. Technical progress of a labor-augmenting type is allowed for by a trend variable T. We assume that the level of technical knowledge is expressed by an index, $\exp(\lambda t)$, where t is a time trend, and that the level of embodied technique in existing plant and equipment at time t, T_t, is represented by a weighted average of $\exp(\lambda t)$ over the preceding ten years, where the weight is new investment over the same period (eq. (5.1)). Cost minimization under eq. (A.4) gives us a set of four log-linear marginal productivity relations, each of which has a different constant term but a common elasticity of substitution, σ. Pooling the productivity and price data for four inputs yields the estimated results in eq. (5.1), where the whole sample period is divided into two periods: before and after the oil crisis. Eq. (5.1) has the smallest residual sum of squares among the equations obtained by assigning to λ various values within a plausible range. Estimated results show that the average annual rate of progress in available technical knowledge, λ, is 7 and 6 percent per year for the years 1962–69 and 1974–81, respectively, while the elasticity of substitution, about 0.4, is almost the same for

both periods.

Capacity output is defined as the value of *GDPM* obtained by substituting labor force *LFE* for L in the estimated version of eq. (A.4) (namely, eq. (5.2)).

Since *GDPM* is the output of the whole economy, labor input must include self-employed and family workers, *NU*, as well as employees, *NW*. In view of the large differential between the productivities of these types of input, however, labor input is defined here as the sum of *NW* and a discounted *NU*, where the discount rate is the income differential, *DFL* (eqs. (6.4) to (6.9)). The desired level of L, i.e. L^*, is calculated from the marginal productivity formula for labor (eqs. (5.1) and (6.1)). The actual level of L is regressed on this desired level and a lagged value of L (eq. (6.2)). Finally, a version of the Phillips curve is estimated to determine the wage level of employees (eq. (6.10)).

3. THE FINAL TEST AND DYNAMIC PROPERTIES OF THE MODEL

The explanatory effectiveness of the model over the period 1965–76 was examined by the so-called final method of *ex post* forecasting.[3] In this method forecast values of the endogenous variables for the starting year (1965) are obtained by using observed values of the exogenous variables and the lagged endogenous variables, while those for subsequent years are obtained by using observed values of the exogenous variables for each sample year and calculated values of the lagged endogenous variables obtained by past forecast. The results are presented in **Table 2.** In this simulation the variables relating to Japan, such as GNP, wholesale price indexes for industries, and the exchange rate, were treated as exogenous. In addition, the constant term of the employment equation was raised by 80 thousand persons, since the equation turned out to be unsuccessful in explaining the observed dynamic behavior of the unemployment rate.

Column (1) of the table shows the average absolute percentage error of selected endogenous variables. It can be seen that the errors for total supply, *GDPM*, and private consumption, C, are small, while those for exports, imports,

[3] See A. S. Goldberger, *Impact Multipliers and Dynamic Properties of the Klein–Goldberger Model* (North-Holland Publishing Co. 1959), pp. 49–51.

TABLE 2. The Results of Ex Post Forecasting, 1965–73

		(1) Average absolute percentage error*	(2) Average growth rate: actual	(3) Average growth rate: computed	(4) Error: (3) – (2)
(1) *GDP*:	GDP	3.45	10.99	10.67	–0.32
(2) *GDPM*:	total supply	3.23	13.11	12.18	–0.93
(3) *C*:	private consumption	2.82	8.53	7.53	–1.00
(4) *I*:	fixed investment	7.29	17.88	16.54	–1.34
(5) *X*:	exports	5.89	24.62	23.43	–1.19
(6) *M*:	imports	8.53	14.05	11.46	–2.59
(7) *P*:	GDP deflator	6.87	5.16	4.20	–0.96
(8) *PC*:	consumption deflator	5.78	4.90	4.43	–0.47
(9) *W*:	wage earings	6.41	9.16	7.61	–1.55
(10) *N*:	persons engaged	1.11	4.26	4.03	–0.23
(11) *MGJPMO*:	imports from Japan	10.83	27.82	26.13	–1.69
(12) *XGJPXG*:	exports to Japan	19.90	21.70	10.26	–11.44

*The average absolute percentage error

$$= \left(\sum_{t=1}^{T} \left| \left(\hat{X}_t - X_t \right) / X_t \right| / T \right) \times 100,$$

where $\hat{X}_t$ = the calculated value of a variable in period t,

X_t = the actual value of a variable in period t,

T = the number of periods.

and price variables are relatively large. Columns (2) and (3) present the actual and forecast average growth rates of the variables over the period 1965–73. By and large, the forecast value of the average growth rate is fairly close to the observed value, implying that the general trends in most of the variables are followed by the model simulation.

Table 3 examines the multiplier effect of government expenditure. A dynamic path was calculated in which government consumption expenditure was raised by a one billion Taiwanese dollars (T$), other exogenous variables being kept at the same level as in the *ex post* forecast described above. The figures in **Table 3** are the difference between the *ex post* forecast solution (call it the "control" solution) and the expansionary one. As shown in Row (1), the value of the multiplier is 1.089 in the first year and reaches a peak value of 1.657 in the third year. These values are lower than those for Japan. The value of the multiplier for the Japanese model is 1.28 in the first year and reaches a peak of 1.92 in the seventh year.[4] The lower

[4]See M. Saito and T. Oono, *An Energy Model of the Japanese Economy, 1961–1979*.

value of the multiplier for Taiwan may be ascribed to the fact that "import leakage" is larger in Taiwan than in Japan: the ratio of imports to GNP in 1975 was 0.30 in Taiwan but only 0.11 in Japan. Other rows of **Table 3** show the effects of the increase in government consumption on selected variables in terms of the percentage change in the level of the control solution for each variable (see the footnote to Table 3).

TABLE 3. The Effect of a Sustained Increase of One Billion Taiwanese Dollars (T$) of Government Consumption, 1965–70

	1965	1966	1967	1968	1969	1970
(1) *GDP* (billion T$)	1.089	1.263	1.657	1.322	0.690	–0.746
(1)' *GDP* (%)	0.430	0.466	0.562	0.419	0.193	–0.187
(2) *GDPM* (billion T$)	1.248	1.548	2.322	2.549	2.727	2.304
(2)' *GDPM* (%)	0.404	0.461	0.621	0.615	0.581	0.437
(3) *C* (%)	0.138	0.245	0.389	0.499	0.605	0.668
(4) *I* (%)	0.000	0.193	1.020	1.035	1.072	0.618
(5) *X* (%)	0.075	0.056	0.003	–0.132	–0.327	–0.583
(6) *M* (%)	0.290	0.443	0.853	1.255	1.854	2.395
(7) *P* (%)	–0.319	–0.152	0.137	0.807	1.701	2.809
(8) *PC* (%)	–0.209	–0.070	0.159	0.693	1.389	2.214
(9) *W* (%)	0.026	0.158	0.472	0.969	1.674	2.474
(10) *N* (%)	0.016	0.041	0.073	0.108	0.139	0.162
(11) *MGJPMO*	0.452	0.572	0.815	0.874	0.883	0.717
(12) *XGJPXG*	–0.065	0.080	0.156	0.258	0.239	0.021

*(%) implies $\{ (X_t - \bar{X}_t) / \bar{X}_t \} \times 100$,

where X_t = the solution of a variable in period t for the "expansionary" economy,

$\bar{X}_t$ = the "control" solution of a variable in period t.

4. LINKING THE TAIWANESE AND JAPANESE MODELS

The Taiwanese and Japanese models were linked together by making the following variables common to both countries:[5]

PWHIJ: wholesale price index of the whole of Japanese industry

[5]For the purpose of linkage, exports from Japan were disaggregated into exports to Taiwan and those to other countries. Similarly, imports into Japan were disaggregated into imports from Taiwan and those from other countries.

PJ_i: wholesale price index of item i in Japan

RATJ: exchange rate of Japan

MGJPMO: imports of commodities from Japan

XGJPXG: exports of commodities to Japan

The explanatory effectiveness of the linked models over the period 1965–1973 was tested by the final method as described earlier. In **Table 4** the results of the linked models are compared with those of the unlinked Taiwanese model. Columns (1) and (2) of the table contain the average absolute percentage error of the linked models and its difference from that of the unlinked Taiwanese model,[6] respectively. It can be seen that, by and large, the average absolute percentage errors of the linked models are fairly close to those of the unlinked model. Columns (3) and (4) are the errors in the average growth rate for the linked models and the unlinked one, respectively. The figures are very close to each other, indicating that linking the Taiwanese model with the Japanese one does not give rise to any significant increase in errors. Columns (5) and (6) present, respectively, the average absolute percentage error and the error in the average growth rate of the Japanese variables obtained from the simulation of the linked models. Generally speaking, the errors in the real variables for Japan are larger than those for Taiwan, while the errors in the nominal variables (prices and wages) are smaller.

Now we examine the interdependence between the economies by estimating the multiplier in the linked models. **Table 5** presents the results of a simulation in which the government consumption expenditures of Taiwan are raised by one billion T$ over the period 1965–68. The first four columns of the table show the effects of the increase in government expenditure on the Taiwanese economy.[7] By comparing **Tables 5** and **3** it can be seen that there is practically no change in the multiplier effect between the unlinked and linked Taiwanese models. In addition, the last four columns of **Table 5**, which present the impact multiplier of Taiwanese government expenditure on the Japanese economy, show that a 0.4–0.6 percent increase in the GDP growth rate of Taiwan does not exert any significant influence

[6]The errors in the unlinked Taiwanese model are presented in Column (1) of **Table 2**.

[7]The solution of the unlinked Taiwanese model is presented in **Table 3**.

TABLE 4. The Results (Percentages) of Ex Post Forecasting Using the Linked Models, 1965–73

	Taiwan				Japan	
	(1) Average absolute percentage error*	(2) (1) – Error of unlinked model	(3) Error in the growth rate	(4)	(5) Average absolute percentage error* (linked)	(6) Error in the growth rate (linked)
			Linked	unlinked		
(1) *GDP***	3.68	+0.23	–0.36	–0.32	6.67	–0.69
(2) *GDPM***	3.31	+0.08	–0.94	–0.93	5.26	–0.58
(3) *C*	2.87	+0.05	–0.99	–1.00	4.86	–0.89
(4) *I*	7.58	+0.29	–1.46	–1.34	16.94	–0.71
(5) *X*	5.77	–0.12	–1.16	–1.19	9.99	–1.21
(6) *M*	8.02	–0.51	–2.49	–2.59	3.11	+0.00
(7) *P*	6.76	–0.11	–0.86	–0.96	5.21	+0.74
(8) *PC*	5.68	–0.10	–0.40	–0.47	3.96	+0.65
(9) *W*	6.54	–0.13	–1.57	–1.55	1.62	+0.00
(10) *N*	1.11	0.00	–0.23	–0.23	2.16	–0.56
(11) *MGJPMO*	9.79	–1.04	–1.57	–1.69	–	–
(12) *XGJPXG*	19.49	–0.41	–10.94	–11.44	–	–

*See Table 2.
**In the case of Japan, GNP or GNPM.

on Japanese economic activities.

On the other hand, **Table 6** presents the results of a simulation in which the government consumption expenditure of Japan is raised by one billion yen over the period 1965–68. The first four columns show the effects of Japanese expansion on the Taiwanese economy. On average over this four-year period a 1.813-percent annual increase in the growth rate of Japanese GNP will give rise to a 0.055-percent annual increase in that of Taiwan; i.e. a one-percent rise in the growth rate of Japanese GNP might be expected to yield a 0.030-percent rise in that of Taiwan. Therefore, it may be concluded that economic repercussions from Japan to Taiwan will be much larger than those from Taiwan to Japan.

5. THE IMPACT OF TECHNICAL PROGRESS ON ECONOMIC PERFORMANCE

In this section we attempt to make a quantitative assessment of the effect of technical progress on economic performance. The method adopted here is simulation using the estimated models. The assessment is first made on the basis of the unlinked Taiwanese model, and then repeated using the linked models.

TABLE 5. The Effects of a Sustained Increase of One Billion Taiwanese Dollars (T$) in Taiwanese Government Consumption, 1965–68 (Linked Models)

	Taiwan				Japan			
	1965	1966	1967	1968	1965	1966	1967	1968
(1) *GDP* (billion T$ or yen)*	1.089	1.264	1.660	1.328	−0.781	−1.438	−2.547	−3.164
(1)' *GDP* (%)*	0.430	0.466	0.563	0.422	−0.001	−0.002	−0.003	−0.003
(2) *GDPM* (billion T$ or yen)*	1.247	1.547	2.323	2.552	−0.919	−1.546	−2.734	−3.338
(2)' *GDPM* (%)*	0.404	0.461	0.622	0.617	−0.001	−0.002	−0.003	−0.003
(3) *C* (%)	0.138	0.245	0.389	0.500	0.000	0.000	0.000	0.000
(4) *I* (%)	0.000	0.192	1.020	1.037	−0.002	−0.004	−0.005	−0.006
(5) *X* (%)	0.075	0.055	0.002	−0.130	−0.011	−0.015	−0.022	−0.022
(6) *M* (%)	0.290	0.443	0.854	1.255	−0.002	−0.001	−0.002	−0.002
(7) *P*	−0.319	−0.152	0.136	0.805	−0.000	−0.001	−0.001	−0.001
(8) *PC*	−0.209	−0.071	0.158	0.692	0.000	0.000	0.000	0.000
(9) *W*	0.026	0.158	0.472	0.970	0.000	0.000	0.000	0.000
(10) *N* (%)	0.016	0.042	0.074	0.108	−0.000	−0.001	−0.001	−0.001
(11) *MGJPMO* (%)	0.452	0.572	0.816	0.876	–	–	–	–
(12) *XGJPXG* (%)	−0.065	0.077	0.152	0.255	–	–	–	–

*In the case of Japan, GNP or GNPM.

TABLE 6. The Effects of a Sustained Increase of One Billion Yen in Japanese Government Consumption, 1965–68 (Linked Models)

	Taiwan				Japan			
	1965	1966	1967	1968	1965	1966	1967	1968
(1) *GDP* (billion T$ or yen)*	0.086	0.144	0.199	0.207	1.303	1.404	1.494	1.594
(1)' *GDP* (%)*	0.034	0.053	0.068	0.066	1.852	1.841	1.809	1.748
(2) *GDPM* (billion T$ or yen)*	0.123	0.203	0.315	0.433	1.424	1.538	1.640	1.757
(2)' *GDPM* (%)*	0.040	0.061	0.084	0.105	1.844	1.827	1.789	1.725
(3) *C* (%)	0.019	0.038	0.059	0.083	0.224	0.380	0.558	0.734
(4) *I* (%)	0.000	0.015	0.089	0.124	0.518	2.788	2.515	2.109
(5) *X* (%)	0.200	0.250	0.266	0.246	−0.097	−0.199	−0.285	−0.334
(6) *M* (%)	0.062	0.092	0.148	0.230	1.778	1.690	1.600	1.528
(7) *P*	−0.001	0.011	0.049	0.141	−0.178	−0.140	−0.039	0.072
(8) *PC*	0.006	0.039	0.113	0.228	0.125	0.162	0.199	0.274
(9) *W*	0.005	0.022	0.063	0.136	0.012	0.092	0.201	0.357
(10) *N* (%)	0.002	0.005	0.010	0.016	0.313	0.597	0.740	0.802
(11) *MGJPMO* (%)	0.110	0.135	0.177	0.236	–	–	–	–
(12) *XGJPXG* (%)	1.098	1.638	1.961	2.285	–	–	–	–

*In the case of Japan, GNP or GNPM.

5.1. The Unlinked Taiwanese Model

In the Taiwanese model the rate of labor-augmenting technical progress was estimated as 7 percent per year for 1961–73 in eq. (5.1) above. Suppose now that this rate is 6 percent per year, i.e. one percentage point lower than the initial estimate. A simulation for 1965–73 under this latter assumption, other things being kept unchanged, describes the growth path whose main features are presented in **Table 7**. Columns (1) and (2) of the table give the average growth rates of selected variables for the 6-percent path and their difference from the "control" solution (see Columns (3) of **Table 2**). It can be seen that a slowdown of one percent in the rate of Taiwanese technical progress will result in a decrease of 2.10 percent in the growth rate of GDP, an increase of 5.70 percent in the inflation rate of the GDP deflator, and an increase of 0.13 percent in the growth rate of employment. The annual increase of 0.13 percent in the average growth rate of employment for nine years, representing a fall of 1.18 percent in the unemployment rate in 1973 may be impossible, since the labor market of Taiwan reached a state of full employment around 1971 and the unemployment rate was 2.24 percent in 1973.[8] Therefore, if the rate of technical progress had been one percent slower, effective demand would have had to be reduced. Let us suppose that government expenditures were cut down so as to keep the unemployment rate at the level of the control solution. Columns (3) and (4) present the growth rate for the simulated path and the differences between this and the control solution, respectively. They show that a one-percent slowdown in the rate of technical progress would lead to a fall of 1.04 percent in the average growth rate of GDP and an increase of 0.95 percent in the inflation rate of the GDP deflator. One might argue, assuming the causal relationship outlined above to be linear, that if the rate of technical progress were zero percent, the Taiwanese economy would have experienced a fall of 7.28 percentage points in the growth rate of GDP, which is about two-thirds of the total GDP growth rate. Column (5) presents calculated values for the Japanese model corresponding to the Taiwanese figures of Column (4). The Japanese figures indicate that the effect on economic performance of the one-percent slowdown in the rate of technical progress is somewhat weaker in Japan than in Taiwan. In fact, a calculation showed that in the case of Japan, if the

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[8] S.W.Y. Kuo, *The Taiwan Economy in Transition* (Westview Press, 1983, Chap.4).

rate of technical progress were zero percent, the Japanese economy would have experienced a drop of 6.12 percentage points in the growth rate of GNP, which is about 60 percent of the total GDP growth rate.

TABLE 7. The Effect of a One-Percent Slowdown in the Rate of Taiwanese Technical Progress, 1965–73 (Unlinked Model)

	(1) 1% fall in the rate of technical progress	(2) (1) – (control solution)	(3) (1) and slower growth of government consumption	(4) (3) – (control solution)	(5) Japanese figure comparable to (4)
(1) *GDP**	8.57	–2.10	9.63	–1.04	–0.68
(2) *GDPM**	11.55	–0.63	11.31	–0.87	–0.66
(3) *C*	7.77	+0.24	6.95	–0.58	–0.46
(4) *I*	14.41	–2.13	14.85	–1.69	–0.94
(5) *X*	22.05	–1.38	23.02	–0.41	–0.71
(6) *M*	14.52	+3.06	11.11	–0.35	–0.48
(7) *P*	9.90	+5.70	5.15	+0.95	+0.61
(8) *PC*	8.39	+3.96	5.10	+0.67	+0.52
(9) *W*	10.46	+2.85	7.55	–0.06	+0.10
(10) *N*	4.16	+0.13	4.01	–0.02	+0.02
(11) *MGJPMO*	25.07	–1.06	24.93	–1.20	–
(12) *XGJPXG*	9.11	–1.15	9.51	–0.75	–

*In the case of Japan, GNP or GNPM.

5.2. The Linked Models

Let us now turn to the linked models. **Table 8** presents the results of a simulation using the linked models, in which the rate of Taiwanese technical progress is set at 6 percent, i.e. one percent lower than the initial estimate, and Taiwanese government consumption is reduced so as to keep the unemployment rate at the same level as in the control solution. Column (1) shows the difference between the *Taiwanese* growth-rate values for each variable and the corresponding control solutions. It is clear that the impact of a one-percent slowdown in Taiwanese technical progress is practically the same as that obtained from the simulation of the unlinked Taiwanese model (see Column (4) of **Table 7**). Similarly, Column (2) of **Table 8** shows the difference between the *Japanese* growth rate values for each variable and the corresponding control solutions. We notice that the one-percent

slowdown of Taiwanese technical progress would have led to a slight stimulus favorable to Japan, for example, a 0.01-percent rise in GNP growth rate, a 0.03-percent rise in the growth rate of exports, and a 0.85-percent fall in the imports-from-Taiwan growth rate. These figures seem very small. One might argue, however, assuming that the causal relationship is linear, that Japan would have experienced a 0.07 (= 0.01 × 7) percentage-point rise[9] in GNP growth, 0.21 percentage points more export growth, and 5.95 percentage points less growth in imports from Taiwan than if there had been no technical progress in Taiwan. The first two of these might have had an insignificant effect on the Japanese economy as a whole, but the 5.95 percentage-point change in imports from Taiwan would have had a substantial impact on the businesses concerned in both countries.

Finally, **Table 9** presents the results of a simulation in which the rate of Japanese technical progress is set at 8 percent (i.e., one percentage point lower than in the initial estimate) and Japanese government consumption is reduced so as to keep the growth rate of employment at the same rate as in the control solution. Columns (1) and (2) are, respectively, the differences between the Taiwanese and Japanese growth rates of each variable and those of the control solution. The effect on the Japanese economy of the one percentage-point slowdown in Japanese technical progress is practically the same as that calculated using the unlinked Japanese model (Column (5) of **Table 7**), while its effect on the Taiwanese economy is very small. A comparison, however, of Column (2) of **Table 8** and Column (1) of **Table 9** reveals that the latter is significantly larger than the former, implying that the effect of Japanese technical progress on Taiwanese performance is much larger than the effect of Taiwanese technical progress on Japanese performance.

According to our estimates of the production functions for both countries, the average annual rate of Japanese technical progress fell from 9 percent to 3 percent after the 1973 oil crisis, while the rate of Taiwanese technical progress fell from 7 percent to 6 percent. The former implies a 0.36 (= 0.06 × 6)-percent fall in the GDP growth rate of Taiwan, a 4.02 (= 0.67 × 6)-percent fall in the GNP growth rate of Japan, and a 5.94 (= 0.99 × 6)-percent increase in the rate of growth of Taiwan-to-Japan exports, while the latter signifies a 0.85-percent decrease in the

[9]The estimate for the rate of Taiwanese technical progress was 7.0 percent.

TABLE 8. The Effects of a One-Percent Slowdown in the Rate of Taiwanese Technical Progress, 1965–73 (Linked Models)

	(1) The effect on Taiwan (slower technical progress) – (control solution)	(2) The effect on Japan (slower technical progress) – (control solution)
(1) *GDP**	–1.03	+0.01
(2) *GDPM**	–0.86	+0.01
(3) *C*	–0.58	+0.00
(4) *I*	–1.69	+0.01
(5) *X*	–0.42	+0.03
(6) *M*	–0.36	–0.00
(7) *P*	+0.93	+0.00
(8) *PC*	+0.66	+0.00
(9) *W*	–0.07	+0.00
(10)*N*	–0.02	+0.00
(11)*MGJPMO*	–1.20	–
(12)*XGJPXG*	–0.85	–

*In the case of Japan, GNP or GNPM.

TABLE 9. The Effects of a One-Percent Slowdown in the Rate of Japanese Technical Progress, 1965–73 (Linked Models)

	(1) The effect on Taiwan (slower technical progress) – (control solution)	(2) The effect on Japan (slower technical progress) – (control solution)
(1) *GDP**	–0.06	–0.67
(2) *GDPM**	+0.02	–0.70
(3) *C*	+0.04	–0.46
(4) *I*	–0.05	–0.96
(5) *X*	+0.02	–0.72
(6) *M*	+0.24	–0.48
(7) *P*	+0.61	+0.61
(8) *PC*	+0.52	+0.52
(9) *W*	+0.13	+0.09
(10)*N*	+0.01	+0.00
(11)*MGJPMO*	+0.34	–
(12)*XGJPXG*	+0.99	–

*In the case of Japan, GNP or GNPM.

respective rates. Therefore, the net effects are a 1.39-percent fall in the GDP growth rate of Taiwan, a 4.01-percent fall in the GNP growth rate of Japan, and a 5.09-percent increase in the growth rate of Taiwan-to-Japan exports. The first two effects explain the greater part of the fall in the GDP growth rates of both countries. The last effect must have been the main cause of the subsequent trade friction between the two countries.

APPENDIX

List of Variables

Notation	* exogenous	Explanation	Unit
C		private consumption expenditure	millions of 1976 NT$
CG	*	government consumption expenditure	millions of 1976 NT$
DEP		capital consumption allowances	millions of current NT$
DIV		dividends	millions of current NT$
GDP		gross domestic product	millions of 1976 NT$
GDPM		gross domestic supply	millions of 1976 NT$
GNPP		gross national product	millions of current NT$
I		gross domestic capital formation	millions of 1976 NT$
IBG	*	interest on public debt	millions of current NT$
J	*	increase in stocks	millions of 1976 NT$
M		imports of goods and services	millions of 1976 NT$
NFI	*	net factor income from the rest of the world	millions of current NT$
NI		national income at factor cost	millions of current NT$
P		deflator for gross domestic product	1976 = 1.0
PC		deflator for private consumption expenditure	1976 = 1.0
PCG		deflator for government consumption expenditure	1976 = 1.0
PI		deflator for gross domestic capital formation	1976 = 1.0
PM		deflator for imports of goods and services	1976 = 1.0
POP	*	population	thousands of persons
PX		deflator for exports of goods and services	1976 = 1.0
SUB		subsidies	millions of current NT$
TI		indirect business taxes	millions of current NT$
TRP	*	personal income tax and other household transfers	millions of current NT$
WN		employee compensation	millions of current NT$
X		exports of goods & services	millions of 1976 NT$
YC	*	corporate income before taxes	millions of current NT$
YDP		private disposable income	millions of current NT$
YG	*	general government income from property & government enterprises	millions of current NT$
YPP		personal income	millions of current NT$
YRP		private income from property	millions of current NT$
YUI		compound income	millions of current NT$

Notation	* exogenous	Explanation	Unit
JRATET	*	exchange rate of Japan	Yen/US$
ME		imports of fuels	millions of 1976 NT$
MG		imports of commodities	millions of 1976 NT$
MGJPMO		imports of commodities from Japan	millions of current NT$
MGR		imports of commodities other than fuels from countries other than Japan	millions of 1976 NT$
MJ		imports from Japan	billions of current Yen
MJi		imports of item *i* from Japan; *i* = 1 (foods), 2 (chemicals), 3 (textiles), 4 (metals), 5 (machinery), and 6 (others)	thousands of 1976 US$
MO		imports of commodities other than fuels	millions of 1976 NT$
MS	*	imports of services	millions of 1976 NT$
Pi		price index of industry *i*; *i* = 1 (primary), 2 (foods), 3 (textiles), 4 (chemicals), 5 (petrochemicals), 6 (metals), 7 (machinery), and 8 (construction, utilities, and services).	1976 = 1.0
PJ		deflator for increase in stocks	1976 = 1.0
PJi		wholesale price index of item *i* of Japan; see *XJi* for each item	1976 = 1.0
PME	*	deflator for imports of fuels	1976 = 1.0
PMG		deflator for commodity imports	1976 = 1.0
PMJi		import price index of item *i* from Japan; see *MJi* for each item	1976 = 1.0 (US$)
PMO	*	deflator for imports of commodities other than fuels	1976 = 1.0
PMS	*	deflator for service imports	1976 = 1.0
PXi		export price index of item *i*; see *XJi* for each item	1976 = 1.0 (NT$)
PXG		deflator for commodity exports	1976 = 1.0
PXS	*	deflator for service exports	1976 = 1.0
PWT	*	price index of world trade (US dollar base)	1975 = 1.0
RATE	*	index of exchange rate (NT$ per one US$)	1976 = 1.0
RATJ	*	index of exchange rate of Japan (Yen per one US$)	1976 = 1.0
VJ	*	index of gross national product in constant prices of Japan	1976 = 1.0
WT	*	quantity index of world trade	1975 = 1.0
XG		exports of commodities	millions of 1976 NT$
XGJPXG		exports of commodities to Japan	millions of current NT$
XGR		exports of commodities to countries other than Japan	millions of 1976 NT$
XJ		exports to Japan	billions of current Yen
XJi		exports of item *i* to Japan; *i* = 1 (foods and agricultural product), 2 (chemicals), 3 (machinery), and 4 (others)	thousands of 1976 US$
XS	*	exports of services	millions of 1976 NT$
YCD		corporate income before taxes, excluding dividents	millions of current NT$

Notation	* exogenous	Explanation	Unit
DFL		income differential between employees and nonemployees, defined by eq. (6.5)	–
KIF		end-of-year stock of capital	millions of 1976 NT$
L		adjusted number of persons engaged of the whole economy	thousands of persons
*L**		desired level of *L*, defined by eq. (6.1)	thousands of persons
LF	*	number of labor force of the whole economy	thousands of persons
N		number of persons engaged of the whole economy	thousands of persons
NU		number of self-employed persons and family workers	thousands of persons
NW		number of employees	thousands of persons
PLD		price index of domestic product of industry *i*	1976 = 1.0
PLM		price index of import product of industry *i*	1976 = 1.0
PLIO		cost index of industry *i*, defined by eq. (4.2)	1976 = 1.0
PCIO		weighted average of industry prices, defined by eq. (4.11)	1976 = 1.0
PCGIO		weighted average of industry prices, defined by eq. (4.11)	1976 = 1.0
PGDPM		deflator for gross domestic supply	1976 = 1.0
PIIO		weighted average of industry prices, defined by eq. (4.11)	1976 = 1.0
PJIO		weighted average of industry prices, defined by eq. (4.11)	1976 = 1.0
PK		price index of capital services, defined by eq. (4.35)	1976 = 1.0
PO	*	wholesale price index of others	1976 = 1.0
PXGIO		weighted average of industry prices, defined by eq. (4.11)	1976 = 1.0
PWHIJ	*	wholesale price index of the whole industry of Japan	1976 = 1.0
R	*	maximum rate of medium- and long-term bank loan	per cent per year
T		index of technology level, defined by eq. (5.1)	–
UR		unemployment rate	percent
VMC		capacity level of gross domestic supply, defined by eq. (5.2)	millions of 1976 NT$
W		employee compensation per employee	thousands of NT$ per person
WU		compound income per person	thousands of NT$ per person

List of Coefficients

Notation	Explanation
$A(j,i)$	material input coefficient; i.e., the amount of output j required to produce one unit of output i
$D(i)$	capital consumption allowances per unit of output in industry i
$F(j,i)$	the proportion of the value of the ith industry output which corresponds to the jth final demand and category; j =1 (private consumption), 2 (government consumption), 3 (gross domestic capital formation), 4 (increase in stocks), and 5 (exports); see Pi for i = 1,2,...,8.
$T(i)$	ratio of indirect taxes less subsidies to output in industry i
$S(i)$	mark-up ratio, or the normal rate of business surpluses to output in industry i
$WD(i)$	weight of domestic price in the price index of industry i
$WM(i)$	weight of import price in the price index of industry i

List of Dummy Variables

Notation	Explanation
DUME	= 1 when the explained variable in eq. (5.1) is ln (*ME / GDPM*); = 0 otherwise
DUMK	= 1 when the explained variable in eq. (5.1) is ln (*KIF / GDPM*); = 0 otherwise
DUML	= 1 when the explained variable in eq. (5.1) is ln (*L / GDPM*) · *T*; = 0 otherwise
DUMO	= 1 when the explained variable in eq. (5.1) is ln (*MO / GDPM*); =0 otherwise
*D*5159	= 1 for 1951–59; = 0 otherwise
*D*63	= 1 for 1963 ; = 0 otherwise
*D*6599	= 1 for 1965– ; = 0 otherwise
*D*6699	= 1 for 1966– ; = 0 otherwise
*D*72	= 1 for 1972 ; = 0 otherwise
*D*7499	= 1 for 1974– ; = 0 otherwise
*D*7599	= 1 for 1975– ; = 0 otherwise
*D*7799	= 1 for 1977– ; = 0 otherwise
*D*8099	= 1 for 1980– ; = 0 otherwise
*D*8199	= 1 for 1981– ; = 0 otherwise

List of Equations

Eq No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period
I. Expenditure					
Gross Domestic Product					
(1.1)	$GDP = C + CG + I + J + X - M$				
(1.2)	$GDP \cdot P = C \cdot PC + CG \cdot PCG + I \cdot PI + J \cdot PJ + X \cdot PX - M \cdot PM$				
(1.3)	$GDPM = GDP + M$				
(1.4)	$PGDPM = (GDP \cdot P + M \cdot PM) / GDPM$				
(1.5)	$GNPP = GDP \cdot P + NFI$				
Consumption					
(1.6)	$\ln (C/POP) = \underset{(8.39)}{0.429} \ln \{(YDP / PC) / POP\} + \underset{(8.64)}{0.511} \ln (C/POP)_{-1} + \underset{(1.46)}{0.0119} D5159 + \underset{(4.76)}{0.116}$	0.999	1.850		1953–81
Fixed Investment					
(1.7)	$\ln I = \underset{(1.06)}{0.449} \ln GDP_{-1} + \underset{(4.05)}{1.925} \ln GDP_{-2} - \underset{(6.09)}{0.921} \ln KIF_{-1} - \underset{(22.4)}{6.489}$	0.996	1.053		1961–81
(1.8)	$KIF = 0.97\ KIF_{-1} + I$				

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period
II. The Foreign Sector					
Imports from Japan					
(Foods and agricultural products)					
(2.1)	$\ln MJ1 = \underset{(2.22)}{1.634} \ln GDP - \underset{(3.46)}{0.803} \ln \{PMJ1 / (P2 / RATE)\} - \underset{(2.03)}{1.093} \ln VMC_{-1} + \underset{(0.61)}{4.425}$	0.968	1.633	0.87	1964–81
(Chemicals)					
(2.2)	$\ln MJ2 = \underset{(1.71)}{1.738} \ln GDP - \underset{(0.16)}{0.107} \ln \{PMJ2 / (P4 / RATE)\} - \underset{(0.82)}{0.667} \ln VMC_{-1} - \underset{(0.16)}{1.360}$	0.940	1.921	0.83	1964–81
(Textiles)					
(2.3)	$\ln MJ3 = \underset{(0.56)}{0.449} \ln GDP - \underset{(0.53)}{0.349} \ln \{PMJ3 / (P3 / RATE)\} - \underset{(0.39)}{0.241} \ln VMC_{-1} + \underset{(1.49)}{9.515}$	0.925	1.622	0.83	1964–81
(Metals)					
(2.4)	$\ln MJ4 = \underset{(9.35)}{1.251} \ln GDP - \underset{(4.23)}{0.927} \ln \{PMJ4 / P6 / RATE)\} - \underset{(2.13)}{3.812}$	0.987	2.574	0.67	1964–81
(Machinery)					
(2.5)	$\ln MJ5 = \underset{(5.67)}{1.499} \ln GDP - \underset{(1.82)}{0.686} \ln \{PMJ5 / P7 / RATE)\} - \underset{(1.76)}{6.227}$	0.974	2.313	0.70	1964–81
(Others)					
(2.6)	$\ln MJ6 = \underset{(3.92)}{1.307} \ln GDP - \underset{(2.10)}{0.451} \ln \{PMJ6 / (PO / RATE)\} - \underset{(1.18)}{5.395}$	0.989	1.511	0.85	1964–81
Exports to Japan					
(Foods and agricultural products)					
(2.7)	$\ln XJ1 = \underset{(1.57)}{0.387} \ln VJ - \underset{(1.81)}{0.639} \ln \{PX1 / RATE) / (PJ1 / RATJ)\} + \underset{(2.01)}{0.431} \ln XJ1_{-1} + \underset{(2.67)}{7.389}$	0.725	1.365		1965–81
(Chemicals)					
(2.8)	$\ln XJ2 = \underset{(0.57)}{1.013} \ln VJ - \underset{(1.51)}{0.557} \ln \{PX2 / RATE) / (PJ2 / RATJ)\} + \underset{(3.64)}{0.611} \ln XJ2_{-1} + \underset{(0.27)}{0.372} \ln VMC - \underset{(0.06)}{1.083}$	0.955	1.818		1965–81
(Machinery)					
(2.9)	$\ln XJ3 = \underset{(3.42)}{4.737} \ln VJ - \underset{(0.66)}{0.777} \ln \{PX3 / RATE) / (PJ3 / RATJ)\} + \underset{(1.79)}{0.221} \ln XJ3_{-1} + \underset{(6.49)}{8.999}$	0.941	1.945		1965–81
(Others)					
(2.10)	$\ln XJ4 - 0.64 \ln VJ = \underset{(1.14)}{1.135} \ln \{PX4 / RATE) / (PJ4 / RATJ)\} + \underset{(4.14)}{0.744} \ln XJ4_{-1} + \underset{(1.52)}{3.518}$	0.920	2.024		1965–81

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period
	Imports from Countries other than Japan				
	(Fuels)				
(2.11)	$\ln ME = \underset{(27.4)}{1.379} \ln GDP - \underset{(11.5)}{0.971} \ln (PME / P) - \underset{(2.58)}{0.271} \ln (PME / P)_{-1} - \underset{(11.7)}{7.947}$	0.974	1.136		1961–81
	(Commodities other than fuels)				
(2.12)	$\ln MGR = \underset{(11.9)}{1.791} \ln GDP - \underset{(5.07)}{1.460} \ln (PMO / P) - \underset{(5.92)}{12.192}$	0.982	1.078		1963–81
	Exports to countries other than Japan				
(2.13)	$\ln XGR = \underset{(5.21)}{2.370} \ln WT - \underset{(1.04)}{0.193} \ln \{(PXG / RATE) / PWT\} + \underset{(0.58)}{0.182} \ln VMC_{-1} + \underset{(2.22)}{9.699}$	0.994	1.198		1961–81
	Identities : Imports				
(2.14)	$M = MG + MS$				
(2.15)	$M \cdot PM = MG \cdot PMG + MS \cdot PMS$				
(2.16)	$MG = ME + MO$				
(2.17)	$MG \cdot PMG = ME \cdot PME + MO \cdot PMO$				
(2.18)	$MO \cdot PMO = MGJPMO + MGR \cdot PMO$				
(2.19)	$\ln MGJPMO = \underset{(50.9)}{1.021} \ln \{37.95\ RATE \sum_{i=1}^{6} MJi \cdot PMJi / 1000\} - \underset{(1.12)}{0.241}$	0.994	1.426		1964–81
(2.20)	$MJ = \{ MGJPMO / (37.95\ RATE) \} \cdot JRATET / 1000$				
	Identities : Exports				
(2.21)	$X = XG + XS$				
(2.22)	$X \cdot PX = XG \cdot PXG + XS \cdot PXS$				
(2.23)	$XG \cdot PXG = XGJPXG + XGR \cdot PXG$				
(2.24)	$\ln XGJPXG = \underset{(70.0)}{0.998} \ln \{37.95\ RATE \sum_{i=1}^{4} XJi \cdot PXi / 1000\} - \underset{(0.83)}{0.117}$	0.996	2.380		1963–81
(2.25)	$XJ = \{ XGJPXG / (37.95\ RATE) \} \cdot JRATET / 1000$				

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period
III. Distribution					
National Income					
(3.1)	$TI = 0.146\ GNPP - 559.7$ (101.) (0.69)	0.997	1.278		1952–81
(3.2)	$SUB = 0.0023\ GNPP - 308.5$ (5.49) (1.28)	0.501	1.331		1952–81
(3.3)	$DEP = 0.0782\ GNPP - 1574.8$ (106.) (3.81)	0.998	1.507		1952–81
(3.4)	$NI = 0.779\ GNPP + 1826.0$ (428.) (1.78)	0.999	1.079		1952–81
Unincorporated, Property and Corporate Income					
(3.5)	$YUI = 0.0555\ (NI + IBG - YG) + 11404.1$ (18.2) (8.80)	0.920	0.270		1952–81
(3.6)	$YRP - DIV = 0.120\ (NI + IBG - YG) + 821.1$ (96.2) (1.55)	0.997	1.201		1952–81
(3.7)	$YC = YCD - DIV$				
(3.8)	$DIV = 0.455\ YC + 0.0794\ YC_{-1} + 1724.0$ (9.55) (1.50) (1.84)	0.984	1.292		1952–81
(3.9)	$YPP = NI + IBG - YG - YCD$				
(3.10)	$YDP = YPP - TRP$				

Eq. No.	Equation

IV. The Price Sector

Industry Price

(4.1) $Pi = WD(i) \cdot PiD + WM(i) \cdot PiM, \quad i = 1,2, \cdots ,8$

$WD(i)$ =	0.668	0.954	0.961	0.793	0.818	0.712	0.651	0.948
$WM(i)$ =	0.332	0.046	0.039	0.207	0.182	0.288	0.349	0.052

(4.2) $PiIO = [\sum_{\substack{j=1 \\ j \neq i}}^{8} A(j,i) \cdot Pj + D(i) \cdot PI] \; / \; [\, 1 - A(i,i) - T(i) - S(i) \,], \quad i = 1,2, \cdots ,8$

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$[A(j,i)]$ =	(1)	0.1475	0.5083	0.0714	0.0317	0.7086	0.0174	0.0021	0.0400
	(2)	0.1430	0.1204	0.0023	0.0040	0.0000	0.0000	0.0000	0.0056
	(3)	0.0023	0.0014	0.3909	0.0239	0.0000	0.0006	0.0010	0.0080
	(4)	0.0491	0.0166	0.1602	0.4678	0.0114	0.0220	0.0340	0.0319
	(5)	0.0264	0.0062	0.0088	0.0198	0.0419	0.0136	0.0048	0.0446
	(6)	0.0060	0.0161	0.0016	0.0122	0.0161	0.5447	0.1712	0.0283
	(7)	0.0126	0.0038	0.0097	0.0108	0.0044	0.0106	0.3429	0.0232
	(8)	0.0668	0.0763	0.1098	0.1324	0.0248	0.1714	0.1282	0.2182
$[D(i)]$ =		0.0378	0.0114	0.0314	0.0484	0.0625	0.0179	0.0202	0.0491
$[T(i)]$ =		0.0233	0.1412	0.0229	0.0427	0.1366	0.0456	0.0581	0.0353
$[S(i)]$ =		0.1653	0.0410	0.0397	0.0951	−0.0260	0.0457	0.0858	0.1879

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period
(4.3)	$\ln P1D - 0.518 \ln P1IO = 0.736 \ln (WL / GDP) + 0.701$ (6.65) (6.79)	0.944	1.816	0.65	1964–81
(4.4)	$\ln P2D = 0.419 \ln P2IO + 0.603 \ln (WL / GDP) + 0.077\ D63 + 0.168\ D72$ (2.10) (2.46) (2.50) (5.81)	0.996	1.809		1963–81
	$- 0.164\ D7999 + 0.417$ (6.85) (2.87)				
(4.5)	$\ln P3D - 0.660 \ln P3IO = 0.255 \ln W - 0.591 \ln (GDP / L) - 0.175\ D7499$ (0.69) (1.01) (0.98)	0.707	1.382		1963–81
	$- 0.213\ D8099 + 2.334$ (1.72) (1.52)				
(4.6)	$\ln P4D - 0.718 \ln P4IO = 1.276 \ln (WL / GDP) - 0.418$ (7.32) (1.13)	0.849	2.150	0.96	1964–81
(4.7)	$\ln P5D - 0.977 \ln P5IO = 0.641 \ln (WL / GDP) + 0.547$ (3.39) (3.12)	0.733	1.975	0.86	1964–81
(4.8)	$\ln P6D - 0.696 \ln P6IO = 0.507 \ln (WL / GDP) - 0.274\ D6699$ (5.29) (6.20)	0.755	2.109		1963–81
	$- 0.255\ D7599 - 0.435\ D8199 + 1.127$ (3.69) (5.79) (8.24)				
(4.9)	$\ln P7D - 0.704 \ln P7IO = 0.290 \ln (WL / GDP) + 0.006$ (1.68) (0.02)	0.614	0.992	0.94	1963–71
(4.10)	$\ln P8D - 0.430 \ln P8IO = 0.400 \ln (WL / GDP) + 1.062$ (2.70) (4.67)	0.962	1.228	0.94	1964–81

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period

Deflators for Final Demands

(4.11) $PFIO = F \cdot P$

$$[PFIO] = \begin{bmatrix} PCIO \\ PCGIO \\ PIIO \\ PJIO \\ PXGIO \end{bmatrix}, \quad P = \begin{bmatrix} P1 \\ P2 \\ \cdot \\ \cdot \\ \cdot \\ P8 \end{bmatrix}$$

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$F =$	(PC)	0.0818	0.3087	0.0303	0.0253	0.0175	0.0031	0.0533	0.4801
	(PCG)	0.0001	0.0010	0.0087	0.0088	0.0542	0.0083	0.0118	0.9069
	(PI)	0.0112	0.0000	0.0013	0.0002	0.0000	0.0072	0.4024	0.5777
	(PJ)	0.2191	0.1224	0.0709	0.1085	0.0286	0.0912	0.1637	0.1955
	(PXG)	0.0370	0.0815	0.2178	0.1051	0.0210	0.0387	0.2162	0.2827

(4.12) $\ln PC = 1.047 \ln PCIO - 0.014$ (39.9) (1.03)	0.997	1.662	0.51	1964–81
(4.13) $\ln PCG = 0.882 \ln PCGIO + 0.080$ (9.37) (0.53)	0.995	1.038	0.93	1964–81
(4.14) $\ln PI = 1.030 \ln PIIO - 0.058$ (17.2) (2.13)	0.990	1.248	0.63	1964–81
(4.15) $\ln PJ = 1.264 \ln PJIO - 0.094$ (14.0) (0.58)	0.993	1.851	0.94	1964–81
(4.16) $\ln PXG = 1.199 \ln PXGIO - 0.027$ (24.3) (1.36)	0.987	1.764	0.36	1964–81

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period
	Export Prices				
(4.17)	$\ln PX1 = \underset{(18.0)}{1.0576} \ln P2 + \underset{(2.12)}{0.0621}$	0.950	1.054		1964–81
(4.18)	$\ln PX2 = \underset{(12.1)}{1.2135} \ln P4 + \underset{(0.70)}{0.0319}$	0.895	0.991		1964–81
(4.19)	$\ln PX3 = \underset{(23.1)}{1.4554} \ln P7 - \underset{(1.88)}{0.038}$	0.969	1.592		1964–81
(4.20)	$\ln PX4 = \underset{(14.4)}{1.4943} (0.85 \ln P3 + 0.15 \ln P6) + \underset{(1.04)}{0.0277}$	0.924	0.851		1964–81
	Import Prices from Japan				
(4.21)	$\ln PMJ1 = \underset{(18.4)}{1.118} \ln (PWHIJ \cdot RATJ) + \underset{(1.37)}{0.0476}$	0.941	0.738		1960–81
(4.22)	$\ln PMJ2 = \underset{(12.9)}{0.754} \ln (PWHIJ \cdot RATJ) + \underset{(2.12)}{0.0707}$	0.887	0.975		1960–81
(4.23)	$\ln PMJ3 = \underset{(29.8)}{0.594} \ln (PWHIJ \cdot RATJ) + \underset{(0.96)}{0.0110}$	0.977	2.023		1960–81
(4.24)	$\ln PMJ4 = \underset{(25.2)}{0.930} \ln (PWHIJ \cdot RATJ) + \underset{(0.14)}{0.0029}$	0.968	1.508		1960–81
(4.25)	$\ln PMJ5 = \underset{(22.3)}{0.547} \ln (PWHIJ \cdot RATJ) + \underset{(0.85)}{0.0118}$	0.960	1.124		1960–81
(4.26)	$\ln PMJ6 = \underset{(38.3)}{0.958} \ln (PWHIJ \cdot RATJ) + \underset{(3.91)}{0.0556}$	0.986	1.347		1960–81

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period
	Wholesale price index				
(J.1)	ln $PJ1$ = 1.813 ln $PWHIJ$ + 0.0558 (16.0) (1.37)	0.924	1.067		1961–81
(J.2)	ln $PJ2$ = 1.491 ln $PWHIJ$ + 0.0876 (13.5) (2.22)	0.897	1.335		1961–81
(J.3)	ln $PJ3$ = 1.054 ln $PWHIJ$ + 0.0708 (13.2) (2.48)	0.892	1.248		1961–81
(J.4)	ln $PJ4$ = 2.176 ln $PWHIJ$ + 0.1255 (22.9) (3.67)	0.961	1.190		1961–81
	Import Prices, Industry Category				
(4.27)	$P1M = 0.07\ PMJ6 \cdot RATE + 0.45\ PME + 0.48\ PMO$				
(4.28)	$P2M = 0.09\ PMJ1 \cdot RATE + 0.91\ PMO$				
(4.29)	$P3M = 0.66\ PMJ3 \cdot RATE + 0.34\ PMO$				
(4.30)	$P4M = 0.45\ PMJ2 \cdot RATE + 0.55\ PMO$				
(4.31)	$P5M = 0.07\ PMJ6 \cdot RATE + 0.93\ PME$				
(4.32)	$P6M = 0.66\ PMJ4 \cdot RATE + 0.34\ PMO$				
(4.33)	$P7M = 0.43\ PMJ5 \cdot RATE + 0.57\ PMO$				
(4.34)	$P8M = 0.07\ PMJ6 \cdot RATE + 0.93\ PMO$				
	Price of Capital Services				
(4.35)	$PK = PI \cdot \{(R / 100) + 0.035\} / 0.165$				

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period

V. Production Function

(5.1) $\ln\{(L / GDPM) \cdot T\} = const + \sigma\left[\frac{1}{2}\ln(PGDPM / W)_{-1} + \frac{1}{2}\ln(PGDPM / W)_{-2} + \ln T\right]$

$\ln(KIF / GDPM) = const + \sigma\left[\frac{1}{2}\ln(PGDPM / PK)_{-1} + \frac{1}{2}\ln(PGDPM / PK)_{-2}\right]$

$\ln(ME / GDPM) = const + \sigma\left[\frac{1}{2}\ln(PGDPM / PME)_{-1} + \frac{1}{2}\ln(PGDPM / PME)_{-2}\right]$

$\ln(MO / GDPM) = const + \sigma\left[\frac{1}{2}\ln(PGDPM / PMO)_{-1} + \frac{1}{2}\ln(PGDPM / PMO)_{-2}\right]$

$\sigma = 0.3825$ (1.01)
$const = -2.8953\ DUML - 0.8049\ DUMK - 2.6162\ DUME - 2.4260\ DUMO$ 0.995 1962–69

$\sigma = 0.3942$ (3.72)
$const = -2.9151\ DUML - 0.8227\ DUMK - 3.2821\ DUME - 1.3304\ DUMO$ 0.995 1974–81

$$T_t = \frac{\sum_{i=0}^{9} \exp[0.070(t-i) - 0.010D\cdot(t-i-22)]\cdot I_{t-i}}{\sum_{i=0}^{9} I_{t-i}}$$

t = time (1953 = 1.0)
D = 0 for $t-i < 22$ (i.e., before 1973); =1 for $t-i \geq 22$ (i.e., after 1974)

Capacity Output

(5.2) $VMC = 1.15\left[0.5159\times10^{-3}(T\cdot LFE)^{-\vartheta} + 0.1219(KIF_{-1})^{-\vartheta} + 1.0703\times10^{-3}(ME)^{-\vartheta} + 1.7599\times10^{-3}(MO)^{-\vartheta}\right]^{-1/\vartheta}$, 1962–73
$\vartheta = 1.6144$

$VMC = 1.15\left[0.6143\times10^{-3}(T\cdot LFE)^{-\vartheta} + 0.1241(KIF_{-1})^{-\vartheta} + 0.2421\times10^{-3}(ME)^{-\vartheta} + 0.03422(MO)^{-\vartheta}\right]^{-1/\vartheta}$, 1974–81
$\vartheta = 1.5368$

Eq. No.	Equation	$\bar{R}^2$	D.W.	ρ	sample period

VI. Employment and Wage

(6.1) $\ln L^{\bullet} = -2.8953 + \sigma \left[\frac{1}{2} \ln (PGDPM / W)_{-1} + \frac{1}{2} \ln (PGDPM / W)_{-2} + \ln T \right] + \ln GDPM - \ln T$

$\sigma =$ 0.3825 for 1962–69,
0.3942 for 1974–81

(6.2) $\ln L = \underset{(4.03)}{0.332} \ln L^{\bullet} + \underset{(7.34)}{0.659} \ln L_{-1} + \underset{(0.61)}{0.0884}$ — 0.994 — 1.632 — — 1960–81

(6.3) $\ln NW = \underset{(0.91)}{0.212} \ln L + \underset{(5.30)}{0.861} \ln NW_{-1} - \underset{(0.92)}{0.5759}$ — 0.995 — 0.654 — — 1960–81

(6.4) $L = NW + NU \cdot DFL$

(6.5) $DFL = WU / W$

(6.6) $N = NW + NU$

(6.7) $UR = 1 - (N / LF)$

(6.8) $W = WN / NW$

(6.9) $WU = YUI / NU$

(6.10) $(W - W_{-1}) / W_{-1} = \underset{(2.06)}{0.323} \cdot \frac{1}{2} \{(PC - PC_{-1}) / PC_{-1} + (PC_{-1} - PC_{-2}) / PC_{-2}\}$
$\underset{(3.32)}{- 0.038}\, UR \underset{(2.88)}{- 0.125}\, D6599 \underset{(1.35)}{+ 0.056}\, D64 \underset{(4.34)}{+ 0.200}\, D74 \underset{(4.24)}{+ 0.322}$ — 0.783 — 1.426 — — 1961–81

ECONOMIC PROBLEMS OF SMALL DEVELOPED COUNTRIES

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ECONOMIC PROBLEMS OF SMALL DEVELOPED COUNTRIES

Prof. Dr. P. de Wolff

1. INTRODUCTION*

The subject of this paper is not a clearly limited one. Even if we restrict ourselves to the group of small developed European countries we will find big differences between their economies. They differ considerably in size as far as their populations are concerned and still more with respect to the size of their territories and natural endowments. The latter factor in particular leads to large differences in their economic structure.

Moreover some of the differences are to a lesser extent due to size as to differences in economic policy, demographic factors, etc. In many respects the Netherlands occupy a special position, in particular with respect to its relations with the FRG. Therefore, conclusions may only be generalized with great care. Nevertheless, they seem to be of sufficient interest to contribute to a more general discussion.

In the following paragraphs some remarks will be made on the role of foreign trade, investments, the development of new technologies and, finally, a few tentative conclusions will be drawn.

2. THE ROLE OF FOREIGN TRADE

2.1. Commodities

Obviously, one of the main economic disadvantages of small countries as compared to bigger ones is the size of their home markets. In order to be able sufficiently to profit from the advantages of large scale production,

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*To a considerable extent this paper relies on studies carried out by and under the auspices of the Netherlands' Scientific Council of Governmental Policy, in particular on the work of Mr. C.W.A.M. van Paridon, see [1], [2] and [3].

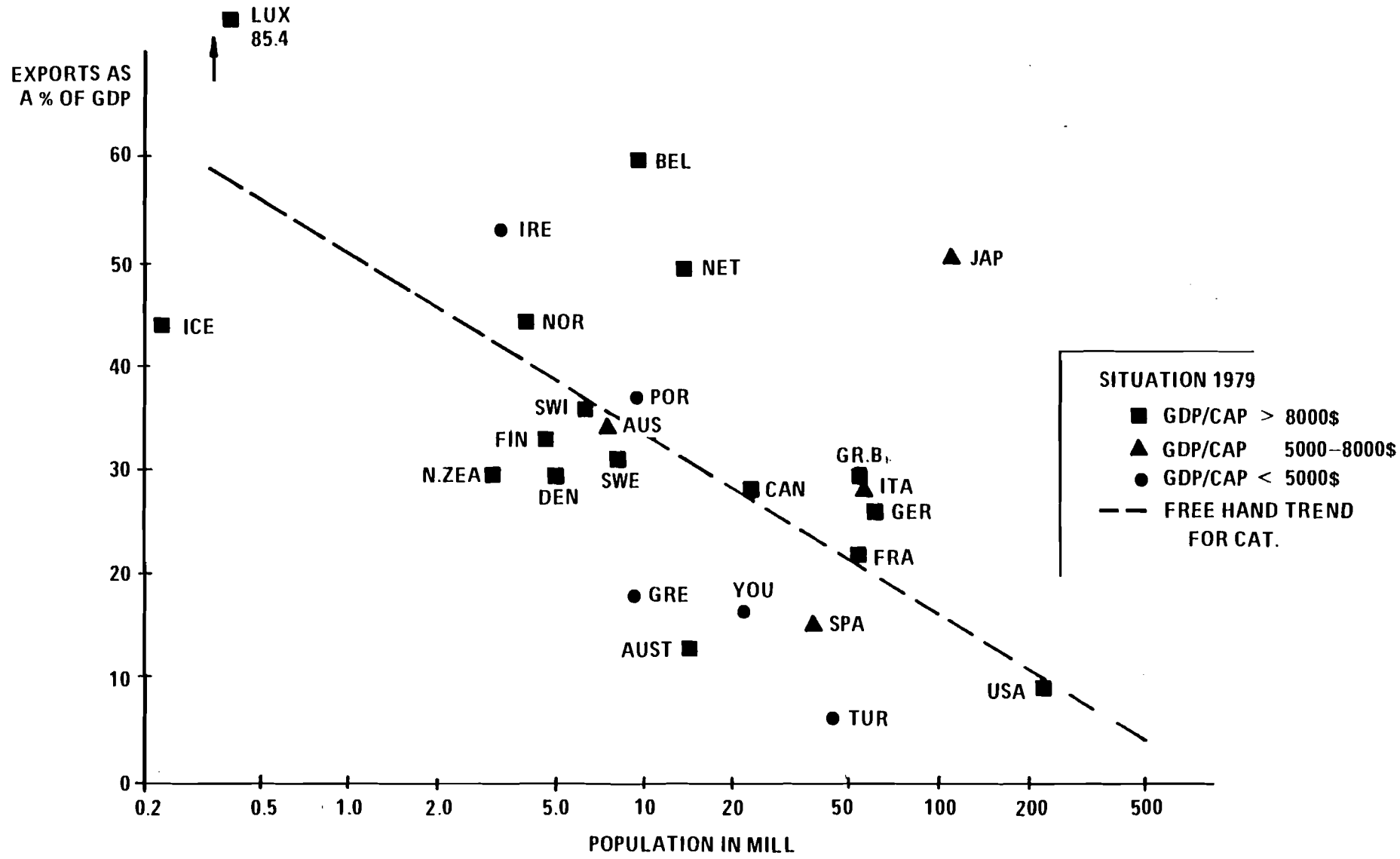
they usually have to rely more heavily on foreign trade than the bigger countries. Moreover, experience shows that small countries can only obtain a high level of income per capita at a relatively high share of exports of goods and services in the GDP. Therefore, this share tends negatively to be with population size and positively with the level of prosperity. This is clearly demonstrated by Figure 1, referring to the OECD countries. However, it need not surprise that the correlation is not very strong and, consequently that large differences occur between countries of the same size and roughly the same level of income per capita. Many other factors play a role, in particuar the size of the natural resources. These explain, e.g., to a considerable extent why Swedens' share is much lower than for Belgium or the Netherlands.

A high level of exports is as economic disadvantage not only as it usually is more expensive to operate in a foreign market than at home, due to transportation costs and costs of obtaining relevant information, etc., but also due to trade barriers of different types. These comprise in the first place import duties but even for countries belonging to a free-trade area or a customs union, as e.g., the EEC, where visible barriers are of little importance, there usually exist many invisible ones, e.g., special requirements with respect to quality, packing, inspection, the preference of governmental bodies to buy national products, etc. These factors act to the disadvantage of importers as compared to local producers and they tend to sharpen the competition between the former ones. In addition to these factors, which mainly lead to costs burdening exports and which are difficult to statistically measure, there is of course the high vulnerability connected with extensive exports. Fluctuations in exports tend strongly to be correlated to fluctuations in GDP, be it that the latter usually are smaller than the former. (This is also valid for bigger countries.) In this paper attention will be drawn to two other aspects which may lead to disadvantages, viz. the regional and the sectorial composition of small country exports. This will be illustrated by the economic relations between the Netherlands and the FRG.

As to the first one, obviously, there is a strong tendency to concentrate export activities on neighbouring markets and in most cases their share in total exports is very high. Trade between the Netherlands and the FRG has always been very important. Between the two world wars the share of Dutch exports to the FRG fluctuated around 25%, the average for imports was slightly lower, i.e., 22%. During the first years after W.W.II these shares, for obvious reasons were much lower but already in 1960 they were again quite close to their pre-war values and, afterwards they rose still more. In 1970, e.g., the share of imports amounted to 27%, that of exports 32%! During the recent depression they dropped a little but are still very high. The ensuing surplus of the trade balance on current account is due to the important exports of fuels to the FRG. If this item is left out a deficit results, just as with respect to the FRG's trade with its other small neighbours. In relation to the NNI there is a striking difference between pre- and post-war years. Dutch exports to the FRG are now of the order of 12 to 15% the NNI and more than twice as high as before W.W.II. This, of course, expresses the very strong upsurge of international trade in general during the post-war years.

These favorable results, however, should not conceal the fact that the Dutch competitive position deteriorated during the 1970s and the Netherlands' share in the FRG's imports declined from 14.1% in 1975 to 12.4% in 1979, be it that a slight improvement is to be observed in more recent years. At the same time, a considerable shift in the composition of the exports took place, a fact that will be considered in more detail later on.

FIGURE 1: RELATION BETWEEN SHARE OF EXPORTS IN GDP, POPULATION AND GDP/CAP



Before entering into the advantages and disadvantages of the trade relations referred to, it is interesting to compare their size to similar situations elsewhere. A few interesting examples are given in Table 1, which shows that the FRG-Dutch relations are by no means extraordinarily strong. On the contrary, there are several cases with much higher corresponding shares, in particular the top-ranking Canadian-USA one. (Table 1, by the way, also clearly illustrates the preponderant position in inter-European trade occupied by the FRG.) Needless to say that the number of factors determining the shares is very large. Some of them, however, can be analyzed to some extent. At first it will be clear that the national income of the importing country plays a crucial role. The bigger it is the higher the share in the exports of the exporting country may be expected to be. The membership of an economic community, as e.g., the EEC will be an important factor too, and thirdly, despite the fact that all cases refer to contiguous countries or to countries lying closely together there are still widely differing distances between the various couples.

Table 1. Selected large/small country relationships, showing the relative size of GNP and the percentage of small country imports and exports accounted for by the large country (1978).

Relationships		GNP of the small country as a percentage of the GNP of the large one	Large country share in	
Large country	Small country		imports of smaller country	exports
FRG	Denmark	8.7	21.8	16.5
FRG	Austria	9.1	47.7	29.0
FRG	Netherlands	20.5	24.4	30.8
FRG	Switzerland	13.2	27.1	18.0
FRG	Belgium	15.7	24.4	22.7
FRG	Sweden	13.7	19.9	11.6
UK	Ireland	3.9	53.2	46.9
France	Belgium	21.3	16.3	19.0
USA	Canada	9.7	69.6	67.7

Sources: OECD, National Account Statistics and Trade by commodities.

The analysis can be carried out in different ways but the so-called delta-coefficient offers a convenient tool. Let total exports of country i be a fraction x of total world imports M_w and imports Mj of another country j be a fraction y of M_w. Now if the trade between countries is distributed entirely independently from special relations between these countries, one would expect exports X_{ij} from i to j to be equal to a fraction x.y of M_w. Therefore, the delta coefficient is defined as the ratio of the actual fraction to this expected one, vis.:

$$\Delta = \frac{X_{ij}}{M_w} : (x.y) = \frac{X_{ij}}{M_w} : \left(\frac{X_i}{M_w} \times \frac{M_j}{M_w}\right) = \frac{X_{ij}}{X_i} : \frac{M_j}{M_w}$$

The formula shows that Δ can also be interpreted as the share of i's export to j divided by the share of j's import to world imports.

The idea underlying Δ can be varied in different ways. Exchanging the role of exports and imports a coefficient will be obtained which can be used to study the influence of j's imports on i. It is also possible to compute a coefficient similar to Δ based on total trade (imports plus exports). And, instead of basing Δ on world trade the coefficient can be computed from the trade within a restricted area of which i and j both form part, e.g., the EEC. Finally, instead of using actual trade figures the coefficient may be based on data corrected in some sense, e.g., for distance.

In order to give a general idea of the interrelations in world trade, Table 2 presents a few figures for important trading partners. It shows that there is a tendency to block building between the USA, Canada and Japan on the one hand and the EEC countries on the other. However, apart from the couple USA-Canada, these relations are not very outspoken. However, more interesting in the present context are the results presented in Table 3.

Table 2. The interrelations between a number of countries represented by their delta coefficients (averages for 1968, 1973 and 1978).

Exporting country	Importing area			
	EEC-9	USA	Canada	Japan
EEC-9		0.72	0.38	0.27
FRG	2.12	0.77	0.29	0.32
Netherlands	2.88	0.37	0.16	0.16
BLEU*	2.89	0.58	0.16	0.17
USA	0.79		6.61	2.03
Canada	0.42	6.11		1.31
Japan	0.38	2.53	0.79	

*Belgo-Luxemburgian Economic Union

Source: Computed by the Netherlands' Scientific Council for Governmental Policy

Table 3. The interrelationship between a number of country pairs (averages for 1968, 1973 and 1978).*

	Delta coefficients based on		
	World trade	Intra-EEC trade	a gravity model
Netherlands - FRG	3.53	1.15	1.94
Netherlands - BLEU	5.11	1.41	2.06
Netherlands - France	1.80	0.60	0.82
Netherlands - Italy	1.36	0.58	1.52
Netherlands - UK	1.44	1.21	0.91
FRG - Austria	4.50		1.47
FRG - Switzerland	2.74		1.05
FRG - France	2.59	0.95	0.86
FRG - BLEU	2.98	0.88	1.97
FRG - Denmark	2.26		
FRG - Italy	2.52	1.15	1.72
FRG - UK	0.95	0.85	0.65
BLEU - France	3.88	1.17	1.36
BLEU - Italy	1.31	0.50	1.93
BLEU - UK	1.37	1.00	0.87
France - Italy	2.98	1.42	1.03
France - UK	1.16	1.05	0.47
Italy - UK	0.95	1.08	1.04
Sweden - Finland	11.31		
Sweden - Denmark	10.58		
Sweden - Norway	12.16		
Austria - Switzerland	5.87		1.54
UK - Ireland	11.80		
Canada - USA	6.36		

*The figures refer to averages of exports and imports.

Source: See Table 2.

Although the shares in the course of time do not show strong fluctuations the figures in Table 3 are averages for 1968, 1973 and 1978 and, therefore, may be considered as reasonably representative for recent years. The first column based on world trade confirms the conclusion already derived from Table 1, i.e., that the Dutch-FRG trade is not exceptionally strong. The figure for the trade between the Netherlands and the BLEU is still higher and is still exceeded by the Δ for the Austrian-FRG trade. Much higher figures appear to exist for the inter-Scandinavian trade and also for the trade between the UK and Ireland. An entirely different picture appears from the second column, related to intra-EEC trade only. In this case the coefficients are much closer to one, which proves that the intra-trade is much more homogeneously distributed than the EEC-country shares in world trade. A somewhat similar result emerges from the third column where the various trade flows have been corrected for distance.* However, there are still a number of differences. For example, the UK-Netherlands trade appears to be stronger than could be expected on grounds of distance.

On the basis of the preceding data one may be inclined to conclude that the Netherlands-FRG trade relations are rather favorable. The share is not exceedingly high, the trade balance is positive and the relation refers to one of the strongest economic partners in Europe. To a large extent this conclusion is correct, but there are a number of underlying, less favorable tendencies which come to light when looking at the regional distribution of the Dutch exports within the FRG, as well as to the composition of the trade with respect to commodities.

With respect to the first aspect, it will be clear that the strong tendency to concentrate export activities on neighboring countries is also valid for the regional distribution within the FRG. This is demonstrated by Table 4 which shows the breakdown of exports for three areas and for a number of the FRG's trading partners. The figures refer to semi-manufactures and manufactures (excluding fuels) as for these commodities transportation costs are of relatively little importance. Correcting the figures in Table 4 for distance and for differences in GDP of the three areas leads to small changes but does not change the picture very much and, therefore, these figures have not been mentioned. It is no surprise that a large part of Dutch exports go to the Rhineland-Westphalia, this being the area closest to the Netherlands. The share even increased over time as can be seen from Table 5.

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*The corrected flow $\bar{X}_{ij}$ is derived from the actual X_{ij} with the help of an equation of the following type

$$\log. \bar{X}_{ij} = \log. X_{ij} + a.\log. D_{ij} + b$$

D_{ij} is the distance between the economic centers of gravity of i and j, based mainly on distances for sea-borne traffic. The methodology used for computing the coefficients a and b is described in [4].

Table 4. Breakdown of exports for three FRG areas and for a number of exporting countries in percentages (1979).

Country	North*	NRW*	South*
France	16.3	29.0	54.7
BLEU	13.4	49.6	37.0
Italy	11.4	25.2	63.4
Denmark	54.4	18.2	27.4
Netherlands	17.7	51.3	31.0

*Comprised of:
North: Hamburg, Bremen, Berlin, Schleswig Holstein, Lower Saxony
NRW: North-Rhine-Westphalia
South: Baden-Wurttemburg, Bavaria

Source: See Table 2.

Table 5. Distribution of (total) Dutch exports over FRG areas. Index numbers of the growth of these areas.

	Exports as a % of total			Growth of GDP		
Year	North	NRW	South	North	NRW	South
1970	22.8	48.5	28.6	100.0	100.0	100.0
1975	20.2	53.1	26.7	151.3	150.3	153.5
1979	18.3	53.3	28.4	201.8	197.4	211.0

Source: See Table 2.

The second part of Table 5 shows the well-known fact that the FRG's economic center of gravity is moving southward and that due to structural problems of the area, NRW's rate of growth is lower than for the other two areas. It need not be stressed that Dutch exporters have to be aware of these tendencies and in time must take steps to reinforce their market position in the South if, in the long run, the Netherlands are not to lose an important part of their share in the FRG's imports. This argument becomes more forcible when it is remembered what already has been pointed out, i.e., that the recent development of the Dutch share in the FRG's imports is not very favorable.

With respect to the sectorial distribution of Dutch exports it is a well known fact that agricultural products play an important role. But still more important is the export of fuels. Due to its favorable position at the North Sea and at the mouth of the Rhine, Meuse and Scheldt, the Netherlands have been able to build up an important refinery industry based on the imports of crude oil and exporting refined products. Since the discovery of big gas deposits in the early 1960s this product is also exported on a considerable scale. Due to these circumstances Dutch exports are rather biased, more than those of most other European countries. With respect to the FRG, this skewness is even more marked, as demonstrated by Table 6.

Table 6. Relative position of total Dutch commodity trade in total and with the FRG, 1980 (percentages).

SITC	Category	Exports		Imports	
		Total	To FRG	Total	From FRG
1	Food and live animals, drinks and tobacco	18.7	20.4	12.6	6.7
2,4	Non-edible raw materials, animal and vegetable oils and fats	6.1	6.9	7.1	3.5
3	Mineral fuels	22.2	31.1	24.1	5.0
5,6 8	Chemical products, manufactures	34.8	30.7	35.1	53.4
7	Machinery and transportation equipment	17.0	10.2	19.8	29.5
9	Other commodities	1.2	0.7	1.3	1.9
TOTAL		100.0	100.0	100.0	100.0
	1 - 4	47.0	58.4	43.8	15.2
	5 - 9	51.8	40.9	54.9	82.9

Source: Foreign trade statistics, Central Bureau of Statistics

The trade flows between the two countries are to a certain extent complementary to each other in the sense that the Netherlands largely supplies agricultural products and fuels, whereas the FRG delivers chemical products, manufactures, machinery and transportation equipment. During the 1970s the skewness even increased as agricultural products and fuels roughly kept their shares in the FRG's imports and the shares for manufactures, machinery and transportation equipment dropped considerably. Here appears another unfavorable aspect of the trade relations concerned, as the prospects for the strong items are not very rosy either.

Forecasts made a few years ago by the Agricultural Economic Research Institute led to the conclusion that the total volume of Dutch agricultural products probably will continue to rise in the coming years. Putting 1975 equal to 100, estimates for 1985 and 1990 are 124 and 130, respectively, but the corresponding figures for exports to the FRG are 109 for both years. Obviously, the situation is different for different sectors. Prospects for processed food are rather favorable but for pig fattening and for several other sectors the situation is the opposite. On the whole no progress in the coming years is to be expected in the FRG. Moreover, the forecasts are based on a continuation of the prevailing EEC agricultural policy which at present is quite uncertain. The prospects for the Dutch dairy industry, in spite of its high productivity, are rather gloomy. The fact that the share of North Rhine-Westphalia in Dutch agricultural products to the FRG is still higher for other commodities is also an important factor in this respect.

The prospects for fuel exports are not attractive either. At present these exports are not only low due to the depression, but even under more prosperous circumstances it will take quite a long time before overcapacities in the refinery industry and in the FRG one in particular, will have been absorbed. At the same time the competition of other countries like the Arabian ones may be expected to grow. The exports of natural gas are restricted by the size of the deposits and although these are big enough to cover the national needs for several decades to come, it is quite certain that they gradually will taper off after 1990. This will lay a heavy burden on the balance of payments as the value added of the gas is very high. In order to compensate for one guilder lost in the export of gas, export possibilities for about two and a half guilders will have to be found in other sectors.

2.2. Services

The Netherlands' foreign trade in services is not as important as its commodity trade but by far not negligible as may be seen from Table 7. It usually yields a surplus on the balance of payments on current account, which in 1980 amounted to 1% of the GDP. The share of the FRG in this trade is also lower than for commodities, but it produces a surplus which is larger than the total surplus for services. Of the three categories presented in Table 7, transportation yields a very high surplus. However, it is largely wiped out by the deficit on travel expenditures, due to the fact that the Dutch are very fond of travelling abroad and spend more abroad than visitors to the Netherlands do. This imbalance is due to the climate and also the geographical structure and historical development; these factors are responsible for the fact that the Netherlands can offer less varied attractions to foreign tourists than several other countries.

Due to its open character, the Netherlands' flow of imported and exported commodities are very large. But the unique situation, already mentioned, enabled the country in the course of time to build up an extensive transit trade (see Table 8). In particular, sea borne arrivals and departures in Dutch harbors are very large. In absolute terms their volume is of the same order of magnitude as for considerably larger countries such as France, Italy and the UK, and it surpasses the activities in the FRGs harbor by a factor well over two. The FRG's share in Dutch transit trade is high, as shown in Table 9. Two-thirds of the sea borne traffic went to the FRG. The share of the FRG in land-sea traffic is almost 100%!

Table 7. Foreign trade in services (on a cash basis), 1980 (in bill.glds).

	Export of Services		Import of Services		Balance	
	Receipts		*Expenditures*			
	Total	Share of FRG	Total	Share of FRG	Total	Share of FRG
Transportation[a]	11227	2326	3098	431	8129	1895
Travel	3264	1402	9228	1583	-5694	-181
Other Services	10866	4987	9704	1854	832	3133
TOTAL	25297[b]	8715	22030[c]	3868	3267	4847

[a] Includes bunker supplies and ship repair.
[b] 7.8% of the 1980 GDP.
[c] 6.8% of the 1980 GDP.

Source: The Netherlands' Bank, Report for 1980.

Table 8. Commodities loaded and unloaded in the Netherlands (mill. tons.)[a]

	Loaded Exports and Transit		Unloaded Imports and Transit	
	1970	1978	1970	1978
Sea borne	64	68	201	242
Inland Shipping	82	83	43	43
Road	15	22	18	23
Rail	6	5	7	3
Pipe Line	25	46	0	--
TOTAL	192	224	269	311

[a] Due to changed custom formalities the 1978 imports from the BLEU are included, they are estimated at 18.4 mill.tons.

Source: See Table 6.

Table 9. Sea-borne transit trade (in mill.tons), 1978.

	Arrivals			Removals		
	Total	from FRG	%	Total	to FRG	%
Sea - Land	110	72	65.5	28	14	50.0
Sea - Sea	25	6	24.0	15	--	----
TOTAL	135	78	57.8	43	14	32.6

Source: Statistics of the international goods traffic, Central Bureau of Statistics.

In addition to sea-borne traffic there is also a very important international inland shipping and road transportation. A considerable part of the traffic shown in Table 9 is carried out by these two means. Therefore, it will be clear that for these two the relation with the FRG is also preponderant. Of 45 mill.tons in 1978 transported by road, 68.9% had the FRG as origin or destination, and the share of Dutch companies was two-thirds. Comparable figures for international inland shipping were 126 mill.tons and 82.5%, 58% by Dutch companies.

The sea - land transit is for almost 70%, depending on ores, scrap metals and crude oil. Agricultural products, coal and oil occupy another 13%. In land - sea transit coal, semi-finished products and metals are important (73.9%), in sea - sea transport crude oil is responsible for almost 50%.

The composition, as well as the origin and destination of the flows is very important for transit as for commodity trade. Despite the deteriorated competitive position of the West European steel industry, as compared to the NIC's and the Eastern European countries, a continuing economic growth of the FRG is to be expected, and this will have a favorable effect on Dutch transit possibilities, in particular as the Rotterdam harbor can accommodate large-type ore carriers. Nevertheless, the trade has to be aware of growing competition. Italian harbors may be able to take over a part of the trade, again in connection with the move of the FRG's southward movement of its economic potential.

For the transit of mineral oil, the situation is rather uncertain. Many countries try to become less dependent on oil supplies and the FRG is no exception. In view of the heavy opposition, a rapid growth of the use of nuclear energy is not very probable, but a shift to coal is a real possibility. This development could have a strong effect on the transit of oil through the Netherlands, in particular as also other supply routes may become more important. Sea - land shipping on the other hand might profit from a shift to coal.

A few remarks may be in place on differences in national policies affecting transportation. It is Dutch official policy that transportation just like commodity trade, ought to be free and open to international competition in order to make sure that the most efficient firms will obtain the

best opportunities. The extensive Dutch road transport has been developed on this principle. However, the EEC has not yet adopted a general policy in this field and the volume of road transport between member states is still based on bilateral agreements which usually take the form of annually permitted quota. These are often intended to protect national firms or even to achieve more general economic goals. There is, for example, in the FRG a tendency to restrict road transportation in order to improve the bad situation of its railways.

3. INVESTMENTS

With respect to foreign investments the Netherlands occupy a special position. The volume of foreign investments in the country is important but its own investments abroad are considerably higher. As far as direct investments are concerned the Netherlands is a net exporter.* In relation to its GDP as well as to the total volume of its internal volume of investments in fixed assets the Netherlands rank very high (see Table 10).

Table 10. Direct investments of a number of important investors[a].

	Direct Investments	
Country	As a % of the GDP	As a % of gross investments in fixed assets
Netherlands	1.48	6.64
Denmark	0.70	3.23
Japan	0.64	1.79
UK	0.61	3.20
Sweden	0.54	2.49
BLEU	0.46	2.44
FRG	0.45	1.97
Canada	0.43	1.87
France	0.32	1.36
USA	0.28	2.00
Italy	0.20	0.95

[a]Averages for the years 1971 up to and including 1976.

Source: H. Krägenau, Internationale Direktinvestitionen, Verlag Weltarchiv GmbH, 1979.

*Investments conferring on the investor partial or complete control on the activities concerned.

This situation has developed since the early 1970s. A large part of these investments is directed to industrial enterprises, mainly winning of minerals, oil- and chemical industry, and food processing. This share is higher than for most other countries investing abroad on a large scale. To a large extent this is caused by the direct investments of the big multinations having their seat in the Netherlands (Philips, Shell, Unilever, Akzo and a few others).

Dutch investment behavior cannot be considered to constitute a problem typical for small countries. Nevertheless, it has clear disadvantages. Apart from the fact that a given anount of foreign investments does not create as much employment as the same amount invested at home, there are other problems.

It is often argued that direct investments abroad lay a foundation for continuing trade in goods and services. However, a distinction must be drawn between foreign investments in the long run increasing the home level of economic activities and those which merely amount to a reallocation of certain activities. Where the former will have a stimulating effect, the latter will have the opposite effect. That this latter effect actually plays a role can be illustrated again by the relation of the Netherlands to the FRG. A considerable part of Dutch direct investments goes to the FRG. In 1980 it amounted to 9.5 bill. DM (16.3% of total foreign direct investments). Table 11 shows that the ratio of the turn over of Dutch manufacturing companies in the FRG to the exports from the Netherlands to it is considerably higher than the corresponding ratios for all foreign manufacturing companies in the FRG to total foreign exports to the FRG.

Table 11. Production in the FRG of foreign investors to their countries exports to the FRG, (1) for the Netherlands, (2) for all countries.

Types of Commodities	Ratio of turn over of Dutch manufacturing companies in the FRG/Dutch exports of goods to the FRG (1)	Ratio of foreign manufacturing companies in the FRG/foreign exports of goods to the FRG (2)
Manufacturing	136	132
Chemicals	63	158
Oil	172	418
Brick, Clay, Asbestos, Plastics, Ceramics, Glass	37	149
Iron, Steel	1269	176
Mechanical Engineering	306	172
Vehicles	274	178
Electrical Engineering	205	183
Instruments	42	355
Food, Drink, Tobacco	34	119

Source: H. Krägenau, Survey of Dutch-German direct investment relationship. The Netherlands Scientific Council for Governemtn Policy, working paper, The Hague, 1982.

This is particularly true for those products in which the Dutch competitive position on the FRG's market is rather weak (iron and steel, mechanical engineering, vehicles, and electrical engineering). This strongly supports the assumption that substitution is taking place and that industrial activities are being displaced to the FRG, thereby adversely affecting the Dutch future trading position. This conclusion is reinforced by looking into the mirror image of the phenomenon under consideration, viz. the FRG's investments in the Netherlands. They are considerably smaller and amounted to 4 bill. DM in 1980 (6.7% of the FRG's direct investment abroad) and it will be clear from the proceeding that their composition is rather different from the Dutch one. More than half of it refers to metal- and electrotechnical industries. A considerable part of it is placed in services. Table 12 shows from a break down slightly different from that of Table 11, that the comparable figures are much lower. They also illustrate the fact that the FRG's industries are much keener on exports than on direct investments abroad.

Table 12. Production abroad of FRG investors/FRG exports, (1) for the Netherlands, (2) for all countries.

Types of Commodities	Ratio of turn over of Dutch manufacturing companies in the Netherlands/export of goods to the Netherlands (1)	Ratio of turn over of FRG manufacturing companies in the world/ FRG exports of goods to the world (2)
Manufacturing	16	43
Chemicals	53	109
Iron, Stell	16	38
Machinery	8	20
Electrical Engineering	10	62
Iron Seet Steel, Metal	33	27
Textiles	12	19
Brick, Clay	22	52

Source: See Table 11.

The tendency of national firms to invest abroad is usually due to higher expected returns than on comparable investments at home. Production costs may be lower, it may also be more attractive to produce in a big market. However, other reasons may also play a role. With a number of countries, in particular developing ones, trade is only possible if production is partly displaced to these countries. The Dutch Philips concern offers a case, where both factors played a role. Due to a continuing increase in labor-productivity it has been able, from 1971 to 1983, to considerably increase its sales in

real terms. During the same period its total employment dropped from 267 000 to 343 000, i.e., by 6.5%. Its personnel in the Netherlands went down from 99 000 to 71 200, or by 28%!*

The investment behavior referred to may perhaps be stronger in an open very trade-minded country like the Netherlands but the opposite, viz. the withdrawal or reduction of foreign investment in a small country seems to be a common risk. Particularly in a period of economic recession foreign investors are inclined to protect their home investments and shift the burden to their foreign holdings. A good example is offered by the fate of the Estel concern in which the Dutch steel company Hoogovens NV participated together with the FRG company Hoesch. When the crisis in the steel industry necesitated heavy support for this industry, it required the resolution of the concern and a merger to Hoesch with Krupp in order to be sure that only national enterprises would benefit from this aid.

4. NEW TECHNOLOGIES

Nowadays, the conviction is widely held that the developed countries will only be able to improve or at least maintain their present levels of propserity if they succeed on a sufficiently large scale to participate in the development of new technologies. And in this respect most European countries appear to lag behind the USA and Japan. Figure 2 gives an interesting picture of the different developments of industrial production and employment in the USA and in Europe of the EEC [5].

During 1958 to 1980 the USA's production rose on average only slightly more than in Europe (2.6% p.a. versus 2.43% p.a.), but whereas employment in the USA increased by 1.3% p.a. Europe showed a decline of 0.3% p.a. This difference is the result of heavy investments in Europe and stimulated by a high rise of labor costs. Due to it the productivity gap between the USA and Europe existing during the first post-war years now largely has disappeared. But it is unmistakable that part of the difference in employment has to be attributed to a stronger development of new technologies in the USA.

This conclusion can be illustrated by the following numbers. For a group of six mature companies (Bethlehem Steel, Du Pont, General Electric, General Foods, International Paper, and Proctor and Gamble) sales during 1954 to 1974 on average went up by 7.8% p.a., employment only by 1.9%. But for five strongly innovative companies (Polaroid, 3M, IBM, Xerox, and Texas Instruments) the corresponding figures were 16.5% and 10.8%! For typical young, high technology companies, the growth was still higher as can be seen from Table 13. Although statistics are lacking it is very probable that the Japanese development shows similar features. The question therefore arises as to the chances of small countries to obtain a fair share in the development of new technologies. It is a comforting fact in this respect that this development is not the prerogative of industrial giants which usually are to be found in the biggest countries only. On the contrary, experience shows that in particular in the USA several innovations started in small enterprises founded by active scientists coming from universities or industrial firms and prepared to take the risk of exploiting an idea from the field of their own experience. In the course of time, successful ones may

*Data supplied by the Netherlands Central Bureau of Statistics

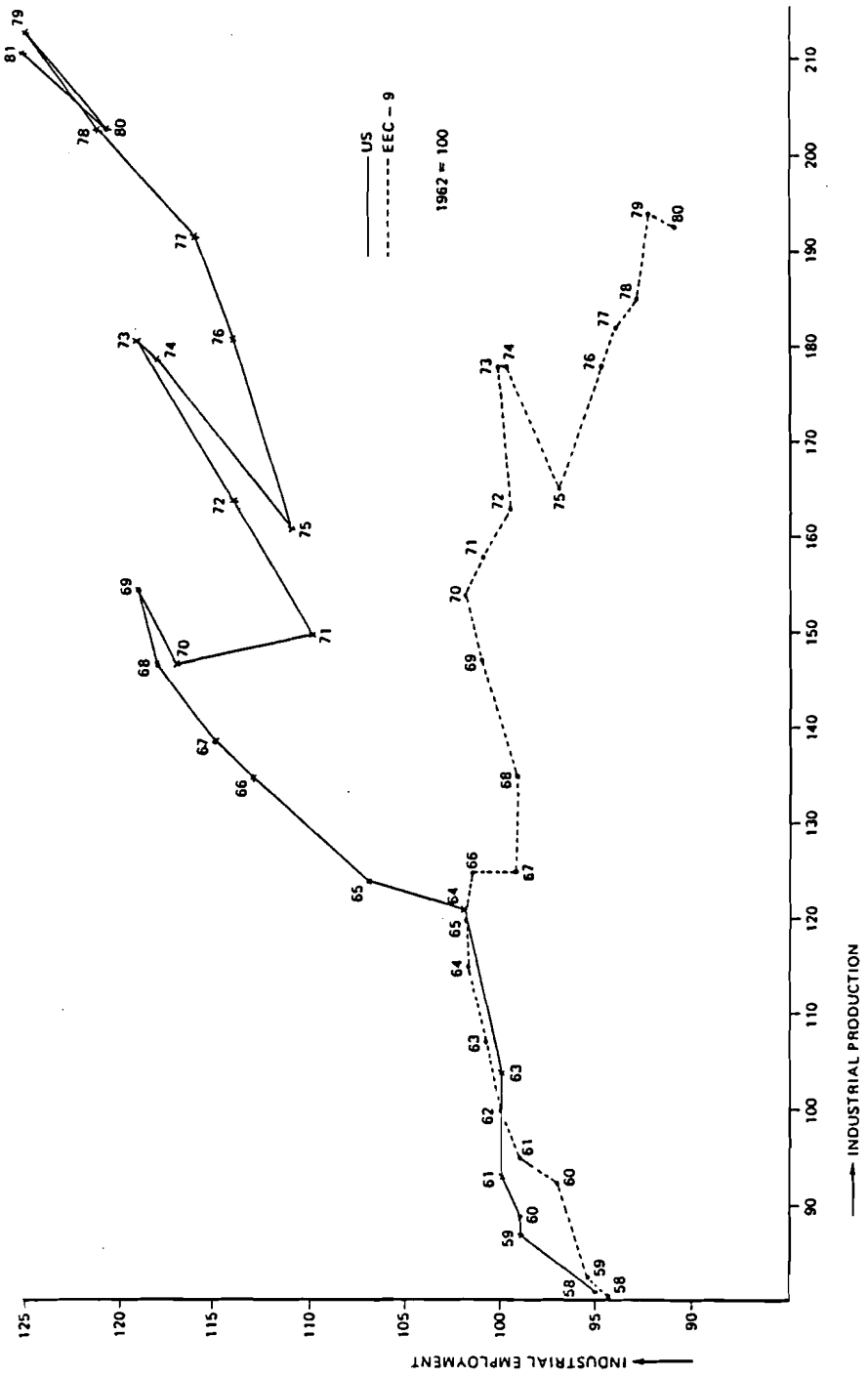

Figure 2. Manufacturing output and employment in EEC-9 and the US.

Table 13. Average annual growth (percentages) during 1969 - 1974 of young high technology companies.

Date incorporated	Name	Sales	Employment
1968	Data General	140.5	82.5
1959	National Semiconductor	54.3	59.4
1960	Compugraphic	50.2	24.0
1957	Digital Equipment	36.8	30.7
1964	Marion Labs	24.5	25.4
Weighted average		42.5	40.7

Source: Reference 5 page 132.

grow on their own strength, through mergers or they may be bought up by larger firms. However, the start usually takes place at a rather modest scale. Silicon Valley in California offers a typical example. However, in order that similar starts be possible in small countries, a number of conditions have to be fulfilled.

At first, there has to be an appropriate effort in R & D. And in this respect the situation in several small countries is not very favorable. Big countries are favored anyhow due to their size, but they spend a larger part of their GDP on R & D than most smaller countries, and their shares moreover are declining, see Table 14. In addition to these governmental expenditures there are, of course, considerable amounts spent on R & D by private firms. For most countries comparable figures appear not to be available, but it is quite probable that the situation with respect to the totals will not be much better for the small countries.

A second condition is the presence of a stimulating climate for small enterprises. Here too, the USA took the lead with its so called Small Business Act but nowadays similar policies are pursued in many other countries through support of various kinds to firms starting up. A third important condition is the availability of venture capital. In most cases banks are not willing to grant credits to newcomers. They want to see results before opening the credit tap. Therefore, other sources ought to be available to overcome the difficulties of the first years. And even in this respect the situation in the USA seems to be more favorable than elsewhere.

Last but not least, there ought to be a sufficient supply of motivated and gifted persons prepared to take risks. This is largely a question of mentality and probably the one most difficult to be stimulated.

Table 14. Government spending on R & D in a number of countries, as a percentage of their GDP

Country	1975	1978	1981
FRG	1.23	1.11	1.15
France	1.17	1.06	1.29
Italy	0.36	0.38	0.67
Netherlands	0.96	0.97	0.93
Belgium	0.73	0.74	0.62
UK	1.27	1.16	1.33
Ireland	0.44	0.47	0.42
Denmark	0.58	0.56	0.48
USA	1.24	1.24	1.21

Source: Government Financing of Research and Development, 1975 - 1982, Eurosat, 1983.

The chances for small countries to successfully enter fields of new technology, which have already reached a certain level of maturity (large scale computers, integrated circuits) or require very big investments (coal gasification) are small. This does not exclude the possibility of acquiring production facilities in these fields through foreign investments or licences, but these are not the most appropriate ones for their own efforts. However, there are several fields where opportunities for small countries appear to be more favorable, or where starts have already been made, such as bio-technology (biomass, bioengineering), energy related technologies (heat pumps, solar- and wind energy), advanced information technology, robot technology, etc. But in all cases, carefully designed policies will be needed in order to obtain success.

5. CONCLUSIONS

In the preceding paragraphs a number of problems have been treated related to small countries and mainly illustrated by the Dutch experience in particular in its relation to the FRG. Therefore, already in the introduction it has been said that generalizations have to be made with great care. Nevertheless, a few conclusions seem to be possible.

Due to the size of their home markets, small countries to a large extent have to rely on exports. In addition to the fact that these entail higher costs than home sales they have to specialize in a restricted number of areas. Therefore, they are rather vulnerable to sudden changes in foreign demand for their products. The recent difficulties of the Swiss watch industry offer a striking example. As a consequence of the very rapid penetration of electronic watches it had to carry through an extensive reconstruction and a considerable volume of high skill became obsolete.

Small countries are usually strongly dependent on exports to neighboring markets and the same type of risks may occur as with respect to commodities. Even a displacement of the economic center of gravity of an important market may have unfavorable consequences as in the case of Dutch exports to the FRG.

The principles of free trade are less frequently adhered to in the case of services, such as transportation, than for commodities. Therefore, countries specializing in such activities may be hit by policy changes in these fields from the part of their trading partners.

A large volume of foreign direct investments has great advantages but they may be risky too as foreign investors easily can shift their activities if higher returns are to be expected elsewhere.

A high volume of foreign investments may also restrict the room for adequate economic policies in the receiving country. For example, it is said that the composition of the Canadian industry is largely determined by the heavy direct investments from the USA. However, this does not seem to be an impediment to a high national income per capita!

The entrance into new technologies is not entirely reserved for big countries. They often start on a scale which by no means surpasses the possibilities of small countries. However, they will only come about provided a number of conditions is fulfilled. In this respect, big countries are again in a more favorable condition.

Finally, there is of course the possibility of political pressure of big countries on smaller ones, in particular their neighbors. However, this paper is entirely restricted to economic aspects and the political problem has not been touched upon.

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TECHNOLOGY TRANSFER FROM MULTINATIONAL ENTERPRISES TO SMALL DEVELOPING COUNTRIES: THE CASE OF GREECE

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INTRODUCTION

The case study presented here has the following objectives:

- To examine the behavior of a sample of foreign controlled companies in the field of technology transfer in Greece for the period 1977-1983 during which Greece experienced unfavorable economic conditions;
- to present methodological issues in the field of technology transfer from Multinationals (MNC) into small developing or peripheral countries;
- to discuss the complexity of forces and factors which determine Greece's position in the international division of labor.

The study is based on interviews (with questionnaires) with managers of 28 foreign controlled manufacturing companies in Greece which had been under foreign shareholding in the range of 15 to 100 percent. There were two exceptions—one which established production in 1981, the other acquired foreign control in 1981. Foreign shareholding dates from five to twenty years. Interviews were held in August 1982. The list of companies was taken from the Financial Directory of Greek SA manufacturing companies in 1979 (ICAP 1982). In 1979, the total assets of the respondents amounted to US $ bn 1.1, and represented 36 percent of the assets of the foreign controlled sector in the Directory, and 7.1 percent of the total assets of all manufacturing SA in the Directory. In 1979 the respondents had 16,500 employees, which represented 29.5 percent of the employment of the foreign controlled manufacturing sector, and 5 percent of the manufacturing SA in the Directory. Some ten respondents were included, in 1979, amongst the top 100 by assets and sales; only one employed 50, 11 between 100 and 499, and 17 between 500 and 1,700.

THE CASE FOR TECHNOLOGY TRANSFER IN SMALL DEVELOPING COUNTRIES

The question of technology transfer into the manufacturing industry of the small developing countries presents us with intractable issues when it is set in a period of unfavorable conditions, slow growth trade, reversal of the high rates of growth of the 1960s and early 1970s, as is the case in Greece; besides, there has been a growing consciousness for more socially responsive models of development.

[*] This paper was not presented orally at the meeting but was prepared especially as a contribution.

The first issue concerns the technology gaps between advanced and developing countries; these have become more marked with the achievements and the high rates of growth in profit in the high research intensity industries during the 1960s and 1970s (Porat, 1976; and Dunning and Pearce, 1980). Second, there is a weak technological infrastructure in small developing countries. Third, developing countries spend few resources on activities which could increase the amount of technology transfer and have a potential for developing and upgrading the living standard: For example, research on minerals and agriculture, investment in environmental protection and modernization of public corporations, spending on R&D, in both the private and the public sectors in Greece during 1960-80, represented annually less than 0.2 percent of the GNP, while persons employed on R&D were less than 2,500 in 1981 (CERP 1972, 1983). Fourth, the production of science based technology is concentrated in the industrially advanced countries and related to their own requirements, while few resources are devoted to the problems of the less developed ones (Pavit, 1971).

Transfer of technology has been an essential part of the industrialization strategy of the developing countries which compete for the attraction of MNC as they were considered the repositories of advanced technology; but they are prone to receive the latest stages of the product cycle (Vernon, 1966), fragmented processes which are labor intensive and have low value added and investment with low capital intensity compared to that in advanced countries and with limited economic potential (Helleiner, 1973). The strategy of small developing countries is constrained by the small size of their market and the legacy of the import substitution policy and protectionism which created an unflexible manufacturing structure. They have to become outward looking and competitive in their manufacturing by introducing advanced technology and expanding to exports; as their comparative advantage of low cost labor diminishes – as is the case in Greece – there is a case for the restructuring of manufacturing toward more advanced processes.

The political decision-makers in small developing countries have to face two questions related to the transfer of technology from MNC. First, making the right choice of technological field in relation to the existing manufacturing structure and the strategy for the future; second, to evaluate the role of MNC in shaping their position in the international division of labor.

It has been suggested that intermediate technology is more suited to the means of the small developing countries because it is labor intensive, favors small scale and costs less than the inflexible highly capital intensive technology of the modern industry (Schumacher, 1974). Also, appropriate technology is considered as the right choice as it meets resource endowments of the poorer countries (Schumacher, 1974). Opposite arguments (Emanuel, 1983) support that developing countries should favor advanced technology and capital intensive processes in order to improve the mix of factors of production, to increase social output, welfare and private profitability. Two facts support this premise: first, labor intensive processes have a low value added, and second, the developing countries are in short supply of manufacturers whose demand is covered by imports.

With regard to the second question, MNC overprices technology and there are several ways to do so: transfer pricing, royalties on licenses of outmoded techniques, overpricing of inputs delivered to subsidiaries from old stocks of outmoded technology, and commission charges on exports paid to sales subsidiaries abroad.[1] Technological achievements of MNC can yield them an oligopolistic position in one field, serve for survival and for the exploitation of world resources. One example is the aluminum industry. In a study by the UN (1979), it was considered that the cost of undertaking the investment in an aluminum smelter outside the MNC by local organizations was prohibitive – the technology fee of US $50 per metric tone being

one of the reasons. The political decision-makers can play a role in the final impact of the location of MNC subsidiaries; they ascertain incentives to diminish the risks of investments, such as subsidies to exports and to production, protection of the home market, high depreciation rates and concessions. But MNC are in a position to restrain reactions of governments in developing countries which are designed to either reduce MNC profits or to increase MNC contribution to the social cost of the host country. Evidence is given from the case of the taxation of bauxite exports from Jamaica; the imposition of tax has led MNC to relocate their production to other countries with vast bauxite deposits, and has not caused any lasting damage to the profit position of the companies (Francis, 1981).

THE CONDITIONS IN THE GREEK MANUFACTURING INDUSTRY IN THE EARLY 1980s

The socio-economic structure of Greece typifies a country of the south Mediterranean periphery and her problem of social and economic backwardness. Regional imbalances were recognized and reported in the memorandum of the Greek government submitted to the Commission of the European Communities in 1982. Along with many other peripheral countries, Greece has since 1975, experienced a slowdown in economic growth, in public and private consumption, high inflation, and a deterioration in her balance of payments. Besides the unfavorable international environment, there are structural domestic constraints that prevent the development of the manufacturing industry and the improvement of productivity. This also contributes to the weakining of Greece's position in the international division of labor.

As recently as 1981 the agricultural sector employed 31 percent of Greece's work force, and contributed 16 percent to the gross domestic product (GDP). Compare this to the manufacturing industry, employing 19 percent of the work force and contributing a little more than 25 percent of the GDP (NSSG, 1981; OECD, 1982).

Since the mid-1970s there has been a significant shift in the pattern of growth in Greece:

- from 1976-1981 the average annual growth rate of manufactured output and investment was half of that for the preceding 10 year period. The traditional manufacturing sectors (SIC 20-29), and the basic processing sectors, (basic metals, petroleum, petroleum products, and non metallic minerals), exhibited higher growth rates relative to the advanced ones which developed more recently. Manufacturing investment shows a concentration in branches with low profitability internationally, (cotton yarns and fabrics, garments and food processing);
- the deteriorating competitive position of Greek manufacture is reflected in the slowdown of productivity gains; taking 1974 as a base year, the productivity index in 1979 was 113, and it fell to 109 in 1980;
- a fair proportion of social needs for consumer goods and capital goods are covered by imports, which also displaced outmoded and expensive homemade manufacturing; in 1974 manufactured imports were 250 percent more than the value of manufactured exports, in the late 1970s this ratio trebled, and imports represented 50 percent of Greece's manufactures, (NSSG Bulletin, OECD, 1983 CERP, 1983).

Constraints to the Transfer of Technology

A number of international and domestic forces have limited the competitive position of Greece in both the home and export markets. The Greek industry has to overcome the constraints of the small size of the home market, and the level of exports that are required to increase efficiency in the cost structure, and the introduction of innovations feasible. Technological innovations are essential to gain an advantage in the home and export markets vis-á-vis rivals because Greece has lost her advantage in cheap labor.

1. The slowdown in world trade since the rise in oil prices in 1979 intensified competition from East and West European Countries and the developing world for export markets where Greece had a competitive advantage (Middle East and EEC countries);
2. The decline of home and export markets further deteriorated the capacity utilization and accentuated the falling productivity rate;
3 The cost of production owes it increase to the reduction of the working hours per week, the rise in wages, and the increase in the cost of raw materials, minimum wage levels at the end of 1982 were 250 percent more than those of 1978;
4 There is a deterioration in labor relations with respect to the demands of the employers for higher productivity – labour in Greece is not remunerated according to productivity scores, but rather by a flat wage rate, and annual increases, which compensates only for the loss of purchasing power.
5 The rising cost of borrowing money, in the short- and long-term, absorbs a great proportion of the gross profit (more than 25 percent in 1980). Greek manufacturers have found competition in export markets from West European manufacturers who are able to give credit to their clients at lower interest rates;
6 The slowdown in new investment was exacerbated by the deterioration of the financial position of many large firms - in 1982 the assets of the 50 largest manufacturing companies showed a net loss of 8.67 bn Dr, compared to a net profit of 5.72 bn Dr in 1981;
7 Investment and technological innovations are also inhibited by the small size of manufacturing establishments, and the dominance of family ownership in the control and decision making of the firms. The 1976 census of manufacturing establishments showed that some 85 percent are artisan units, each employing 1-4 persons.

In the early 1980s manufacturing establishments with over 50 employees represented 1 percent of the total, and contributed 60 percent to the manufacturing output. Small artisan units concentrated on the traditional sectors – furniture, garments, footwear, bakeries, and repair shops, – and are registered as productive units. Large Greek owned establishments specialize on traditional products – fertilizers, cement, iron fittings and pipes, paper, cotton textiles, shipbuilding and ammunition. Domestic industrialists, with the exception of the plastics sector, exhibit a limited potential and experience in the design and organization of productive units in the modern sector. They mostly copy foreign products to low standards and specifications for the protected home market; they are absent in those branches which could form a potential platform for the development of advanced products which could generate multiple effects, for example, scientific instruments, electronic components and electrical machines.

Policy on Technology Transfer in the Manufacturing Industry

Since the postwar years the government has opted for technology transfer with the aid of foreign direct investment, regarding this as the shortest path to modernization and structural change in the Greek manufacturing industry. Two important laws in 1953 and 1961 (2687/1953, 4171/1961) institutionalized the protection of foreign direct investment and the transfer of technology, and provided for:

- constitutional protection from nationalization of rights;
- reduction of taxation in the income of imported capital;
- relief from duties, indirect taxes and tariffs on the imported equipment and raw materials;
- subsidies on exports;
- concessions agreed individually according to the importance of investment;
- protection of licenses and patents.

According to the respondent subsidiaries the major shortcomings of this legislation have been the bureaucratic procedures to secure the benefits, the low levels allowed for exports of profits (12 percent on imported capital annually); and the taxation of the exports of profits by the difference created from the initial exchange rate and the revaluation of the currency.

The objectives of the Economic Development Plans since the association of Greece with the Common Market in 1962, gave priority to the development of the manufacturing industry for three reasons:

1 to take full advantage of its entry into the EEC;

2 to substitute for imports;

3 to improve the balance of payments with exports.

The 1983-1987 Economic Development Plan does not depart from the earlier industrial strategy, and considers that an additional role of the manufacturing industry is to contribute essentially to the creation of jobs, and to the transfer of part of the economically active population from less productive activities to more productive ones. In the postwar Plans this role had been assigned to the construction industry, which at present is in a deep decline.

The 1983-1987 draft Plan for Economic Development (CERP 1983), accepts that the basic means for economic competition is the technological upgrade of the manufacturing industry, and the enrichment of the human infrastructure in the enterprises. The main points in the Plan concerning the transfer of technology for the promotion of industry include:

- promotion of a modern and competitive industrial system which will exploit the advantages of Greece, a shift from the traditional sectors to advanced technologies, (information, biotechnology and electronics);
- in the short and medium term, sectoral projects and programs will assist with the defensive restructuring of those traditional sectors which are important in exports, and employ a significant part of the working population (textiles, drinks, fur, cement, and food), to to overcome their problems in international competition, these programs will include protection measures against cheaper imports from Third World Countries;

- shift to modern processes with a potential for exports, and the ability to generate multiplier effects and external economies;
- measures to assist with technology transfer a "competitive import substitution" in activities with a substantial home market;
- upgrading of the human infrastructure in enterprises.

MULTINATIONAL COMPANIES IN GREECE

Until 1970, with the exception of the aluminum, cotton yarns and fruit canning industries, the main avenue to the establishment of productive units of Multinational Companies (MNC) was the protected home market. This was reflected in the mode of entry:

- takeovers of large local units;
- development from a sales subsidiary;
- joint ventures;
- agreements with the Public Corporations for supplies with locally made components, capital goods, finished products, and drugs.

The main volume of foreign direct investment in Greece took place between 1957 and 1969 when Greece experienced the highest postwar growth rates, and was directed into large capitally intensive units, and into processes established in Greece for the first time: aluminum, oil refining, petrochemicals, detergents, telecommunication equipment, and tin plates. In 1963 some 68 percent of the foreign cash flow into Greek manufacturers was in chemicals, transport, electrical equipment; in 1966, 60 percent had come from three multinationals, EXXON, Pechiney, Ethyl, and an international holding which invested in shipyards (Roumeliotis 1977).

After 1970 the growth rate of foreign direct investment in manufacture slowed down,[2] the size of foreign controlled establishments became smaller than that in the 1957-1969 period, and there had been a shift in the sectoral orientation toward more labor intensive processes: packaging and formulation of drugs, and toward labor intensive processes for exports to EEC countries – clothing on subcontracting, fruit canning, and electrical appliances. Labor costs took more than 30 percent of the product cost in these processes.

Another important development of the 1970s concerned a major shift of the two largest subsidiaries in the aluminum and steel industry toward the home market.

The proportion of aluminum output sold in Greece increased from 15 percent in 1972 to 50 percent in 1980, the figures corresponding to the steel plant are 48 and 69 percent.[1]

This suggests multiplier effects in the home market industry, for example, aluminum output sold in the home markets increased from 20,000 t in 1972 to 83,000 t in 1980; the steel plant, a subsidiary of Japanese Nippon, sold 13,000 t of steel products in 1970, and 225,000 t in 1982.

Throughout the 1970s the share of exports of the foreign controlled sector in Greece's exports decreased, it fell from 18.8 percent in 1973 to 16 percent in 1980 (Confederation of Greek Industries); this trend was most discernible in the two largest exporters, the aluminum and the steel plant – the share of the aluminum plant in Greece's export fell from 7 percent in 1973 to 3.9 percent in 1980, and the share of the steel plant fell from 2 percent to 0.9 percent.

In 1983, MNC were the exclusive makers in the home market of a number of products requiring know-how, organization and advanced technology, without

meaning that they transferred updated technology and the latest equipment. These products include, margarine, baby food, packaging materials, drugs, hygienic materials, detergents, petrochemicals, industrial dyes, rubber tires, tinned and galvanized pates, tin, aluminum, transformers, TV sets, telecommunication equipment, electrical materials, power meters, and transport equipment.

Table 1 presents an estimate of the share of the foreign controlled sector in total assets and employment in the 5,000 manufacturing companies of the Greek financial directory in 1979 (ICAP, 1982). The first column includes the share of companies with a shareholding of over 36 percent, (there are 184 subsidiaries), with total assets US $ bn 2.40, and 43,000 employees, and represent 15.3 percent of assets and 13.3 percent of employment. There were 72 foreign controlled companies with a shareholding from 10 to 35 percent, total assets of manufacturing companies in the 1979 Directory, and 4 percent of employment. In 1979 the foreign controlled sector represented 8.2 percent of Greece's manufacturing workforce. An earlier estimate (Gianitsis, 1978) for the year 1975 showed manufacturing companies with a foreign shareholding of over 50 percent, represented some 17.6 percent of the assets of the Directory of that year.

As shown in Table 1, the foreign controlled sector favors modern branches and has a weaker representation in the traditional markets. A trend to disinvestment was suggested by the respondents in the 1970s, in plastics, veneered boards, and ceramic tiles. In the 1980s this trend extended to the oil refinery and petrochemicals subsidiaries of EXXON, it coincided with the expiration of the contract which concluded concessions for 20 years, and which the government refused to renew.

METHODOLOGICAL ISSUES

This section suggests that to understand the behavior of the foreign controlled sector in the transfer of technology it should be put into the perspective of the interaction of several variables and their parameters. Three of the main variables include:

- technical features of the recent changes in products and processes transferred;
- size of output in relation to the home market;
- the degree of standardization of the product and processes in relation to the home market.

It is likely that the density of variables and parameters in technology transfer in the small markets of developing countries is greater in comparison to that of the markets of larger developed economies. This is likely because subsidiaries of MNC in developing countries do not specialize in a narrow range of products and processes, but, engage in a wider range of modern and traditional products and processes required by the social needs, the size of the market cannot support a reasonable cost, such a variety of products requires an immense technological infrastructure, non existent in small developing economies. Such is the case for consumer chemicals, – detergents and cosmetics, food products and household appliances. Small developing countries may have to choose their strategy of development between "specialization according to comparative advantage" and diversification of the existing structure which formerly was, and is, based on their resource endowments, for example, cotton based textiles in Greece. The first option will increase dependence and imports of manufactures, and the second conflicts with the required economies of scale and the size of the home market.

Table 1. Foreign Direct Investment in Greek Manufacturing (includes SA), percentage share of total assets, and employment by sectors, 1979.

	% in total assets shareholding		% in employment shareholding	
	36–100%	10–35%	36–100%	10–35%
food	5.5	1.7	12.7	1.5
drink	27.4	--	31.0	--
tobacco	--	--	--	--
textiles	2.0	7.2	3.7	5.5
clothing	9.6	--	16.7	2.2
wood	2.5	2.6	2.9	2.4
furniture	--	--	--	--
paper and paper products	14.4	2.3	12.0	17.0
printing and publishing	--	--	--	--
leather	13.8	--	13.7	--
rubber and plastics	17.1	1.3	14.9	1.5
chemicals	34.3	1.4	25.7	3.3
oil, oil products and coal	10.2	--	9.1	--
non metallic minerals	6.2	9.6	9.4	10.4
basic metals	40.6	11.3	30.1	7.9
metal products	10.4	2.1	8.4	4.7
non electrical machines	17.3	11.9	10.2	14.6
electrical appliances	42.1	16.8	42.1	4.4
transport equipment	23.3	--	12.1	--
miscellaneous	55.7	1.4	24.0	3.5
total manufacture	15.3	4.4	13.3	4.0

Source: Figures are based on the Financial Directory of Greek Companies, ICAP 1981, and other interviews.

The Change of Technical Features of Products and Processes

Among the most important features of this report the following can be listed:

1 Changes in the inputs of the product and/or a substantial change of the product itself. The latter requires structural changes in the user domain and is consequently related to the institutional framework and possibly to increased public spending. Such is the case of fiber optics which may replace the conventional telecommunications network, and required a new technology environment based on digital technology.

2 Modernization of the processing equipment where the inputs and the products undergo minor changes, such as in the cases of spray drying and extruding of cereals, which replaced the older technology of roller drying, changes in the technology of the reversing mills of cold rolled coils, hot dipped galvanizing. The major objective of this change is the increases in productivity with the reduction of working time. This is a feasible alternative for small countries but it can be questionable when the incentives may increase the social cost (for example, increased amortization rate).

3 Reorganization of the workplace and training – this may achieve better labor relations and a pleasant diversity of tasks, respondents consider that there can only be negligible gains in productivity compared to the gains from spending for new equipment.

4 Changes in objective management decision making. This technology transfer aims to reduce the cost of sales and the state induced bureaucratic cost. This is an important innovation, widely adopted by the respondents.

Scale of Production

The size of assets has been accepted as a criterion for economies of scale, automation and technological advance. There has been an association between the substitution of capital for labor and the size of Greek manufacturing plants (Nikolaou, 1980). The respondents had been asked to compare the size of their plants with their affiliates in West Europe, or to similar units. None of the respondents considered their plant to be large or above medium size, respondents considered that the set of criteria regarding the size of a plant should include the following:

- optimum scale of plant may be revised over time. A respondent, manufacturing margarine replied that the optimum scale of margarine plants of the affiliates had been revised downwards because there is a trend to decentralization of certain processes out of the plant;
- comparisons of productivity between affiliates – some Greek managers doubted the assertions of the parent company for the low productivity at the Greek plants, because such statements have political cost.
- the range of products – for example, the subsidiary of Unilever produces a far greater diversity of margarines and oils than do affiliated plants in Europe;
- vertical integration and the amount of work left for subsidiaries – it is not always the case that subsidiaries are supplied from the parent plant the full range of inputs. In cosmetics, drugs, dyes, and partly in petrochemicals, for example, intermediate materials are processed one or two stages before the final one. Subsidiaries may integrate production of components at the factors when local suppliers who are oriented to the local market fail to supply in sufficient quantities and to the required technical specifications, such is the case in circuit breakers, sockets and switches;
- excess capacity relative to the market size;[3]
- imports of the technologically advanced manufactures that may or may not originate from the parent plant and substitute for the outmoded and costly locally produced.

Standardization and Automation

Standardization and automation permit production on a mass scale as it reduces the number of parameters involved in the production process, the latter, in small countries increases in relation to the volume of output, for example, number of clients, standard inputs and raw materials, storage, and deliveries. Respondents commented, during the interviews, that the use of automation in small developing countries primarily concerns the cost of substitution of capital for labor. The use of advanced equipment precludes inappropriate standards of local supplies of inputs, and this problem is overcome by imports, as is the case of packaging material for drugs. There is a case then to upgrade the standards of local

suppliers to harmonize with European specifications.

Third, automation may be introduced in most labor intensive processes of a productive unit only when wages are rising, as for example, in the handling of inputs, storage and packaging.

Fourth, the makers of custom made goods, some 18 respondents, said that the major constraints to modernize all the processes in their plant had been the shift in the emphasis of orders each year. Twelve of them supplied public corporations, and this was the reason for establishing production in Greece, six plants had subcontracting agreements and orders varied.

In the 18 enterprises part or whole of the production was from stocks, and part of the product was unstandardized, for example, the stamping of tins changed with the client, and this represented more than 10 percent of the cost of production. The reason for the highly unstandarized production is the mode of establishment of the foreign controlled companies which primarily aimed at the small Greek market and the orders from the State. This dependence has been a constraint for the transfer of technology and modernization in the long term.

INVESTMENT OF THE SAMPLE OF FOREIGN CONTROLLED COMPANIES 1977–1983

Table 2 presents a breakdown of the investment objectives of the 28 foreign controlled companies for the period 1977-1983. As shown in the table, the primary concern for investment was the modernization of the existing equipment and the expansion of capacity for the existing products. There was little concern for technologically new products, and even less for the introduction of traditional ones or for product differentiation.

Table 2. Distribution of a sample of 28 foreign controlled companies in Greece by the objective of new investment completed between 1977-1983 and planned for 1984

Objective	N
Modernization of the existing equipment	19
Expansion of capacity (new products excluded)	18
Pollution	9
Replacement and renewal of existing equipment was the single reason	8
Technologically new product first introduced in Greece	13
Traditional product first introduced in Greece	3
Modifications and differentiation of existing products	7
Restructuring of product mix	3

Source: Interviews, August 1983. Some companies had several objectives, therefore the number of objectives exceeds the number of companies.

Investment of 19 respondents (two thirds of all), had aimed at the modernization of the existing equipment for higher productivity gains and reduction of the working time; it included increase in the speed of the processing equipment, the

introduction of numerically controlled machine tools in one case, automation in the handling of components and materials, in packaging and storage and standardization of factory space. It is most important that 12 of the 19 respondents modernized primarily as a response to the growth of their exports (freezer trucks, fruit canning, power meters, cables, switches, circuit breakers, asbestos/cement products, aluminum, plastic distribution panels). Some 18 respondents increased the capacity with new investment where older products were produced, but only 10 of them said that there had been an increase in employment levels of over 5 percent from the levels of 1977. 18 respondents said that employment at the office and factories had either remained the same or was reduced since 1977.

Some 8 respondents replied that their investment concerned spare parts and renewal only but not significant increases in productivity, working time savings, or automation, the reasons had been – the small scale of production, irreplaceable hand working for the export garments sector, already automated processes, and the small potential for essential improvements, for example, petrochemicals and fertilizers.

Some 13 respondents introduced a technologically new product (Flufene, radial tires, distribution panels, microswitches mini circuit breakers, fiber optics, drugs, tub margarines, welded beer cans, malaminated veneered boards, and professional products for baking confectionery, and transport equipment); 11 of these respondents had at the same time expanded their capacity for their older products. Only 4 from the 13 respondents had introduced their technologically new product as a response to export markets exclusively. Three companies introduced traditional manufactures mainly for exports: cereals and baby foods, marmalade, and structural asbestos/cement materials. This suggests that foreign controlled companies are more likely to introduce a traditional product for exports than a technologically new one. There were 7 respondents (with modification) in the type of product, and only 3 had substantially restructured their product mix: one case involved a change from bus chassis assembly to freezer truck assembly because of changes in export markets, and two cases cases concerned phasing out engines production and household appliances because products were displaced by cheaper EEC imports.

Anti-pollution equipment inside and outside the factory has been a minor source of investment. Only one third of the respondents devoted funds for this purpose, – this was either because of the heavy fines imposed on environmental pollution or it was necessary in order to increase productivity, such was the case in cotton yarns and aluminum industry.

Age of Technology

Twelve of the thirteen respondents that completed investment in a new technologically product between 1977-1983 were asked to assess the age of the technology of their product at the time of its introduction in Greece and the years since this technology had been used at the factory. The results are listed in Table 3 for 14 products. Only one product, mini circuit breakers, was designed in Greece in 1982. The company used imported components which made up for the most advanced part of the product. In 13 products technology was between 3 to 10 years old at the time of the introduction. Methods of production currently used at the factory date from the 1970s. Finally, two of the products, plastic distribution panels and welded beer tins, were said to be outmoded and replaced in Europe.

Table 3. Age of technology in products for which investment was completed between 1977-1983 or planned to 1984, in by 12 foreign controlled companies.

Product	age of product when introduced, years	date of production technology used in 1983
Cereals (roller dryed)	traditional	outdated
Plastic distribution panels	?	outdated
Military transportation equipment	10	1972
Military transportation equipment	9	1975
Professional materials for bakeries etc.	6	1977
Fibre optics	5	1977
Welded beer cans	3	1977
Tub margarines	3	1977
Radial tires	4	1979
Welded open top tins	4	1979
Miniature circuit breakers	own design	1982/83
Electrical switches	5	1982
Melaminated veneered boards	10	1983

Source: Interviews with a sample of foreign controlled manufacturing companies, August 1983.

NOTES

1. The Greek aluminum plant paid FOB prices of aluminum for exports to a trading subsidiary of the present plant.
2. The table below gives the amount of foreign direct investment in mil. of US $ from the approved applications for manufacturing investment:

Statement	US $ mil.
1973	389
1974	537
1975	141
1976	414
1977	241
1978	101
1979	119 (Jan.-Sept.)

Source: Unpublished list from the Ministry of Planning and Coordination.

3. For example, the capacity of all plants in Greece manufacturing asbestos-cement products and veneered boards is nearly double the market size.

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STRUCTURAL CHANGE INDUCED BY FOREIGN TRADE.
What are the Advantages for the Country?

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INTRODUCTION

During the last 30 years the volume of world trade expanded faster than the average growth rate of real GNP of the different countries. This means that in the average the percentage of GNP which is exported as well as the percentage of imports in GNP was growing. Each country depends economically more and more on the state of the economy of other countries: mankind is becoming one interdependent economic system, eventually. But this means structural adjustment on the part of each country: the more open the economy, the more adjustment to the world market demand and to world market prices is needed. Structural change is painful, in general: some people lose their working places, have to change their profession and have to move to other places; capital invested in shrinking industries declines in value, and rises in expanding industries. Thus the investment flows will change and capital will be re-allocated. On the other hand, there might be a substantial gain from trade for the country in the long run.

Our problem is: what kinds of structural change are to be expected if a country which is relatively small compared to the world as a whole gives up autarchy and opens herself to the world market? How does the situation after the opening up compare to

*Views or opinions expressed herein do not necessarily represent those of IIASA or its National Member Organizations.

the situation before, or in other words: are there gains from trade?

This problem is well treated in all text books on international trade in the static context, i.e. if total capital and labor in the country are given and will only be re-allocated between industries after trade. Compare, for example, the books of Mundell (1968), Takayama (1972), Sohmen (1973), Schittko (1976), Dixit and Norman (1982) and others. But this can only be considered as a first approximation. We have to look at the growth paths of the economy before and after the opening up of the economy to the world market. This dynamic problem is not so well treated in the literature. But there are some books (or chapters in books) on this problem, see Gabisch (1976), Gehrels (1975), Nobel (1982), Ramanathan (1982), and, of course, there are articles on this subject, some of them are listed in the bibliography. But there is no complete solution. I shall offer this for the two commodity case, where each commodity is produced under a neo-classical production function, under the assumption of flexible exchange rates without capital flows, i.e. the savings of the country are always invested in the country though the capital goods may (partially or totally) come from other countries. Labor is also supposed to stay within the country.

We compare the asymptotic behavior of the economy under the two regimes, i.e. we compare the equilibrium growth paths, but not the transition from one path to the other. This is admissible since the growth on the equilibrium path is stable: the system reaches the equilibrium path by automatically. We shall show this at the end of the paper.

In a dynamic setting, it is not selfevident what is meant by: "gains from trade". These "gains" may be measured in different ways. Thus we shall consider different measures.

1. THE MODEL

Assume that the country has two industries:

i = 1 : production of investment goods I

i = 2 : production of consumption goods C.

Each industry produces under a neo-classical production function

$$Y_i = F_i(L_i\pi, K_i) \quad , \; i = 1,2, \tag{1.1}$$

Y = net output, L = labor, π = labor efficiency (equal in both industries), K = capital, F_i homogeneous of degree one, quasi-concave. Thus (1.1) may be rewritten:

$$y_i = \pi \cdot g_i(\kappa_i) \quad , \quad y_i := \frac{Y_i}{L_i} = \text{net output per worker}$$

$$\kappa_i := \frac{K_i}{L_i\pi} = \text{capital labor ratio, labor in efficiency units, in industry i} \tag{1.1a}$$

$$g_i := F_i(1,\kappa_i)$$

We further assume that total labor and labor efficiency grow exogenously at a constant nonnegative rate:

$$L_t = L_o e^{w_L t} \quad , \quad \pi_t = \pi_o e^{w_\pi t} \tag{1.2}$$

Total labor and total capital are allocated to the two industries:

$$L = L_1+L_2 \quad \text{or} \quad : \; L_i = \alpha_i L \quad , \quad \alpha_i \geq 0 \quad , \quad \sum_i \alpha_i = 1,$$

$$K = K_1+K_2 = L\pi(\alpha_1\kappa_1+\alpha_2\kappa_2) \qquad \alpha_i = \text{proportion of labor employed in industry i} \tag{1.3}$$

We define

(a) $$\kappa := \frac{K}{L\pi} = \alpha_1\kappa_1+\alpha_2\kappa_2 = \text{total capital labor ratio}$$

(b) $$\bar{y}_i := \frac{Y_i}{L} = \pi\alpha_i g_i(\kappa_i) = \text{net output per capital in industry i} \tag{1.4}$$

(c) $$y := p\bar{y}_1+\bar{y}_2 = \text{real GNP in consumption units}$$

(d) $$p := \frac{p_1}{p_2} = \text{price ratio of investment goods to consumption goods, } p_i = \text{current price of commodity i}$$

Let ℓ be the nominal wage rate, z the rate of interest. Assume that workers have the savings rate s_L and capital owners the savings rate s_K, where $0 < s_L, s_K < 1$. Thus we get for nominal

investment $\tilde{I}$, nominal consumption $\tilde{C}$, and nominal GNP $\tilde{Y}$:

$$\tilde{I} = s_L \ell L + s_K zK \ , \ \tilde{C} = (1-s_L)\ell L + (1-s_K)zK$$
$$\tilde{Y} = Y_1 p_1 + Y_2 p_2 = \tilde{I} + \tilde{C} = \ell L + zK \tag{1.5}$$

Real GNP (measured in consumption goods) is defined by

$$Y := Y_1 p + Y_2 \ , \text{ and we get: } Y = \bar{\ell} L + \bar{z} K, \tag{1.6}$$

where $\bar{\ell} = \frac{\ell}{p_2}$, $\bar{z} = \frac{z}{p_2}$, and

$$y := \frac{Y}{L} = \bar{\ell} + \bar{z}\pi\kappa \tag{1.6a}$$

In the closed economy total real saving determines the production of the investment goods industry:

$$S := \dot{K}p = s_L(Y-\bar{z}K) + s_K \bar{z} K = s_L Y + (s_K - s_L)K \cdot g_2' \tag{1.6b}$$

and per capita, since $\dot{K} = Y_1$:

$$\bar{y}_1 p = \frac{S}{L} = s_L y + (s_K - s_L)\kappa\pi g_2' \tag{1.6c}$$

In the open economy equation (1.6b) holds also, but not equation (1.6c), since investment goods may be exported or imported. Imports and exports will be determined later.

We assume that the producing firms minimize cost and have to take the output prices and factor prices as given. Then the marginal productivity equations hold, i.e. we get for the nominal wage rate ℓ, which is equal in both industries:

$$\ell = \pi \cdot p_i [g_i(\kappa_i) - \kappa_i g_i'(\kappa_i)] > 0, \tag{1.7a}$$

$i = 1,2$, if both commodities are produced in the country, and $g_i(\kappa_i) = \kappa_i = 0$, if commodity i is not produced in the country.

Similarly, we get for the interest rate (equal in both industries):

$$z = p_i g_i'(\kappa_i) \tag{1.7b}$$

The wage-profit rate λ (where the wage rate relates to labor in efficiency units) follows immediately:

$$\lambda := \frac{\ell}{\pi z} = \frac{g_i(\kappa_i)}{g_i'(\kappa_i)} - \kappa_i \quad \text{, a strictly increasing function} \tag{1.8}$$

Thus the inverse function exists:

$$\kappa_i = \phi_i(\lambda), \quad \phi_i' > 0 \tag{1.9}$$

The price ratio p follows from (1.7):

$$p = \frac{g_2'(\kappa_2)}{g_1'(\kappa_i)} \tag{1.10}$$

Figure 1 shows p as a function of κ_1 and κ_2 in the Cobb-Douglas case[1]. This price ratio is determined endogenously in the case of a closed economy. But in a small open economy price ratios adapt to those in the world market which are exogenously given:

$$p_w = p = \frac{g_2'(\kappa_2)}{g_1'(\kappa_1)} \tag{1.10a}$$

Thus, since the domestic and foreign goods are supposed to be qualitatively equal:

$$\frac{p_i}{e} = p_{iw} \text{ , } i = 1,2, \quad e = \text{exchange rate} \tag{1.10b}$$

Equation (1.10b) shows that the absolute purchasing power parity theory holds in the model which, in the absence of capital flows

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1) For this figure and for the following numerical illustrations we assume $Y_i = (L_i\pi)^{\gamma_i} \cdot K_i^{(1-\gamma_i)}$, $\gamma_1 = \cdot 7$, $\gamma_2 = \cdot 8$, $s_L = \cdot 1$, $s_K = \cdot 2$, $w_Y := w_L + w_\pi = \cdot 02$, $p_w = \frac{p_{1w}}{p_{2w}} = \cdot 75$ (to be explained later). Note that in this case $\gamma_1 < \gamma_2$. If $\gamma_2 < \gamma_1$ some of the following relations change. This will be indicated below. I want to thank Dipl.math. Alfons Kirchen, Bonn University, for carrying out the numerical computations.

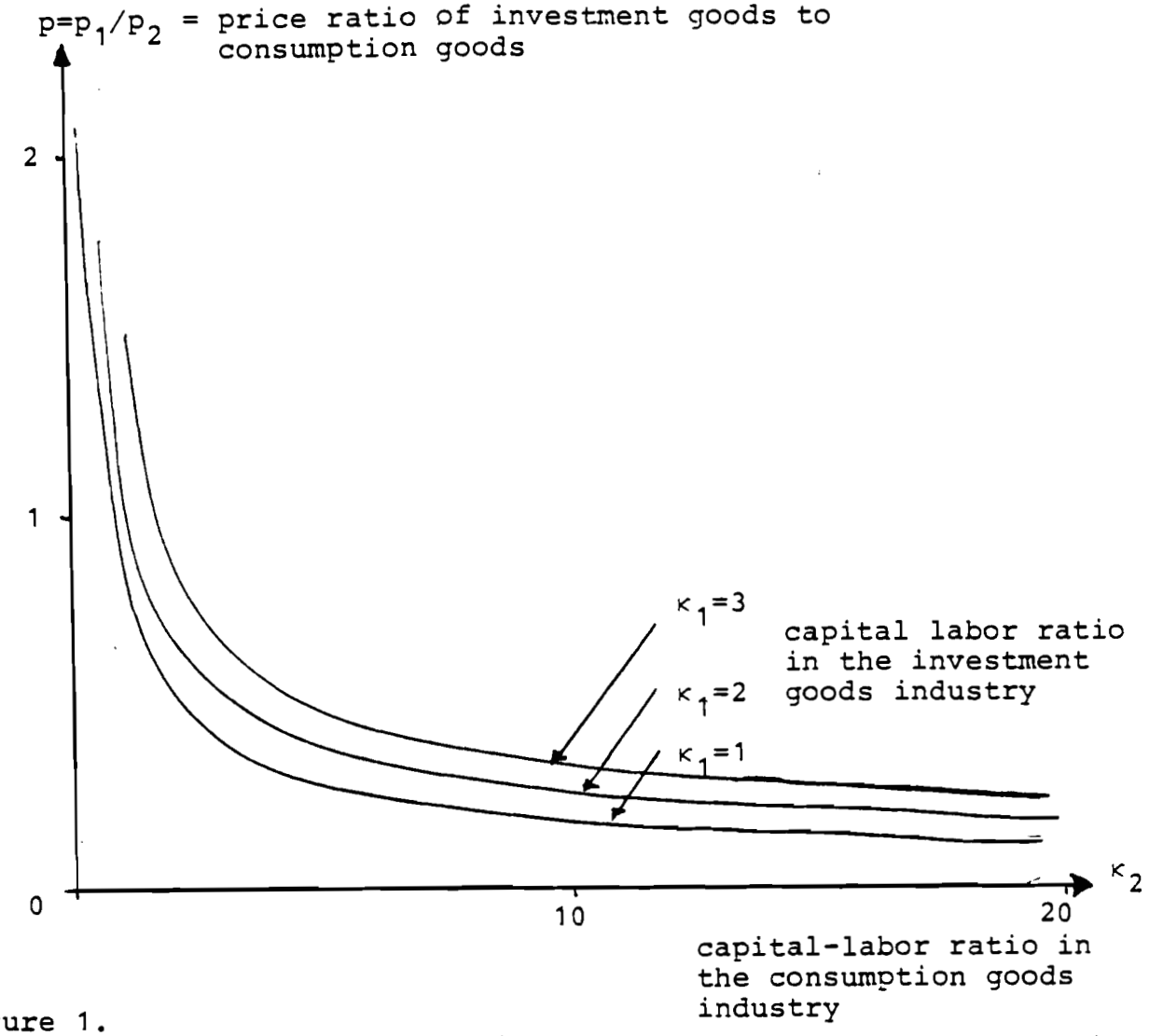

Figure 1.

and with homogeneous commodities without transportation costs is rather self-evident.

From the definitions above we may express the labor proportions α_i by the capital-labor ratios:

$$\alpha_1 = \frac{\kappa - \kappa_2}{\kappa_1 - \kappa_2}, \quad \alpha_2 = \frac{\kappa_1 - \kappa}{\kappa_1 - \kappa_2}, \quad \kappa_1 \neq \kappa_2 \tag{1.11}$$

The κ_i are functions of λ, see equation (1.9). But κ is also a function of λ.

A. For the closed economy we get[2]:

$$\kappa = \frac{\kappa_1\kappa_2 - [(1-s_L)\kappa_2 - s_L\kappa_1]\cdot\lambda}{s_K\kappa_2 + (1-s_K)\kappa_1 + \lambda} =: \hat{h}(\lambda) \qquad (1.12)$$

Thus, if λ is determined, all variables are determined in the case of a closed economy. Unfortunately, $\hat{h}(\lambda)$ might not be monotone. In this case there might be several solutions, see Figure 2[3].

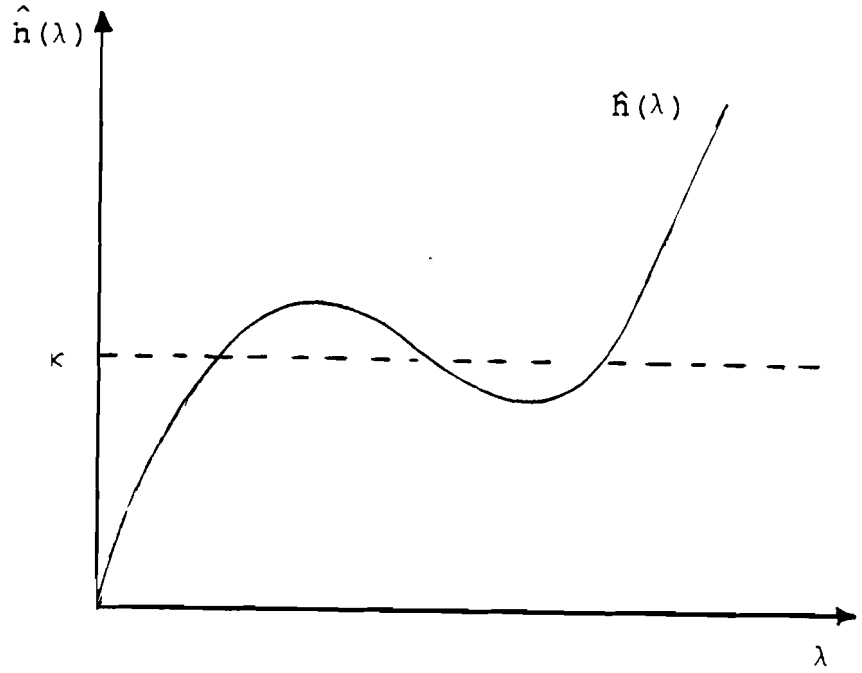

Figure 2.

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2) Inada (1965) was the first to derive this formula. From equation (1.4c) and (1.6b) one gets: $\bar{y}_1 p(1-s_L) = s_L\bar{y}_2 + (s_K-s_L)\cdot\kappa\pi g_2'$. Substitute $\bar{y}_i$ from equation (1.4b), p from (1.10) and α_i from (1.11) and divide by $\pi g_2'$ to get

$$(*)\quad (1-s_L)\frac{\kappa-\kappa_2}{\kappa_1-\kappa_2}\frac{g_i}{g_1'} = s_L\frac{\kappa_1-\kappa}{\kappa_1-\kappa_2}\frac{g_2}{g_2'} + (s_K-s_L)\kappa \quad .$$

From equation (1.8) $\frac{g_i}{g_1'} = \lambda + \kappa_i$. By substituting this into equation (*) and solving for κ we get (1.12).

3) This picture is taken from Inada (1963), p. 122.

Sufficient conditions for $\hat{h}' > 0$ are

(a) $\kappa_1 = \kappa_2$. In that case we are back at a one commodity economy.

(b) $\kappa_2 > \kappa_1$ and $s_K \geq s_L$: the capital intensity of production in the consumption goods industry is larger than that in the investment goods industry and the propensity to save out of the capital income is not smaller than that out of labor income. These are the famous Uzawa stability conditions for a two-sector growth model, see Uzawa (1962); Uzawa derived them for $s_L = 0$ and $s_K = 1$.

(c) $\kappa_2 < \kappa_1$ and $s_K < s_L$. This is the Anti-Uzawa case.

There are still more sufficient conditions. They all may be derived from $\hat{h}'(\lambda) > 0$, $\hat{h}(\lambda)$ according to equation (1.12). We assume that one of these conditions holds and that $\hat{h}' > 0$. Then the solution $\hat{\lambda}$ is unique. Let $\hat{p}$ be the resulting price ratio under autarchy.

B. For the <u>open economy</u> we have to consider the case of exports of investment goods and the opposite case.

(a) <u>Exports of investment goods</u>. This case arises if $p_w > \hat{p}$, i.e. if the prices of investment goods on the world market are relatively higher than the investment goods prices under autarchy. All domestically used investment goods come now from own production. Thus, if I_{ij} are the deliveries of investment goods of country i to country j and if we denote the country considered by 1 and the rest of the world (= the world market) by 2, we get:

$$I_{11}p_1 = s_L \cdot \ell L + s_K \; z \; K \text{ and } I_{21} = 0 \qquad (1.13a)$$

Total production of investment goods consists of that part I_{11} which is invested within the country and the part I_{12} which is exported:

$$I_{11} + I_{12} = Y_1 = F_i(L_1\pi, K_1) = L_1\pi g_i(\kappa_1) \qquad (1.13b)$$

Thus $I_{12}p_1 = p_1 L_1 \pi \cdot g_1(\kappa_1) - s_L \ell L - s_K z K$, or

$$\frac{I_{12}p_1}{L\pi} = p_1\alpha_1 g_i(\kappa_1) - s_L\frac{\ell}{\pi} - s_K \cdot z\kappa \quad , \quad I_{21} = 0 \; . \tag{1.13c}$$

The consumption demand of the country will be satisfied partially by domestic products C_{11}, partially by imports C_{21} from the world market. Consumption goods have to be bought at world market prices p_{2w} and at the current exchange rate. Thus:

$$C_{11}p_2 + C_{21}ep_{2w} = (1-s_L)\ell L + (1-s_K)zK \tag{1.14a}$$

and

$$C_{11} = Y_2 = F_2(L_2\pi, K_2) = L_2\pi g_2(\kappa_2) \tag{1.14b}$$

Therefore we get, similarly as in equation (1.13b):

$$\frac{C_{21}ep_{2w}}{L\pi} = (1-s_L)\frac{\ell}{\pi} + (1-s_K)z\kappa - p_2\alpha_2 g_2(\kappa_2) \tag{1.14c}$$

$$\text{and } C_{12} = 0$$

Because of $p_w = \frac{p_1}{p_2}$ in the open economy equation (1.13a) may be rewritten:

$$I_{11}p_w = s_L\frac{\ell}{p_2}L + s_K\frac{z}{p_2}K$$

Since $I_{11} = \dot{K}$ and since on the equilibrium growth path $\frac{\dot{K}}{K} = \frac{\dot{Y}}{Y} = :w_Y$ (i.e. : the capital coefficient is constant, w_Y = real rate of growth of GNP) we get

$$Kw_Y p_w = s_L(g_2 - \kappa_2 g_2')\pi L + s_K g_2' \cdot K \tag{1.15*}$$

Solving this equation for κ: = $K/L\pi$ we arrive at

$$\kappa = \frac{s_L[g_2(\kappa_2) - \kappa_2 g_2'(\kappa_2)]}{w_Y \cdot p_w - s_K g_2'(\kappa_2)} = : h(\lambda, w_Y, p_w) \tag{1.15}$$

Thus we see that in the open economy the capital labor ratio κ depends not only on the wage-profit ratio λ, but also on

the growth rate w_Y and the price ratio p_w on the world market. We again assume $\partial h/\partial\lambda > 0$ in order to get a unique solution.

(b) Export of consumption goods (or: import of investment goods). This case arises if $p_w < \hat{p}$, i.e. if the consumption goods are relatively more expensive on the world market than under autarchy. After some calculations we arrive at the same expression (1.15). Thus, for the determination of the capital-labor ratio it does not matter whether the country exports investment or consumption goods. Nevertheless, we shall give the formulae. Total investment (in value terms) is determined by:

$$I_{11}p_1 + I_{21}ep_{1w} = s_L\ell L + s_K zK \text{ , and} \tag{1.16a}$$

$$I_{11} = Y_1 = L_1\pi\cdot g_1(\kappa_1) \text{ .} \tag{1.16b}$$

Therefore:

$$\frac{I_{21}ep_{1w}}{L\pi} = s_L\frac{\ell}{\pi} + s_K z\kappa - p_1\alpha_1 g_1(\kappa_1) \quad , \quad I_{12} = 0 \tag{1.16c}$$

The total production of consumption goods (in value terms) is determined by

$$C_{11}p_2 + C_{12}Y_2 = p_2Y_2 = p_2L_2\pi g_2(\kappa_2) \tag{1.17}$$

Consumption demand is

$$C_{11}p_2 = (1-s_L)\ell L + (1-s_K)zK \tag{1.17a}$$

Therefore

$$\frac{C_{12}p_2}{L\pi} = p_2\alpha_2 g_2(\kappa_2) - (1-s_L)\frac{\ell}{\pi} - (1-s_K)z\kappa \text{ and } C_{21} = 0. \tag{1.17b}$$

From (1.16) we get for capital accumulation:

$$\dot{K} = I_{11} + I_{21} = s_L\frac{\ell}{p_1}L + s_K\cdot\frac{z}{p_1}K$$

From this equation (considering $\dot{K} = K\, w_Y$ in equilibrium and $p = p_w$) equation (1.15*) and (1.15) follow immediately. Thus as far as the capital-labor and the wage-profit ratio is concerned, we need not care which types of goods are exported or imported.

The corner solution of perfect specialization of the country occurs if $p_w = g_2'(\kappa_2)/g_1'(\kappa_1)$ for $\kappa_1 = 0$ or $\kappa_2 = 0$.

We still have to determine the exchange rate. It follows from equalization of demand and supply on the market for foreign currency. If investment goods are exported, this amounts to

$$I_{12}\,\frac{p_1}{e} = C_{21}p_{2w} \tag{1.18}$$

Considering equations (1.13c) and (1.14c) and $p_i = e \cdot p_{iw}$ this relation may be transformed to

$$e = \frac{s_L \ell/\pi + s_K z\kappa}{p_{1w}\alpha_1 g_1(\kappa_1) + p_{2w}\alpha_2 g_2(\kappa_2)} = \frac{p_i[s_L g_i - g_i'(s_L\kappa_i - s_K\kappa)]}{p_{1w}\alpha_1 g_1 - p_{2w}\alpha_2 g_2}, \qquad i = 1,2. \tag{1.19}$$

If consumption goods are exported, equation (1.18) has to be substituted by

$$I_{21}p_{1w} = C_{12}\,\frac{p_2}{e} \tag{1.18a}$$

Considering equations (1.16c) and (1.17c) and $p_i = e \cdot p_{1w}$ this may be transformed to the same equation (1.19). Thus the exchange rate also depends on κ_1, κ_2 and κ, but in addition also on the domestic price level

$$\bar{p} = \beta_i p_i \quad , \quad i = 1,2. \tag{1.20a}$$

as well as on the world market price level:

$$\bar{p}_w = \gamma_i p_{iw} \quad , \quad i = 1,2 \tag{1.20b}$$

All variables of the model are determined, if λ is determined: $\kappa, \kappa_1, \kappa_2$ are functions of λ and all other variables are functions of κ, κ_1 and κ_2. λ follows from capital accumulation. For the closed economy we have $\dot{K} = Y_1$ and thus:

$$\frac{\dot{\kappa}}{\kappa} = \frac{Y_1}{K} - w_Y \quad , \text{ where } w_Y := w_L + w_\pi \tag{1.16}$$

and w_Y = equilibrium growth rate of the economy

Since $\frac{Y_1}{K} = \frac{\bar{Y}1}{\pi} = s_L y + (s_K - s_L)\kappa\pi g_2'$, see (1.6b), $y = \bar{l} + \bar{z}\pi\kappa$, see (1.8), and $\bar{z} = \frac{z}{p_2} = pg_1'$, see (1.7a), we may rewrite equation (1.16) as:

$$\frac{\dot{\kappa}}{\kappa} = \frac{g_1'}{\kappa}(s_L\lambda + s_K \cdot \kappa) - w_Y \tag{1.17}$$

where κ and g_1' are functions of λ. In equilibrium growth, $\dot{\kappa} = 0$. Thus the equilibrium value $\hat{\lambda}$ of λ in the closed economy is determined by

$$f(\lambda) = w_Y \quad , \quad \text{where } f(\lambda) := \frac{g_1'}{\kappa}(s_L\lambda + s_K\kappa) \tag{1.18}$$

In the open economy there is no direct relation between capital accumulation and the production of investment goods, since investment goods may be imported or exported. Instead of equation (1.16) we get the more general relation:

$$\frac{\dot{\kappa}}{\kappa} = \frac{\dot{K}}{K} - w_Y \tag{1.19}$$

In equilibrium, κ = const. , thus $\dot{\kappa} = 0$ and from equation (1.19)

$$\dot{K} = w_Y K \quad \text{or} \quad w_K := \frac{\dot{K}}{K} = w_Y \tag{1.20}$$

The four variables $\kappa, \lambda, \kappa_1, \kappa_2$ are determined by the four equations

$$\kappa = \frac{s_L[g_2(\kappa_2) - \kappa_2 g_2'(\kappa_2)]}{w_Y \cdot p_w - s_K g_2'(\kappa_2)} \tag{1.15}$$

$$\lambda = \frac{g_i(\kappa_i)}{g_i'(\kappa_i)} - \kappa_i \quad , \qquad i = 1,2 \tag{1.8}$$

$$p_w = \frac{g_2'(\kappa_2)}{g_1'(\kappa_1)} \tag{1.10a}$$

The world market price ratio p_w and the equilibrium growth rate $w_Y = w_L + w_\pi$ are given. Figures 3 and 4 show the solutions for λ, κ_1 and κ_2 as a function of the world market price ratio p_w[4]. If the investment goods become more expensive on the world market relative to consumption goods, the capital-labor ratios in both industries will decline. This results in a decline of the real wage rate relative to the real profit rate.

4) The assumption on the production function and on other parameter values are the same as in note 1, i.e. $\gamma_1 < \gamma_2$. The sign of $\frac{dp_w}{d\lambda}$ is not always the same. For Cobb-Douglas production functions we get $\frac{dp_w}{d\lambda} \cdot \frac{\lambda}{p_w} = \gamma_1 - \gamma_2$. Thus for $\gamma_1 > \gamma_2$ the graph in Figure 4 will be rising, not falling. If γ_1 and γ_2 are not constant as in the Cobb-Douglas case, the phenomenon of factor price reversal may occur.

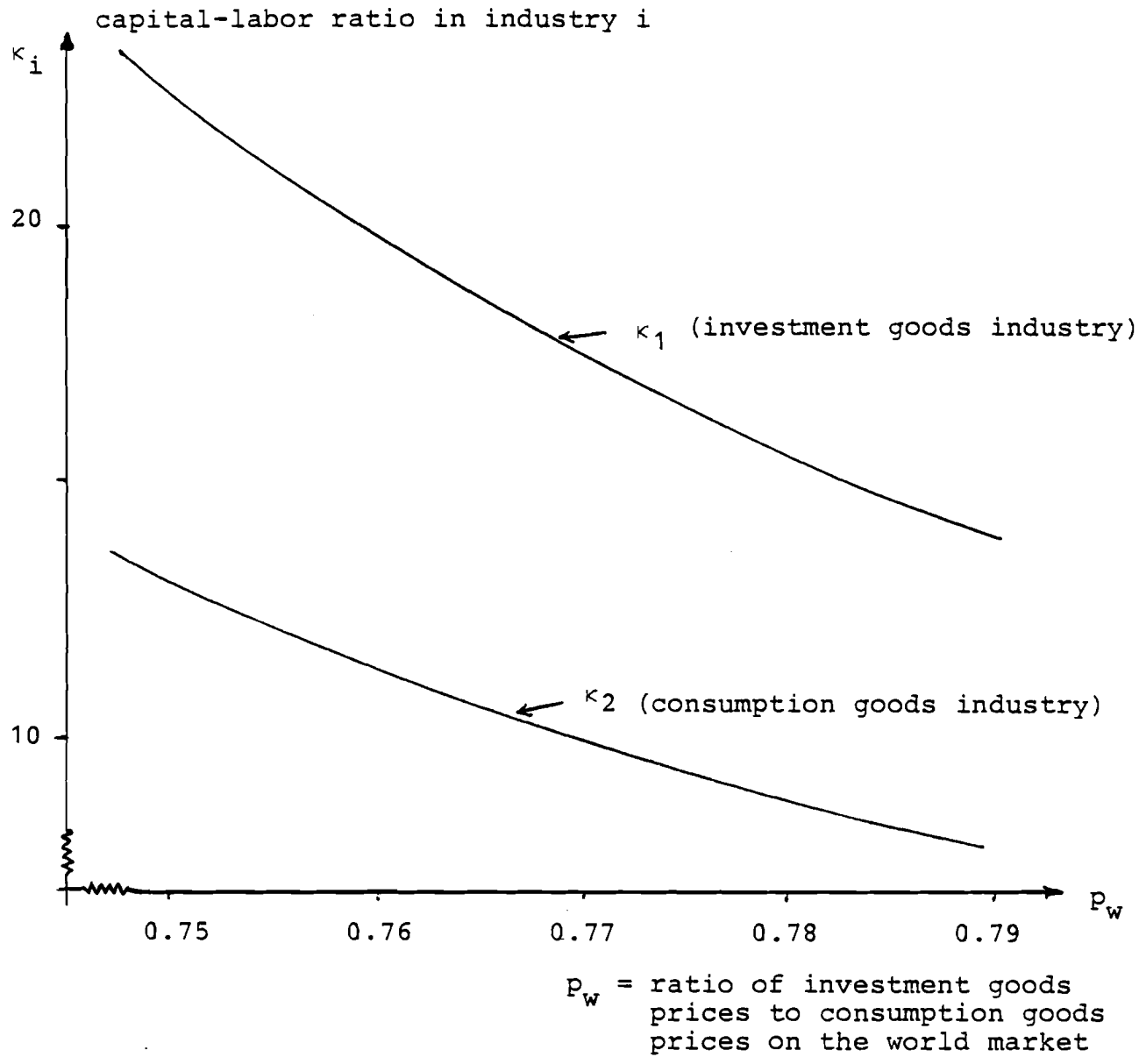
capital-labor ratio in industry i
κ_i
20
10
κ_1 (investment goods industry)
κ_2 (consumption goods industry)
p_w
0.75
0.76
0.77
0.78
0.79
p_w = ratio of investment goods prices to consumption goods prices on the world market

Figure 3.

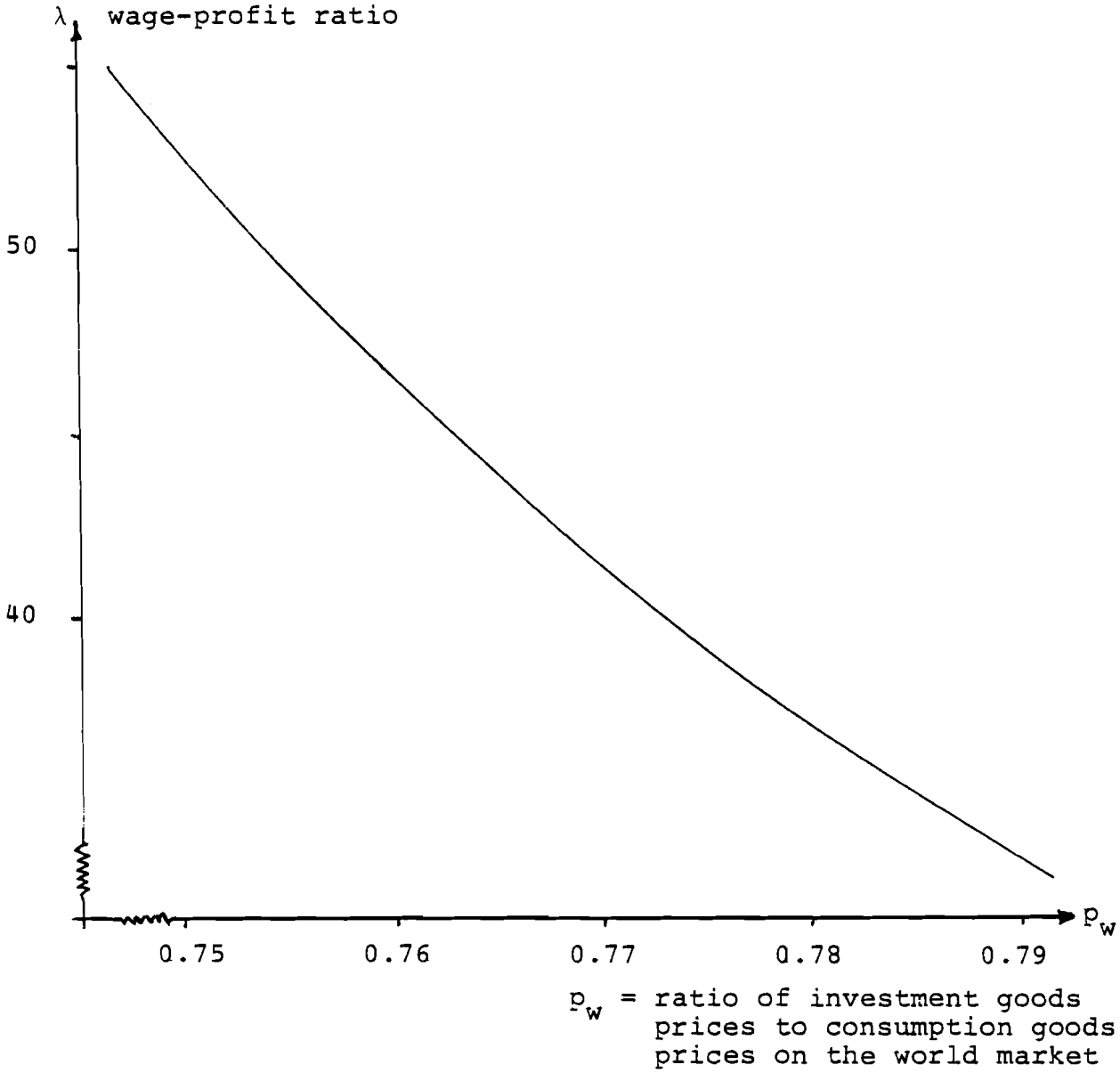
λ wage-profit ratio
50
40
p_w
0.75
0.76
0.77
0.78
0.79
p_w = ratio of investment goods prices to consumption goods prices on the world market

Figure 4.

2. STABILITY OF THE MODEL

It only makes sense to look to equilibrium growth paths if the system converges to these paths. We shall show that our system does converge if some not very restrictive conditions are fulfilled. If the country exports investment goods we get from (1.13):

$$\dot{K} = I_{11} = s_L \frac{\ell}{p_1} L + s_K \frac{z}{p_1} K \tag{2.1}$$

and considering (1.7a) and (1.7b): $\frac{\dot{K}}{K} = s_L(g_1 - \kappa_1 g_1') \cdot \frac{1}{\kappa} + s_K g_1'$

Considering (1.8) we thus get from equation (1.19):

$$\frac{\dot{\kappa}}{\kappa} = f(\lambda) - w_Y \quad , \quad \text{where } f(\lambda) := \frac{g_1'}{\kappa}(s_L\lambda + s_K\kappa) \quad , \tag{2.2}$$

as in the case of the closed economy, see equation (1.18).

The equilibrium solution of λ is determined by

$$f(\lambda) = w_Y \tag{2.2a}$$

The necessary and sufficient condition for local stability is

$$H'(\kappa) < 0 \quad , \quad \text{where } H(\kappa) := \kappa f(\lambda) - w_Y\kappa = g_1'(s_L\lambda + s_K\kappa) - w_Y\kappa \tag{2.3}$$

$$\text{at the point } f(\lambda) = w_Y$$

We get

$$H'(\kappa) = g_1'' \frac{d\kappa_1}{d\lambda} \cdot \frac{d\lambda}{d\kappa}(s_L\lambda + s_K\kappa) + g_1'(s_L\frac{\partial\lambda}{\partial\kappa} + s_K) - w_Y \tag{2.4}$$

We assumed $d\kappa/d\lambda > 0$. Thus the first expression on the right hand side of equation (2.4) is negative. The last two terms become $g_1' s_L(\frac{d\lambda}{d\kappa} - \frac{\lambda}{\kappa})$ at the point $f(\lambda) = w_Y$. Thus a sufficient condition for stability is $\frac{d\lambda}{\partial\kappa} < \frac{\lambda}{\kappa}$ or $\frac{\partial\lambda}{\partial\kappa}\frac{\kappa}{\lambda} < 1$. This implies $\lambda'' < 0$ and thus $\kappa'' > 0$. Another sufficient condition is that s_L is small enough. For $s_L = 0$ stability is guaranteed. Since equation (2.2) is identical to equation (1.18), the same stability condition applies for the closed economy.

If the country imports investment goods (i.e. exports consumption goods), equation (2.1) changes to:

$$\dot{K} = I_{11} + I_{21} = s_L \frac{\ell}{p_1} L + s_K \frac{z}{p_1} K \,, \qquad (2.5)$$

cf. equation (1.16a)

But this does not alter the foregoing derivation. Thus the same results appear again. Equations (2.2) and (2.2a) determine the general solution to the problem, and the stability conditions are generally applicable. We assume that they are met.

3. SOME RESULTS: ECONOMIC CHANGES INDUCED BY FOREIGN TRADE

We now compare the situation on the equilibrium growth paths of an economy before and after opening up to the world market.

a) The growth rates in both sectors of the economy are equal and do not change by foreign trade as long as the growth rate of the labor force and of labor efficiency stay the same. We get

$$w_Y = w_{Yi} = w_L + w_\pi \qquad (3.1)$$

Of course, it may be expected that by the opening of the country to world trade also technical knowledge will be transferred to the country. In this case w_π would rise and thus also the growth rate. But this is not considered in the model.

b) The level of GNP, the amount of commodities which are available within the countries and consumption per capita will change. As a rule, all of these aggregates will rise which means that the country has an advantage from foreign trade. But there may be exceptions. In a two- and more sector-economy there is no unequivocal measure of the aggregate. Prices change by foreign trade as well as the production structure. Which price system should be chosen? Should we measure GNP in consumption or investment units? We deal with these problems in the next paragraph. Here we may say, that as a rule the level of GNP and of consumption per capita rises. Thus Figure 5 is representative for almost all cases. But, as already said, there are exceptions.

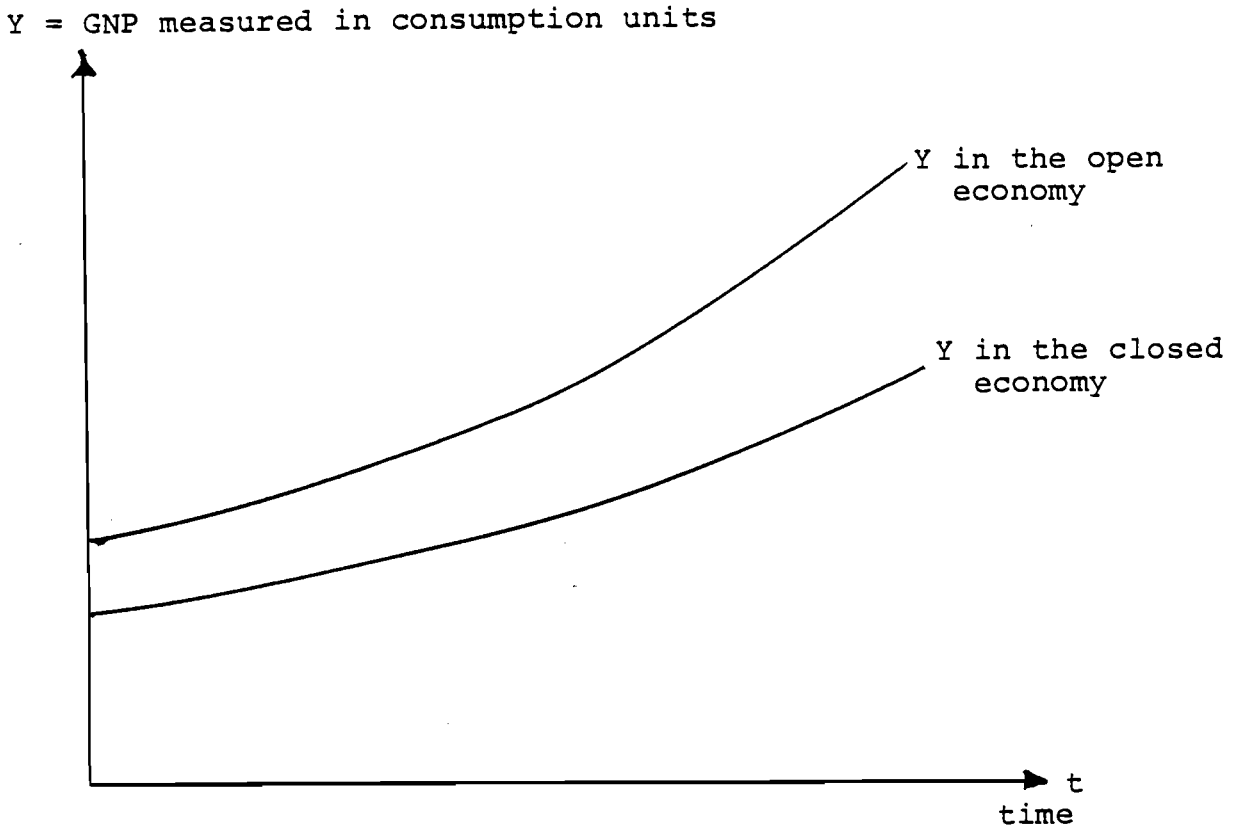

Figure 5.

c) Foreign trade induces structural change in the sense, that some industries expand, others shrink. In our 2-sector economy this follows immediately from the equation derived in the last paragraph. If the ratio p_w of investment to consumption goods prices on the world market differs from the price ratio $\hat{p}$ of these two commodities under autarchy, that good whose price is relatively higher on the world market will be partly exported and its production expanded; the production of the other commodity will shrink. Figure 6 shows the size of production per capita in both industries as a function of the world market price ratio.

The graphs are derived from numerical solution of the system (1.15), (1.8), (1.10a) and by substituting the resulting total capital-labor ratio κ, wage profit ratio λ and the sectoral capital-labor ratios κ_i into the equations (1.11) for α_i and into the equation (1.4b) for $\bar{y}_i$. The production functions and parameter values are indicated in note 5; p_w has been changed parametrically.

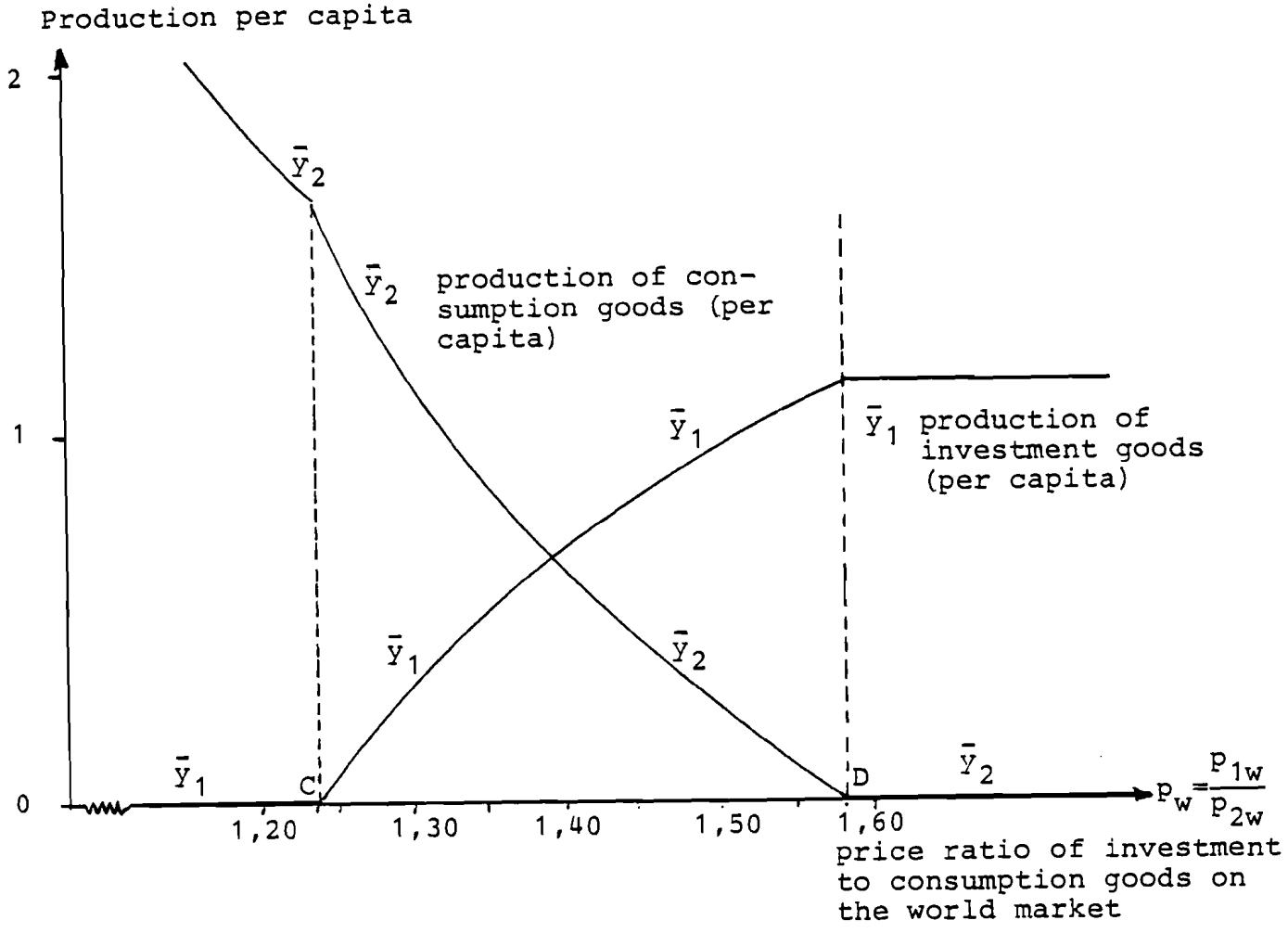

Figure 6.

From Figure 6 we see that there are three regimes. At very low price ratios p_w (between O and C) the investment good will not be produced by the country. It is so cheap on the world market, that the country totally specializes in the production of consumption goods which have a relatively very high price on the world market. The production level of the consumption good will always rise if the investment goods become cheaper (or the consumption good sells at higher prices), since the capital-labor ratio goes to infinity if the price of the investment goods goes to zero.

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5) The numerical calculations have been done by Dipl.math. Hermann Ross of Bonn University. I thank him for his help. The production elasticities $\gamma_1 = \cdot 9$, $\gamma_2 = \cdot 7$ have been used, cf. note 1; other parameters are as in note 1).

If the investment goods become more expensive (to the right of point C in Figure 6), the domestic production of the investment goods starts. In the second regime (between the points C and D) both commodities are produced. The production of the consumption good declines and that of the investment good rises, if the world market price ratio moves from C to D. At point D the consumption good is so cheap on the world market and the investment good so expensive that the production of the consumption good is stopped. In regime three (to the right of point D) all factors of production are allocated to the production of the investment good. The capital-labor ratio depends on the domestic savings ratios. All investment goods not used for domestic capital accumulation will be exported. With rising world market prices of the investment goods more consumption goods will be imported and available in the country. But this does not influence production and thus is not visible in Figure 6.

The graphs in Figure 6 may be put into the form of a long-run transformation curve. From the solution of the system we get (as illustrated in Figure 6):

$$\bar{y}_i = \phi_i(p_w) \quad , \quad i = 1,2 \tag{3.2}$$

Since $\phi_2(p_w)$ is strictly monotone in $0 < p_w < D$ we may form the inverse function $p_w = \phi_2^{-1}(\bar{y}_2)$. Substituting this into equation (3.2) for i = 1 yields the analytic expression for the long-term transformation curve:

$$\bar{y}_1 = \phi_1(\phi_2^{-1}(\bar{y}_2)) =: \phi(\bar{y}_2) \tag{3.3}$$

Figure 7 (solid line) shows the long-term transformation curve derived from Figure 6. This curve is still concave. But this need not be the case (see the dotted line transformation curve). Each point on the long-term transformation curve indicates an equilibrium value. The case of a convex long-run transformation curve is exceptional. We do not consider it. There is a one-to-one correspondence between each point on the transformation curve and the price ratio p_w on the world market such that higher p_w values are situated more north-west on the curve (see the arrow in Figure 7).

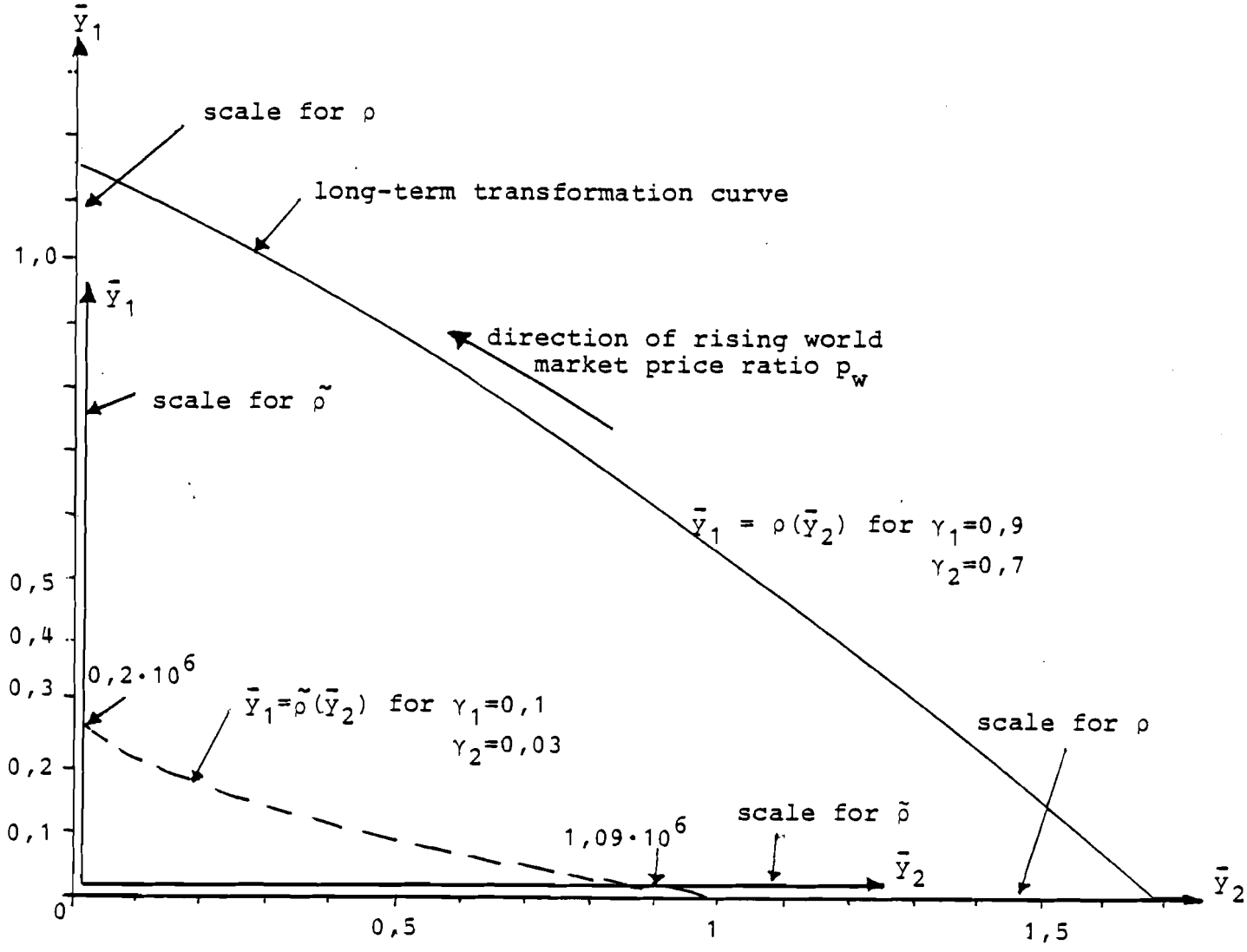

Figure 7 .

Unfortunately, the long-run marginal rate of substitution is not equal to the price ratio at the production point as it is the case for the short-run transformation curve. The short-run transformation curve is defined as the set $\{\bar{y}_1, \bar{y}_2\}$ of production per capita which will be produced at a price ratio p, if total labor and total capital are fixed. On this curve we have

$$dy = pd\bar{y}_1 + d\bar{y}_2 = 0 \tag{3.4}$$

such that

$$\bar{y}_1 = \psi(\bar{y}_2) \tag{3.4a}$$

and under cost minimization

$$\frac{d\bar{y}_1}{d\bar{y}_2} = -\frac{1}{p} = -\frac{g_1'(\kappa_1)}{g_2'(\kappa_2)} < 0 \quad , \text{ cf. (1.10a)} \tag{3.4b}$$

The second derivative is also negative:

$$\frac{d^2\bar{y}_1}{d\bar{y}_2^2} < 0 \tag{3.4c}$$

Thus we get the wellknown Figure 8 for the short-run transformation curve.

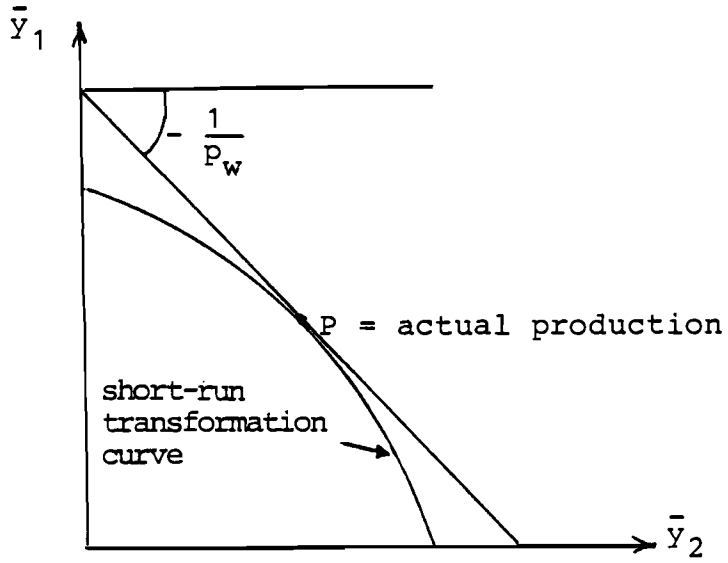

Figure 8.

But the short-run and the long-run transformation curves always cut at the production point, P, if the production function for the two sectors are different.[5] Figure 9 shows the situation.

The economy moves on the expansion path. The fact that the long-run transformation curve is not tangent to the exchange line of the two commodities on the world market has important

5) To see this, compare the two derivatives at the production point P.

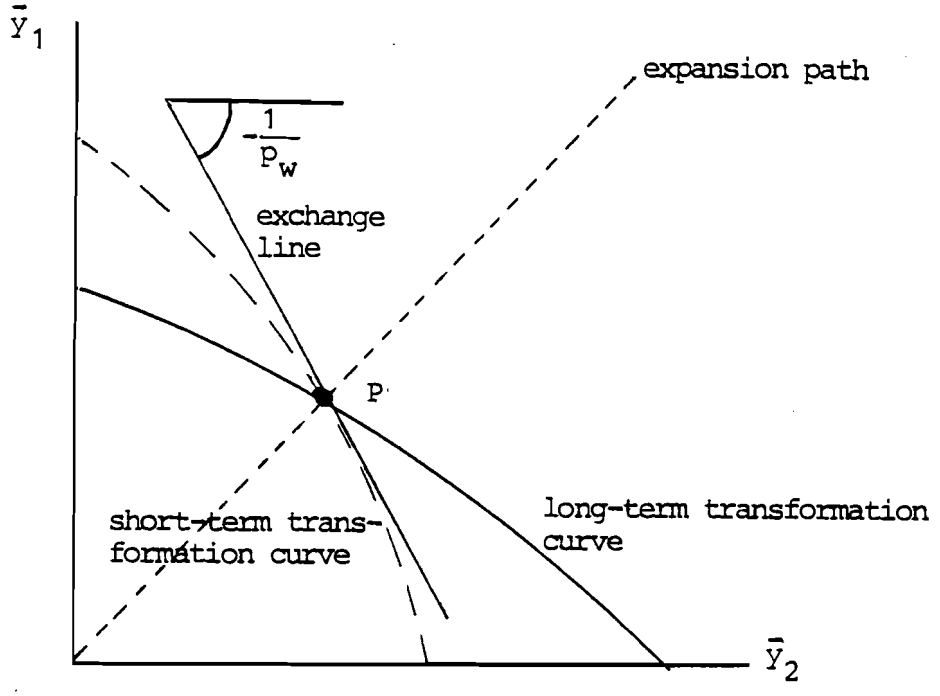

Figure 9.

consequences for the optimality of foreign trade. We shall come to that later.

d) What is the impact of a change of world market prices on factor prices? The Stolper-Samuelson theorem (1941) states that a relative price rise of a commodity induces a relative price rise of that factor which is more intensively used at the production of that commodity which became relatively more expensive and a relative fall of the price of the other factor. Thus, if the price of investment goods rises relatively on the world market (i.e. if $dp_w/dt > 0$) and if the capital-labor ratio is smaller in the investment goods industry than in the consumption goods industry, then the wage rate will rise with respect to the rate of interest.

This theorem holds only under certain conditions which become clear when we derive the theorem from the system of paragraph 1. We assume that

$$p_w(\lambda) = \frac{g_2'(\kappa_2(\lambda))}{g_1'(\kappa_1(\lambda))} \quad , \quad \text{cf. equation (1.10a)} \quad ,$$

is a monotonous function of λ. Thus

$$\frac{dp_w}{d\lambda} = \left[\frac{g_2''}{g_2'}\cdot\kappa_2' - \frac{g_1''}{g_1'}\cdot\kappa_1'\right]\cdot p_w \quad .$$

From (1.8) we get

$$g_i' = \frac{g_i}{\lambda+\kappa_i} \quad . \quad \text{Thus } g_i''\cdot\kappa_i' = \frac{dg_i'(\kappa_i(\lambda))}{d\lambda} = -\frac{g_i}{(\lambda+\kappa_i)^2}$$

and therefore (after some manipulations):

$$\frac{dp_w}{d\lambda} = \frac{\kappa_2 - \kappa_1}{(\lambda+\kappa_1)(\lambda+\kappa_2)}\cdot p_w \tag{3.4}$$

We assume that there is no reversal of factor intensities, i.e. $\kappa_2(\lambda) - \kappa_1(\lambda)$ does not change its sign in the admissible region of λ. Now the Stolper-Samuelson theorem follows immediately from (3.4):

$$\left.\begin{matrix}\kappa_2 > \kappa_1 \\ \kappa_1 > \kappa_2\end{matrix}\right\} \leftrightarrow \frac{d\lambda}{dp_w}\begin{cases} > 0 \\ < 0 \end{cases} \quad , \tag{3.5}$$

where $\lambda := \frac{\ell/\pi}{z}$, $p_w = \frac{p_{1w}}{p_{2w}}$.

This result may be graphically illustrated by looking at the shifts of the wage-profit curves of the two sectors which are induced by relative price changes on the world market. We first derive the wage profit curves. From (1.6), (1.7b) and from $p=p_w$ we get

$$\kappa_1 = g_1'^{-1}\left(\frac{\bar{z}}{p_w}\right) =: r_1\left(\frac{\bar{z}}{p_w}\right) \quad , \quad \kappa_2 = g_2'^{-1}(\bar{z}) =: r_2(\bar{z}), \tag{3.6}$$

where $r_i' < 0$, $i=1,2$,

$\bar{z} = \frac{z}{p_2}$ = real interest rate

From (1.6), (1.7a) and from $p=p_w$ we get for the investment goods industry:

$$\bar{\ell} = \pi p_w [g_1(r_1(\frac{\bar{z}}{p_w})) - r_1(\frac{\bar{z}}{p_w}) \cdot g_1'(r_1(\frac{\bar{z}}{p_w}))] = \tag{3.7}$$

$$= : \pi p_w \cdot G_1(\frac{\bar{z}}{p_w}) \quad ,$$

for the consumption goods industry:

$$\bar{\ell} = \pi [g_2(r_2(\bar{z})) - r_2(\bar{z}) \cdot g_2'(r_2(\bar{z}))] = : \pi \cdot G_2(\bar{z})$$

The graph of $\pi p_w G_1$ is the wage-profit curve for the investment goods industry, πG_2 for the consumption goods industry. These curves have a negative slope and are convex:

$$\frac{d\bar{\ell}}{d\bar{z}} = \frac{d\bar{\ell}}{\partial \kappa_i} \cdot \frac{\partial \kappa_i}{d\bar{z}} = - \pi \kappa_i < 0 \quad , \quad i=1,2 \tag{3.7a}$$

$$\frac{d^2\bar{\ell}}{d\bar{z}^2} = - \pi \frac{d\kappa_i}{d\bar{z}} = \begin{cases} - \frac{\pi}{p_w g_1''} > 0 & \text{for } i = 1 \\ - \frac{\pi}{g_2''} > 0 & \text{for } i = 2 \end{cases} \tag{3.7b}$$

The real wage rate and the real interest rate must be equal in both industries, that means that the two curves must intersect. We assume that there is only one point of intersection, otherwise there would be a reversal of factor intensities, and the Stolper-Samuelson theorem does not apply. Figure 10 shows the wage-profit curves for the two industries.

In case of technical progress ($d\pi/dt > 0$), both curves move upwards proportionately. Or: measured in efficiency units $\bar{\ell}/\pi$ and $\bar{z}/\pi$ both curves stay constant. Since

$$\frac{\partial \bar{\ell}}{\partial p_w} = \begin{cases} \pi [G_1 + \frac{\bar{z}}{p_w} \cdot r_1] > 0 & \text{for industry 1} \\ 0 & \text{for industry 2} \end{cases} \tag{3.8}$$

the wage-profit curve for sector 1 moves upwards if the p_w rises, i.e. if the price of commodity 1 rises relatively on the world

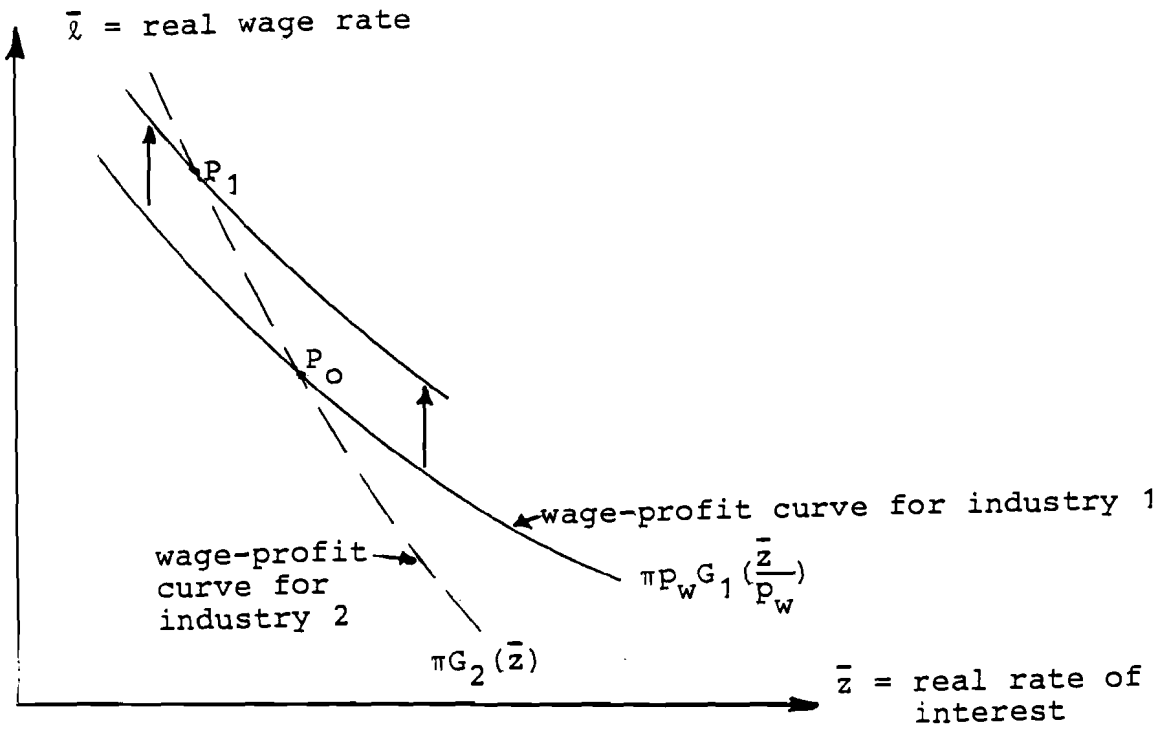

Figure 10.

market. Since the wage-profit curve for industry 2 does not change, the point of intersection of both curves moves from P_o to P_1. Therefore, the real wage rate rises relative to the real interest rate. But the slope of the wage-profit curve is proportional to the capital-labor ratio:

$$\frac{d\bar{\ell}}{d\bar{z}} = -\pi \cdot r_i \cdot r_i' g_i'' = -\pi \kappa_i \quad , \quad i=1,2, \tag{3.9}$$

since

$$r_i' g_i'' = 1 \quad \left(\text{note that } r_1' = \frac{1}{\frac{d(\frac{\bar{z}}{p_w})}{d\kappa_1}} = \frac{1}{g_1''} \quad \text{and}\right.$$

$$\left. r_2' = \frac{1}{\frac{d\bar{z}}{d\kappa_2}} = \frac{1}{g_2''} \right) \quad .$$

In Figure 10 the slope of the wage-profit curve of the consumption goods industry (= industry 2) is (in absolute value) larger than that of the investment goods industry (= industry 1). Thus $\kappa_2 > \kappa_1$: the investment goods industry is more capital intensive than the consumption goods industry. Therefore, a price rise of investment goods on the world market raises the wage rate at the expense of the interest rate.

e) The impact of changes of other parameters on the open economy will be stated only shortly. We have to look at the system of equations (1.15), (1.8), (1.10a). From that we infer:

(aa) the impact of higher savings ratios s_L out of labor income and s_K out of capital income consists in raising the total capital-labor ratio κ and to shift labor from production of consumption goods to production of investment goods. The factor prices stay the same. This follows from

$$\frac{\partial \kappa}{\partial s_L} > 0, \quad \frac{\partial \kappa}{\partial s_K} > 0 \quad \text{(see equation (1.15))}, \quad \frac{\partial \kappa_i}{\partial s_L} = \frac{\partial \kappa_i}{\partial s_K} = 0, \; i=1,2,$$

(see equation (1.8) and (1.10a)) and therefore

$$\frac{\partial \alpha_1}{\partial \kappa} > 0, \quad \frac{\partial \alpha_2}{\partial \kappa} < 0$$

(see equation (1.11)).

(bb) Higher growth rates $w_Y = w_L + w_\pi$ depress the capital labor ratio κ. Given the savings ratios, growth will be more extensive than intensive.

f) There are two other theorems in the theory of international trade which may be found in each text book of international trade but are purely static and not applicable for growing economies.

(aa) The Rybczynski theorem (1955) states that if one factor of production is relatively expanded whereas the commodity price relations stay constant, the production of that sector which uses this factor more intensively will relatively rise.

This theorem states only short-term reactions, i.e. consequences of changes of the short-run transformation curve if

the price ratios are constant. In other words: it gives partial results which do not apply for long-term equilibrium growth. For example, if the total labor force suddenly becomes larger but the rate of growth of the labor force stays the same as before, all per capita values stay the same (the system is linear homogeneous in labor), and that means: the sector proportions stay unchanged on the equilibrium path. The Rybczynski theorem does not apply. Nevertheless, it is a partial aspect of the system in paragraph 1 above and may be derived from it by looking only to some equations.

Since the world market price ratio stays constant the capital labor ratios within each industry are not changed by changes in total capital and total labor.

We get from (1.10a): $(*)\kappa_2 = g_2'^{-1}(p_w \cdot g_1'(\kappa_1)) =: \kappa_2(\kappa_1, p_w)$
and from (1.7): $p_w[g_1(\kappa_1) - \kappa_1 g_1'(\kappa_1)] = g_2(\kappa_2(\kappa_1, p_w)) -$
$- \kappa_2(\kappa_1, p_w) \cdot g_2'(\kappa_2(\kappa_1))$ with the solution

$$\kappa_1 = \psi_1(p_w) \tag{3.10a}$$

Substituting this back into equation (*) we get

$$\kappa_2 = \psi_2(p_w) \tag{3.10b}$$

Thus κ_1 and κ_2 stay constant in the Rybczynski case.
Let $\kappa_1 > \kappa_2$. Then from (1.11)

$$\frac{\partial \alpha_1}{\partial \kappa} > 0, \quad \frac{\partial \alpha_2}{\partial \kappa} < 0 \tag{3.11}$$

and from (1.4b):

$$\frac{\partial \bar{y}_1}{\partial \kappa} > 0, \quad \frac{\partial \bar{y}_2}{\partial \kappa} < 0 \; . \tag{3.12}$$

For $\kappa_1 < \kappa_2$ all inequality signs change. Equations (3.11) and (3.12) are the Rybczynski theorem: if capital is expanded relative to labor and the investment goods industry (= industry 1) is more capital intensive than the consumption goods industry (= industry 2), labor will be shifted from

consumption to investment goods industry and the investment goods industry will expand, the consumption goods industry will shrink. But this is a situation of disequilibrium. Other equations of the system are not satisfied that way: the savings ratios, i.e. the demand side is left out.

(bb) The Heckscher-Ohlin theorem, (see Heckscher, 1919; Ohlin, 1933) does not apply either. It cannot even be derived within the limits of our model, since it considers two countries producing two commodities under neo-classical production functions. Our model concentrates on one country (assumed to be relatively small) and confronts it with a world market, the prices of which cannot be influenced by the country. The production function of the other countries forming the world market are not specified in our model. Moreover, the Heckscher-Ohlin theorem is purely static. It says:

> Even if two countries would have the same production functions and the same savings ratios and thus the same demand functions, there would be foreign trade. That country with a relatively higher amount of labor would export the labor intensive good, and that with a relatively higher amount of capital would export the capital intensive good.

But this is only a transitory phenomenon since irrespective of the absolute size of the population all values per capita, all price ratios and real wages and interests will be equal in both countries on the equilibrium path. Thus there will be no trade between these countries in equilibrium.

In concluding we may state that there are transitory as well as lasting structural effects of foreign trade on a country's economy. Will they be to the advantage of the country? This is the problem of the next paragraph.

4. ADVANTAGES FROM FOREIGN TRADE

Is there an advantage for the country to open its borderlines for foreign trade? This is an old question already considered by Ricardo in the static context and answered affirmatively. Almost all text books follow that line. In the dynamic context there are some articles on this subject, but not many. I mention Togan (1975), Bertrand (1975), Smith (1976), Gabisch (1976) and (1981).

Togan (1975) considers the case of the savings ratio s (i.e. $s_L = s_K = : s$ in our notation) and measures the advantage from trade by consumption per capita (C/L in our notation). Let $\hat{s}$ be the optimal savings ratio for the closed economy ($\hat{s}$ = production elasticity of capital in a one-sector economy),[6] and $\hat{p}$ the price ratio of investment to consumption goods in this case. He shows that consumption per capita is larger with foreign trade than under autarchy, if $s < \hat{s}$ and $p_w < \hat{p}$ or if $s > \hat{s}$ and $p_w > \hat{p}$. That means: if the country saves "not enough" and the investment goods on the world market are relatively cheaper than they are under autarchy, foreign trade is advantageous. The same applies, if the country saves "too much" and if the consumption goods are relatively cheaper on the world market than they are under autarchy. Smith (1976) showed that this result is also true under more general conditions.

But these are only local conditions which do not tell the whole truth. Moreover, consumption per capita is only one criterion for advantages from foreign trade. Thus it is worthwhile to look into this problem again.

We restrict ourselves to advantages or disadvantages which follow from our model. There might be other advantages connected with foreign trade (for example, transfer of technical knowledge which raises the rate of growth of technical progress in the country, availability of goods which for one reason or another are not available within the country, advantages from economies of scale and from the international division of labor, etc.). Thus our results may be thought of as the lower limit of advantages from

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6) Actually, Togan considers gross production, not net production as we did in paragraph 1. But this is not essential.

trade. As an introduction, we start with the usual textbook argument for foreign trade under static conditions.

a) Advantage from Foreign Trade Under Static Conditions and Under the Assumption of a Social Utility Function

Assume that the country has a fixed amount of labor and capital which can be allocated to the production of consumption or investment goods. The short-run transformation curve of Figure 8 demonstrates the production possibility set of the economy in this case. Assume further that there exists a social utility function which reflects the preferences of the society (or of the planning board) and that the market mechanism or the planning board succeeds in guiding the economy to the optimal point. In this case, foreign trade is always advantageous. Figure 11 shows the situation. $\hat{P}$ is the optimal production point for the closed economy. It maximizes social utility under the constraint of the transformation curve. Assume that the consumption good has a relatively higher price at the world market: the exchange line touches the transformation

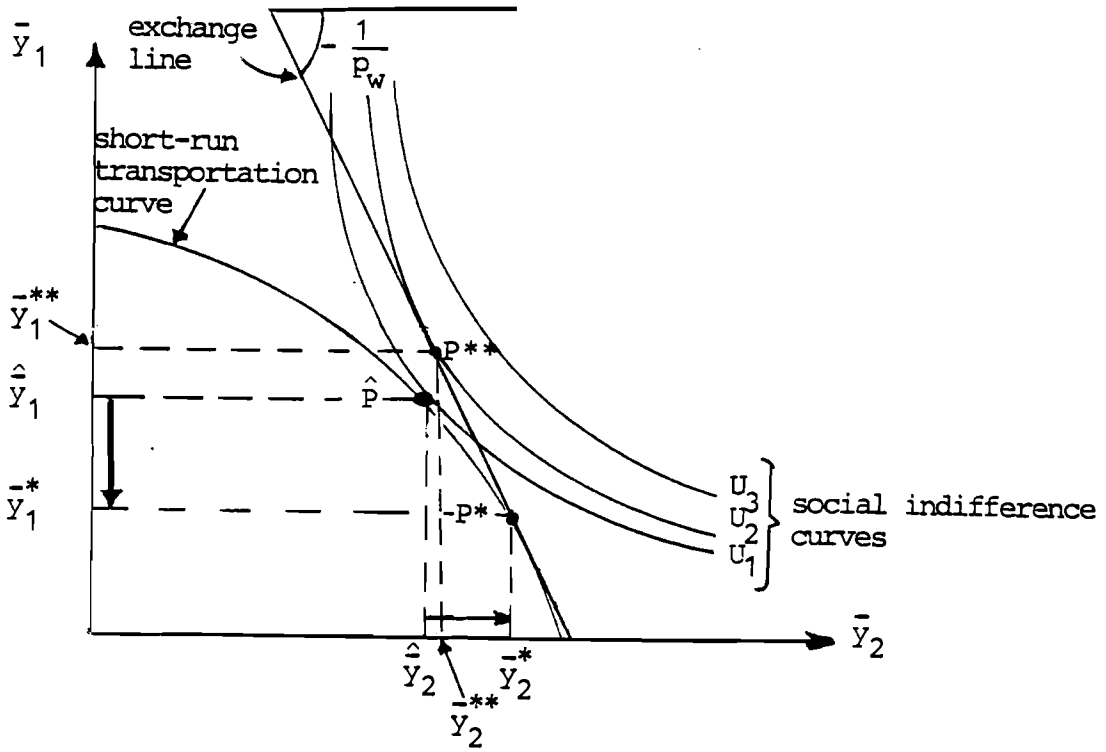

Figure 11.

curve at point P*. Thus the production of investment goods will be reduced from $\hat{\bar{y}}_1$ to $\bar{y}_1^*$ and the production of consumption goods will be expanded from $\hat{\bar{y}}_2$ to $\bar{y}_2^*$. Now the amount $(\bar{y}_2^* - \bar{y}_2^{**})$ of consumption goods will be exported and the amount $(\bar{y}_1^{**} - \bar{y}_1^*)$ of investment goods imported. The actual situation of the country is indicated by P**, and P** lies necessarily on a higher indifference curve. In this example the country has even more of both commodities; but this need not be true. This result appears however the price ratio p_w of investment to consumption goods may be provided it is different from the price ratio $\hat{p}$ under autarchy. In this case there would be no foreign trade. Thus the result is: foreign trade is always advantageous.

b) Advantage from Foreign Trade Measured by the Potential Amount of Consumption Goods

The arguments of the foregoing section (a) have two drawbacks: 1. they only consider the static re-allocation of resources but not the different growth paths under autarchy and under foreign trade, 2. there might not be such a thing as a social utility function, or if it exists, it is not observable. Thus we should look for other welfare measures. In this section we consider three different measures which give three different answers as to the advantage of foreign trade. In this paragraph we define as "advantage" from foreign trade the additional amount $\Delta\bar{y}_2$ of consumption goods per capita which the country could buy on the world market if it would keep the same amount $\bar{y}_1$ of investment goods which were available under autarchy.

Thus we do not ask: which amount of consumption goods are actually available with foreign trade compared to the amount under autarchy (this amount may be smaller), but which amount could be made available (e.g., by interventions of a planning board) by trading additional investment goods ("additional" compared to the situation under autarchy) for consumption goods. But we still retain the short-term view, i.e. we consider the short-run transformation curve.

Let $\bar{y}_i(p_w)$ be the amount of commodity i per capita with foreign trade, if the world market price ratio is p_w. The set $\{\bar{y}_1(p_w), \bar{y}_2(p_w)\}$ is graphically represented by the short-run transformation curve

in Figure 8. Let $\hat{\bar{y}}_i$ be the production per capita under autarchy. Then the potential additional amount $\Delta\bar{y}_2$ of consumption goods - which is now our measure for the advantage of foreign trade - is defined by

$$\Delta\bar{y}_2 := [\bar{y}_1(p_w) - \hat{\bar{y}}_1]\cdot p_w - [\hat{\bar{y}}_2 - \bar{y}_2(p_w)] , \tag{4.1}$$

$\bar{y}_i = \psi(\bar{y}_2)$, $\psi' < 0$, $\psi'' < 0$. According to the mean value theorem we have (changing the notations):

$$(y_1^1-y_1^0) = \psi'(\xi)\cdot(y_2^1-y_2^0) \geq \psi'(y_2^1)\cdot(y_2^1-y_2^0), \quad \text{where}$$

$$y_2^0 \leq \xi \leq y_2^1.$$

Under foreign trade we get from (1.10a) $\psi'(y_2^1) = -\frac{1}{p_w}$. Thus $y_1^1 p_w + y_2^1 \geq y_1^0 p_w + y_2^0$ and therefore

$$\Delta\bar{y}_2 = (y_1^1-y_0^1)p_w + (y_2^1-y_2^0) \geq 0. \tag{4.2}$$

Thus foreign trade measured in this way is always advantageous, irrespective of any social utility function.

Figure 12 illustrates this result. $\hat{P}$ is the production point under autarchy. The amount $\hat{\bar{y}}_1$ of investment goods produced under autarchy should be retained also under foreign trade. If p_w is the price ratio on the world market, P* will be the production point under foreign trade. E indicates the amount of consumption goods which can be obtained on the world market by trading the additional investment goods. $\hat{P}E$ measures the advantage from foreign trade. This is always positive if the world market price ratio is different from the price ratio under autarchy.

Figure 13 shows this result in another form: $\hat{p}$ is the price ratio under autarchy. I think the figure is self-explanatory.

Unfortunately, this nice result does not carry over to the dynamic case. If we substitute the long-run transformation curve for the short-run curve, things change. We only consider the normal case of a concave long-run transformation curve without factor price reversal, see Figure 7, solid line.

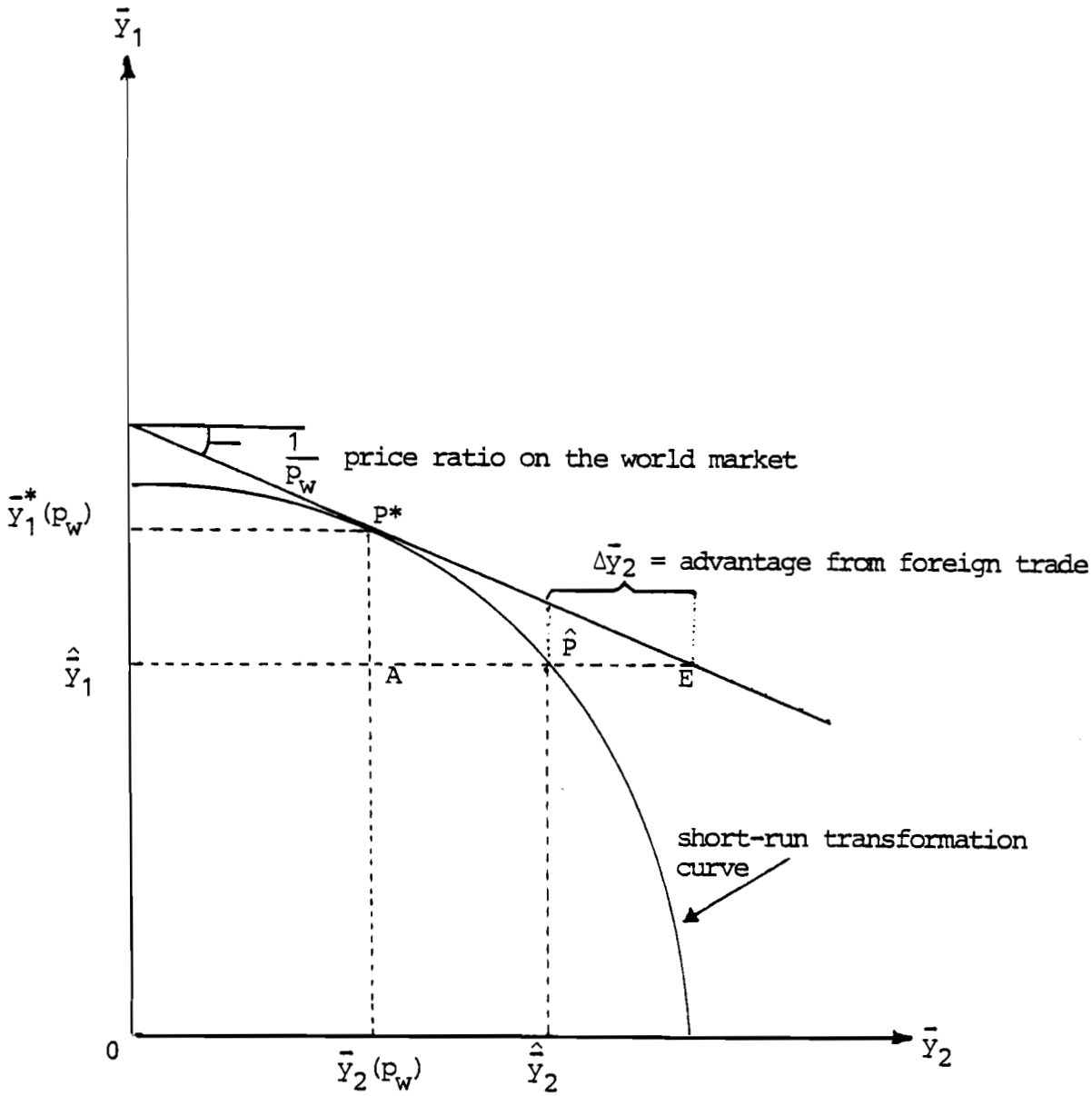
$\bar{y}_1$
$\frac{1}{p_w}$
price ratio on the world market
$\bar{y}_1^*(p_w)$
P*
$\Delta\bar{y}_2$ = advantage from foreign trade
$\hat{P}$
$\hat{\bar{y}}_1$
A
E
short-run transformation curve
0
$\bar{y}_2(p_w)$
$\hat{\bar{y}}_2$
$\bar{y}_2$

Figure 12.

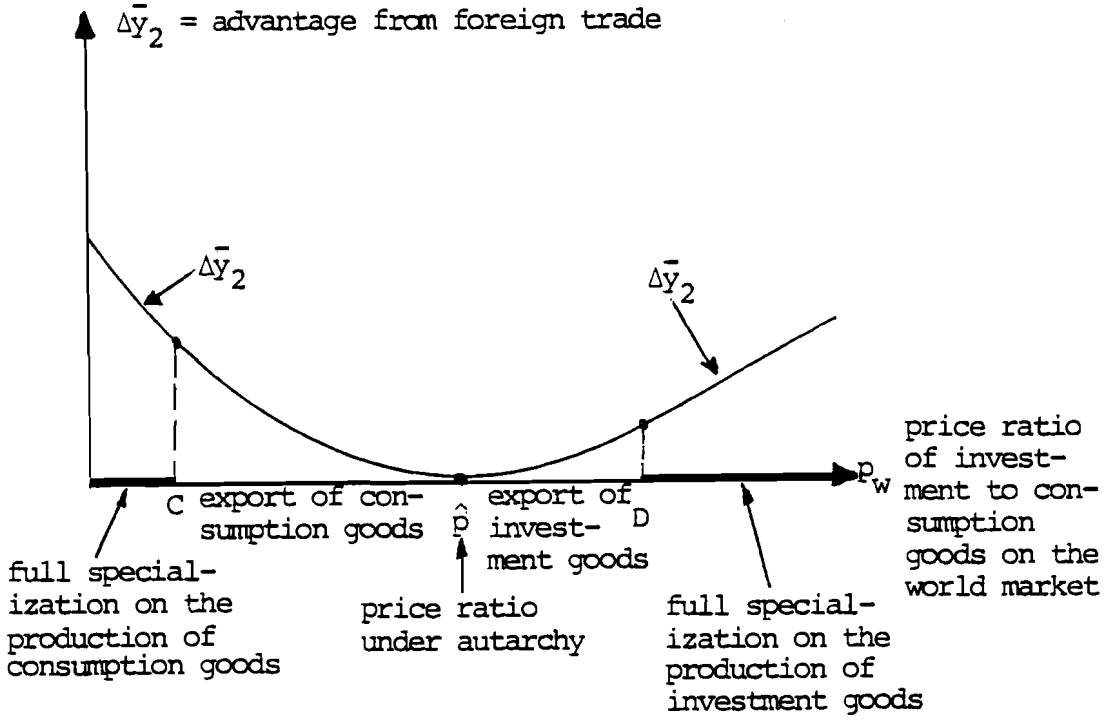

Figure 13.

Figure 14 shows the situation for the case that the production elasticity of labor is larger in the investment goods industry than in the consumption goods industry. If the amount $\hat{\bar{y}}_1$ of investment goods which is available under autarchy (= production point $\hat{P}$) should be retained (or acquired) under conditions of foreign trade and an additional amount of consumption goods should be available, the intersection points A,B,C of the exchange lines with the line $\hat{\bar{y}}_1$ must lie to the right of $\hat{P}$. But this is only true for the point C. That means that only if the exchange line is steeper as the exchange line $\hat{E}$ under autarchy, i.e. if the investment goods are relatively cheap on the world market, the foreign trade is advantageous. In this case only some more production of consumption goods is necessary to get the same amount of investment goods on the world market and there are still more consumption goods left.

This result is not very convincing. The measure we used was a hypothetical amount of consumption goods. Perhaps it is more

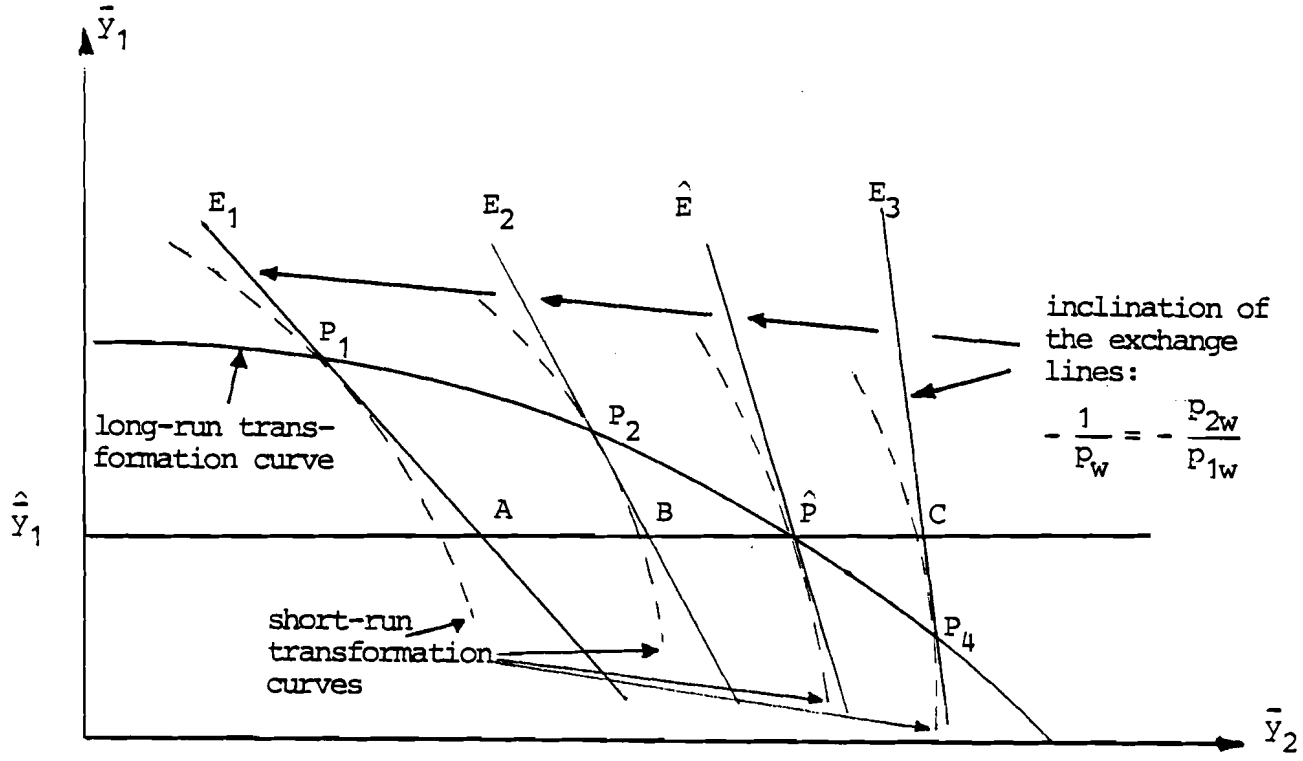

Figure 14.

appropriate to use actual, observable variables as measure. This will be done in the following paragraphs.

c) Advantage from Foreign Trade Measured by the Amounts of Commodities Available Within the Country

The problem with this measure is that it depends on the valuation of commodities. We have consumption and investment goods. They cannot be simply added up. Thus we have to make a decision. We evaluate all commodities in consumption units at the price ratios which are actually used in the country. Consider first the case $\hat{p} < p_w$, which means that the country exports investment goods. The amount $\tilde{y}$ of commodities per capita available in the country in units of consumption goods is (cf. equations (1.13a), (1.14a):

$$\tilde{y} := (I_{11}p + C_{11} + C_{21}\frac{ep_{2w}}{p_2})/L$$

$$= \pi[\alpha_1 p g_1(\kappa_1) + (1-\alpha_1) g_2(\kappa_2)] = \tilde{y}(p_w) \qquad (4.3)$$

where $p = p_w$ under foreign trade, $\kappa_i = \kappa_i(p_w)$, $\alpha_i = \alpha_i(p_w)$, see equations (1.8), (10a), (1.15) and (1.11).

If $\hat{p} > p_w$ the country exports consumption goods. The amount of goods (in consumption good units) available in the country is now (cf. equations (1.16a) and (1.17b)):

$$\tilde{y} := (I_{11}p + I_{21}\frac{ep_{1w}}{p_2} + C_{11})/L \qquad (4.4)$$

$$= \pi[\alpha_1 p g_1(\kappa_1) + (1-\alpha_1)g_2(\kappa_2)] =: \tilde{\tilde{y}}(p_w) \text{ for } p = p_w$$

Thus $\tilde{y} = \tilde{\tilde{y}}$. We do not have to care which type of commodities are exported and which are imported.

Figure 15 shows the graph of $\tilde{y}(p_w)$ for Cobb-Douglas functions and parameter values indicated in note 1. The function $\tilde{y}(p_w)$ of equation (4.3) is valid between points C and D. Beyond these points, when full specialization occurs, other functions are valid which are not reproduced here. But their graph is given in Figure 15.

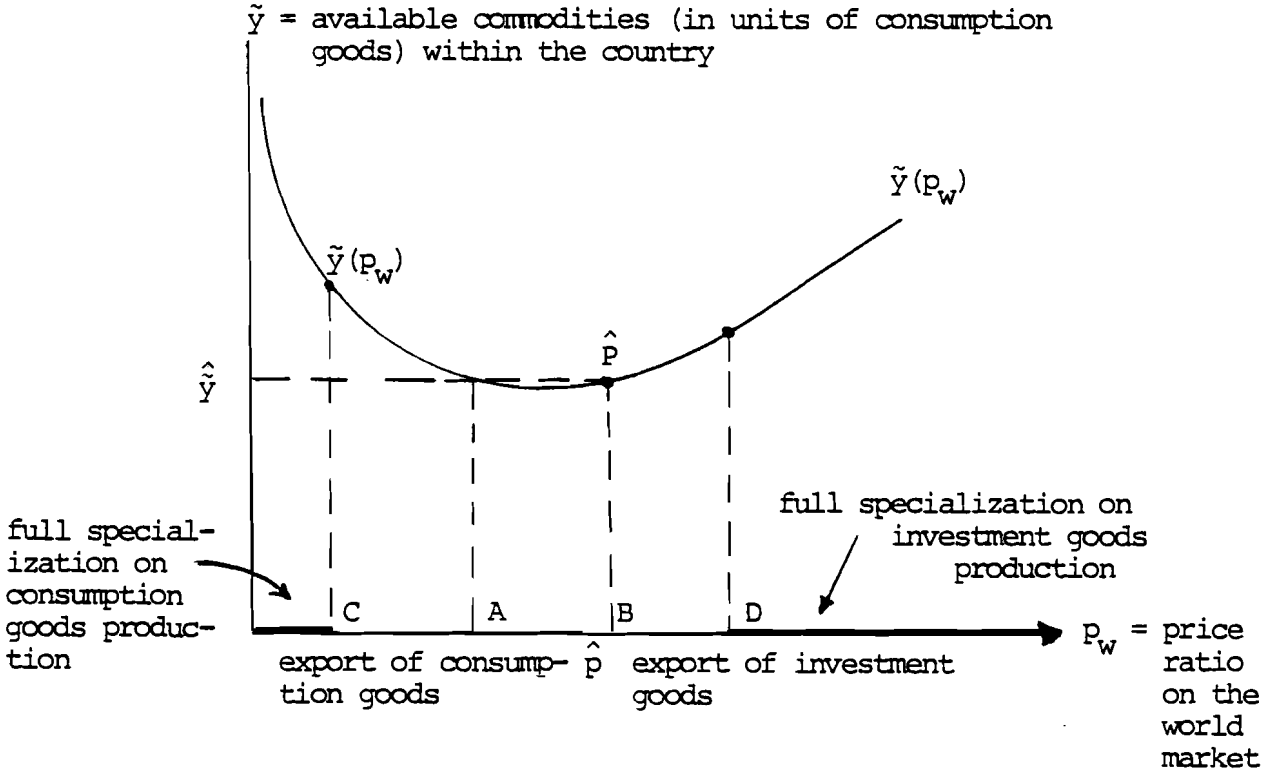

Figure 15.

Again, $\hat{p}$ is the price ratio under autarchy, $\hat{\tilde{y}}$ is the amount of commodities available within the country under autarchy. $\hat{P}$ is the autarchy point.

As may be seen, there is a small region AB where foreign trade is disadvantageous for the country. This disadvantage is small and stems from the fact that we measure the advantage in units of consumption goods. If the investment goods are only a bit cheaper on the world market than under autarchy, then not many more investment goods can be bought by selling consumption goods. But since their value (in units of consumption goods) has fallen, the total value may also fall. But this effect is small and probably not of practical importance. "In general" there is an advantage in foreign trade for the country, measured in commodities available in the country.

d) Advantage from Foreign Trade Measured by Consumption per Capita

This measure seems to be more natural than others since consumption is the ultimate goal of production. It is also prominant in the literature. For the open economy we get from (1.5) for real consumption per capita:

$$\frac{C}{L} = (1-s_L)\,\frac{\ell}{p_2} + (1-s_K)\,\frac{z}{p_2}\,\frac{K}{L} \tag{4.5}$$

By substituting $\frac{\ell}{p_2}$ from (1.7a), $\frac{z}{p_2}$ from (1.7b) and $\frac{K}{L} = \pi\kappa$ from (1.15), $p_w = \frac{g_2'}{g_1'}$ from (1.10a) we get after some manipulations:

$$\frac{C}{L} = \pi(g_2 - \kappa_2 g_2')\left[(1-s_L) + \frac{(1-s_K)\cdot s_A}{\frac{w_Y}{g_1'} - s_K}\right] =: c(p_w), \tag{4.6}$$

since $\kappa_i = \kappa_i(p_w)$, see equation (1.10a).

In general, the sign of $\frac{\partial \kappa_i}{\partial p_w}$ is undetermined. For the Cobb-Douglas functions and parameter values used in Figure 4 we get $\frac{\partial \kappa_i}{\partial p_w} < 0$.

For the closed economy equation (4.6) applies for the case $\hat{p} = p_w$, where $\hat{p}$ is the price ratio under autarchy. In this case we get from (1.18)

$$\frac{w_Y}{g_1'} - s_K = s_L \cdot \frac{\lambda}{\kappa} \quad . \tag{4.7}$$

From (1.12) and (1.8) we get

$$\frac{\lambda}{\kappa} = \frac{s_K\kappa_2 + (1-s_L)\kappa_1 + \frac{g_2}{g_2'} - \kappa_2}{\frac{\kappa_1\kappa_2}{\frac{g_2}{g_2'} - \kappa_2} + [(1-s_L)\kappa_2 + s_L\kappa_1]} \tag{4.8}$$

Substituting (4.8) into (4.7) and this into (4.6) yields the consumption per capita $\hat{C}/L$ under autarchy:

$$\frac{\hat{C}}{L} = \pi(g_2 - \kappa_2 g_2') \left[(1-s_L) + (1-s_K) \frac{\frac{\kappa_1\kappa_2 g_2'}{g_2 - \kappa_2 g_2'} + [(1-s_L)\kappa_2 + s_L\kappa_1]}{s_K\kappa_2 + (1-s_L)\kappa_1 + (\frac{g_2}{g_2'} - \kappa_2)} \right] \tag{4.9}$$

where $\kappa_i = \kappa_i(\hat{p})$, $\hat{p} = \frac{g_2'(\kappa_2)}{g_1'(\kappa_1)}$, $\kappa_i = \phi_i(\lambda)$ (cf. equation (1.9))

and λ determined by (1.18), i.e. by (4.7), where $\kappa = \hat{h}(\lambda)$, see equation (1.12).

If the foreign trade is advantageous under this criterion, C/L must be larger than $\hat{C}/L$ for all $p_w \neq \hat{p}$. But this is not true, in general. The derivative of C/L with respect to p_w is not zero at the point $\hat{C}/L$, in general. It may have any sign. We get:

$$\frac{d(C/L)}{dp_w} = \pi(\tilde{z}_1 \frac{\partial\kappa_2}{\partial p_w} - \tilde{z}_2 \frac{\partial\kappa_1}{\partial p_w}) \tag{4.10}$$

where $$\tilde{z}_1 := -\kappa_2 g_2'' [(1-s_L) + \frac{(1-s_K)s_L}{\frac{w_Y}{g_1'} - s_K}] > 0$$

$$\tilde{z}_2 = - (g_2 - \kappa_2 g_2') \frac{(1-s_K) s_L \cdot w_Y \cdot g_1''}{(w_Y - s_K g_1)^2} > 0$$

Nevertheless, more definite results may be reached if we specify the production functions or make some other assumptions. Especially we shall assume that C/A is a convex function of p_w. This is true for Cobb-Douglas production functions. Now three cases may occur (see Figure 16).

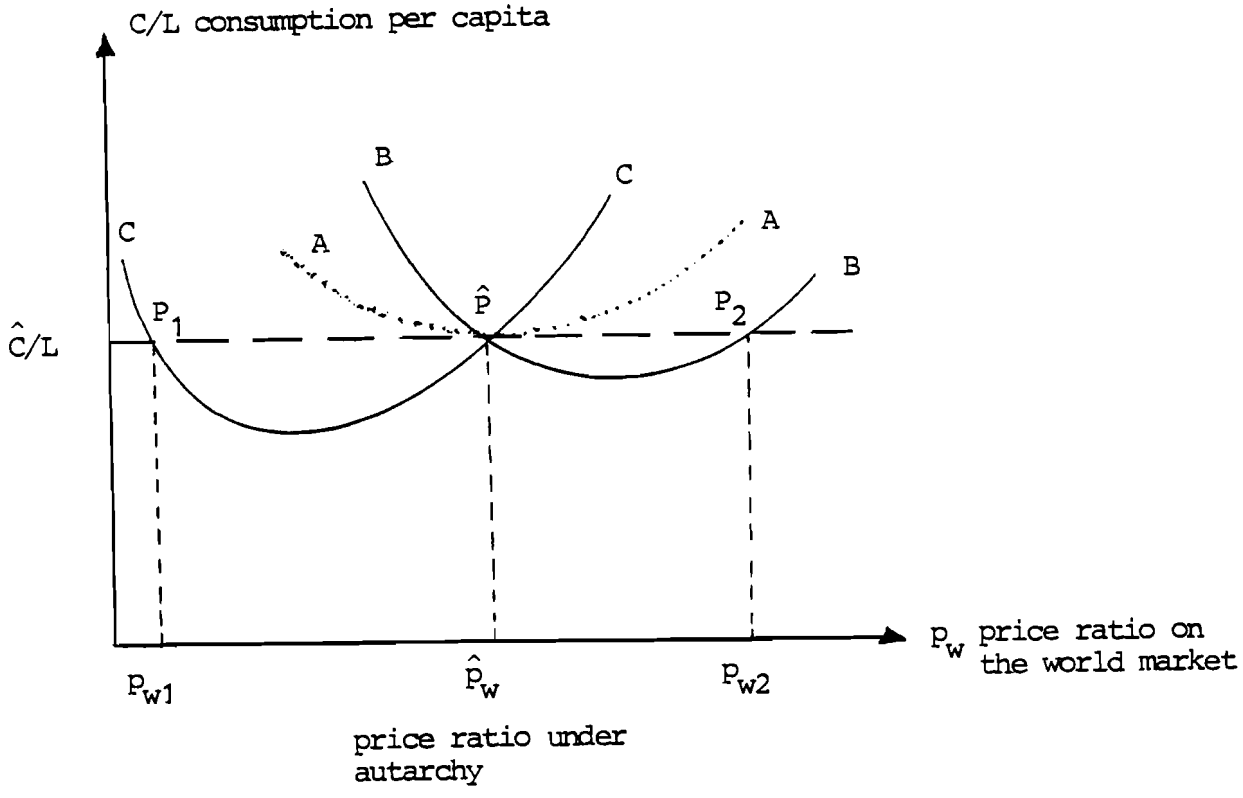

Figure 16.

In case A (see the dotted line in Figure 15) foreign trade is always advantageous. This occurs:

a) if the savings ratios s_L and s_K are optimal in the sense that the maximal consumption was reached under autarchy. In the case of Cobb-Douglas production functions (see note 1) above) this means: if

$$s_L = \frac{1-\gamma_2}{\gamma_1}(1-s_K) \quad , \tag{4.11}$$

where γ_1: = production elasticity of labor in the investment goods industry, γ_2 the same in the consumption goods industry;

b) if the savings ratios keep specific relations. They follow from the condition $\frac{\partial}{\partial p_w} C/L = 0$ for $p_w = \hat{p}$ and may be written:

aa. $s_L = \frac{1-\gamma_2}{\gamma_1}(1-s_K)$

This is identical with equation (4.11) , or

bb. $s_L = \frac{1-\gamma_2}{\gamma_1}(1-s_K) - q \quad ,$ (4.12)

where

$$q: = \frac{1-\gamma_2}{D} \{ (1-s_K)N_2 + \gamma_1 [\gamma_1 s_K - \gamma_2(1-s_K)] \}$$

$$D: = \gamma_1(1-s_K)\gamma_2(\gamma_1-\gamma_2) - (1-\gamma_2)\gamma_1 N_2$$

$$N_2: = \gamma_1 + s_K(\gamma_1 - \gamma_2)$$

Figure 17 shows these functions (4.11) and (4.12).

The optimal savings ratios s_L^* and s_K^* are indicated by the line s_L according to (4.11). In Figure 17 we used the parameter values $\gamma_1 = \cdot 8$, $\gamma_2 = \cdot 7$ and $w_Y = \cdot 02$, cf. note 1) above. For $\gamma_2 > \gamma_1$ a similar graph comes up, only the "grooves" are situated differently.

In case B there is a "groove" between $\hat{p}_w$ and p_{w2} where foreign trade reduces the consumption per capita (= groove to the right in Figs. 16 and 17). Investment goods will be exported, but their price is only a bit higher than under autarchy. The allocation of addi-

tional factors to the investment goods industry reduces the consumption goods industry and this reduction is not overcompensated for by the import of consumption goods since these goods are scarcely less expensive than under autarchy.

In case C there is a "groove" between p_{w1} and $\hat{p}_w$. Consumption goods are exported but the world market price of these goods is not high enough to compensate for the re-allocation of factors from the investment goods industry to the consumption goods industry.

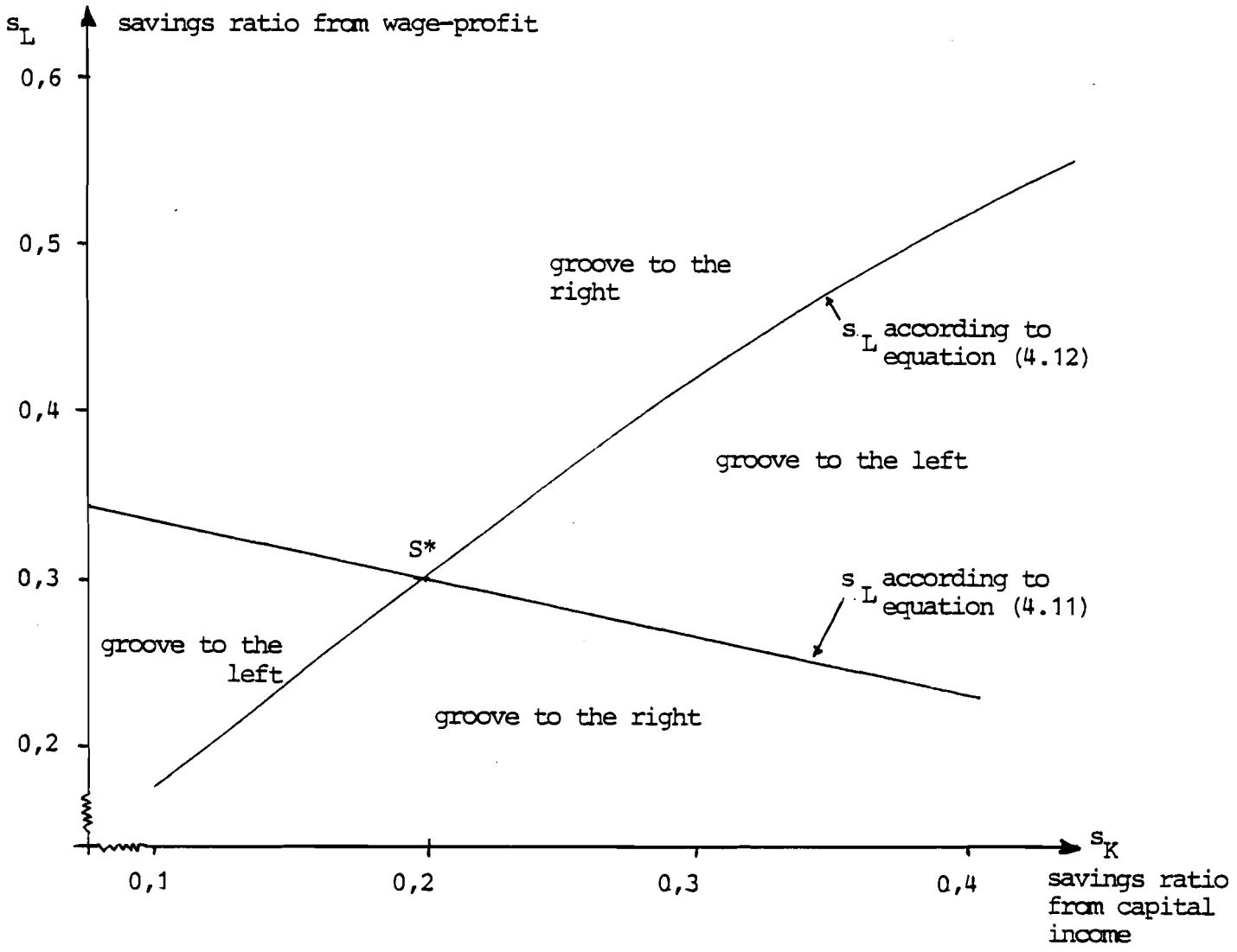

Figure 17.

These grooves are rather small and flat. Thus deviations from the optimal savings ratios do not matter very much if they are not extreme.

In concluding this paragraph we may state that the structure induced by foreign trade is advantageous for the country in the long run if we measure the advantage by consumption per capita and if the price ratios on the world market are significantly different from those under autarchy. The economy moves to a higher growth path, see Figure 5. This advantage is still larger, if we take into account the transfer of knowhow, economies of scale and other advantages from the division of labor which are not taken into account in this model.

The results apply to any country, be it developed or not, if it is small relative to the rest of the world. If the country is abundant in labor but has only a very small savings ratio, a very low productivity rate and outdated production methods such that the production functions are inferior to those in other countries, production and consumption per capita will be very low. So will be the real wage rate. As a rule, we may assume that a country like this will export consumption goods and import investment goods and that the domestic price ratio $\hat{p}$ between investment and consumption goods is far away from the actual world market price ratio p_w. Thus consumption per head will rise by foreign trade (see line B in Figure 16). After a while the savings ratio will follow, that means: capital accumulation and industrialization starts. That is the line which Mexico, Brazil, Argentina, Taiwan, Hongkong, Singapore and other countries pursued. The thesis of Emmanuel (1972) that foreign trade itself means exploitation of developing countries is simply wrong. There are so many inconsistencies and errors in his arguments that they do not deserve any attention; cf. Stein (1984), p.143 ff. Moreover, why do the developing countries not simply close their borders if they feel exploited by foreign trade? Why do they complain about trade barriers if trade is detrimental? Thus we can forget this opinion.

Actually, we have to make all efforts to keep world trade free and to resist the protectionist pressure which comes from those industries which have to shrink under foreign trade.

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TASK FORCE MEETING ON

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