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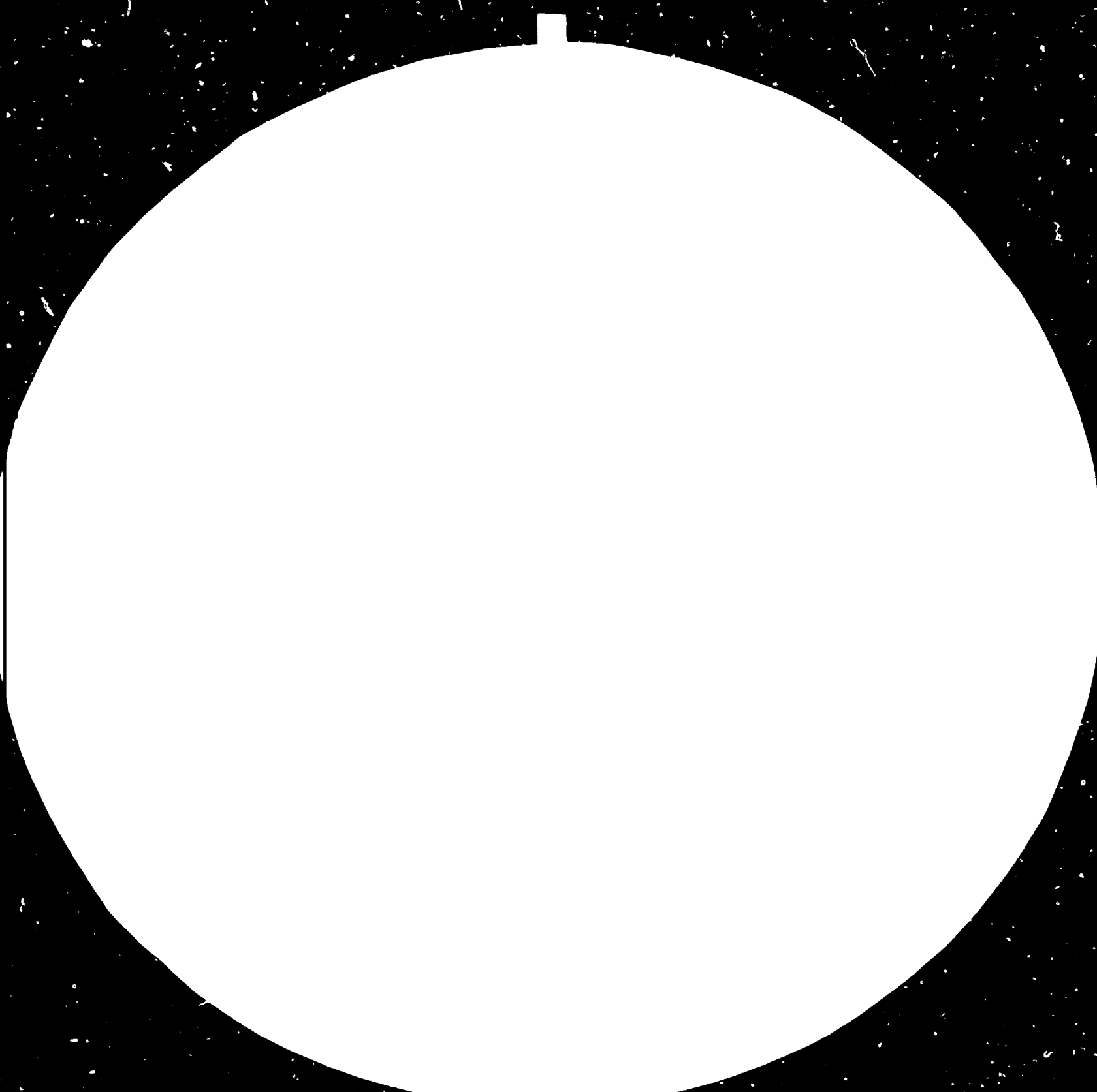
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CAPITAL GOODS IN PERSPECTIVE:
DEFINITION, IMPORTANCE AND ANALYSIS OF FACTORS AFFECTING DEMAND
WITH SPECIAL REFERENCE TO ARAB COUNTRIES

Sectoral Working Paper Series
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22

SECTORAL WORKING PAPERS

In the course of the work on major sectoral studies carried out by the UNIDO Division for Industrial Studies, several working papers are produced by the secretariat and by outside experts. Selected papers that are believed to be of interest to a wider audience are presented in the Sectoral Working Papers series. These papers are more exploratory and tentative than the sectoral studies. They are therefore subject to revision and modification before being incorporated into the sectoral studies.

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Preface

This document has been prepared by the Sectoral Studies Branch, Division for Industrial Studies as part of a project entitled "Techno-economic study for the development of the capital goods industry in the Arab world" (Project No. UF/RAB/82/123) undertaken in co-operation with the Arab Industrial Development Organization (AIDO). The objectives of this project were to encourage the establishment of capital goods industries in Arab countries and support regional co-operation and integration.

This document will also be used as an input to the ongoing study programme on the capital goods industry which is carried out by the Sectoral Studies Branch.

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I. Definition

Definition of categories in a manner that will provide useful empirical meaning has frequently posed major conceptual difficulties in economics. The presentation of an inclusive and exclusive definition for capital goods is no exception and in fact presents a special challenge. Various analyses of the capital goods industry have not been consistent in their definition of the industry and have been based on differing outlooks. One traditional definition has classified capital goods as those goods that provide their services not only in the current period but in the medium run and long run.

The problem here is that the definition of current period, medium run, and long run then becomes an arbitrary matter. Others have defined capital goods as those goods that are used to produce other goods. The problem with this definition is that it is not exclusive. It could be argued that food consumed by production staff indirectly aids production and could thus be classified as a capital good, an obviously unacceptable classification.^{1/}

Diversity and heterogeneity are essential characteristics of capital goods. It is estimated that the number of different goods that can be classified as "capital goods" is close to four million. These goods differ from each other with regard to their process of production; the structure of production and degree of finish when moving downstream in the production process; their degree of complexity; the functions they perform (e.g. supplying energy, transmitting energy, control and regulation, and structure); their use (the whole spectrum from multipurpose universal machines to machines performing very specific and specialized tasks); and their end-use destination (all sectors of the economy from agriculture to service are serviced by capital goods of varying types in one way or another. Some capital goods are common to all branches of industry). Reflection on these facts makes clear

^{1/} For a discussion see Stewart, Frances, Technology and Underdevelopment, Westview Press, Boulder, Colorado, 1978.

the bewildering diversity and heterogeneity of the goods produced by the industry. Yet, these diverse and heterogeneous products are related to each other in various economic systems by their contribution to the integrated activities of the production branch of that economy and by technical and economic interdependencies. The extreme diversity makes an ordering of capital goods necessary. Otherwise attempts at analyzing the industry and arriving at recommended strategies and plans of action will either be impossible or will descend to the level of tautologies, or any statement made will be so general that it would be of little practical use. Arriving at a classification scheme that would allow one to achieve some ordering out of this diversity is of great importance.

The search for an acceptable definition and classification of capital goods must focus on the distinctive feature of these goods. The distinctive feature of capital goods is that they cause the reproduction and expansion of the stock of social wealth and the flow of social income through their contribution to gross fixed-capital formation. Thus they fulfil the economic function of capital investment.^{2/} A subset of the capital goods industry has the ability to reproduce itself and to produce the means of production. This is the core of the capital goods industry. Machine tools constitute a dominant portion of this core. Given this definition of capital goods, it is observed that capital goods are concentrated in and constitute a part of the metal-converting (mechanical, electrical, transport and engineering) industries. The metal-converting industries in addition to capital goods produce intermediate goods and durable consumer goods.^{3/}

Unfortunately there is no correspondence between this definition of capital goods and the world industrial and trade statistics classification schemes (ISIC and SITC). Capital goods are concentrated in ISIC class 38, "Manufacture of Fabricated Metal Products, Machinery and Equipment", with five subclasses. Those products in this class relating to consumer goods (automobiles, domestic electrical appliances, and mass consumer electronics) should be eliminated.

^{2/} Sites, buildings, and non-tangible assets excluded.

^{3/} A discussion of other definitions of capital goods is contained in the Appendix.

In international trading statistics, Revision 2, capital goods are concentrated in SITCs 69, 7 and 87. In Revision 1 they are concentrated in SITCs 69, 7 and 861. Appendix 1 identifies capital goods according to this nomenclature.

Capital goods have many characteristics that can be used as a basis for their classification into various subgroups. In fact, various authors have presented classification schemes based on one or more of these characteristics. Therefore a multitude of classification schemes have been presented, many of them inconsistent with each other, and this has been the source of much confusion and hindrance to a better understanding of the industry. The UNIDO secretariat maintains that the choice of technological complexity as a basis for classification of capital goods is one of the best choices. The concept of complexity^{4/} is by no means easy to define and more difficult still to measure. A proper definition would take into consideration not only issues directly relating to hardware but also issues relating to software and technical infrastructure. UNIDO has previously exerted major efforts in this direction. The analysis of complexity allows grouping of production according to the progressive mastery of technology required, and this in turn determines the point and mode of entry and the actions and resources and linkages required by a given country facing specific conditions.

Thus the concept of complexity relates directly to the prospects, constraints, and required strategies for development of capital goods industries.

II. Role of Capital Goods

As there is no specific nomenclature for capital goods, it is difficult to estimate their production precisely. Subject to this reservation world production of capital goods in value added terms can be estimated at over one-third of the world's industrial production.

^{4/} Report of the "First Consultation on the Capital Goods Industry", Brussels, Belgium, 1981, ID/WG.342/3.

It is not only their volume and value which makes capital goods so important, but also the key role that they play in the industrialization process. The machinery and equipment part in fixed capital plays a decisive role in the process of capital accumulation. At the same time the capital goods industry produces the means of production and is a catalyst for technological progress. Since the development of this industry involves mastering a wide range of technology and expertise, it also promotes innovations and innovative approaches.

Beyond this it is clear that without a capital goods industry the developing countries, even if they achieve the rate of industrial growth corresponding to the objectives of the Lima Declaration, cannot emerge from dependence. Dependence in fact will even be accentuated by this type of industrialization. Their industrial fabric will depend exclusively on the industrial and technological centres of the industrialized countries. Internal integration of the industries, and even sub-regional integration, will be almost impossible.

In this relation the effect of the capital goods industry on the international division of labour is another aspect of its vital importance.

Under the impulse of technical progress and in particular under the impulse of the widespread use of automation, a differentiation has taken place in the industrialized countries between the following productive sections:

- first, the consumer goods and intermediate goods industries, with the widespread use of continuous production processes, work stations and unskilled labour.

- second, the capital goods industries and the specialized design companies (engineering, management and maintenance) which are increasingly linked to them where a polarization of skilled labour has taken place.

It is on the basis of this social division which operates in the industrialized countries that an attempt has been made to impose the new

international division of labour: the industrialized countries would specialize in capital goods industries, specialized service companies and research centres, whilst the consumer goods and intermediate goods industries, having been largely dispossessed of their software activities and their skilled labour, can be transferred to the developing countries with less of a challenge to the international division of labour.

Thus it is around the capital goods industry that the principal challenge of the new international division of labour is located, and it is around this same industry that competition is becoming more intense in the industrialized countries for exports to the Third World and that the outcome of the struggle for reduction of developing countries' technological and economic dependence will be centred.

The imbalance between the developing and developed countries is evident in the low contribution of the former to the world production of capital goods (approximately 6 per cent) compared to the developed countries. The developing countries' share of world exports of capital goods is only about 3.5 per cent, whereas their share of imports reaches approximately 30 per cent. This deep-seated imbalance is accompanied by other imbalances between the developing countries themselves. Machine-tool production in developing countries is concentrated in about 10 countries. Brazil and China account for over half this production.

The new forms of dependence in which the new international division of labour encloses the developing countries through capital goods is formulated in a clear, unambiguous and almost cynical manner by the Interfutures Report in a paragraph on the high technology industries: "Whatever their development strategies the Third World countries will have to expand their investment and, consequently, increase the volume of their capital goods requirements. Yet in 1973 their share (excluding China) in the manufacture of machinery was no more than 3 per cent of the world total. By the end of the century this could have risen to 13-14 per cent. The developed countries of the West and East will therefore probably retain their high level of specialization in this branch, whose growth should offset, at least in part, their relative decline in the traditional industries. This phenomenon could be even more pronounced with

regard to industrial machinery. As for the Third World it will probably increase its imports of capital goods from the North substantially. To a large extent technology is incorporated in production goods. Consequently the capital goods content of international trade is going to be decisive in shaping the forms of industrialization of the developing countries."^{5/} One cannot be clearer than this. International commerce is seen therefore as the fundamental means of orienting and modelling the industrialization of the developing countries in a decisive manner.

The capital goods industry, by its direct action and the indirect measures necessary for its implementation and by its unique position in being linked directly to virtually all sectors of the economy, is a motive force in development and an engine for technological growth. It creates the conditions not only for operating the industrial system but also for the self-reproduction of this system.

In other words the establishment of a capital goods industry is one of the essential conditions for avoiding pseudo-transfers of technology - that is to say, the use of technology without its assimilation. Because its mastery implies the domination of a wide range of technologies, the capital goods industry and the engineering infrastructure which is associated with it make it possible to move away from the path of purely copying transfers and opens up the route to the creation of local innovative capabilities. The establishment of the industry is one essential condition for the realization of "appropriate technologies". Labour-intensive technologies incorporating less fixed capital are not generally produced in the industrialized countries, and there is little chance that they will be in the near or medium-term future. This task can therefore only be assumed by the capital goods industries in the developing countries themselves. To use Schumpeter's terminology, the "creative destruction" of existing imported and inappropriate capital stock cannot be achieved by the importation of even more inappropriate capital stock. It must be done through the local capital goods sector.

^{5/} Organization for Economic Co-operation and Development, Facing the Future: Mastering the probable and managing the unpredictable, Interfutures Report, p. 266, Paris, 1979.

There is another extremely important aspect of the capital goods industry and one which is often minimized--the software. The quantitative importance of the service and design activities in the capital goods industries, that is to say, of software, should be emphasized. Normally, in terms of the number of jobs, these service and design activities account for 25-30 per cent of the total jobs in the capital goods sector. In the consumer goods and intermediate goods sectors, the software activities are in general much lower, representing only about 10-15 per cent of the jobs.^{6/}

Software activities develop as a function of the complexity of the capital goods being produced in an economy. This development is carried out through:

- diversification of design and R and D activities;
- diversification of production organization activities: activities involving methods, planning and supplies;
- diversification of technical support activities;
- diversification of quality-control activities;
- diversification of marketing and engineering of demand activities.

The quantitative and qualitative importance (appreciated in terms of their diversity) of software activities in the capital goods industries is due in large part to an observed movement and transfer of software activities linked with the consumer goods and intermediate goods industries towards the capital goods industries. This movement and transfer is the principal result of technical progress trends in the industrialized countries.

^{6/} IREP, Université des Sciences Sociales de Grenoble, Transfer of Technology and Engineering in the Capital Goods Industry, February 1980.

It is under the impulse of the widespread and generalized use of automation that innovation in the consumer goods and intermediate goods industries is also increasingly taken over by the capital goods industries. Thus the capital goods sector is rapidly becoming the focal point of development of the all important software activity of the industrial sector of the economy.

Finally, capital goods industries, particularly some branches, have the characteristic of being relatively inexpensive in fixed capital investment per job created. From this point of view they do not have as heavy requirements as other industries, such as iron and steel.

This is because these industries are generally skill and knowledge intensive, and since skill and knowledge have a tendency to be person-embodied, the capital goods industries have a tendency to be labour intensive.

Their establishment and development will therefore contribute substantially to the fight against unemployment and under-employment in the developing countries. However, because of the very fact of its skilled labour intensity a high level of specific training activity is required to allow the fruit of the labour intensity of the industry to be realized.

III. Factors affecting demand for capital goods with special reference to Arab countries

At the beginning, it is necessary to clarify a few terms so as to prevent confusion later on. The important distinction to be made is between effective demand and potential demand or market potential. The demand potential or market potential of capital goods for Arab countries can be thought of as the total amount of capital goods that would be purchased in Arab countries (either from domestic or international sources) in a specified time period and under a given set of conditions. These conditions themselves might be controllable or uncontrollable. Demand for capital goods is then determined through the relationship that links it to controllable factors given a certain set of uncontrollable factors. Thus demand is not a single number and its

determination depends on the configuration of both controllable and uncontrollable factors. Here the main factors affecting demand will be examined in five separate groups:

- A. Demographic factors
- B. Economic factors
- C. Psychological and social factors
- D. Technological factors
- E. Government policy factors

The controllability or uncontrollability of these factor groups and their constituent subfactors will vary over time and place, but in any case a careful examination of them will go a long way in assisting us to understand why certain levels of demand are achieved. Not only do these five groups of factors affect demand, they affect each other in a complicated series of interactions (for example the easily recognized triangular interactions between government policy, technological factors, and economic factors). With these caveats the effects of each of the major groups of factors determining demand for capital goods will now be analyzed.

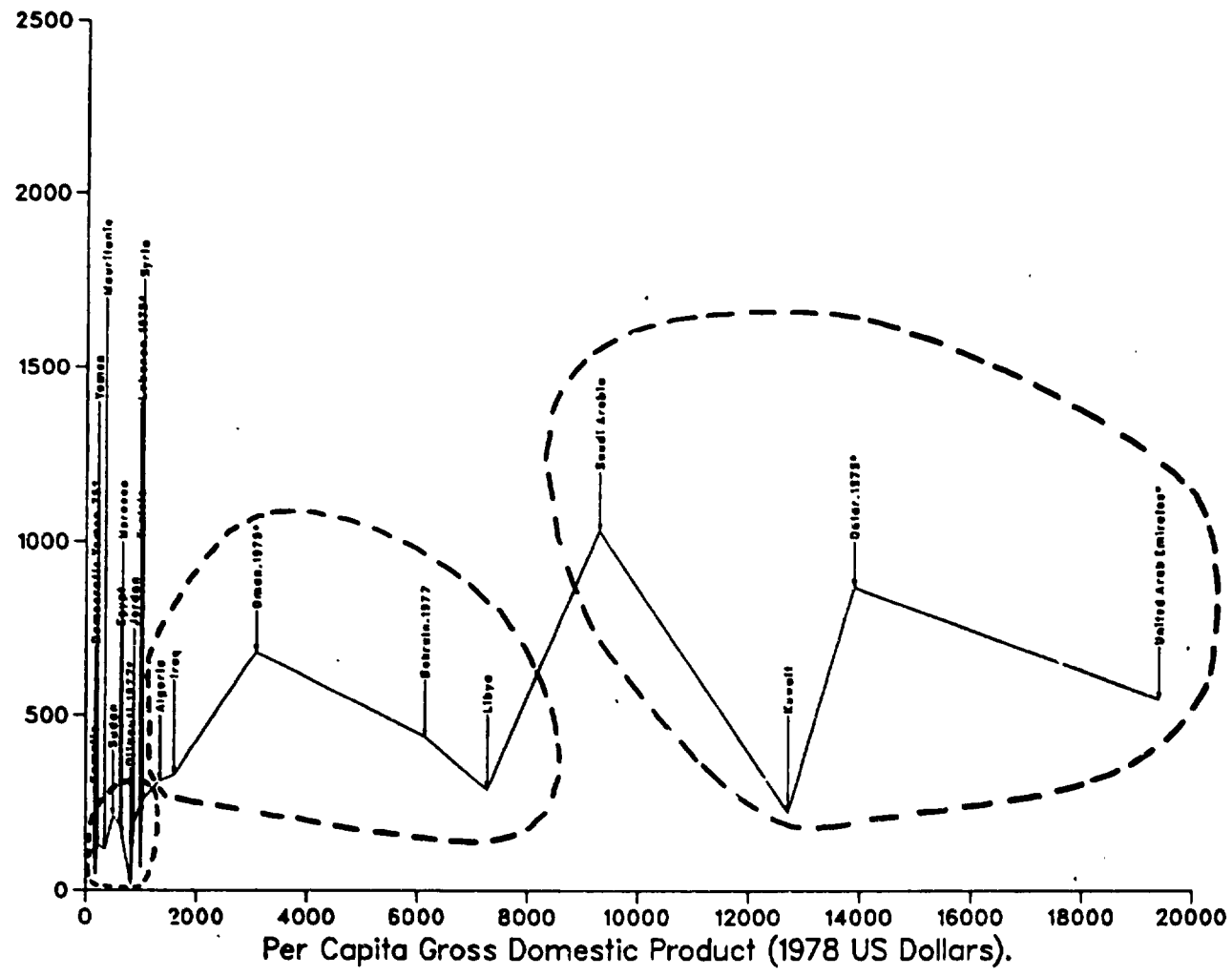
A. Demographic factors

Demographic factors can affect demand for capital goods through two often contradictory mechanisms: First, increases in population can cut into per capita income and national savings which are necessary for investment and realization of demand for capital goods. Second, increases in population by increasing total demand for consumer goods increase derived demand for capital goods. However, the latter demand will depend upon the existing level of industrialization. Consequently, one should stress the linkage of GDP per capita and industrial production output as factors affecting the demand for capital goods.

Figure 1 shows the 1970 to 1978 growth in per capita gross domestic product versus per capita gross domestic product for 21 Arab countries.

FIGURE 1

Growth in Per Capita Gross Domestic Product 1970 to 1978 vs
1978 Per Capita Gross Domestic Product
for The Arab Countries.



Raw data from United Nations, "Yearbook of National Account Statistics, 1980", New York, 1982.

Three groups of Arab countries can be distinguished here:

The first group, consisting of Kuwait, Qatar, Saudi Arabia and the United Arab Emirates, are oil-rich countries with high per capita GDP levels and high growth of per capita GDP. One can venture that in these countries an increase in population would increase derived demand for capital goods more than enough to offset the effect of the accompanying reduction in per capita GDP as these countries exhibit some indications of saturation effects of per capita GDP levels.

The second group, consisting of Algeria, Bahrain, Iraq, the Libyan Arab Jamahiriya, and Oman, are countries with moderate levels of per capita GDP and high-to-moderate levels of growth of per capita GDP. In these countries one can expect a trade-off of the negative and positive effects of population growth on demand for capital goods. The trade-off relation obviously varies between, say, the Libyan Arab Jamahiriya, with a very sparse population density and relatively high per capita GDP level, and Iraq, with a much larger population and lower per capita GDP. In any case Algeria and Iraq are marginal with respect to their membership in the second or third group.

The third group consists of countries with rather low levels of per capita GDP and low-to-moderate rates of growth of GDP. In these countries there is also a varying trade-off relationship between population growth and demand for capital goods, the demand-reducing effects of population growth becoming progressively more important at lower levels of per capita GDP and its growth rate. The countries in this group are: Democratic Yemen, Djibouti, Egypt, Jordan, Lebanon, Mauritania, Morocco, the Yemen Arab Republic, Somalia, Sudan, the Syrian Arab Republic, and the United Arab Emirates.

Table 1 shows that there is a clear correlation between the value of import of capital goods and industrial production in Arab countries. However, caution should be exercised in interpreting the results in that oil-related industrial production plays a dominant role in a number of these countries, and it is difficult, in relation to demand for capital goods, to separate the income effects from the industrial development effects of industrial production levels using this set of data.

Table 1. Value of industrial production (1980)

Value of imports of capital goods except transport equipment (1979)
for selected Arab countries

Arab countries	Industrial production 1980 ^{a/} 10 ⁹ \$ US (World Development Report 1982)	Imports of capital goods except transport equipment (1979) 10 ⁹ \$ US (Bulletin of Statistics on World Trade in Engineering Products, 1980)
Saudi Arabia	90,035	7,717
Iraq	26,140	3,818
Libyan Arab Jamahiriya	23,104	2,636
Algeria	22,725	2,720
Kuwait	21,600	1,415
Egypt	8,040	2,447
Morocco	5,740	726
Syrian Arab Republic	3,483	807
Tunisia	2,555	637
Sudan	1,000	260
Jordan	700	360
Yemen Arab Republic	417	na
Somalia	124	na
Mauritania	161	na

^{a/} Manufacturing, mining, construction, electricity, water and gas.

B. Economic factors

Business cycle theories in developed countries usually emphasize the role of capital investment (of which capital goods investment is a major component) as one of the main causes of economic activity up-turns and down-turns. The theories state that the decision to make or not to make capital investments results from the comparison by decision-makers of the marginal efficiency of the investment and the marginal cost of capital. Here the expectations of decision-makers regarding the future play an important role in capital investment and in determining demand for capital goods. In developed market economies cyclical down-turns reduce primary demand, and therefore derived demand for capital goods. They also might encourage decision-makers to defer investments in capital goods until any declines in the price of capital goods that might result run their full course. The reduction in national savings that might occur in periods of down-turn would also reduce savings available for investment in the sector.

These effects, among others, lead us to expect that the capital goods industry is a cyclical industry, growing faster than the economy as a whole in periods of growth and declining faster than the economy as a whole in periods of decline.

If we apply this framework to the Arab countries we see that a number of modifications are required. In the oil-rich Arab states the general availability of funds ensures a higher and more sustained demand for investment in capital goods, and national savings do not pose the major bottleneck. In the other Arab states, these elements of stabilization are not so evident. However, given the important role of government in the economies of these countries and specifically in the capital goods sector, the marginal cost-benefit analysis is done at the social, not commercial, level, and with a generally longer time-horizon than the private sector would have. These factors should reduce the cyclical swing. A very important characteristic of demand for capital goods that must be taken into account here is the derived nature of such demand. This derived nature is an important source of instability of demand. The demand for capital goods arises in an indirect way

through the demand by the final consuming sectors (whether individual consumers or the government) of the goods and services capital goods are used to provide. The derived demand for capital goods at a specific point in time reflects the perceived projected demand for consumer good in the present and future. The time-horizon involved varies for different goods and depends on the time required to fill an order for that type of machine to provide the required function in the future. This adds an element of perception and further uncertainty to the derived demand for capital goods.

Another element that leads to possible fluctuations of demand for capital goods is their rather long lifespan; because of this, available capital goods can be seen as embodying capital stock inventory. Industrial customers can be expected therefore to engage in the equivalent of inventory management of their capital stock in response to fluctuations in final demand. Thus in periods of down-turn not only is the demand for the flow of capital goods services reduced, there is also a reduction in inventory through depletion which further reduces the effective demand the capital goods industry is faced with. The opposite happens in periods of boom. Hence the fluctuation in demand for capital goods is more pronounced than the fluctuation in demand for the goods and services they produce. The difficulties in projecting demand for capital goods that arise because of these fluctuations are augmented by the indeterminacy of its price elasticity in the short run. For normal consumer goods a reduction in price can be expected to be accompanied by an increase in demand. For capital goods, as indicated previously, a reduction in price can be interpreted as signalling a period of declining prices due to reduced demand, technological factors, excess production capacity in capital goods plants, etc., and buyers will be cautious in making purchases until the situation has cleared up. The opposite is true of price increases. In the long run however, the price elasticity could be expected to behave normally.

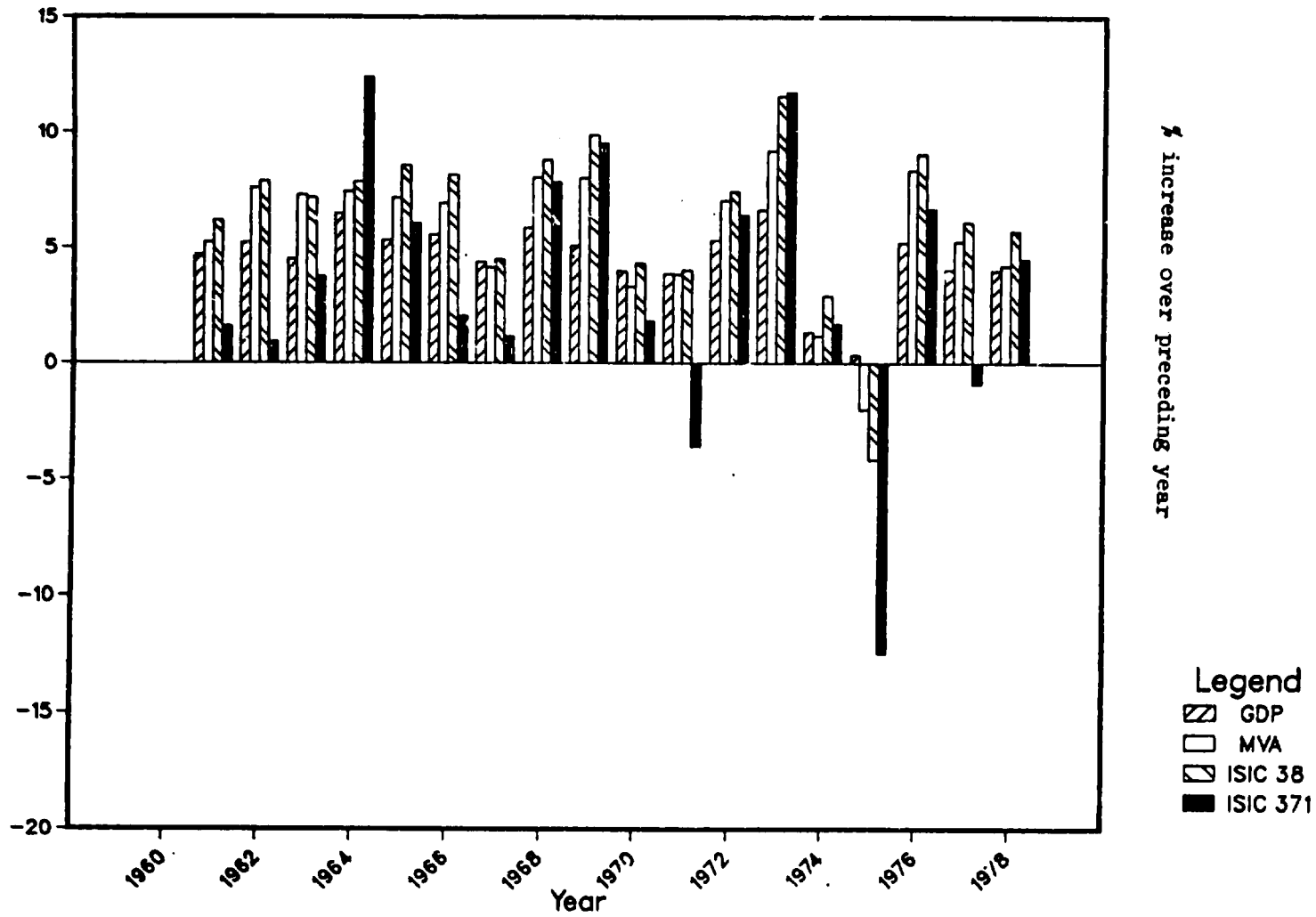
The impact of the price of a capital good on the decision to purchase that capital good in a specific instance is strongly dependent on the share of project costs represented by that capital good and the importance of that capital good in the overall process or project. If the cost of the capital

good in question is small compared to the overall costs of the project or production process in question, then this impact (i.e. the price elasticity) will be lower than if the capital good constitutes an important fraction of the cost, especially if the capital good is essential to the project. In other words it can be expected that the propensity to buy a certain capital good that is an integral and necessary part of large integrated project and yet constitutes a small part in the cost structure will not vary with moderate changes in its price. The greater the importance of the capital good in the cost structure of the overall project, the higher, one can expect the effect of prices to be on the decision to buy or not to buy the capital good.

Figure 2 shows that for the developed countries the engineering industries (ISIC 38), which approximate the capital goods industries, are indeed the most active from a cyclical point of view, tending to grow faster in periods of economic boom (rapidly growing GDP) and to decline in periods of declining GDP. However, for developing countries the engineering industries are much less in step with the overall economic activity cycle as represented by the growth of GDP (Figure 3). Figure 4 shows that in the Arab countries after the 1973 oil-price increase, any close connection between the GDP cycle and the engineering industries cycle is broken and that the latter shows very erratic behaviour. Two major factors could account for this: (1) increases in imports could cause local capacity utilization to drop significantly in certain years and (2) rapid increases resulting from the oil-price increase are followed by an adjustment process as the industry regroupes.

In the Arab countries one would expect that in addition to lower cyclical forces there would be a lower price elasticity for capital goods as well. For both oil-producing and non-oil-producing countries commitment to capital goods purchases are made with a long time-horizon, often in accordance with national plans, and with little attention to possible fractional fluctuation in prices. In the oil-rich Arab countries price elasticity might be even lower, somewhat due to the generally strong financial bases of these countries which reduces the importance of minor price fluctuations to them.

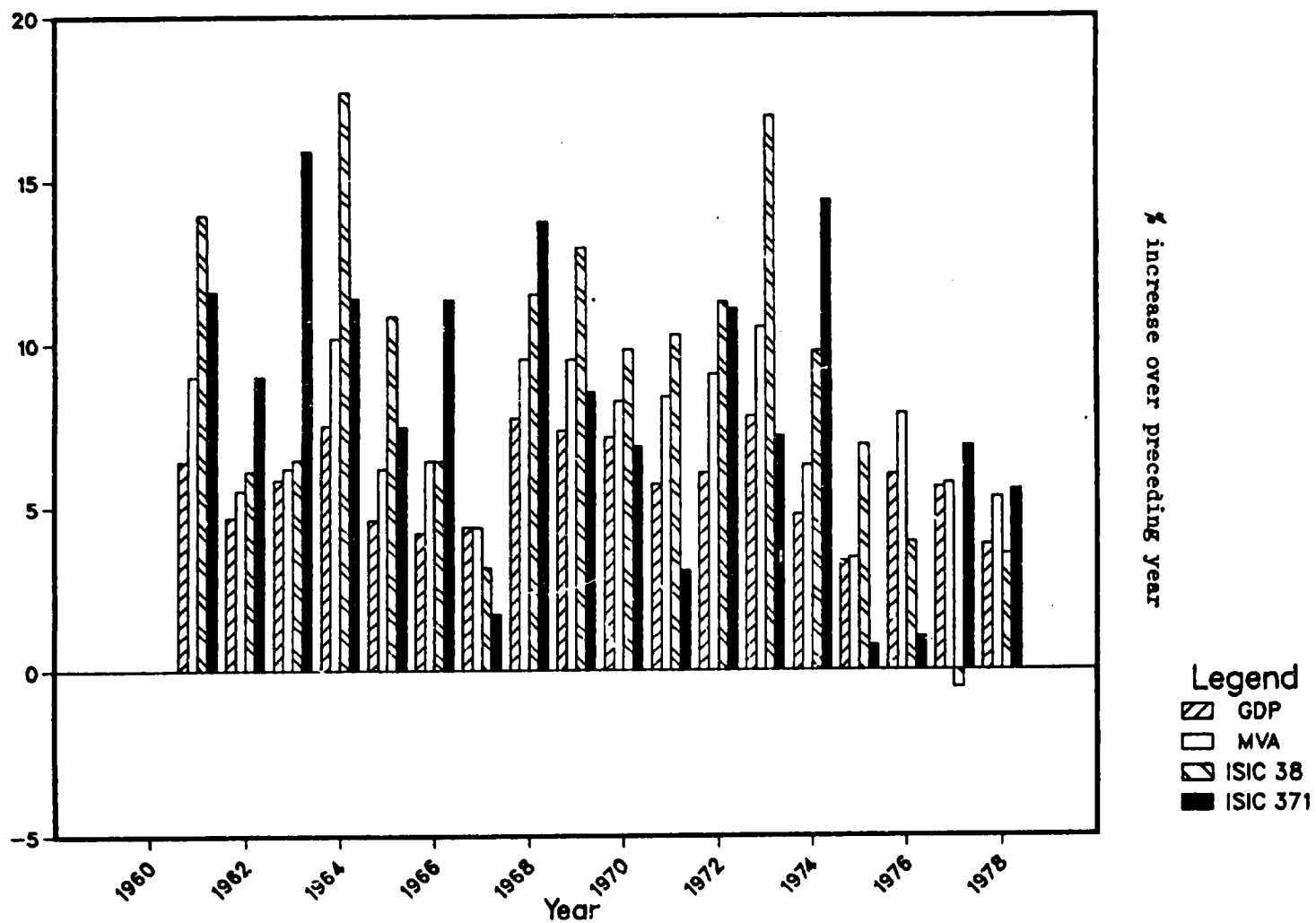
FIGURE 2
DEVELOPED COUNTRIES.
Annual Growth Rates from 1961-1978 of
GDP, MVA, ISIC 38, ISIC 371.



Source of raw data: UNIDO statistics

FIGURE 3

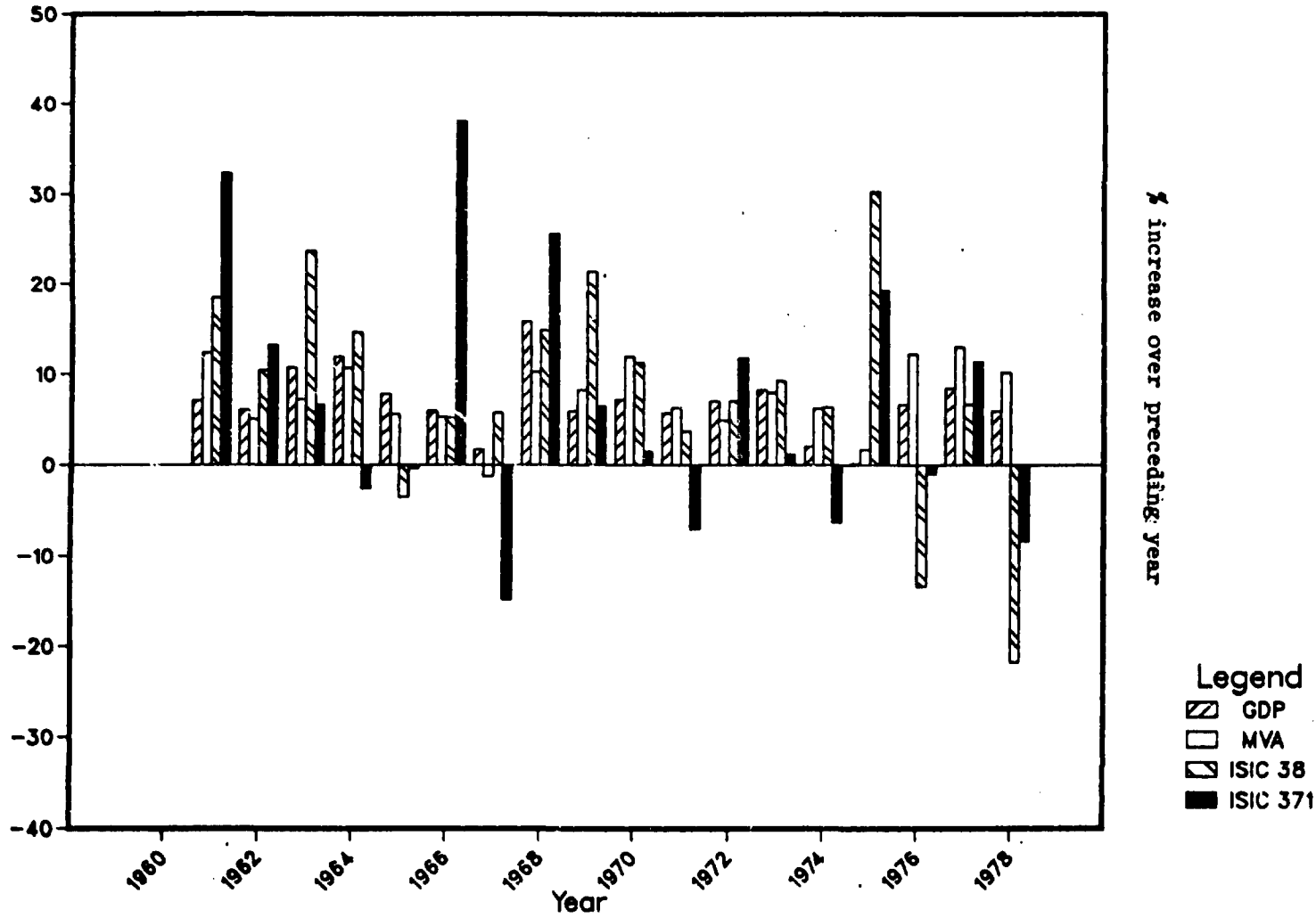
DEVELOPING ECONOMIES. Annual Growth Rates from 1961-1978 of GDP, MVA, ISIC 38, ISIC 371.



Source of raw data: UNIDO statistics

FIGURE 4

ARAB COUNTRIES. Annual Growth Rates from 1961-1978 of GDP, MVA, ISIC 38, ISIC 371.



% increase over preceding year

Legend
GDP
MVA
ISIC 38
ISIC 371

Source of raw data: UNIDO statistics

It must also be noted here that maximum industrial output, and hence maximum derived demand for capital goods, will occur only when the optimal combination of production factors has been achieved. This optimal combination has to be continuously and dynamically maintained. It must be noted also that the optimal combination of production factors is affected partly by technological facilities and partly by economic features. Under varying technical conditions, each economic or production target may be reached by using different combinations of capital and labour. Whether any economy or region will employ either a labour-intensive technology or a capital-intensive one is decided by the relative evaluation of production factors, through a series of explicit and implicit criteria.

In oil-producing Arab countries, natural endowments, the pressure to build up advanced infrastructures, certain features of the labour population, and economic policies all work toward a growing demand for advanced or for the most up-to-date machinery and equipment. In scarcely populated oil economies, the demand for equipment with high labour productivity is even greater because of the absolute labour shortage.

A substantial difference in the pattern of demand can be expected in non-oil-producing economies. Here demand is directed mainly towards medium-standard techniques with their relatively low-skilled labour requirements. Consequently, one could postulate that, ceteris paribus, it might be more realistic and easier to replace the present imports of capital goods with local production in non-oil-producing countries. Also due to a relative scarcity of foreign currency reserves in these countries, the economic pressure and motivation for local production of capital goods can be expected to be greater.

C. Psychological and social factors

These factors play an important role in demand determination through their effect on (1) final consumer demand; (2) expectations regarding economic outlook; (3) willingness to invest; and (4) buyer motivation and purchase behaviour.

- (1) Psychological and social factors, including the important demonstration effect, have an important impact on diffusion of new tastes and types of demand for final consumer goods. This statement is especially true of Arab countries where even in the absence of other factors, a shift to demand for more modern non-traditional goods in private and even public sectors will lead to a greater need for new capital goods.
- (2) Expectations of decision makers regarding the future of the economy will affect their perceived demand for final consumed goods and thus their perceived derived demand for capital goods. In the absence of sufficient data and resources for environmental and economic analysis, these psychological intakes and perceptions may have a much more important effect in Arab countries and other developing countries than they would have in a country where better structured data is available and where sufficient resources for analyzing the data and making forecasts exists.
- (3) The willingness to invest is an important area where psychological and social factors come into the picture in determining demand for capital goods. It is a well known fact that various decision-making agents will react differently to perceived risk, i.e. they will exhibit differing risk-aversion. Capital goods purchases are by nature a risky proposition in that the return cannot be obtained in the very short run. Other factors being the same, a firm that follows an all-or-nothing strategy will act differently from a very conservative firm, a cash-rich firm will act differently from a cash-poor firm, a large firm will act differently from a small firm and governments will act differently from the private sector. Psychological and social factors affecting willingness to invest are too complex and numerous to allow very broad generalizations at this stage. In developing countries, including Arab countries, however, there can be little question that governments when faced with the same opportunity for investment tend to apply more of a social benefit-risk analysis, taking into account secondary and spillover effects of capital

investment decisions. This would increase the relative likelihood, with respect to the private sector, of governments undertaking a risky but socially beneficial project. Capital goods investments are inherently long term and risky with a relatively high level of required investment. Especially in periods of economic or political instability this leads to an expected increase in the ratio of government demand to private demand for capital goods. The same behaviour can be expected in Arab countries where analysis of potential projects and of the environmental situation leads one to expect that the largest and most stable element of capital goods demand in the future will be government demand for capital goods.

- (4) Buyer motivation and purchase behaviour are the last set of important psychological and social factors. An important characteristic of the purchase of capital goods is that the buyer must be able to justify his purchase on more or less logical grounds. This can be done by reference to one or more of the following characteristics of the specific capital good under question: i) its operational characteristics; ii) its cost (initial and on-going); iii) the accompanying service provided by the supplier and iv) the accompanying technical assistance. Arab countries and most other developing countries tend to have suboptimal ability for capital goods purchase-specification, and less than required attention is paid by them to implicit non-observable costs of materials, wastage, down-time, maintenance requirements, actual efficiency, the required support system, the fit of the capital good with the rest of the process, and so on. They also rely heavily on supplier technical assistance and service. Thus while the other factors discussed here (chiefly demographic and economic factors and government policy) will determine the overall level of demand for capital goods, this will be in a vague and unspecified form and will often be translated to firm specifications by engineers and consultants who are often from outside the Arab region. This brings forward the possibility that totally exogenous, and sometimes completely unjustifiable, factors

might affect demand for capital goods in these countries. However as the Arab countries become more sophisticated and develop their engineering and technological skills, it can be expected that they will perform more and more of these functions themselves and that demand for capital goods in the region will become more specific and clearly defined.

D. Technological factors

The fourth set of factors determining demand for capital goods are technological factors. A number of subfactors can be examined here:

- (1) capital-output ratio; (2) depreciation and obsolescence rates;
- (3) technological base and infrastructure; (4) end-user technology.

- (1) Capital-output ratio: A capital-output ratio is the ratio of the flow of capital goods services to the flow of output. For the same desired final output, demand for capital goods varies with this ratio. Three factors can be expected to exert a major influence on the capital-output ratio. First, the range of capital-outputs available for the production tasks at hand. Although one can expect considerable capital-labour substitution, especially in certain supporting tasks, there is little evidence that Arab countries have exerted efforts in this area. Therefore for the Arab world the ratio can be considered as given in the short and medium terms, the development of which is dominated by developed countries. Because of the relative abundance of capital and increasing labour costs in developed countries, it can be expected that available capital-output ratios will tend to increase in value. This is indeed an observed trend and confirmed by a number of empirical studies.^{7/} The second factor that would affect the capital-output ratio of Arab countries is the level of their efforts to develop or select appropriate technologies in the "optimal technology" sense of the word. There is very little

^{7/} See Stewart, Frances, Technology and Underdevelopment, Westview Press Boulder, Colorado, 1977.

evidence of concerted Arab efforts in this direction. The third factor is industrial efficiency and capacity utilization. Unfortunately, in Arab countries as in many other developing countries, the lack of attention given to utilization and adaptation of technology appropriate to local conditions has been a major factor contributing to low efficiency and low utilization rates. If the inefficient use of unadapted, inappropriate technologies continues in Arab countries, derived demand for capital goods for the same final goods demand level will be higher than if adapted, appropriate technologies were used efficiently. This would be excessive demand for extra capital goods caused by inefficient use of existing or planned capital goods in Arab countries.

- (2) Depreciation and obsolescence rates: Since the decision to purchase a capital good, especially in the private sector, is based on its initial cost and its effect on the cost structure of the firm, and also on its technical characteristics, the rate of depreciation and obsolescence can be expected to have an impact on demand for capital goods in all markets including the Arab countries. However, this impact would be less in those countries where there is less sensitivity to minor changes in costs (such as oil-rich countries), or where the private sector (which is more sensitive to direct financial implications) has a smaller relative role. There is another obvious effect in that with more rapid depreciation or obsolescence of capital goods there is an increase in replacement demand. The direction of this effect of obsolescence and depreciation is in the opposite direction of the costs effects. In a situation with increasing rates of obsolescence and depreciation of capital goods, if the importance of the goods in question are such that the negative effects of increasing costs are outweighed by the positive effects of replacement demand, the net effect of such obsolescence and depreciation on demand for capital goods would be positive. One important industry in the Arab countries where this can be expected to be strongly observed is the oil industry. Because of the vital importance of the

industry, any depreciated or obsolete equipment would be expected to be replaced rapidly. It must be noted that one might expect the relative inadequacy of repair and maintenance in developing countries to increase depreciation rates in these countries.

- (3) Technological base and infrastructure: Another broad technological factor that can hasten or impede development of demand for capital goods is the availability of a technological base (sufficient number of scientists, managers, engineers, technicians and R and D efforts) and infrastructure (electricity, roads, and communications). This will directly affect the general and technical absorptive capacity for the capital goods of an economy. That there is a long way to go in Arab countries before the infrastructure and technology base are sufficiently developed is well known. The level and rate of development differs for various Arab countries. If, for example, we examine one element of the technology base (i.e. the number of scientists and engineers per 100,000 of population) we find that for the Arab countries as a whole the number is around 800 (1976 figures), while in the ECWA region the number is only 523, indicating the more developed base in the Arab countries of North Africa. These numbers compare unfavourably with the developed countries' numbers (2,875), but quite favourably in comparison to Africa (80) and Asia (125), excluding Japan (125). Even in the ECWA countries there is a marked difference from a low of 19 in 1973 in Democratic Yemen to a high of 1,572 in 1974 in Qatar. As efforts to develop a technology base and infrastructure in Arab countries begin to bear fruit as a whole, the increase in demand for capital goods can be expected to gain further momentum.
- 4) End-user technology: The technology of the end-users of capital goods and their direction of technological development will be an important determinant of demand for capital goods. With growth of new modern end-user sectors in Arab countries (e.g. petrochemicals, utilities, transportation, communication), it can be expected that there will be continued high demand for capital goods in these countries.

E. Government policy

Government policy can have direct effects on demand for capital goods and, by more or less influencing all the other demand-determining factors, can also be expected to exert major indirect effects.

A complete discussion of the extremely important impact of governments on capital goods industries in developing countries is not possible here because of space limitations. Suffice it here to say that governments can affect demand for capital goods, among others, through the following channels: overall economic policy, demand management and stabilization policy, procurement policy, planning efforts, promotion of technology base and infrastructure, legislation, taxation, international co-operation and transfer of technology policy, and import policy, to name a few. The government's impact can obviously be both positive and negative.^{8/} The point to be made is that analyzing and forecasting demand for capital goods requires thorough understanding and a grasp of the present and expected policies of the governments involved. In the Arab countries, the emergence of industry and thus derived demand for capital goods has been, generally speaking, the outgrowth of a broad import-substitution policy, with tariffs as the main instrument of protectionism. However, these policies have not always been consistent or coherent in all the countries of the region, and have been to a large extent governed by tax revenue and other financial objectives of the governments involved. The policy of import-substitution has resulted in high tariffs for consumer goods and thus derived demand for capital goods. At the same time, the low protection offered to capital goods has caused much of this demand to be met through imported capital goods. If we examine other aspects of Arab countries' industrialization policies, we find that monetary and credit policy has been used in varying degrees to promote industrialization. Taxation has not had a major effect because of its tendency to have a low rate and to be inconsistently applied. Lack of continuity in industrial promotion

^{8/} For a discussion of possible negative impacts of contradictory government policies see UNCTAD, Technology Issues in the Capital Goods Sector: A Case Study of Leading Industrial Machinery Producers in Brazil, TD/B/C6.AC.7/6/1982.

measures has been an outstanding feature of Arab industrial promotion policies. Governments have provided varying levels of guidance, credit, direct investment and support of financial institutions. Technical advice, training, and research is markedly inadequate. The level of government intervention in these countries has varied widely. A regional outlook is lacking in Arab industrial policies. In short there is a long way to go before a consistent, co-ordinated and integrated industrial strategy emerges in the region.^{9/} Until this is achieved industrial activity, and as a result, demand for capital goods will be at a suboptimal level; a large part of whatever demand exists will be met through imports of capital goods and not through increased local capital goods production.

IV. Concluding remarks

The analysis of the demographic, economic, psychological and social, technological, and government policy factors determining demand for capital goods in the Arab countries clearly points to the existence of a complex array of factors that affect such demand. This complexity increases the difficulty of forecasting demand for capital goods in the region. However, it also points to the existence of a large number of degrees of freedom in actions for bringing this demand closer to the optimal level.

Three factors seem to play a crucial role in explaining the demand for capital goods:

- (1) The ability to finance imports for capital goods which, for some Arab countries, does not pose a major problem.

^{9/} For a thorough discussion of industrial policy in selected Arab countries, see United Nations Economic and Social Council, Industrialization and Industrial Policy in the ECWA Region (A Preliminary Report), E/ECWA/ID/WG.4/18, January 1982.

- (2) Technological absorptive capacity in terms of existence of a developed technological base, infrastructure and human resources. This is especially an important factor in those Arab countries where financing does not present a major bottleneck.
- (3) Government policy.

Whatever importance one can give to demographic, economic, psychological and technical factors, one cannot fail to recognize the leading role played by government policy in affecting demand for capital goods. In fact, government policy affects each of the above-mentioned factors affecting demand for capital goods.

In addition, government policy directly affects demand for capital goods, through, among others, the following channels: development plans and objectives, procurement policy, and technology transfer policy and regulations. Indeed, governments appear as major purchasers and end-users for capital goods in most Arab countries.

Appendix 1

Delimitation of Capital Goods According to ISIC
and SITC Nomenclatures

A. ISIC Nomenclature

- Principal group 381:
part of group 3811: hand-tools, axes, hatchets, chisels, hammers, spades, hoes, rakes, other agricultural and garden tools, hand saws, tools for masons and plumbers and precision tools.
Group 3813: structural metalwork

- Principal group 382 (Manufacture of machinery except electrical)
the whole of the group^{1/}

- Principal group 383:
group 3831: electrical machines and equipment
group 3832: part^{2/}
group 3839: part^{3/}

Source: IREP, Universite des Sciences Sociales de Grenoble, The Typology of Capital Goods, UNIDO/ICIS Contract, January 1980.

1/ An ambiguity exists within group 3825 which comprises, in addition to computers, products which are difficult to classify amongst capital goods (typewriters, etc.).

2/ Equipment for telephones, telegraph, radio and television; equipment for signalling and detection, radar, etc.

3/ Wires and cables, various connecting, switching and cut-out appliances, etc.

Note: This delimitation of capital goods is in accordance with the definition of capital goods used here, which is based on their distinctive economic function.

Principal group 384:

- group 3841: shipbuilding and ship repair work
- group 3842: railway equipment
- group 3843: vehicles with engines, excluding industrial vehicles
- group 3845: airframe construction

Principal group 385

- group 3851: professional and scientific equipment; measuring and control equipment.

B. SITC Nomenclature (Revision 2)

In section 6:

only groups

- 691: structural metalwork
- 692: metal containers
- 695: hand-tools and tooling

In section 7:

- division 71: machines and equipment for energy
- division 72: special machines
- division 73: machine tools
- division 74: machines for general industrial use
- division 75: machines for data processing only
- division 76: telecommunications equipment only

in division 77:

- 771: machines for electrical energy
- 772: electrical equipment: cut-outs, switchgear
- 773: equipment for the distribution of electricity
- 774: electrical equipment for medical uses

in division 78:

- 782: industrial vehicles
- 783: road vehicles
- 788: tractors and other vehicles

division 79: other transport equipment

division 87: professional and scientific and control
instruments.

Other definitions have relied on the nature of the product, the nature of the technology, or the nature of demand. Here again the choice of the classifying characteristic has been arbitrary and not according to an analysis of basic underlying sets of characteristics. Others have classified capital goods in terms of their input supplier status which is their position according to the net supplies of their output that go to other industrial sectors, in other words, in terms of their high forward linkages. The shortcoming of this approach is that the question of what percentage of the output of high forward-linkage industries is consumed is ignored. Another group of approaches, of varying sophistication, rank the capital-goodness of consumer-goodness of an industry according to the proportion of its output that is consumed in the current period. The arbitrary nature of the definition of current period, industry structure and level of aggregation causes this approach to lack conceptual rigour.

Another approach uses the average time it takes for an industry's output to resolve itself completely into consumption goods as a basis for ranking the capital-goodness of an industry. The problem with this approach is that if anything further than ranking, e.g. actual categorization of goods into capital or non-capital, is attempted, there must again be resort to an arbitrary benchmark.^{4/}

^{4/} For various bases of definition of capital goods see: Hirschmann, A.C., The Strategy of Economic Development, Yale University Press, New Haven, 1958; Hazari, B.R., "Empirical Identification of Key Sectors in the Indian Economy", Review of Economics and Statistics, Vol. 52, No. 3, pp. 301-303, 1970; UNIDO, "First Consultation on the Capital Goods Industry", Issue No. 1, "Potentialities and Possible Progress", ID/WG.324/1, 3 July, 1981; and CHNG, M.K. "The Empirical Identification of a Capital Goods Sector", Oxford Bulletin of Economics and Statistics, Vol. 43, No. 2, May 1981.

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