

MAR 14 1972

# **POLICY ASPECTS OF FOREIGN INVESTMENT BY U.S. MULTINATIONAL CORPORATIONS**

**U.S. DEPARTMENT OF COMMERCE  
Bureau of International Commerce  
Office of International Investment**

**JANUARY 1972**





**THE ASSISTANT SECRETARY OF COMMERCE**  
Washington, D.C. 20230

January 10, 1972

MEMORANDUM FOR THE SECRETARY

Subject: Multinational Corporation Investment Study

I am pleased to transmit a study entitled, "Policy Aspects of Foreign Investment by U.S. Multinational Corporations".

This study is the first part of the larger multinational corporation project which you commissioned me to undertake in August of last year. It was prepared by the Office of International Investment, Bureau of International Commerce.

The study identifies and discusses several key areas in which Government commercial and economic policies and multinational corporate investment decisions interact: employment, technology transfers, investment controls, and the balance of payments. To provide background and perspective, the study also reviews the role and significance of the multinational corporation and surveys the motives that underlie U.S. foreign investments.

I believe that the study provides useful insights into this area of international commercial policy and will help to clarify some of the issues raised by business and labor concerning the impact of foreign investments by U.S. multinational companies.

  
Harold B. Scott  
Assistant Secretary for  
Domestic and International Business

Enclosure

POLICY ASPECTS OF FOREIGN INVESTMENT

BY U.S. MULTINATIONAL CORPORATIONS

U.S. Department of Commerce  
Bureau of International Commerce  
Office of International Investment

Staff Study

January 1972

The multinational corporation is a bold and imaginative--and necessary--response of U.S. business to the inexorable pressures of international commerce. While the growth of multinational investment should not be viewed uncritically, the effort that it represents to maintain our position in the international commercial community should not be subjected to criticism that fails to take account of (today's) realities. . . . Rather than erect barriers that can ultimately force U.S. multinational corporations to become multinational corporate emigrants, we should bend our efforts to ensuring that their activities are supportive of broader national and international objectives.

Maurice H. Stans  
 Secretary of Commerce  
 June 25, 1971

CONTENTS

This study de  
 ment by Ameri  
 corporations  
 focused on th  
 investment wh  
 Commerce has  
 the direction  
  
 The multinat  
 first time, a  
 and employe  
 and abroad.  
 required for  
 Business Eco  
 central ob  
 is to provi  
 U.S. govern  
 assisting  
 program to  
 commerce.  
  
 This paper  
 of internat  
 oriented ob  
 claims and c  
 rations, it  
 areas in  
 act and (2)  
 interaction  
  
 For this pur  
 possibilitie  
 ment, transf  
 of payments  
  
 Treating the  
 the risk of  
 multination  
 underlying c  
 multination  
 a matter of  
 plant and eq  
 and (c) the  
 the United S  
 but perhaps

	Page
Introduction . . . . .	1
I. The Multinational Corporation: An Overview. . . . .	3
II. The Impact of the Multinational Corporation on Employment . . . . .	18
III. The Multinational Corporation and the Transfer of Technology . . . . .	30
IV. Response of Multinational Corporations to U.S. Foreign Direct Investment Controls . . . . .	41
V. The Impact of the Multinational Corporation on the Balance of Payments. . . . .	59
VI. The Political Impact of the Multinational Corporation. . . . .	81
References . . . . .	85

## Introduction

This study deals with the policy implications of international investment by American business enterprise, particularly the multinational corporations. It is the first part of a more comprehensive project focused on the causes and effects of U.S. multinational corporate investment which was commissioned in August of 1971 by Secretary of Commerce Maurice H. Stans. The project is being carried out under the direction of Assistant Secretary of Commerce Harold B. Scott.

The multinational corporation project is intended to provide, for the first time, a full quantitative description of the financial, commercial and employment activities of U.S. international corporations at home and abroad. Major responsibility for the data gathering and processing required for this purpose rests with the Commerce Department's Office of Business Economics, with a comprehensive and continuing "data bank" a central objective of that phase of the project. In addition, the project is to provide the materials and analyses required for assessing present U.S. Government policies in the international investment field and for assisting policy-level officials in the formulation of new policies and programs to meet the changing needs of U.S. international and domestic commerce.

This paper, prepared by the Office of International Investment, Bureau of International Commerce, is a first step toward meeting this policy-oriented objective. In anticipation of data to quantify and verify claims and counterclaims concerning the effects of multinational corporations, it attempts (1) to identify significant economic and commercial areas in which public policies and multinational corporate investment interact and (2) to describe the major policy consequences that flow from such interactions.

For this purpose, and with no pretension of exhausting the range of possibilities, the main policy areas discussed are: domestic employment, transfers of U.S. technology, capital controls and the balance of payments.

Treating these areas of Government-business-labor relations separately runs the risk of partial and erroneous conclusions, since the real effects of U.S. multinational investment cannot be assessed without full comprehension of underlying causes and possible alternatives. In this regard, critics of multinational investment generally assume: (a) that foreign investment is a matter of corporate choice, not of necessity; (b) that the firm's domestic plant and equipment could continue to serve existing and prospective markets; and (c) that, if actually needed, new capital investment could be made in the United States instead of abroad, with no appreciable effects on anything but perhaps profits.

Defenders of the multinational corporation, on the other hand, claim the opposite: (a) that without compelling reasons of market penetration or protection, no company would undertake investment and production in a new country--a step that means moving from known to unknown costs of production, physical plant and equipment, government regulations, tax laws, raw material sources and suppliers, marketing and distribution practices, labor force, management staff, banking facilities, etc.; (b) that, in the face of a rapidly developing competitive environment, the firm could not hope to serve present or prospective domestic and foreign markets by production from existing (or expanded) domestic facilities; and (c) that foreign investment is, in most cases, not a direct substitute for, but rather a supplement to, domestic investment. Although the first hypothesis may describe the international investment motives of some enterprises, the weight of available evidence points to market preemption and preservation as among the most important reasons for foreign investment by American business.

An opening, overview section of this study illuminates further this fundamental question of why U.S. industry undertakes foreign investment. In addition, the overview provides a framework within which the separable effects of multinational investment can be examined.

In assaying the motives for U.S. international investment, the role of the multinational corporation in the international economy, and the impact of U.S. foreign investment on the U.S. economy, it is important to note the dynamic nature of the international investment scene. U.S. companies are faced with a complexity of market and non-market factors that tug and pull at investment decisions. Domestically, antitrust legislation, securities and exchange regulations, corporate and inter-company taxation, pollution abatement measures, labor costs, capital costs, distribution problems, strikes, and a host of other factors influence decisions on the location of investment. Internationally, the emergence of an international capital market; the establishment of the European Economic Community; the existence of exchange rate disequilibria, foreign investment incentives, and indigenous manufacturing requirements; the rapid growth of new markets; the internationalization of technical knowledge and technology; large differentials in wage rates; a variety of foreign trade barriers; and a host of similar factors influence the volume and direction of U.S. capital investment flows. These factors open up an array of further work concerning multinational corporation policies that ranges far beyond the scope of this paper.

Finally, it should be noted that the purpose of this staff paper is to illuminate areas of common interest and concern to multinational corporations, labor, Government, and other affected sectors of the United States economy. It is not intended to prejudge, portray nor necessarily reflect U.S. Department of Commerce or U.S. Government attitudes or policies in the areas covered.

## I. THE MULTINATIONAL CORPORATION: AN OVERVIEW

### The Problem

Viewed in historical perspective, the multinational corporation has demonstrated surprising vitality and flexibility in adjusting to economic and political changes. It has, in fact, demonstrated not only great tenacity in surviving but also an ability to expand, even when governments have attempted to suppress its growth.

In the United States, multinational corporations go back to the 1850's. They grew rapidly, and by 1900 about one-half of the then-existing 50 largest corporations had significant overseas operating interests, including manufacturing and distribution outlets. This growth continued through the 1920's but it slackened in the 1930's as a result of the world-wide depression. The new element that emerged during the 1940's was not the concept of the multinational enterprise, with its perception of a common corporate strategy, but the capability of having the management of that strategy take place at a common nerve center based on a flow of common information.

Until the 1930's, most countries paid little attention to the capacity of multinational corporations for moving across international boundaries; except for purposes of trade, no reasons existed for imposing restrictions at their boundaries. By the mid 1930's, however, Lord Keynes had demonstrated that it was possible to pursue maximum income and full employment objectives within national boundaries. As nations began to articulate national goals and priorities, they were confronted by entities that could move across boundaries, institute policies, and undertake activities which could frustrate these efforts. Governments discovered that international corporations by their activities abroad had demonstrated the porosity of such boundaries.

This apparent conflict between the multinational corporation with its supranational point of view and the nation-state with its national economic concerns and special interest groups has given rise to a host of economic and political problems. These must be resolved if the potential inherent in multinational enterprise is to be utilized for promoting world welfare. For both its adherents and opponents acknowledge that the multinational corporation is here to stay and will probably grow in the future. What is at issue at this juncture is the degree of freedom that should be allowed or the nature and extent of regulation that should be imposed on its present operations and future growth in order to make it better serve often divergent national interests.

In the last 15 years two events have focused public attention here and abroad on the activities of U.S. multinational corporations. One was the massive influx of American capital into Europe, especially into the Common Market countries. This investment produced an economic revolution in management and technology; stimulated a massive upsurge in income, employment, and trade; and resulted in a vast improvement in living standards. As a direct consequence, the EEC countries became potent competitors of the United States in our own as well as in foreign markets within relatively few years.

The impact of this movement has been dramatically portrayed by the French journalist-politician Servan-Schreiber in his book The American Challenge. While accurately depicting the relative backwardness and inefficiencies of European entrepreneurs which he felt could be overcome by emulating American managerial techniques, he laid excessive emphasis on the extent to which U.S. multinational companies were buying into European industry. American firms were thus acquiring dominant control over the high technology sectors of the European economy on which it depended for future growth. He neglected, however, to counterbalance these observations with the benefits conferred on European industry through the influx of highly efficient U.S. management and technology which went far toward closing the managerial and technology gaps and enhancing the competitive position of European industry. As Fortune noted recently, Servan-Schreiber appeared to miss the main point which is that not only U.S. business but business everywhere is outgrowing national boundaries; an economic infrastructure is evolving which is laying the basis for a world economic and political community.

The second event was the persistent deficit in the U.S. balance of payments during much of the past two decades. This was a deliberate U.S. policy during the early 1950's to promote European recovery from the Second War. It permitted trade discrimination against the United States to allow the building of export markets and to bring about a more equitable distribution of the world's monetary reserves. The persistence of this deficit after 1960, however, led to rising concern in the United States and abroad. For these deficits led to massive outflows of gold, a large accumulation of short-term claims on the United States held mainly by Europe and Japan and, in 1971, the appearance of a series of monthly deficits in our merchandise trade accounts for the first time since 1893.

Although the causes of the deterioration in our balance of payments position were a composite of many trade and non-trade factors, our overall payments deficit and in particular the disappearance of our traditional export surplus which financed our defense, aid and other commitments around the world, was evidence to many of a decline in our competitiveness. To others it was also prima facie proof of a fundamental disequilibrium

in our balance of payments calling for drastic domestic deflationary measures and a devaluation of the dollar. Still others focused on the massive outflows of investment capital which were attributed to the activities of multinational corporations. U.S. trade unions blamed "runaway" plants in Mexico, Hong Kong, Taiwan and Korea which operated with cheap labor and efficient American technology for the export of jobs which, they alleged, were jeopardizing the traditionally high standard of living of American workers. These allegations led to proposals for protectionist trade measures. Recent legislation introduced at the urging of the AFL-CIO leadership (S. 2592, "The Foreign Trade and Investment Act of 1972," introduced on September 28, 1971 by Sen. Hartke) calls for stringent controls on all direct investment activities and also advocates strict regulation on transfers of U.S. technology to U.S.-owned subsidiaries and non-affiliated companies abroad.

While many of these allegations rest on shaky empirical foundations, a case is nevertheless being fashioned that the multinational corporation is a major culprit in our declining export fortunes and is, by its very successful operations abroad, creating export competition for the United States. The multinational corporation is thereby alleged to be undermining prospects for continued U.S. economic growth and jeopardizing the living standards and jobs of American workers.

In assessing and developing public policy approaches in the international investment field, one must first become better informed about the multinational corporation and its impact on the domestic and international economy. But it is in this area that researchers are most handicapped. For while considerable information is currently available and a good deal of research is underway, much more current factual data are needed if informed policy judgments are to emerge. The most comprehensive data now available are from the census of international investment which covers only the year 1966. Data dealing with the effects of international investments on exports, imports, employment and technology transfers are still unavailable. If the impact of the multinational corporation is to be studied, a continuous flow of data covering a period of years is necessary. The computerized data bank being set up by the Department of Commerce is a first major step in this direction.

The issues discussed in the following pages attempt to deal selectively with some of the more important problems thrust up by the growth of multinational enterprise. These include the effects of foreign direct investment on domestic employment and the balance of payments, the impact of technology transfers on the U.S. competitive position, and the effects of mandatory foreign direct investment controls on the operations of the multinational corporation. Since in most cases the statistical underpinnings are lacking, the discussion is centered around the writing and analyses of leading experts in the field of multinational enterprise. Yet, here too,

there is no clear consensus either as regards the analysis of the problem or the appropriate policies to be instituted. Some analysts, especially in the universities and business, regard the whole area of investment decision-making as essentially a prerogative of the private sector. Government intervention in their view, except during periods of national emergency, serves only to disrupt a complex system of relationships which is itself still evolving and which has already contributed much to the general welfare. In the opinion of some analysts, the government's piecemeal approach to improving the short-term U.S. balance of payments position largely through capital constraints of one type or another, has not been a success but has only led to a proliferation of controls. To these critics, ad hoc expedients of the sort used during the past 10 years have been more cosmetic than effective and have tended to ignore the long-term adverse impact on the balance of payments which they regard as detrimental to long-range U.S. economic interests.

On the other side of the argument, there is a general but unexplained uneasiness about the multinational corporation and its impact. It is undeniable that our balance of payments has been in deficit, and the outflow of capital, which has strengthened our competitors and has allegedly contributed to a decline in our share of free world export growth, is among the factors which some feel are weakening the domestic economy. These developments, as well as the large growth in imports, are in some way related to the operations of multinational corporations. In this situation, there is a general feeling that "something needs to be done" to insulate highly vulnerable sectors of the economy from external competition in order to prevent a loss of U.S. jobs and to stem the capital outflow associated with U.S. foreign investment. One reaction was the imposition of mandatory foreign investment controls. There is some feeling that this does not go far enough and that perhaps our whole attitude toward liberal trade and investment policies needs to be re-evaluated.

There is a similar ambivalence toward the multinational corporation as viewed by the capital-receiving country. There the fear is that giant American corporations will devour native industries and impose alien controls over their economy. On the other hand, those countries do not dispute the fact that the international corporations have contributed substantially to their welfare and technology, and there is understandably a reluctance on their part to do anything to disrupt the benefits already attained by the presence of these companies. Yet in a world of rising economic nationalism, there is a kind of inchoate uneasiness that economic policy formulation is slipping into foreign hands and that something needs to be done to retrieve the levers of economic control and to reassert political sovereignty.

Finally there is the group of proponents of multinational enterprise in the universities, trade associations and business who see the

international corporation as a vehicle for uniting the diverse nation-states with their parochial outlooks into a true world economy which in time might yield to trans-national political formations along the lines first envisioned by the architects of the European Economic Community. In actuality, there is a slow trend in this direction despite the resurgence of nationalism as evidenced, for example, by the steps now underway to reform the international monetary system. While the movement may be a halting one, it is nevertheless a step toward the goal of a world economy envisioned by some proponents of the international company.

#### The Statistics of International Investment 1/\*

Definition of the multinational corporation.--There is no agreed definition of what constitutes a multinational corporation.<sup>2/</sup> Some authorities define it as a company whose foreign sales have reached a ratio of, say, 25% (or some other share) of total sales. Some find the definition in organization; i.e., a company that has global product divisions rather than an international division. Others look to the distribution of ownership or to the nationality mix of managers or directors as the determining characteristics. Professor Raymond Vernon of Harvard University, an outstanding authority on the multinational corporation, regards it as a company that attempts to carry out its activities on an international scale, as though there were no national boundaries, on the basis of a common strategy directed from a corporate center. According to Vernon, affiliates are locked together in an integrated process and their policies are determined by the corporate center in terms of decisions relating to production, plant location, product mix, marketing, financing, etc. Mr. Jacques Maisonrouge, President of IBM World Trade Corporation, characterizes the multinational corporation as one that: (a) operates in many countries; (b) carries out research, development and manufacturing in those countries; (c) has a multinational management; and (d) has multinational stock ownership.

Number of multinational corporations.--Because the definitions are imprecise, it is impossible to say how many companies qualify as multinational corporations. For purposes of regulation, the Office of Foreign Direct Investment lists over 3,000 U.S. companies, although not all would satisfy the criteria cited above. Mr. Judd Polk of the International Chamber of Commerce estimates that 150 companies, about half of them U.S. companies, fall into the category of international companies. Fortune's lists of the 500 largest U.S. and the 200 largest foreign corporations include the most important multinational corporations. Using Fortune's

---

\*Footnotes are presented at the end of the Study.



data and other sources, Professor Sidney Rolfe has estimated that in 1965 over 80 U.S. companies out of Fortune's 500 had over 25% or more of their assets, earnings, production or employment overseas and that 199 companies had 10% or more. Because European corporations are less forthcoming in making data available, the picture of their activities is less complete. From what is available, however, the projection of the European multinational corporation abroad is just as pervasive as our own.

### Significance of the Multinational Corporation

A 1968 study of international investment by the Organization for Economic Cooperation and Development (OECD) (based on 1966 data) provides the most recent investment information available on a relatively comparable basis (see Table 1 below). This study indicates that in terms of book value at the end of 1966, there was close to \$90 billion in overseas direct investments by Development Assistance Committee (DAC) countries (Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States). Thirty billion dollars, or 33%, was invested in the less developed countries. Of this sum, \$11.9 billion was invested in petroleum, \$8.0 billion in manufacturing and \$2.8 billion in mining and smelting. The comparable total U.S. direct investment figure for 1966 is \$54.5 billion, or about 60% of the global total. The United Kingdom is second with \$16 billion, followed by France, Canada, Germany and Japan.

The OECD figures also show that, despite the allegations of Servan-Schreiber, about 40% of total direct investment abroad is held by non-U.S. citizens. Since the figures are based on incomplete data, actual investments are probably somewhat higher. It should be stressed that for all countries covered by the OECD report, the data are reported in terms of book value which understate the current or market value. If the data are adjusted for accrued value, the \$35 billion of non-U.S. investments could, according to Professor Rolfe, easily reach \$50 billion. This would still exclude the countries not covered in the OECD study and would also exclude portfolio investments which are fairly substantial in terms of European investments in the United States.

The real significance of the multinational corporation is further highlighted if one relates its output to investment, trade and GNP. According to Polk, there is roughly a 2 to 1 relationship between output and asset values. Applying this ratio to the \$90 billion in direct investment of the DAC countries for 1966, the total value of international production associated with this direct investment would appear to be at least \$180 billion. If to this one adds portfolio investment, associated output rises to around \$240 billion. In comparison, the \$130 billion of exports from these countries is dwarfed by the output of their overseas investment holdings.

Table 1  
Direct Foreign Investment, Accumulated Assets,  
by Major Countries, End 1966  
(book value, in millions of dollars)

Countries	Petroleum (LDC)	Min. & Smelt. (LDC)	Mfg. (LDC)	Other (LDC)	Total (LDC)
World	25,942 (11,892)	5,923 (2,801)	36,246 (8,047)	21,472 (7,230)	89,583 (29,970)
United States	16,264 (6,975)	4,135 (1,827)	22,050 (4,124)	12,113 (3,915)	54,462 (16,841)
United Kingdom	4,200 (2,167)	759 (298)	6,028 (1,471)	5,015 <sub>c</sub> / (2,255)	16,002 (6,184)
France	d (670)	a (200) <sub>b</sub> /	a (1,230) <sub>b</sub> /	a a	4,000 <sub>b</sub> / (2,100)
Germany	200 (65)	100 (38)	1,800 (645)	400 (97)	2,500 (845)
Sweden	a a	a (65)	a (96)	a a	793 (161)
Canada	a a	250 <sub>b</sub> / (202)	2,988 <sub>b</sub> / (332)	a a	3,238 (534)
Japan	a (222)	a (71)	a (270)	a (33)	1,000 (605)

Note: Italy, Holland, Switzerland, and Belgium data not available;  
Australia total investment is \$300 million.

a Not available.

b Estimate.

c Including agriculture of 1,022 (864 in the less-developed countries, or LDC's).

d Total French oil production estimated at 57.2 million tons in 1966.

Source: Compiled from OECD, DAC (68) 14, Annex C (April 23, 1968).

Looking at the United States alone, direct investments in 1966 were about \$55 billion, which implies about \$110 billion in associated output. By 1970, direct investment had risen to \$78 billion, so that the total output figure would have risen to \$156 billion. If portfolio investments are included, total long-term private investments for 1970 rose to \$105 billion and estimated output to close to \$210 billion. Output associated with U.S. production abroad is thus five times the size of U.S. exports. This disparity is expected to widen if present growth trends continue, since exports are growing at about 7% a year while the output of international companies is growing at 10%.

Another indicator of the significance of U.S. foreign investment is the fact that since 1968 net foreign investment income (repatriated earnings, royalties and fees less direct foreign investment outflows) has been greater than net receipts from the trade account. This shift, as compared to the earlier 1960's, has resulted from the decline in our export surplus and the continued increase in investment income net of direct investment outflows. The latter contributed \$3.5 billion to our balance of payments in 1970, compared to \$2.1 billion from the trade account. This compares to a \$4.9 billion net balance on trade account and a \$0.5 billion net balance on direct foreign investment account in 1960. The trend is even more pronounced in this direction in the past few years.

In terms of total national income and production, the United States actually invests abroad a smaller proportion of GNP than do other major investing countries. According to Professor Rolfe, the United Kingdom, the Netherlands, and Switzerland invest proportionately more of current income than we do; France and Germany lag behind the United States but promise to catch up.

#### The U.S. International Investment Position

In 1969, total U.S. international investments and assets stood at \$167 billion compared to \$54 billion in 1950 (see Table 2 below). This implies an annual rate of growth between 1950-70 of about 6% a year. These figures include monetary reserve assets; i.e., gold, convertible currencies and the IMF gold tranche position. Monetary reserves declined from \$24 billion in 1950 to \$14.5 billion in 1970.

In 1970, in terms of location, about 1/3 (\$23 billion) of U.S. long-term investment was in Canada, 1/3 (\$25 billion) in Europe, 1/4 (\$20 billion) in Latin America, the Middle East and Africa, and under 1/5 (\$11 billion) in Oceania and the rest of the world (see Table 3 below).

Aside from Canada, the second largest recipient of U.S. direct investment is the United Kingdom, with \$8 billion or 10% of the total. Other important U.S. investments as of 1969 were in Germany (\$5 billion),

TABLE 2  
International Investment Position of the United States at Yearend 1950-70  
(millions of dollars)

Type of Investment	1950	1955	Total 1960	1965	1970p/
<u>Net International Investment Position of the U.S.</u> .....	36,727	37,237	44,730	61,577	69,067
<u>U.S. assets and investments abroad, total</u> .....	54,359	65,076	85,589	120,374	166,574
Private investments.....	19,004	29,136	49,310	81,528	119,890
Long-term.....	17,488	26,750	44,497	71,375	104,693
Direct.....	11,788	19,395	31,865	49,474	78,090
Other.....	5,700	7,355	12,632	21,901	26,603
Short-term assets and claims.....	1,516	2,386	4,813	10,153	15,197
U.S. Government non-liquid credits and claims.....	11,090	13,143	16,920	23,396	32,197
Long-term credits.....	10,768	12,420	14,028	20,200	29,699
Monetary reserve assets.....	24,265	22,797	19,359	15,450	14,487
Gold.....	22,820	21,753	17,804	13,806	11,072
<u>Foreign assets and investments in the U.S.</u> .....	17,632	27,839	40,859	58,797	97,507
Long-term.....	7,997	13,408	18,418	26,315	44,758
Direct.....	3,391	5,076	6,910	8,797	13,209
Other.....	4,606	8,332	11,508	17,518	31,549
Non-liquid short-term assets and U.S. Government obligations..	825	900	1,414	3,247	8,777
Liquid assets.....	8,810	13,531	21,029	29,573	47,041

Note: Table is adapted from more detailed tables published in the Survey of Current Business, October 1970 and October 1971. Of the data shown, only the major, underlined items add to totals.

p/ Provisional.

Australia (\$3.3 billion), Venezuela (\$2.7 billion), France (\$2.6 billion), the Middle East countries (\$1.6 billion), Brazil (\$1.8 billion), Mexico (\$1.8 billion), Switzerland (\$1.8 billion), Italy (\$1.5 billion), Argentina (\$1.3 billion), Belgium and Luxembourg (\$1.5 billion), Japan (\$1.5 billion) and the Netherlands (\$1.5 billion).

Classified by industry, 41% of U.S. direct investments in 1970 was in manufacturing (\$32 billion), 28% (\$22 billion) in petroleum, 8% (\$6 billion) in mining and smelting and 23% (\$18 billion) in trade, services, and other categories.

The growth of U.S. investments since 1929 showed the largest proportionate increases going to Europe, the Middle East and Africa, and Oceania, with a smaller proportionate growth in Canada. The most dramatic percentage decrease was in investments to Latin America which dropped from 46.7% of the 1929 total to 18.8% in 1970. There was also a substantial shift in the composition of investments in the direction of petroleum and manufacturing and away from mining and smelting and trade, services, and other categories.

The yield on U.S. direct investment has declined steadily since 1950. Although earnings rose from \$1.8 billion in 1950 to \$8.7 billion in 1970, the yield computed on book value dropped from a high of 19% in 1951 to 12% in 1970, which was a slight increase over the previous three years. In terms of area, yields from West European investments have dropped considerably throughout the 1960's, from about 14% in 1960 to 10.7% in 1970. This decline was largely the result of rising competition in Europe. Rates of return were significantly better in other parts of the world.

In regard to industry, yields from petroleum investments (14.8%) were above those in manufacturing in 1970 (11.3%). Over the 1960's, however, petroleum yields fluctuated between 12-14%, whereas manufacturing investment yields were lower in most years.

Foreign investments in the United States in 1970 were \$97.5 billion, of which under one-half, or \$44.8 billion, was in long-term investments. Of the other half, \$47.0 billion was in liquid assets and the rest in non-liquid, short-term assets. Direct investments were only 30% of total long-term investments; 70% was in portfolio investments, reflecting a direct bias in Europe toward portfolio and other relatively liquid investments. The reverse is true for U.S. investments abroad.

In terms of growth, total foreign assets in the United States grew about 9% a year between 1950-70, from \$17.6 billion to \$97.5 billion. Of this sum in 1970, \$13.2 billion were in direct investments. The principal countries with direct investments in the United States were Canada, the

TABLE 3

Growth of U.S. Direct Investments Abroad, by Area and Industry  
1929 - 1970 a/

	Amount in Billion Dollars			Percent of Total		
	1929	1950	1970 <sub>p/</sub>	1929	1950	1970 <sub>p/</sub>
All Areas, Total . . . . .	7.5	11.8	78.1	100.0	100.0	100.0
Canada . . . . .	2.0	3.6	22.8	26.7	30.5	29.2
Latin America . . . . .	3.5	4.6	14.7	46.7	39.0	18.8
Europe . . . . .	1.4	1.7	24.5*	18.7	14.4	31.4
Middle East & Africa . . .	0.1	1.0	5.1	1.3	8.5	6.5
Other areas . . . . .	0.5	0.9	11.0	6.6	7.6	14.1
Developed Countries, Total . .	n.a.	n.a.	53.1	n.a.	n.a.	68.0
Less Dev. Countries, Total . .	n.a.	n.a.	21.4	n.a.	n.a.	27.4
International, Unallocated . .	n.a.	n.a.	3.6	n.a.	n.a.	4.6
All Industries, Total . . . . .	7.5	11.8	78.1	100.0	100.0	100.0
Mining and Smelting . . . . .	1.2	1.1	6.1	16.0	9.3	7.8
Petroleum . . . . .	1.1	3.4	21.8	14.7	28.8	27.9
Manufacturing . . . . .	1.8	3.8	32.2	24.0	32.2	41.2
Other . . . . .	3.4	3.5	17.9	45.3	29.7	23.0

Notes: Detail may not add to totals because of rounding.

a/ Book value at yearend

p/ Provisional

\* Excludes Eastern Europe

n.a. Not Available

Source: Survey of Current Business, passim.

United Kingdom, the Netherlands and Switzerland. These direct investments were largely in manufacturing (46%), petroleum (23%) and insurance (17%); the rest was placed in trade, finance and miscellaneous industries. The return on foreign-owned direct investments in the United States in 1970 was about 7%.

The net investment position of the United States rose from \$36.7 billion in 1950 to \$69.1 billion in 1970, despite the continuous balance of payments deficits over most of the last 20 years and the very substantial increase in foreign-owned assets in the United States. This is the result of the tremendous rise in U.S. assets abroad over the last two decades--from \$54 billion to \$167 billion. The largest single factor accounting for this dramatic increase was direct investments which are explained to a large extent by the foreign operations of multinational corporations. This large net asset position is an important measure of our international economic strength despite the difficulties the dollar has been encountering in international money markets.

#### Motives for Investing Abroad

Sorting out the motives underlying either individual or collective behavior is a very complex process not readily amenable to quantification or to facile generalizations. Yet criticisms of the motives underlying activities of multinational companies by certain industry and labor groups have tended to oversimplify the motives for investing abroad or have even implied invidious motives to specific investments. If one were to inquire into the motives for international investment by multinational companies, the following might be typical: (1) a need to get behind tariff walls to safeguard a company's export markets; (2) greater efficiency and responsiveness by producing in the local market as compared with exporting to it; (3) the possibility of lower production costs which make it cheaper to produce components abroad; (4) the fear that competitors going abroad may capture a lucrative foreign market or may, by acquiring cheaper sources of supply, threaten the domestic market position of the company; (5) a need to diversify product lines to avoid fluctuations in earnings; (6) a desire to assist licensees abroad who may need capital to expand operations; (7) a desire to avoid home country regulations, e.g., antitrust laws in the United States.

In a more general sense, however, the fundamental forces impelling corporations to invest abroad is the quest for profit and the fear that their present or prospective market position will be lost to foreign or domestic competitors. As with domestic investment, foreign investment must be weighed in terms of alternative investment opportunities in order to reach an optimum return on capital within a reasonable time period and with a reasonable differential for the risks involved in foreign operations.

Certain industries are by nature international and their motives for investing abroad are clear. These include the petroleum, extractive and plantation industries. In these cases the sources of materials are located abroad and exploiting them has required international investment. To develop fully these resources companies have had to set up international production, refining and marketing facilities abroad.

The proliferation of international companies in the manufacturing field is governed by a more complex set of motives. Firms may be motivated by offensive or defensive strategies. An example of the former is the case when an international firm attempts to link its technology, reputation, and managerial capacity with low cost production inputs (i.e., labor, raw materials, etc.). The company may feel that producing abroad is cheaper than exporting from the United States. Much of the migration of U.S. capital to Europe in the last decade may be explained in these terms. On the other hand, Pechiney Aluminum Company of France came to the United States because it felt it could profit by combining superior technology with lower cost capital and electrical energy here rather than elsewhere.

Licensing often leads to direct investment because in time the licensor feels he can better exploit his technological advantage by manufacturing abroad rather than by licensing foreign firms. The opportunity to expand sales may be inhibited by the lack of licensee capital, and manufacturing facilities may be established to take advantage of anticipated opportunities.

Another dominant motive for going abroad is the desire of companies to be near their markets, so that products can be supplied and serviced more quickly. In addition, products can be tailored to local tastes and costs of production and transportation can be minimized.

The desire to surmount tariff walls is a major defensive reason for investing abroad. Getting behind the EEC tariff wall was certainly a major consideration for U.S. companies going abroad during the last 15 years.

Another defensive motive is the "follow the competitor strategy." In this case, the investment is made to prevent market preemption by a competitor and/or to keep market outlets and sources of supply open. Service companies often invest abroad for defensive reasons because their customers have also done so. This is particularly true of banks, insurance companies, management consulting firms as well as manufacturing companies.

A further motive for investing abroad is to diversify product lines. Diversification can also serve as a defensive motive and can shield the international company from cyclical movements, strikes or threats to

its sources of supply. Some large U.S. multinational companies have at times been able to supply their domestic requirements by importing components from subsidiary companies or affiliates abroad.

A final observation on the subject of motivation for international investment should be mentioned - the organic theory of investment as a motive. It is a concept that is especially favored by Mr. Judd Polk and is often cited as an argument against the continuation of mandatory direct foreign investment controls. This concept holds that a part of each increment in foreign investment is intended not to exploit new markets, innovations and products but to protect the value of existing invested capital. Without adequate continuing investment flows, the theory argues, the existing stock of capital will erode and become obsolescent, thus jeopardizing the entire investment.

Additional investment is thus regarded as a defensive undertaking. One can agree that there is much truth to this notion but proponents of this view overstate their case by arguing that even short interruptions of a year or two can be detrimental. The great ingenuity and flexibility exhibited by U.S. international companies in acquiring investment capital in Europe because of the operation of the OFDI controls is, on the other hand, cited as evidence in support of the theory.

#### The Impact of the Multinational Corporation

The most significant impact of multinational enterprise is in the internationalization of production and in the incipient development of a world economy. In this process, the investment decisions and operations of companies are increasingly viewed in terms of world allocations of resources and of maximizing world welfare. The international company has become the most important vehicle for developing a world system based on a more rational allocation of resources than has been the case in the past. And if existing opportunities are also grasped by the developing countries, it can become an important vehicle for accelerating growth and raising living standards over that vast area of the world.

The internationalization of production brought about by the development of the multinational corporation is regarded by many analysts as the most important event to have occurred in many years and very likely in its ultimate impact to be on a par with the Industrial Revolution of the 18th Century. What is called into question by this development--which is likely to continue--is the whole concept of the traditional nation-state with its politics, sociology and economics. In fact the analytical implications of the development of the international company require a rethinking and restructuring of our modes of thought.

Traditional economic analysis is one area in which a renovation of our analytical apparatus is in order. Thus, according to traditional economic wisdom as passed down by Smith and Ricardo, commodities move internationally while productive factors do not. From this theorem it was concluded that a nation should specialize in those things it did best (the law of comparative advantage) with a minimum of restrictions and import those things that others produced more efficiently. In this analysis, capital movements, and hence international investment, were regarded as a disturbance of equilibrium which at times needed to be regulated in order to preserve commercial or current account freedom.

After two centuries, this is largely the intellectual apparatus of economists, politicians, bureaucrats and central bankers; and the political edifice that is based on these economic constructs is by and large unquestioned. The nation-state is thus the vehicle for organizing economic activity, and a favorable trade balance and a large gold stock are desiderata of international trade. These concepts persist even though international production has outstripped foreign trade as the main channel of international economic relations in terms of size, rate of growth and future potential. The nation-state and nationalism, especially among new nations, is the rallying point for many, even though it is perhaps no longer the optimum form of political organization from an economic viewpoint. Attempts to create viable commodity and capital markets and a viable international monetary mechanism, to harmonize legal systems and statutes and to mitigate tax inequities have all come up against national barriers. The International Monetary Fund (IMF), the International Bank for Reconstruction and Development (IBRD), the General Agreement on Tariffs and Trade (GATT), the Organization for Economic Cooperation and Development (OECD) (with its code of liberalization of capital movements) and the United Nations Conference for Trade and Development (UNCTAD) are steps in the right direction. But what is proposed and done within these organizations is still viewed by individual nation-states in terms of what they regard as their national interest. While underlying trends may point in the direction indicated, the perception of international economic and commercial events is likely to continue along traditional lines.

Several questions have arisen in trying to assess the economic and social impact of the multinational corporation. Attempts have been made to analyze and measure this impact, but the unavailability of information and the complexity of the problem have complicated efforts to reach definitive answers. In the sections that follow, an attempt has been made to discuss some of the more pressing issues that have agitated experts with respect to the operations of multinational corporations. While they are in no sense a comprehensive compendium of topics, they do deal with some of the key questions of concern to policy makers: the impact on employment, the effects of technology transfers, the response to mandatory foreign direct investment controls, and the effects on the balance of payments.

## II. THE IMPACT OF THE MULTINATIONAL CORPORATION ON EMPLOYMENT

### The Problem

Assessing the effects of foreign trade and investment on domestic employment has long engaged the attention of analysts in government, business, labor, and the universities. The expanding volume of foreign investment by U.S. business and the emergence of the multinational corporation as a force in international commerce have heightened interest in, and the importance of, this issue.

Organized labor in the United States claims a net loss of 500,000 job opportunities from 1966 to 1969 because of import competition and attributes a large part of this loss to the international operations of multinational corporations. This charge is challenged by the international companies. They claim that corporate decisions to invest abroad are most often undertaken to defend or expand existing foreign markets or their share of the U.S. market. These companies claim that only because of their foreign investments are they able to continue to sell U.S. products in markets that are threatened by foreign competition. Without foreign production facilities, U.S. exports and the supporting jobs would be lost to foreign competitors.

### Labor's View of the Multinational Corporation

The rapid pace of world economic integration and the emergence of the multinational corporation have evoked a not surprising response from organized labor, both domestic and international. As capital, managerial skill, and technology have moved across national borders at an accelerating rate, labor--one of the least mobile of the factors of production--has developed an increasingly negative assessment of the effects of such flows on the level of domestic employment. In the eyes of American labor unions, the activities of U.S. multinational corporations result in the export of U.S. jobs. The international nature of these firms, moreover, puts them beyond the reach of collective bargaining by national labor unions and beyond the regulatory powers of national governments.

In labor's view, U.S. imports embodying low-wage foreign labor were traditionally small in volume and generally limited to handicrafts and low quality goods. Hence their impact on U.S. employment was, in the past, limited. The multinational company, it claimed, has changed the nature of these imports as well as their quantitative impact on U.S. employment. This transformation is a consequence of combining foreign low-wage labor with modern American capital, management, technology, and marketing skills.

Statements by U.S. labor spokesmen accordingly attribute the worsening U.S. trade position in large part to the rapid growth of investment by U.S. companies in foreign affiliates. Mr. Nathaniel Goldfinger, Director of the AFL-CIO's Department of Research, summarizes labor's position in these terms:

One of the underlying causes of the deterioration of the U.S. position in world trade is the operations of U.S.-based multinational companies, with far-flung foreign subsidiaries, patent and licensing arrangements with foreign companies, joint venture deals and other foreign arrangements. . . . The operations of U.S.-based multinationals have exported American technology, with the loss of U.S. production and employment, for the private advantage of the firm. They are a major factor in the rapid and substantial loss of U.S. production in such relatively sophisticated goods as radios, televisions and other electrical products, as well as in shoes and apparel. . . . What may be rational decisions for . . . a U.S.-based multinational may spell disaster for large numbers of American workers, small business firms, and several entire communities. . . . A large and growing part of what is called U.S. exports and imports are now transactions within the structures of these multinational firms--between the U.S.-based company and its foreign subsidiaries. . . . U.S. trade patterns are thereby affected by the operations of the multinational--and the shape of many American industries and communities, as well. The U.S. government cannot much longer permit the private decisions of multinationals to determine the future of the American economy, without regulations.<sup>3/</sup>

As a concomitant of this assessment of the multinational corporation, labor has abandoned its traditional support for liberal trade and investment policies. Instead, labor leadership is pressing for restrictions on the overseas operations of U.S. firms. As incorporated in S.2592, "The Foreign Trade and Investment Act of 1972," introduced by Senator Hartke, *et al.* on September 28, 1971, labor calls for measures to increase taxes on overseas operations, limit and control capital outflows by American companies, curb the transfer of U.S. technology, regulate U.S.-based multinational companies and regulate the level of certain imports by quotas. This legislative program was set forth in detail at an AFL-CIO "Conference on Jobs" held in Washington, D. C. in July 1971. In addressing 500 delegates from AFL-CIO affiliates, President George Meany pledged that the AFL-CIO would insist on a "consistent foreign economic policy created by the Federal Government--not one created by multinational corporations and banks."<sup>4/</sup>

Labor's anxiety about multinational firms as "runaways," as exporters of U.S. jobs, and as institutions outside the control of national governments, was outlined clearly by Mr. George Meany before the Subcommittee on International Trade of the Senate Finance Committee (May 1971):

An additional major change since World War II--and particularly in the last decade--is the emergence of a new kind of business, the multinational firm. . . . These multinational firms can juggle the production of parts and finished products from one subsidiary in one country to another. . . . This is a runaway to a country with different laws, different institutions, and different labor and social standards. . . . All of these developments--the multinational corporations, the managed economies, the foreign investment, the export of technology--have had a serious impact on U.S. international economic relationships and have displaced large portions of U.S. production. . . . Unlike capital, the worker cannot move about with ease.

In order to impart some degree of substance to these charges, organized labor, while conceding the inadequacy of relevant data, has nonetheless attempted to fashion a measure of such alleged "job exports" between 1966 and 1969. Based on Department of Labor data, it appears that this measure was constituted by estimating that in 1966, about 1.8 million jobs would have been required to produce 74% of U.S. imports assumed to be competitive with U.S.-made products. For 1969, the comparable figure was estimated to be 2.5 million workers, or an increase of 700,000 in "lost" job opportunities. From this total, the 200,000 jobs attributed to increased merchandise exports were subtracted, for a net loss of 500,000 employment opportunities in the three years from 1966 through 1969.

#### Evaluation of Labor's Position

The difficulties involved in attempting to isolate and estimate the net effects of foreign trade on U.S. domestic employment are widely recognized by analysts in this field. Labor's estimating technique accordingly raises a number of questions and is subject to a potentially wide margin of error. To start with, "competitive imports" is difficult to quantify since the ability to substitute domestic production for imported products varies from industry to industry and is highly dependent on seasonal and overall cyclical factors. In labor's view, however, "competitive imports" apparently refers to all products of foreign origin which could, in principle, have been produced in the

United States. As indicated, such imports were apparently estimated to amount to 74% of total U.S. imports in 1969.

A second weakness in the above calculation is its lack of symmetry. That is, it overlooks the fact that, while foreign workers were employed in making products for export to the U.S. market, American workers were employed in producing export products which also could have been made abroad. Accepting for the moment the basic labor approach and aside from the real income loss in abandoning production based on specialization and comparative advantage, an attempt to estimate the net domestic employment effect of foreign trade must take into account both sides of the substitution ledger.

While it is difficult enough to estimate the aggregate effects of foreign trade on U.S. employment, it is even more speculative to attribute a finite portion of that effect to the foreign affiliates of American multinational corporations. Accordingly, it is difficult to accept an estimating technique that seeks arbitrarily to link increased U.S. foreign investment with import growth and then posits a causal, quantifiable relationship between these phenomena and domestic employment.

Despite labor's claim that U.S. foreign investors are exporting U.S. jobs, most analysts hold the view that foreign investment and domestic employment, while obviously related, are largely functions of disparate factors. It is by no means certain, therefore, that domestic employment would rise or fall in proportion to an expansion or contraction of American overseas investments. In fact, overall domestic employment is most directly related, both in theory and in actual practice, to the general state of health of the U.S. economy (in terms of aggregate income and production levels and growth) and to the phase of the business cycle. It is instructive to note, in this connection, that during the 1950's and early 1960's, when the domestic economy generally operated at relatively full employment levels, labor showed only limited interest in the foreign investment question despite the rapid growth of multinational corporations and overseas investment activities during that period. It is only more recently, with the decline in the U.S. competitive position, the slowing of domestic growth, and the rise in unemployment, that trade unions came to assign these unfavorable developments to the activities of the multinational companies.

This view of multinational enterprise tends to overlook the market realities that face U.S. companies and the complex motives that govern their overseas investments. Statements by labor spokesmen have depicted these firms as "runaways" whose aim is to inundate the U.S. market with

low-wage imports, exporting American workers' jobs, and undermining U.S. living standards in the process. In fact, those import categories which have experienced most rapid growth and are perhaps most responsible for dislocations of U.S. firms and displacement of U.S. workers (e.g., textiles, shoes, steel, and automobiles) are overwhelmingly the output of foreign-owned enterprises, not of U.S.-owned affiliates. Of the 13 million short tons of iron and steel imported during 1970, for example, little if any came from American-owned subsidiaries abroad. And of the 1,321,000 foreign cars imported during 1970, over 90% were made by foreign-owned companies. In cases where auto components were imported into the United States from U.S. subsidiaries abroad for further assembly here, such imports were in response to foreign competition and thus helped to preserve U.S. jobs which might otherwise have been lost.

According to Commerce Department data cited by Business Week (December 17, 1970), in 1968, only about 8% of the sales of foreign manufacturing affiliates of U.S. firms showed up as U.S. imports. About 80% of these originated in Canada, where labor conditions are similar to those in the United States and where many unions are the same. (The large volume of imports from Canada was, moreover, dominated by autos and trucks which are governed by the terms of the U.S.-Canadian Auto Agreement.) On the whole then, U.S. foreign direct investment has not been a significant source of job-displacing imports into the United States.<sup>5/</sup>

Indeed, there is much to suggest that U.S. foreign direct investment is a positive factor in creating or preserving jobs for American workers. Recent data indicate that approximately one-quarter of U.S. exports are sold to U.S. affiliates abroad. This suggests that the operations of U.S. firms abroad may actually stimulate increased demand for American-produced materials and components for further processing and/or assembly. While specific manufacturing operations may be shifted internationally (because of greater production efficiency, lower transportation costs, more favorable wage costs, or other competitive factors), the U.S. economy derives continuing benefits from the existence of affiliated plants abroad in terms of continued exports of U.S. goods and services.

As indicated, a major goal of labor appears to be curbing the ability and flexibility of multinational companies in order to protect U.S. jobs and transfers of productive facilities by multinational firms. The suggested means for doing so is to restrict the free movement of capital and technology and to impose restrictions on certain types of imports. Where job dislocations have occurred in the United States, however, they have generally been in low-skill jobs and reflect

a complexity of factors including the trend of industrialized countries to become increasingly service-oriented and to shift production to high-technology goods. In addition, the developing nations employing low-wage labor have a comparative advantage in labor-intensive manufacturing operations.

To remain competitive at home and abroad in products for which wages are an important component of total costs, U.S. companies often have no alternative to transferring operations to lower-wage foreign areas. It is reasonable to assume that no firm would willingly shift its production facilities from a geographic location in which management is fully aware of the costs and conditions of production, marketing, and distribution to a country where all of these conditions are unknown and must be faced anew, unless there were reasons of company market position and profitability that compelled such a move. By the same token, most firms will opt for providing components to their foreign affiliates for further processing (and related product lines for resale) to the maximum possible extent from their home plants, thereby protecting U.S. jobs to the extent permitted by international competitive conditions. In sum, if the products in question were not produced and supplied from abroad by U.S. affiliates, they would likely be supplied by foreign competitors. The choice, therefore, is often not between U.S. or foreign operations, but between foreign operations and no operations at all.

A specific example often cited by labor in support of its position is the consumer electronic products industry where imports now represent more than 30% of domestic consumption. The extent to which one can generalize from this experience, however, is open to question. In a recent comprehensive study of this industry, the Tariff Commission found that "for producers of consumer electronic products, the retention of a significant share of the U.S. market depends largely on the cost reductions realized through the use of foreign labor. . . . For the producers remaining at home, the competitive situation tends to worsen, and they too are confronted with a decision either to conduct some production processes abroad, to become importers, or to discontinue the product line altogether."

Finally, it should be noted that the labor view also discounts the world-wide employment benefits associated with free international flows of goods and capital. Because of differing economic resource endowments, freedom of exchange between nations has traditionally been encouraged as a means of rationalizing world output and increasing living standards. This in turn leads to rising levels of demand and greater employment opportunities throughout the world. In this regard, Dr. N. R. Danielian,



in testimony before the Senate Subcommittee on Trade, pointed out that the multinational corporation is doing for the world economy what the limited liability company did for Europe during the Industrial Revolution some 200 years ago: namely, pooling development capital and skills and applying them to the world at large.<sup>6/</sup>

If foreign investment is viewed in terms of U.S. national interest, it is clear that by gaining access to a wide range of commodities of good quality at reasonable prices, the U.S. consumer has benefitted from the internationalization of production made possible by international investment and liberal trade policies. While not all industries have prospered equally--and, indeed, while some have been unduly injured by imports at levels artificially supported by foreign governments--increases in U.S. exports in the last two decades have contributed importantly to rising levels of domestic income and employment. The economic prosperity of other free world countries can correspondingly be attributed in significant measure to the growth of world trade and investment.

There is a danger, therefore, that labor's attack on foreign investment may lead to the imposition of broad trade and investment controls in the United States. Retaliation by other countries would, of course, result in lower levels of trade and investment and, ultimately, in widespread reductions in income and employment here and abroad. It would appear that in cases where U.S. industries are experiencing difficulties due to foreign competition, adjustment assistance to domestic firms and adequate compensation and retraining opportunities for labor, plus insistence on more equitable trade and investment rules from our trading partners, afford better alternatives to insuring high levels of income and employment in the United States and abroad than do the inward-looking alternatives presently espoused by U.S. organized labor.

#### An Alternative View of Employment Effects

Attempts to estimate the effects of U.S. foreign investment on domestic employment levels encounter a number of well-known difficulties. The first is the lack of evidence of causal relationships. Estimates are also complicated by the fact that labor intensity, labor practices, and conditions of work vary from nation to nation. Moreover, while operations of a single international firm are difficult to identify and trace, the effects of all such firms taken together are even more difficult to isolate.

Nevertheless, available statistical data challenge the labor view that the operations of multinational companies adversely affect American

workers. Valuable insights into this issue may be gained from a recent comprehensive study by the Tariff Commission concerning items 807 and 806.30 of the U.S. Tariff Schedule. These items, which permit certain duty-free exemptions for U.S.-origin goods reentering the United States have been particular targets of organized labor.

Item 806.30 provides that metals processed in the United States can be further processed abroad and returned to the United States upon payment of duty on the value added abroad. Introduced in 1956 as a means of facilitating the processing of metals between the United States and Canada, the measure was not specifically limited to a contiguous country. Item 807 was introduced in the new tariff schedules adopted in 1963 to cover a well-established practice which had been in effect as a result of a 1954 decision by the U.S. Customs Court. While the interpretation of item 807 has been changed through the years by various amendments and clarifications, it provides essentially for duty exemption on U.S.-origin products when imported into the United States as identifiable parts of an assembled article.

The position of labor is that these provisions encourage U.S. companies to ship components abroad to low-wage areas for operations which could be performed by American workers. The AFL-CIO has objected especially to the situation in Mexico whose industrialization program permits materials and components intended for assembly and re-export to enter a 12.5 mile zone along the U.S.-Mexico border duty free. This program was launched by Mexico in 1965 in order to employ Mexican farm workers whose jobs were terminated by cessation of a prior U.S. program which permitted seasonal farm laborers to enter this country from Mexico. According to the labor unions, the number of U.S. plants operating in the Mexican border zone has grown from 30 in 1967 to about 250 today.

In August 1969, President Nixon requested the U.S. Tariff Commission to investigate the economic effects of these tariff items, including their effects on employment opportunities and wage levels in the United States. A comprehensive report was issued in September 1970 which took issue with the viewpoint of labor. While acknowledging that the effect of the tariff items could be "appraised only approximately owing to many uncertainties," the Tariff Commission concluded that repeal of these tariff items would not increase the job opportunities for U.S. workers but would result in a \$150-200 million deterioration in the U.S. balance of trade. The report stated that repeal of items 807 and 806.30:

. . . would not markedly reduce the volume of imports of the articles that now enter the United States under these provisions. Rather, the products would continue to be supplied from abroad by the same concerns but in many

cases with fewer or no U.S. components, or by other concerns producing like articles without the use of U.S. materials. . . . The effects of repeal on U.S. employment can only be estimated. Foreign assembly operations utilizing these provisions now provide employment for about 121,000 workers in foreign countries. Only a small portion of these jobs would be returned to the U.S. if items 807 and 806.30 were repealed. On the other hand, these provisions now provide employment for about 37,000 people in the U.S. . . . Repeal would probably result in only a modest number of jobs returned to the U.S., which likely would be more than offset by the loss of jobs among workers now producing components for exports and those who further process the imported products.

As an alternative to labor's estimate of jobs exported because of U.S. foreign investments, it is possible to assess the effects of U.S. foreign direct investment on U.S. domestic employment by examining the 1965-70 employment levels and trends for those U.S. domestic industries which include the largest U.S. overseas investors. According to Department of Commerce data, 92 of the 133 largest U.S. direct investors abroad are concentrated in the 14 Standard Industrial Classification (SIC) groups, shown below:

SIC No.	Description	Number of Companies
291	Petroleum refining	
283	Drugs	15
281	Industrial chemicals	13
333	Nonferrous metals	11
352	Farm machinery	9
357	Office and computing machines	6
371	Motor vehicles and equipment	6
203	Canned, cured, and frozen foods	5
284	Soaps, cleaners, and toilet goods	5
301	Tires and inner tubes	5
366	Communication equipment	4
331	Blast furnace and basic steel products	4
363	Household appliances	3
262	Paper and pulp mills	3
Other	(Includes 29 SIC groups with one or two large investors in each group)	3
		<u>41</u>
<u>Total</u>		<u>133</u>

Table 4: Average Number Employees by SIC Groups (employees in thousands)

SIC No.	Industry	No. of large Companies*	1965	1966	1967	1968	1969	1970	Change from 1965-70	Percent
	Total Employment		60,444.0	63,864.0	66,063.0	68,146.0	70,141.0	70,664.0	10,220.0	16.9
203	Canned, cured & frozen foods	5	262.4	276.7	276.0	269.5	282.6	285.1	22.7	8.7
262	Paper & pulp mills	3	211.0	218.8	219.4	220.5	224.4	224.1	13.1	6.2
281	Industrial chemicals	11	288.6	300.1	308.7	317.0	314.2	320.3	31.7	11.0
283	Drugs	13	115.3	126.9	135.4	140.0	142.6	150.1	34.8	30.2
284	Soaps, cleaners & toilet goods	5	104.0	107.8	113.4	116.7	122.9	125.5	21.5	20.7
291	Petroleum refining, etc.	15	143.2	147.2	152.8	150.5	146.3	153.4	10.2	7.1
301	Tires & tubes	4	102.1	107.6	102.0	112.4	118.2	114.0	11.9	11.7
331	Blast furnace & basic steel products	3	660.2	649.2	630.7	632.6	643.9	628.9	-(31.3)	-(4.7)
333	Nonferrous metals	9	72.1	77.6	75.5	79.7	87.8	86.3	14.2	19.7
352	Farm machinery	6	135.1	146.0	147.4	140.4	131.9	128.7	-(6.4)	-(4.7)
357	Office & computing machines	6	196.6	213.8	236.3	248.8	254.3	284.7	88.1	44.8
363	Household appliances	3	167.4	182.3	178.4	178.4	182.2	179.0	11.6	6.9
366	Communication equipment	4	428.0	464.9	500.6	514.9	525.1	494.7	66.7	15.6
371	Motor vehicles & equip.	5	853.6	862.7	809.3	867.8	900.8	809.8	-(43.8)	-(5.1)

\* The figures in this column list the number of the largest multinational corporations in each SIC group drawn from an OFDI sample of 133 international companies.

Source: Department of Labor, Employment and Earnings, monthly, various issues.

Office of International Investment  
Bureau of International Commerce

An examination of the relevant data presented in Table 4 does not bear out labor's contention that overseas investment operations result in declining employment. In the 1965-70 period, total employment gains in the United States averaged nearly 17%. Corresponding increases in employment registered by 11 of the selected SIC groups ranged from 6.2% for paper and pulp mills to 45% for office and computing machines. For those industries whose employment levels rose, the composite rate of growth was 16%, or nearly equal to the 17% rate for total U.S. employment. Industries showing increased jobs included some which are experiencing strong import competition as, for example, tires and tubes (12%), communications equipment (16%), office machines (45%), and household appliances (7%).

Three industries showed employment declines from 1965 to 1970 averaging 5%. For the motor vehicles industry, employment figures tend to vary from year to year, reflecting special factors including the Canadian Automobile Agreement. Two other categories--farm machinery and basic steel products--showed slight declines in employment of 4.7% each from 1965 to 1970. Employment trends in the intervening years were not consistent but rose and fell.

In view of the difficulty of separating direct investment effects from other macroeconomic factors affecting employment, caution must be exercised in drawing conclusions from this aggregate data. What seems clear from these data is that the effects on employment due to cyclical and other factors present in the domestic economy tend to swamp the adverse effects--if any--that might result from the foreign trade side. The argument that overseas investment is causing job losses in the United States does not appear to be borne out. Rather, the basic employment trend for these investment-oriented industries has been upward.

### Conclusions

A reasonable interpretation of available evidence leads to the conclusion that U.S. foreign direct investment is not contrary to the interests of U.S. workers but may, in fact, be a positive factor in stimulating U.S. employment and economic activity. The preceding observations suggest that:

- (1) U.S. import competition problems stem from the output of foreign-owned enterprises, not from U.S. affiliates;
- (2) U.S. foreign direct investment accounts for one-quarter of total U.S. exports and provides an important stimulus to the domestic economy and employment;
- (3) Where the United States and third country markets are supplied by American affiliates abroad, elimination of these facilities would result not in increased U.S. employment but in replacement of such output by production by foreign competitors;

- (4) Variations in employment resulting from fluctuations in domestic economic activity are greater than changes often attributed to import competition or to the alleged export of jobs abroad.

In the context of these observations, it would appear that labor's advocacy of restrictions on U.S. international trade and investment is ill-founded. Rather, a satisfactory level of employment in the United States depends basically on a vigorous domestic economy and the ability of U.S. industry to be competitive and profitable in the world economy. The recently-announced new economic policies, aimed at improving domestic productivity and international competitiveness, promise to move the United States speedily in this direction.

In addition to a healthy domestic economy, labor and business must be assured that they will be able to compete fairly in foreign markets. In this connection, efforts to eliminate various non-tariff barriers and other non-market factors are being intensified. On the other side of the coin, active surveillance of possible cases of foreign "dumping" in the U.S. market is of considerable importance. Also, a U.S. commitment to a free international environment must be accompanied by a readiness to assist in the cases of legitimate job displacement from imports by providing flexible and responsive adjustment assistance for workers and firms.

### III. THE MULTINATIONAL CORPORATION AND THE TRANSFER OF TECHNOLOGY

#### The Problem

In the period since World War II, the economic and political relations of nation-states in the Western World have been dramatically altered by events only recently emerged as potent forces on the international economic scene. Among these events have been the expanding operations of the multinational corporation and the heightened economic importance of the ever-increasing pace of technological advance. The conjuncture of these two forces has raised important policy issues and problems for business, labor and national policy makers.

The multinational corporation is clearly an important channel for the transmission of technology abroad. It overshadows, according to some observers, exports, licensing of technology, and the free exchange of scientific information as a means of transferring U.S. technology. Advocates of the multinational corporation view it as a vehicle for raising living standards abroad -- in part through the diffusion of technology -- and improving the world allocation of resources. Critics in Europe, Canada, and the LDC's, on the other hand, claim that it is undermining indigenous industry and leading to control of key sectors of their industrial base by U.S. capital. To critics in the United States, technology transfers by multinational firms are closing the technological gap and eroding America's competitive advantage by combining U.S.-developed technology with efficient, low cost foreign operations based on cheap labor.

#### Technology Transfers and Advantages

It is important to analyze the relationships between technology and trade in order to evaluate the effects of technology transfers on imports and exports. Traditional economic theorists have tended to focus their analysis of international trade on questions of factor endowments, factor mobility, and the theory of comparative advantage. Although individual economists have occasionally speculated on the importance of technology to trade, only over the past 15 or so years have concerted efforts begun to integrate technological considerations into the theory of international trade.

Recent attempts to rationalize economic theory in this field have included efforts to relate trade competitiveness to the employment of highly skilled labor, to distance (both geographical and psychological), to technological

advantages and to product cycles. Although there has been something of a flurry of activity in the area over the past several years, the state of economic theory is unsettled.

On the quantitative side, only limited information is available which is of use in attempting to evaluate the influence of technology on trade. As an example, nearly ten years ago, the Danish economist, Professor Erik Hoffmeyer, studied the pattern of U.S. trade and found that the United States tended to specialize in what he called research-intensive goods. He found that U.S. exports of such goods had increased twenty times in the period between World War I and the mid-fifties, while exports of traditional goods merely trebled.

More recent research in this area by Professor Donald Keesing, found a high correlation, industry by industry, between U.S. research and development expenditures in relation to sales and the U.S. share of OECD country exports of manufactures. The evidence he presented left little doubt of a positive relationship, at least for the United States, between export performance and technological advancement. 7/

Within the Department of Commerce, Dr. Michael Boretsky has investigated this area in detail. Through an analysis covering, *inter alia*, United States and foreign trade trends, productivity and R&D expenditures, Boretsky has produced evidence which tends to support the thesis that the United States depends largely upon the export of high technology products for a favorable balance of trade. Boretsky argues that for the past several years the United States has been losing its technological leadership in the production and export of such products, and that if this trend is not reversed, the United States will face a continually worsening balance of payments position. His writings attribute this loss in competitiveness to a number of factors, including: increased intensity of foreign R&D efforts, slower rates of productivity increase by U.S. firms, the ability of foreign countries to make up considerable technological ground by the adoption of "old technology," exchange rates which put the United States at an unnecessary price disadvantage, and the ability of foreign countries to purchase and assimilate relatively new technologies from innovator countries. 8/

Professor Raymond Vernon has also investigated the R&D factor in international trade and has advanced a theory of the "product cycle," which helps to explain certain aspects of the international behavior of multinational companies. Because it presents a plausible framework for considering the impact of technology and technology transfers upon trade, a brief outline of Vernon's theory is presented below. 9/

Vernon suggests that for several reasons the United States will find its greatest export competitiveness in the production and sale of technologically advanced products. Forces in the U.S. economy such as its highly skilled and educated labor force, the high income character of its demand market, the need for labor saving devices and the availability of risk capital would encourage the expenditure of R&D funds and would make it the natural development grounds for technological products.

Once developed, a new product would at first be produced relatively inefficiently; it would embody a high degree of labor content and its price would be high. During the development stage, production would be principally for the American market and any foreign sales would be serviced from the United States. As the product began to mature and the difficulties were worked out of both its production and its functioning, the labor content and price of the product would drop. Foreign markets would continue to be served from the United States during this stage of development, but increasing foreign demand might well cause the establishment of sales and service facilities abroad. As the product aged and its production became more standardized, the size of foreign markets grew, the difficulties of servicing foreign markets mounted, and the danger of a foreign firm imitating the technology became imminent, the firm would invest abroad. At least initially, the parent would continue to export some complete products or components for sale to the subsidiary. As product standardization became almost complete and the technology was spread widely, competition and trade would be determined almost exclusively on the basis of factor costs, factor proportions and economies of scale. (Other writers would add that a period of competition based on minor product improvements would come about after the diffusion of the technology had occurred but before complete standardization took place.) Eventually, the United States might well become a net importer of the product in question.

Unfortunately, statistical data relating to the actual development, exploitation and transfer of technology are insufficient to corroborate this theory or to measure the trade effects of technology transfers by multinational firms on the technological life cycle. There are, however, certain central points relating to technology and technology transfers which should be made in assessing the effects of multinational investment.

Innovation and technological advantages can strengthen the competitive position of a country whether they enlarge exports or displace imports. However, trade advantages accruing from innovation rest not on a particular break-through but on a continuous flow of new technologies. Individual technological advances tend to be imitated, improved upon or made obsolete by still newer innovations. A particular technological

advantage, therefore, is transitory; and its value to the innovator is greatest during that early period of exclusive ownership when trade will be determined on the basis of the technology itself rather than on comparative cost considerations.

The magnitude of the trade advantage resulting from innovation will depend not only on a continuing stream of new products, but also on the intensity of that stream and on the rate at which the new knowledge becomes available for production outside the innovating country. Of course, the intensity of the development stream will determine the amount of potentially exploitable technology available to the innovating country. The rate of diffusion will delimit the time period within which the technology may be exploited by exporting the technology-embodying product, assuming the country of innovation will not also be the one in which the product may be most cheaply produced.

The natural maximum limit on the time available for the exploitation of technology by exporting would be the time elapsing before a foreign firm in a lower cost country imitated the technology and achieved efficient production without assistance from firms in the innovating country. To the extent firms within the innovating country shorten that natural life-cycle by licensing foreign firms or by investing and taking their technology abroad before independent imitation occurs, the potential time available for the exploitation of the technology by product exports will be reduced. However, it is not such a simple matter to conclude that diffusions by firms within the innovating country are, therefore, detrimental to the national interest. Several intervening considerations must be carefully weighed before any reasonable conclusion may be reached. First, any immediate export or job losses which might potentially result from premature diffusion will be substantially mitigated by exports of component parts to the subsidiary and by the return of royalties, fees and profits from the subsidiary to the parent firm. Second, the subsidiary will permit the continued exploitation of the technology long beyond the time its natural export life-cycle has ended, because, having been the first firm in the foreign market with the technology, it will be the established firm in the industry with whom imitators must contest. Finally, the subsidiary will have also built up learning economies and economies of scale which local firms simply will not be able to equal for a considerable time after they have obtained the actual technology. All exports of components by the parent and returns to the parent of royalties, fees and profits during this stage of competition represent profits which are returns not only on the original technology, but also on the proprietary know-how embodied in the efficient use of the technology, which could not have been obtained by exporting and which might have been lost had the investment been delayed too long. It should also be mentioned

that firms taking technology abroad tend to create a market for their products by instructing foreign firms in the use and advantages of the products. This effect would also be expected to create additional demand for other high technology U.S. products.

It should be remembered that only a few nations are primary generators of technological innovations and that while the United States is pre-eminent in this regard, European countries and Japan also have a history of innovating. Moreover, these countries have proved themselves adept at assimilating and improving upon the technology of others. Caution should be exercised so as not to place too much emphasis upon the United States as a generator of technology -- it is the leading innovator, but the United States has also benefited from work done in foreign countries. A recent OECD study of the "technology gap" investigated a selected group of 140 innovations and found that some 60% had originated in the United States. However, the study also noted several instances where U.S. innovations were based on foreign scientific break-throughs, but few instances of the reverse process were discovered. 10/

As other industrialized nations become more like the United States in terms of their demand markets for high-technology goods, and as they increase their domestic ability to produce new technologies while retaining comparatively lower labor rates, American firms will feel strong pressures to export their technologies through foreign investment. Of course any barriers to trade or national preferences given to domestic firms which act in such a way as to reduce the opportunities for the exploitation of technology through exporting will only add to the pressure for direct investment and the export of technology. In this respect the current strictures raised by the AFL-CIO against the activities of multinational firms should not be dismissed lightly, even though their proposals to curb and regulate the activities of multinational companies would probably serve to make more difficult improvements in our long-term balance of payments.

The multinational firm has become one of the principal vehicles for the exporting of capital, technical knowledge and management know-how from the United States. Although the percentage of U.S. investment in Europe compared to all European investment is relatively slight, the effect of the multinational firm has almost certainly been disproportionate to its size. By bringing technical knowledge and management know-how to Europe it has not only acquainted its potential customers with the benefits deriving from high technology products, but it has also presented a competitive challenge to European firms to imitate American technology and to strive for new technological developments of their own. Through the direct and indirect effects of its technological exports, the multinational firm has assisted in narrowing the "technology gap." The OECD

study previously mentioned studied this gap carefully and found that differences in technology did exist in some industries, but not in others. It also found that in some instances the availability of technology had not been a problem to European firms; in these cases a "gap" developed because European firms had not utilized available technology. One example of this lack of management perceptiveness is cited in a study of the electronic components industry. 11/ It notes that although basic transistor technology became available for license from the Bell Laboratories in the mid-1950's, many prominent European firms did not realize the importance of this innovation until they were faced with the competition of American subsidiaries in Europe some time later. In the past several years, though, the "technology gap" has narrowed, and probably remains in a broad sense only with respect to the less developed countries, Eastern Europe and the U.S.S.R. With the industrialized nations it continues only in a few industries.

Although the multinational firm is the principal channel of commercial technology diffusion, it is by no means the sole channel. Substantial amounts of technology have also been transferred to unaffiliated firms. In particular, Japan has acquired vast amounts of foreign technology without allowing, until very recently, significant amounts of foreign investment. In Europe, also, significant transfers have occurred between unaffiliated firms. The Japanese case is a special one, because the Japanese were able to manipulate their investment and import regulations so as to make licensing agreements the only practical way in which technological advantages could be used to advantage in the Japanese market. 12/

#### The Magnitude of the Problem

Studies of U.S. investment in Europe over the past ten to fifteen years indicate that U.S. firms have mainly entered the faster growing European industries such as transportation equipment, chemicals and synthetics, electronic components, machinery, and food processing. One author, Rainer Hellmann, has estimated that in 1966, the United States controlled 33% of the petroleum refining capacity of the EEC; 25-27% of the European automotive industry; 10-12% of the European chemical industry, but with investment skewed toward the newer and higher-value products; 16% of electronic production, again biased toward the more advanced sectors, with U.S. firms accounting for 50% of industrial semiconductor production and 80% of electronic data processing related production. He also reported that in 1967, 27% of all new investment in the machinery industry (including electrical) within the Common Market was accounted for by American firms. While the exact market shares of American firms in Europe might not be universally agreed upon, the writings of other authorities in the field tend to support Mr. Hellmann's findings. These facts lend

support to the thesis that it is, in fact, the technologically advanced American industries which are most prone to foreign investment. 13/

The extent to which U.S. multinational companies have actually transferred technology to subsidiaries, or have received technology from them, can only be estimated from rather indirect evidence. Records of payments and receipts of royalties and licensing fees are the principal source for such information. The problem with such data is that they reflect returns from a cumulation of transferred technologies and the growth in the industrial sectors to which the technology is applied. This result comes about because the general method of licensing technology calls for both the payment of a flat fee and of incremental sums related to the use or production of the technology. It should also be noted that the figures probably understate the acquisitions of technology by the United States because they do not reflect the value of technology gained by acquiring foreign firms (the net value of manufacturing acquisitions in 1969 totaled \$453 million and Hellmann reports that the firms acquired are frequently leaders in European industry); nor do they reflect the value of improvements to technology granted back to American firms under the terms of original arrangements for the licensing of U.S. technology.

Statistics relating to payments and receipts for technology transfers indicate that the U.S. multinational firm has been a most important means by which commercial technology has been transferred from the United States. Payments of royalties and fees by affiliated companies to American parents amounted to \$641 million in 1969, while payments of management and service fees totaled another \$729 million. Between 1964 and 1969, receipts from affiliates for royalties and license fees amounted to \$2.5 billion, and management and service receipts totaled \$3.9 billion. During that same period, payments by American firms to affiliates totaled only \$442 million. Clearly, there is an imbalance in the U.S. "borrowing" and "loaning" of technology. The disparity is less pronounced with respect to the dealings of unaffiliated firms, but is nevertheless heavily weighted in favor of sales of U.S. technology. These transfers are, however, much less important than are transfers between affiliated firms. Unaffiliated receipts totaled only \$523 million in 1969, while payments amounted to \$120 million. (See Table 5).

Conclusions

1. An important portion of U.S. exports is closely related to technological advantages enjoyed by U.S. business. These technological advantages depend upon expenditures of civilian R&D and on the nature and size of the United States economy.

Table 5

U.S. Receipts and Payments of Royalties and Fees, 1964-1969  
(millions of dollars)

	Non-Affiliated Firms		Direct Investment		Grand Total
	Royalties, License fees, Rentals, Management & Service fees	Royalties, License fees & Rentals	Management & Service fees	Total Direct Investment	
<u>Receipts</u>					
1964	301	264	492	756	1057
1965	335	331	593	924	1259
1966	353	361	669	1030	1383
1967	407	438	702	1140	1547
1968	461	522	724	1246	1707
1969	523	641	729	1369*	1892
Total	2380	2557	3909	6465	8845
<u>Payments</u>					
1964	60	67	(included with royalties, etc. column)	67	127
1965	67	68		68	135
1966	76	64		64	140
1967	105	62		62	167
1968	107	80		80	187
1969	120	101		101	221
Total	535	442		442	977

\*Breakdown does not add to total because of rounding.

Source:

Non-Affiliated Firms: Office of Business Economics (OBE), Survey of Current Business, June 1971.

Direct Investment: Receipts:

Breakdown of revised figures published in October issues of Survey of Current Business 1965-70, prepared by OBE, April, 1971. (Excludes Film Rentals.)

Payments:

OBE, Survey of Current Business, June 1971.

2. National technological advantages depend not upon a particular technology, but on the continued development of new technologies and the rate at which new technologies become available for use in foreign countries.

3. As other industrial nations grow and their economies become more like that of the United States, their ability to stimulate the development and early imitation of new technologies will also grow. This growth, then, will exert continued pressure on the United States as a world leader in the development of new technologies.

4. Available evidence strongly indicates that the United States has been a net supplier of new technologies to the world. It has, however, benefited substantially from the free international flow of technology by acquiring foreign scientific inventions, foreign innovations, and an unquantifiable amount of technology through the acquisition of foreign firms and the grant-back of improvements made by foreign firms on licensed U.S. technology.

5. Although there was a "technology gap" between the United States and Europe some years ago, it was probably never as large as some writers alleged. That gap has, however, now been narrowed in part by technology transfers by U.S.-based multinational companies and in part by the innovative capacities of the Europeans themselves. Such deficiencies as existed could be explained as a shortage of capital and managerial abilities, but these deficiencies are also being remedied. Nevertheless, there does exist a gap of some breadth with the LDC's, Eastern Europe and the Soviet Union. As to other industrial countries, the gap exists only in some industries and appears to be narrowing.

6. The multinational firm has been a principal vehicle for diffusing technology from the United States. No doubt, it has helped to narrow the "technology gap." But it has not been the sole (or probably even the primary) cause of such a narrowing. The independent actions of foreign countries in increasing their R&D expenditures and investment and in adopting "old technologies," as well as the licensing of technology by U.S. companies to unaffiliated foreign firms have also substantially contributed to that end.

7. To the extent that multinational firms have reduced the opportunities for exporting by diffusing technology before a foreign-owned company was capable of imitation, the United States might conceivably derive a short-term benefit from the regulation of such transfers. The potential benefit, of course, would be an extension of the time available for exploiting the technology by exporting.

8. However, this short-term benefit might well prove illusory. The multinational firm has frequently made its initial entry into foreign markets on the basis of its superior technology. By reason of its foreign investments, the multinational corporation has been able to extend the useful life of its technologies beyond the time when its exports, because of cost considerations, would no longer be competitive. If these advantages were sacrificed to a program of control, the result would likely be detrimental to U.S. trade interests.

9. Statistics relating to the sales of multinational firms, which admittedly exclude indirect shipments, do not reflect any great proclivity to return foreign production to the United States. Studies of U.S. imports under items 806.30 and 807 of the Tariff Schedules of the United States, however, do reveal a potential trend which could cause dislocational problems among workers employed by industries subject to stiff import competition. These potential problems result principally from the business reaction to those imports and are not directly a result of technology transfers. More aggressive adjustment assistance programs would seem to be an appropriate method of dealing with such problems should they materialize.

10. Experience with past efforts to control the international flows of capital and technology indicate that it would not be impossible to institute a broad scale program. Such a program would be administratively difficult to manage and would not operate perfectly. It seems clear that it could be done, at some cost, however, including the possible emigration of some U.S. multinational firms.

11. Aside from the technical difficulties inherent in operating a program to control technology, certain more far-reaching problems would arise. First, the United States, if it expects other nations to act in their own interest, could expect little cooperation from foreign governments in enforcing a control program. Second, such controls would tend to undermine a principal rationale for the acceptance of U.S. investment by foreign governments, i.e., the benefits of having access to new technologies. Third, since technology is in many cases little more than unique knowledge in the minds of a few individuals, restraints might have to be placed on the inter-personal relations of individuals having access to that knowledge if a system of controls were to be effective.

12. In sum, the regulation of technology should not be looked to as a significant response to U.S. balance of payments or domestic employment problems. Such a policy would not be impossible to implement, and might cause some short-term gain, but it seems doubtful that the gain would



equal later losses. The type of program posited would, of course, influence its reception in the world, but the net effect would most probably be only to encourage additional foreign efforts to develop their own new technologies and to independently imitate those of the United States.

#### IV. RESPONSE OF MULTINATIONAL CORPORATIONS TO U.S. FOREIGN DIRECT INVESTMENT CONTROLS

##### The Problem

When U.S. mandatory controls on foreign direct investment were instituted in January 1968, the program was presented as a "temporary" measure. At that time, it was said that the controls would remain in effect until more basic measures could be taken to improve the U.S. balance of payments position. Four years later, this temporary measure is still in effect.

U.S. controls on direct overseas investment therefore constitute an important part of the environment within which the multinational corporation operates, and U.S. firms planning direct investments abroad have had to orient, accommodate, and implement their decisions in a manner that met the conditions set by these controls. The ways in which U.S.-based multinational corporations (MNCs) have responded to direct investment controls, and the apparent effects of the controls on corporate investment decisions are reviewed in the following pages.

Data available from Office of Foreign Direct Investments (OFDI) reports on the operations of the capital control program cover the total universe of some 3,350 enterprises whose foreign investment activities are subject to the control program. These data are not disaggregated in a manner that would permit isolation of the multinational corporation response from that of other investing firms subject to the OFDI controls. Statistical data show, however, that fewer than 140 MNCs account for nearly 60% of U.S. private direct investment overseas. Thus, because of their relative importance, multinational corporations may be assumed to account for the major part of the aggregate data reviewed below and to be the principal determinants of any trends observed. Hence, the term "multinational corporation" is used even though the underlying data cover a broader universe of U.S. firms.

##### The Direct Investment Controls

The mandatory controls on foreign direct investment were instituted as part of a broader attack on the U.S. balance of payments problem. The seven elements of the overall program also included measures to tighten the Voluntary Foreign Credit Restraint program administered by the Federal Reserve Board and to encourage foreign investment and

travel in the United States. The more immediate objective was to reduce the 1968 balance of payments deficit by at least \$1 billion.

Responsibility for administering the controls was given to the newly created Office of Foreign Direct Investments which undertook to refine and amend the general regulations established to implement the controls. The goals of the program were to be achieved by a reduction in U.S. "direct investment," defined as the sum of net capital outflows for direct investment and reinvested earnings from existing investments. The program was not intended to discourage direct investment per se, and few restrictions were placed on borrowing abroad by investors, reflecting a desire to shift the financing of investments to foreign capital markets.

The amount of investment that a firm may make during a year (its "allowable") may be calculated in accordance with a number of alternative formulas. Two specify minimum amounts that firms may invest; another uses the level of an enterprise's average annual direct investment during a given base period; and others are based on affiliate earnings during the prior year.

The situation is further complicated by the fact that different coefficients apply to different scheduled areas for a firm choosing the "historical" basis. For instance, a MNC may invest in the less-developed countries (Schedule A) 110% of its base period average, but only 65% in such countries as the United Kingdom, Japan, and Australia (Schedule B), and only 35% in the developed countries of Western Europe and South Africa (Schedule C).

Firms subject to the controls are given a degree of flexibility in the use of the proceeds of long-term foreign borrowing. Under the regulations, a firm may finance direct investment with such funds or may use them to "offset" direct investment--investing funds and repatriating an equal amount of borrowed funds to the United States--without reducing its allowable. A firm's allowable will be charged only when the underlying debt obligations are repaid.

Additional flexibility is afforded in that a firm may request relief from the controls in the form of a specific authorization. Such specific authorizations have been granted for increases in export credit to affiliates, for foreign equity financing transactions, and to meet various types of hardship situations.

#### Experience Under the Regulations

Available data appear to support the contention that multinational firms and other enterprises have not seriously reduced their foreign

direct investment activities due to the OFDI controls. After a sharp dip in 1968, total annual controlled U.S. direct investment resumed the upward trend characteristic of the years prior to the introduction of the mandatory controls. However, a far greater proportion of foreign direct investment is now financed through foreign borrowing than was the case before 1968.

The figures shown in Table 6 (located at the end of this section) illustrate these developments in greater detail. The table incorporates data for the years during which the controls have been in effect, as well as for the voluntary constraint period of 1965-67. The data show that firms subject to the controls reduced their direct investment for 1968, the first year that the controls were in effect, by \$850 million from the \$4.3 billion mark for 1967. However, the annual direct investment figures for 1969 and 1970 show new peaks of \$4.9 billion and an estimated \$6.8 billion, respectively. Thus, even while subject to the constraints of the control program, firms increased direct investment by a significant margin during and after the first year the controls were in operation.

The substantial drop in investment in 1968 remains to be explained. When the program was instituted, the U.S. Government aimed for a \$1.0 billion reduction; but, in fact, a saving of \$2.3 billion was attained. OFDI has offered a partial explanation, reasoning that the firms subject to the controls facing a new and complex set of regulations overcomplied with the program to leave themselves a margin of safety. Some evidence to support this view may be found in the record levels of overseas borrowing reached that year: companies borrowed unprecedented amounts in the Eurobond market and then deposited a high proportion of the proceeds in the Eurodollar market for use in succeeding years. According to this line of thought, the 1969 and 1970 results reflect greater investor familiarity with the direct investment program.

Table 6 also indicates how U.S. corporations altered their investment financing practices to meet the conditions of the controls. From minimal reliance on the foreign borrowing to meet their investment financing needs, U.S. direct investors shifted to substantial employment of offshore funds during the 1968-70 period. The record \$2.2 billion used in 1968 is a significant jump from the \$582 million for 1967. Furthermore, the "use of proceeds" figure has grown since 1968 by approximately \$400 million annually.

Foreign borrowing.--Also of interest are the nature and characteristics of the borrowings from which proceeds were derived. Detailed data on this subject was released by OFDI in July 1971 in

its "Selected Statistics." These data are presented in Tables 7 and 8. The figures are the result of an OFDI survey of long-term foreign and overseas borrowings by U.S. direct investors outstanding on December 31, 1970. Reporting were 339 firms with outstanding borrowings of \$2 million or more; this group accounts for all but \$200 million of the \$11.5 billion of foreign debt reported by the 814 enterprises that are the largest firms subject to the controls.

These tables show that total foreign debt outstanding at the end of 1970 for this group of direct investors was \$11.3 billion. This total was fairly evenly divided between bank borrowing (53%) and security issues (47%). Within the bank debt category, the major items were short-term credits from foreign branches of U.S. banks (\$1.5 billion) and term loans from foreign banks (\$2.3 billion).

With regard to long-term obligations (primarily composed of Eurobond issues), there is an almost even split between non-bank straight debt (\$2.5 billion) and non-bank convertible debt (\$2.7 billion).

The significance of these figures lies not only in the indication they give of the degree to which U.S. firms have shifted to foreign sources of investment financing under pressure from the controls; they also reflect non-quantitative trends that are worth noting. These relate principally to the apparently increasing knowledge of and involvement with foreign financial institutions and markets on the part of U.S. corporate officials. The development of such ties is a by-product of the controls and may represent a change in the financial practices of multinational enterprises that will continue beyond the life of the investment controls.

Prior to the institution of U.S. direct investment controls, the general practice was for U.S. firms to leave to their affiliates responsibility for day-to-day relationships with foreign banks. Since the advent of the controls, U.S. multinational corporations have had to turn to foreign institutions to satisfy their credit needs. Accordingly, U.S. businessmen have built close working relationships with foreign bankers and have also become acquainted with the banking instruments and practices employed abroad. Thus, financial officers of multinational corporations have now created and maintain direct contacts with foreign banks and overseas branches of U.S. banks.

For their part, U.S. and foreign banks have sought to develop the ability to provide financial services across international boundaries to match the scope of their multinational customers' needs. A step

that many U.S. banks have taken as a consequence is to establish an Edge Act Corporation through which they can engage in foreign banking. The rapid increase in the number of overseas branches of U.S. banks is further evidence of their efforts to expand their international financial business. A recent development has involved banks in several countries establishing arrangements for close cooperation on a multinational basis.

Multinational corporations have become heavily involved in the Eurobond market as well. Eurobonds (securities underwritten and marketed by groups of international institutions) were first floated in 1963, the year that the Interest Equalization Tax (IET) was instituted. Prior to that year, foreigners--Europeans in particular--had relied heavily on the New York capital market, enjoying the advantages of relatively lower interest costs and the ease with which large amounts of funds could be raised here. The IET removed the cost advantage and thereby stemmed the outflow of borrowed funds from the United States. Europeans were forced to turn to their own national capital markets and to the developing Eurobond market.

U.S. companies became active in the Eurobond market with the start of the Voluntary Direct Investment Program in 1965, but it was not until the institution of the mandatory program that their participation reached significant proportions. Since use of the proceeds of long-term foreign borrowing does not represent a charge to a firm's investment allowable under the mandatory program, U.S. firms had a great incentive for borrowing in the Eurobond market to meet their investment financing requirements. This provision benefitted the multinational corporations in particular, since investor preferences dictate that only the largest and best known firms can successfully float Eurobond issues. Smaller enterprises typically rely more on bank credit.

A qualification placed on U.S. firms' borrowing in the market under the OFDI program is that in order to be eligible for consideration as a "long-term foreign borrowing," a Eurobond issue by a U.S. direct investor has to be subject to the IET if purchased by a U.S. citizen. In this way, direct investors presumably are prevented from selling Eurobonds abroad to U.S. citizens and thus financing their foreign investments with U.S. funds.

To satisfy this qualification, U.S. firms have established international financing subsidiaries through which they can issue Eurobonds. These have usually been located in Delaware, Luxembourg, and the Netherlands Antilles. They also serve the objective of enabling U.S. firms to float their Eurobonds free of withholding tax, a competitive prerequisite for successful floatation on the market.

The relationship between the multinationals and the Eurobond market can best be described as "symbiotic." While the large multinational corporations have been able to avoid restricting their direct investments by tapping the Eurobond market for capital, their search for financing provided a great impetus for the growth and development of the market. Their increased demands for capital have stimulated growth in the volume of funds channelled to the market, and their participation and the consequent entry of U.S. financial enterprises have led to the use of sophisticated financing instruments and techniques commonly used in the United States. U.S. firms, for example, were largely responsible for the introduction and widespread acceptance of convertible debentures in the Eurobond market.

On the whole, the greater involvement of U.S. multinational corporations in foreign financial markets may be seen as beneficial both from a balance of payments point of view and in terms of widening the sources of funds U.S. and other companies can tap. Nevertheless, some negative points have been raised by U.S. firms about what they regard as compulsion by the U.S. Government for them to borrow overseas. One complaint frequently heard is that borrowing abroad is more costly than raising funds in the United States, since foreign interest rates have generally been higher than those in U.S. domestic markets. Investment plans are adversely affected, it is claimed, since some firms have had to cancel projects rather than finance them with higher cost funds. It is difficult to determine with any degree of certainty the extent to which U.S. foreign direct investment has actually been inhibited as a consequence.

Financing of exports to affiliates.--Since the OFDI program was instituted, concern has been expressed by officials of some multinational companies about the effects of the investment controls on the financing of exports to their foreign affiliates. They contend that the manner in which open account credit extended to their affiliates is treated under the OFDI regulations has the effect of discouraging U.S. exports. The resulting adverse effects on exports, in turn, frustrate the essential purpose of the controls, that of improving the U.S. balance of payments.

The difficulty arises from the fact that year-to-year changes in export credits extended by U.S. companies to their foreign affiliates are treated as transfers of capital which are subject to limitation under the program's regulations. This is true whether the credits are evidenced by open-book balances or in other ways. In principle, any increase from one year-end to the next in amounts owed by a foreign affiliate to the parent company for goods or services

received is considered a form of foreign direct investment which is charged against the U.S. firm's allowable. The latter's leeway to make other foreign direct investments is consequently reduced by a like amount.

The main reason for treating export credits in this manner is that they could theoretically be used to make direct investments abroad. A multinational corporation could advance funds to a foreign affiliate by exporting goods to it and not require payment within the normal time period. The funds that the affiliates would ordinarily have used for such payment could then be available for investment abroad. Thus, failure to treat increases in export credits to foreign affiliates as a form of investment could constitute a loophole in the controls.

In practice, multinational companies adversely affected by this policy are given special authority for increasing such export credits when it can be demonstrated that they are for financing bona fide exports on customary terms and not a disguised form of direct investment. Such specific authorizations are added to the firm's general investment allowable. In some cases, however, where firms have unused investment allowables, or are extending long-term credits (over one year), or appear to be increasing the average maturity of the credits, OFDI may not grant such relief.

In defending this policy as not adverse to U.S. exports, OFDI points out that it has invited applications for specific authorizations to cover export financing and has tried to identify cases where a need may exist. In 1969 the then Acting Director of OFDI told a subcommittee of the House Foreign Affairs Committee that "only 75 of the more than 3,200 investors reporting to the Office applied for open account relief in 1968."<sup>14</sup> Specific relief totalling more than \$90 million was granted in that year. Based on experience under this policy, OFDI has concluded that direct investors have been able to accommodate themselves within their allowables or to find other solutions to meeting open account export financing problems. Thus, OFDI officials, having examined and rejected a number of alternative means of handling the problem, take the position that no policy change is required.

But even when specific authorizations are granted and when these are not charged against the firm's investment allowable, it appears that they present serious administrative problems to the firms involved because of the need for detailed reporting of such transactions and for forecasting exports quarter by quarter. Because of these difficulties, many multinational corporations apparently

do not bother to apply for specific authorizations to cover export credits to their foreign affiliates. Instead, the affiliates are said to borrow abroad near the end of each year enough to reduce their year-end indebtedness to their parent companies, repaying the borrowings shortly after the first of the next year. This is not only onerous and costly to the firms involved but provides no enduring benefit to the U.S. balance of payments.

Furthermore, it is quite likely that some multinational corporations have failed to expand their exports to their foreign affiliates to the fullest extent possible, instead allowing the latter to obtain needed goods and services abroad. In this way, they can dispense with time-consuming applications for specific authorizations and forestall possible compliance problems. This is particularly likely to occur when the firm believes that OFDI will not grant the relief being sought. There is reason to believe, therefore, that U.S. exports may be adversely affected by OFDI's treatment of credit sales from MNCs to their foreign affiliates.

In this connection, it would seem highly desirable as a matter of principle for the U.S. government to move away from regulation of individual companies on a case-by-case basis where inter-company export financing is involved. A more satisfactory approach would be to devise general regulations which apply equally to all firms or to broad classes of firms.

The total amount of exports involved in parent to affiliate transactions is not known but is potentially large. It has been estimated on the basis of 1962-64 sample data that about one-fourth of all U.S. exports go to or through foreign affiliates. It is clear that the total amounts involved are so large that cutting off even a small percentage of total U.S. sales to foreign affiliates could affect our balance of trade. By way of illustration, if potential U.S. exports to foreign affiliates amounted to \$10 billion a year and if 5% of those were replaced by purchase of foreign goods because of the OFDI regulations, the loss of U.S. exports would amount to \$500 million a year.

Affiliate debt.--The influence of the capital control program is not limited to U.S. firms; its impact appears to have extended as well to borrowing by their foreign affiliates. However, it is not possible to determine how much incremental affiliate borrowing during a given period can be attributed to the investment controls and what proportion has resulted from the influence of other factors. One attempt to do such an analysis was published by OFDI in July 1971 under the title, Foreign Affiliate Financial Survey, 1966-69.

The OFDI approach was to use an econometric "model" to study "the relationship between changes in affiliate assets (uses of funds) and changes in the types of financing from parents or other (foreign) sources of funds which existed before the inception of the mandatory program." The data used were taken from reports by 469 direct investors giving balance sheet information on foreign affiliates in which they have a majority interest. The analysis resulted in an estimate that the program may have induced affiliate borrowing in 1968 and 1969 amounting to a total of \$1.4 billion.

The OFDI work represents a good start toward dealing with a difficult area, but the validity of its results is compromised by the omission from the model of many important variables in financial decision-making, e.g., U.S. and foreign interest rates, affiliate or parent profits, tax considerations, and sales performance.

In light of the doubtful results of the OFDI study, and lacking any other evidence on the program's effects on affiliate borrowing, little can be offered other than a judgment that the controls have probably influenced affiliates to increase their borrowing beyond levels that they might have maintained in the absence of controls. Further study is necessary for a more precise determination of the nature of these effects and their impact--e.g., through smaller remitted earnings by affiliates--on the U.S. balance of payments.

#### Balance of Payments Costs of the Controls

It has been pointed out above that the Eurobond market mitigated the restrictive effects of the investment controls since multinational corporations were able to maintain their total levels of investment while reducing transfers of investment capital by borrowing abroad, although at a higher cost. In stimulating this change of corporate financing patterns, the program has benefitted the U.S. payments position. But the investment controls have also stimulated capital outflows from the United States to the Eurobond market--outflows which analysts believe have offset the benefits of the program to some extent. These flows have occurred despite efforts to coordinate the various U.S. capital control programs--the direct investment controls, the Interest Equalization Tax, and the Federal Reserve's Voluntary Foreign Credit Restraint program--so as to block such outflows of funds.

An article that appeared earlier this year in Fortune outlined several channels through which such funds move. Individuals,

attracted by high interest rates, transfer dollars overseas which may be invested in Eurobonds directly or indirectly through a financial institution. Many companies that are not covered by any of the capital control programs--as well as some that are, such as small brokerage houses or mutual funds--also provide funds to the Eurobond market. Gaps in the OFDI regulations allow direct investors to make investments in illiquid instruments, such as time deposits with maturities of longer than one year. The IET does not apply to purchases of new Canadian stocks and bonds. Canadians often reinvest abroad the funds received from such sales in order to take advantage of the higher yields available there. In addition to stimulating capital transfers abroad by U.S. citizens, the direct investment controls apparently have led to withdrawals and diversions of funds from the United States by foreign (chiefly European) investors seeking the higher yields available on the Eurobond market. In one form of disinvestment, Europeans have sold their holdings of U.S. stocks and used the proceeds to purchase convertible Eurobonds.<sup>15/</sup>

Another balance of payments cost that may be attributed to the control program is the annual outflow of interest paid by direct investors on their foreign debt. This outflow has risen as these firms have switched their financing from U.S. to offshore resources. The interest paid represents an outflow of funds that would otherwise (in the case of U.S.-source funds) have accrued to U.S. financial institutions.

In conclusion, one can list and explain all of the ways in which the OFDI program has directly or indirectly stimulated movements of capital from the United States or contributed to the diversion of inflows. But, in the end, it is impossible to assign quantitative values to the various flows. Although it is frequently reported that American individuals and firms regularly deposit funds in the Eurodollar market and purchase Eurobonds, no estimate can be given concerning the volume involved. Despite the fact that the OFDI regulations governing export credit appear to restrict exports, no value can be placed on those that may have been lost. And it is impossible to estimate the size of the flow of funds derived from the liquidation of U.S. securities that may have been reinvested in the market.

#### The Debt Overhang Problem

A potentially serious threat to the U.S. balance of payments that has arisen as a consequence of the direct investment controls is known as the "debt overhang." This term refers to the outstanding

foreign debt that U.S. firms have accumulated during the years that the investment regulations have been in effect.

This accumulation has stemmed largely from OFDI's regulations concerning foreign borrowing by direct investors. As explained above, a direct investor is subject to restrictions on the amounts he can invest overseas (net transfer of capital plus his share of reinvested earnings), but there are only limited restrictions on his borrowing abroad for investment purposes. Thus, a direct investor may amass as much debt as he is able and willing to assume by borrowing from foreign banks or selling his debt obligations on international capital markets.

The problem that the existing volume of "debt overhang" poses is explained as follows: Much of this debt was contracted at relatively high interest rates. Under OFDI regulations, repayment of this debt with U.S. funds would result in a charge against a firm's investment allowable--a definite disincentive for firms with allowables insufficient to meet their needs. But if the program were terminated and U.S. interest rates were substantially below those in Europe, firms might repay a significant portion of their outstanding debt from U.S. funds.

It is difficult to predict what portion of the debt would actually be refinanced in the United States or simply repaid with U.S. funds. The possibility that the proportion might be high constitutes a dilemma for policy-makers. The investment controls have been justified as a temporary measure, to remain in effect until the U.S. balance of payments position is strong enough to warrant their removal. But in removing the controls, the U.S. Government would run the risk of triggering a massive outflow of funds--capital to repay part of the outstanding debt (plus whatever amounts are required to satisfy the year's investment requirements). Thus, without some type of provision for orderly conversion of these debts, abolition of the controls could add to balance of payments difficulties.

A key question is the proportion of the outstanding foreign debt of U.S. direct investors that might be repaid. The answer would depend on a variety of external factors, including the prevailing interest rate differentials between U.S. capital markets and those abroad. Nevertheless, some of the considerations that bear on the question are reflected in the figures on outstanding debt contained in Tables 7 and 8.

Four items account for more than 80% of the total debt outstanding and therefore merit close attention. They are: short-term loans from foreign branches of U.S. banks, term loans from foreign banks, publicly offered straight debt, and publicly offered convertible debt.

Short-term loans from foreign branches of U.S. banks have reached \$1.5 billion and account for 13% of total debt outstanding. There is reason to believe that the bulk of this category is in the form of revolving Eurodollar credits with London-based branches of U.S. banks. Such credits are flexible, easy to arrange, and easy to terminate.

Term loans from foreign banks total \$2.3 billion and equal 20% of the total. These are likely to be denominated in the stronger European currencies and therefore their volume would be subject to fluctuations in accordance with U.S. firms' exchange rate expectations. On the other hand, such credits should be less responsive to interest rate differentials between the U.S. and European financial markets.

With respect to publicly offered straight debt obligations, the likelihood of repayment will depend in part on the call provisions they carry and the premium costs associated with exercising this option. The call provision and premium cost considerations would also weigh in U.S. firms' consideration of whether to repay their convertible public debt obligations. An additional factor with regard to this type of debt would be whether holders might exercise their rights for conversion of their securities into equity.

It is evident, then, that there are a great many unanswered--and perhaps unanswerable--questions about the effects of eventual decontrol on the "debt overhang." The only certainty is that the problem is a serious one which considerably complicates decision-making with respect to the future of the OFDI regulations.

#### Conclusions

One would have to conclude, after reviewing the above analysis and data, that multinational corporations have not been seriously inhibited in pursuing their overseas expansion goals by the U.S. controls on foreign direct investment. After absorbing the initial shock from institution of the program, MNCs raised their annual foreign direct investment to levels beyond those reached in the period immediately prior to imposition of the controls.

They were able to avoid curtailing their direct investment activities by raising substantial amounts of funds through borrowing from foreign

banks (including overseas branches of U.S. banks) and floating debt issues on the Eurobond market. The result has been a significant switch in the investment financing patterns of these corporations, with a much higher proportion of their foreign direct investment being funded with off-shore funds and a concomitant reduction in the role of capital transferred from the United States. A secondary result of the increased borrowing has been a considerable expansion of foreign banking services and rapid development of the Eurobond market.

Negative effects of the controls on MNC operations have also been evident. Charging export credits extended by a U.S. firm to its affiliates against the parent's investment allowable appears to have been a negative influence on the U.S. trade account. Although OFDI has a procedure for granting specific authorizations to cover this type of transaction, many corporations still claim that it is insufficient and that they have been forced to allow affiliates to produce goods overseas because of the controls.

The other negative factor relates to the cost of borrowing abroad. Multinational firms, in complying with the direct investment controls, have found it necessary to borrow funds overseas at higher rates of interest than are available in the United States. Thus, the controls have led to an increase in that portion of the cost of projects financed with offshore funds and a decrease in earnings remitted by affiliates of multinational firms.

In terms of balance of payments effects, the program seems to have had a beneficial short-term impact on our payments position. Under the influence of the control program, U.S. firms have held down their capital transfers, increased their earnings remittances, and stepped up their foreign borrowing. These benefits are offset to some extent by the two negative factors mentioned above as well as outflows of funds from the United States that the program has stimulated directly and indirectly. On balance, these adverse effects probably do not outweigh the immediate balance of payments benefits derived from the program, at least in the short run.

In the long run, the accumulation of foreign debt by U.S. firms--a direct consequence of the investment controls--represents a serious potential threat to the U.S. balance of payments. In the event the program were abolished, a portion of this "debt overhang" might be repaid, resulting in a substantial outflow of funds from the United States. This possibility is a factor which will complicate planning for elimination of the controls.

The New Economic Program announced by President Nixon on August 15, 1971 in allowing the dollar to float substantially altered the

financial and economic conditions within which U.S. firms conduct their investment business. The expected changes in the international monetary system will certainly have a substantial impact on the level and financing of U.S. foreign direct investments. Foreign direct investment will become more expensive for U.S. firms as the U.S. dollar depreciates against other major currencies, and exporting from the United States should become more attractive.

It is probable, therefore, that some firms will cancel plans for marginal projects; but it is impossible to predict whether an increase in the cost of investing will result in an overall decline in the annual rate of U.S. foreign direct investment. Finally, as the new U.S. policies succeed in correcting our balance of payments problems, the need for capital investment controls will diminish.

Table 6  
DIRECT INVESTMENT UNDER THE OFDI CONTROLS, 1965-70  
(millions of dollars)

	1965	1966	1967	1968	1969	1970 Est.
<u>TOTAL, ALL REGULATED SCHEDULES, EXCLUDING CANADA</u>						
Transfers of capital <sup>1/</sup>	3080	3387	3360	2321	3427	4520
Reinvested earnings	1058	1109	934	1129	1530	2250
Direct Investment	4138	4496	4294	3450	4957	6770
Deduction for use of proceeds	(98)	(634)	(582)	(2209)	(2603)	(2992) <sup>2/</sup>
Regulated direct investment	4040	3862	3712	1241	2354	3778
<u>SCHEDULE A</u>						
Transfers of capital	809	816	721	820	993	1379
Reinvested earnings	389	465	417	529	503	856
Direct Investment	1198	1281	1138	1349	1496	2235
Deduction for use of proceeds	(13)	(28)	(39)	(595)	(455)	(652)
Regulated direct investment	1185	1253	1099	754	1041	1583
<u>SCHEDULE B, EXCLUDING CANADA</u>						
Transfers of capital	987	1018	1230	762	1130	1602
Reinvested earnings	492	369	312	409	423	641
Direct Investment	1479	1387	1542	1171	1553	2243
Deduction for use of proceeds	(20)	(160)	(177)	(642)	(638)	(758)
Regulated direct investment	1459	1227	1365	529	915	1485
<u>SCHEDULE C</u>						
Transfers of capital	1284	1553	1409	739	1304	1539
Reinvested earnings	177	275	205	191 <sup>3/</sup>	604 <sup>3/</sup>	753 <sup>3/</sup>
Direct Investment	1461	1828	1614	930	1908	2292
Deduction for use of proceeds	(65)	(446)	(366)	(972)	(1510)	(1582)
Regulated direct investment	1396	1382	1248	(42)	398	710
<u>MEMORANDUM: CANADA</u>						
Transfers of capital	873	971	679	459	744	1073
Reinvested earnings	440	593	481	649	716	493
Total	1313	1564	1160	1108	1460	1566

Source: Office of Foreign Direct Investments,  
Foreign Direct Investment Program: Selected Statistics, July 1971

See following page for footnotes.



Table 6 Footnotes

- 1/ Foreigner's conversion of debt obligations into equity securities of the direct investor are reported in Table I as transfers of capital in the year of conversion. The same treatment is accorded to debt obligations of direct investors' foreign incorporated overseas finance subsidiaries, when such debt obligations are converted by foreigners into equity securities of the direct investor. For compliance purposes, however, transfers of capital charged for such conversions of \$41 million in 1968, \$37 million in 1969, and an estimated \$66 million in 1970 are deferred until the following year.
- 2/ In 1970 use of proceeds includes use of "available overseas proceeds" of foreign borrowing by an overseas finance subsidiary when transferred directly by the overseas finance subsidiary to foreign affiliates of the direct investor. This treatment conforms with specific authorizations granted in 1968 and 1969, which treated all proceeds of overseas finance subsidiary borrowing as "available proceeds".
- 3/ Direct investors electing historical or earnings allowables in 1968 through 1970 were required to exclude total losses of incorporated foreign affiliates in Schedule C when computing regulated direct investment for Schedule C. Such losses of \$210 million 1968, \$104 million in 1969 and \$65 million in 1970 are included in reinvested earnings reported on Table I.

Table 7

SUMMARY OF OUTSTANDING BORROWINGS, SCHEDULED REPAYMENTS, AND FINAL MATURITIES  
(millions of dollars)

	OUTSTANDING 12/31/70		SCHEDULED REPAYMENTS		FINAL MATURITY					
	Amt.	%	1971	1972	1971	1972	1973	1974	1975	1976 & Beyond
<b>A. SHORT-TERM <sup>1/</sup></b>										
Foreign Banks	673	6.0	66	3	438	165	0	0	67	0
Foreign Banks w/ US Equity	127	1.1	0	3	81	12	0	5	6	20
Foreign Branches of US Banks	1,471	13.1	89	21	1,038	191	24	24	107	23
Subtotal	2,271	20.2	155	27	1,557	368	24	29	180	43
<b>B. BANK TERM LOANS <sup>2/</sup></b>										
Foreign Banks	2,272	20.2	259	242	0	201	155	180	325	875
Foreign Banks w/ US Equity	480	4.2	57	31	0	56	21	31	178	102
Foreign Branches of US Banks	836	7.4	197	109	0	176	96	73	209	122
Subtotal	3,588	31.8	513	382	0	433	272	284	712	1,099
<b>C. NON-BANK STRAIGHT DEBT</b>										
Public Offerings	1,922	17.1	115	144	0	80	85	20	155	1,547
Private Placements	545	4.8	55	33	3	39	7	36	126	260
Subtotal	2,467	21.9	170	177	3	119	92	56	281	1,807
<b>D. NON-BANK CONVERTIBLE DEBT</b>										
Public Offerings	2,606	23.1	30	25	0	20	15	0	0	2,561
Private Placements	123	1.1	0	0	84	0	8	0	0	31
Subtotal	2,729	24.2	30	25	84	20	23	0	0	2,592
<b>E. OTHER <sup>3/</sup></b>	210	1.9	36	26	0	10	15	13	6	151
<b>F. GRAND TOTAL</b>	11,265	100.0	904	637	1,644	950	426	382	1,179	5,692

<sup>1/</sup> Renewable and revolving credits, overdrafts, advances, and similar short-term borrowings with stated or nominal maturity of less than one year. Maturities beyond '71 reflect renewable or revolving terms of finance extending beyond the nominal maturity period.

<sup>2/</sup> Term loans and other borrowings from foreign banks and foreign branches of US banks, with stated maturities of more than one year, generally characterized by fixed amortization schedules. Long-term suppliers' credit is included in this category.

<sup>3/</sup> Includes Government loans and other miscellaneous credits, \$2 million of short-term commercial paper, and \$84 million of suppliers' credit.

SUMMARY OF OUTSTANDING BORROWINGS BY YEAR OF ORIGINATION  
(millions of dollars)

	1965 & Prior	1966	1967	1968	1969	1970	OUTSTANDING 12/31/70
<b>A. SHORT-TERM BANK LOANS 1/</b>							
Foreign Banks	0	2	13	36	68	554	673
Foreign Banks w/ US Equity	0	0	0	14	42	71	127
Foreign Branches of US Banks	13	57	19	209	268	905	1,471
Subtotal	13	59	32	259	378	1,530	2,271
<b>B. BANK TERM LOANS 2/</b>							
Foreign Banks	5	51	64	665	749	738	2,272
Foreign Banks w/ US Equity	0	2	0	50	82	346	480
Foreign Branches of US Banks	8	31	23	225	86	463	836
Subtotal	13	84	87	940	917	1,547	3,588
<b>C. NON-BANK STRAIGHT DEBT</b>							
Public Offerings	136	177	208	520	388	493	1,922
Private Placements	21	28	37	175	128	156	545
Subtotal	157	205	245	695	516	649	2,467
<b>D. NON-BANK CONVERTIBLE DEBT</b>							
Public Offerings	75	336	172	1,468	468	87	2,606
Private Placements	74	0	0	0	43	6	123
Subtotal	149	336	172	1,468	511	93	2,729
<b>E. OTHER 3/</b>	0	2	10	30	45	123	210
<b>F. GRAND TOTAL</b>	332	686	546	3,392	2,367	3,942	11,265

1/ Renewable and revolving credits, overdrafts, advances, and similar short-term borrowings with stated or nominal maturity of less than one year. Borrowings originating prior to 1970 reflect renewable or revolving terms of finance extending beyond the nominal maturity period.

2/ Term loans and other borrowings from foreign banks and foreign branches of US banks, with stated maturities of more than one year, generally characterized by fixed amortization schedules. Long-term suppliers' credit is included in this category.

3/ Includes Government loans and other miscellaneous credits, \$2 million of short-term commercial paper, and \$84 million of suppliers' credit.

Source: Office of Foreign Direct Investments, Foreign Direct Investment Program: Selected Statistics, July 1971

## V. THE IMPACT OF THE MULTINATIONAL CORPORATION ON THE BALANCE OF PAYMENTS

## The Problem

Although international capital movements have been studied by economists for many years, the current interest in the problem stems largely from the U.S. balance of payments difficulties that emerged toward the end of the 1950's. This took on added interest since the bulk of U.S. direct investment abroad is undertaken by firms that can be defined as multinational corporations. In seeking the causes of those difficulties, it was natural that analysts should scrutinize capital outflows in general and foreign direct investment in particular. Beginning about 1965, the latter had become one of the conspicuous outflow items in the U.S. balance of payments accounts.

Interest in the problem quickened during the early and middle 1960's as capital outflows increased sharply, leading to the imposition of several types of restrictions on such outflows. In particular, the Department of Commerce program of voluntary restraints on foreign direct investment aroused considerable controversy concerning whether or to what extent it was likely to improve the U.S. balance of payments. Opinions on the subject varied widely. Businessmen generally emphasized that foreign direct investment benefitted the U.S. balance of payments by stimulating exports and by producing a return flow of earnings and other income. Professor Jack N. Behrman, a former Assistant Secretary of Commerce, estimated that such receipts normally pay for the initial capital outflow in a balance of payments sense within about two years. 16/ These observers concluded that the direct investment restraints -- adopted early in 1965 on a voluntary basis and made mandatory in 1968 -- improved the U.S. balance of payments only very briefly and produced adverse net results in the not-very-long run. On the other hand, Government spokesmen and supporters insisted that the investment restraints were regrettable but necessary and that they would improve the U.S. balance of payments for a good many years at least.

Because of the growing interest in the relationships between foreign direct investment and the balance of payments, a number of serious attempts have been made to go beyond assertions and casual theorizing and to investigate the problems analytically. The most important of these are the studies by Bell, Hufbauer and Adler, The Conference Board, and Reddaway. Unfortunately, their results differ considerably. For this reason and because of the very difficult estimating problems involved, all of their conclusions need to be viewed with some skepticism. In the present state of knowledge, it is

therefore impossible to determine with certainty the quantitative effects of foreign direct investment or even at times the direction of the effects.

The principal difficulty confronting all analysts and the above studies in particular is that it is impossible to know exactly what would happen if U.S. firms did not make direct investments abroad. There is no way of being sure what the world would be like in the absence of such investments. Yet this information is needed in order to determine what difference foreign direct investment or the lack of it makes to our balance of payments. One cannot simply take it for granted that nothing else changes when U.S. firms invest abroad or that nothing else would change if they did not invest abroad. One cannot assume, for instance, that the various types of exports which are shipped to foreign affiliates of U.S. firms are entirely dependent on the existence of those affiliates; many of those exports might be made anyway and sold through non-U.S. distributors. Nor can one assume that goods produced abroad by affiliates displace an equal amount of U.S. exports; it may be that if those affiliates did not exist, similar goods would be produced abroad by rival firms and hence exports from the United States would be affected to the same or to even a greater extent.

The main uncertainty is whether U.S. investment abroad supplements or substitutes for investment by non-U.S. firms or, in other words, whether similar investment would be made by rival firms if they were not made by U.S. firms. A secondary question is whether foreign direct investment reduces the volume of domestic investment or leaves it unchanged. A third uncertainty is whether investment abroad tends to increase local demand for the products or whether such demand should be taken as given and fixed. Depending on how these questions are answered, one can obtain very different results in attempting to measure the balance of payments effects of foreign direct investment. Unfortunately, no generally accepted answers are available, and hence each analyst has to make his own assumptions on the basis of his subjective judgment.

The question of whether similar foreign investments would be made by non-U.S. firms if not made by U.S. firms is crucial to any estimates of the effects on the U.S. balance of payments. Analysts have advanced different assumptions of this probability. At one extreme, some have assumed that foreign investment by U.S. firms merely substitutes for similar investment that would otherwise be made by non-U.S. firms, so that the total volume of investment abroad is the same as it otherwise would be. At the other extreme, it may be assumed that investment abroad by U.S. firms supplements or adds to whatever investment is undertaken by non-U.S. firms, thereby increasing the total amount of such investment. One may also take the

in-between position that foreign direct investment by U.S. firms partly substitutes for and partly supplements that of non-U.S. firms. Other analysts assume that the U.S. investment supplements that of non-U.S. firms for a few years and thereafter substitutes for it, the rationale being that non-U.S. firms might not be in a position to undertake similar investment immediately but would be able to do so after awhile.

Whether and to what extent U.S. investment abroad merely substitutes for non-U.S. investment depends on a number of factors of which the following seem to be the main ones:

(a) The part of the world in which the investment is made. Substitution is more likely in developed areas like Western Europe or Canada than in less-developed countries, since the former are more likely to have local firms capable of undertaking similar investments.

(b) The degree of product sophistication. Substitution is less likely with respect to advanced-technology products than with respect to less sophisticated products, because foreign firms may lack the technical know-how to produce the former. However, this will normally be true only for a limited period of time, since the foreign firms will eventually acquire such know-how.

(c) The ability of foreign firms to undertake added investments. This involves not only technical know-how but financial capacity, the aggressiveness of the firms, the availability to them of needed management talent, etc.

(d) The amount of stimulus to investment provided by governments of the host countries. This may consist either of direct investment incentives or of general policies that are conducive to native investment. Where such stimulus is strong, local firms are likely to undertake investments in areas where U.S. firms do not.

(e) The degree of product differentiation. If rival firms can produce goods that are identical to those produced by U.S. firms, non-U.S. investment is more likely to be a close substitute for U.S. investment than if the U.S. firms can differentiate their products by style, quality or brand name.

Professors G. C. Hufbauer and F. M. Adler used three sets of assumptions concerning substitution possibilities in an important econometric study of the problems which they did several years ago for the Treasury Department. <sup>17/</sup> In attempting to measure the effects on the U.S. balance of payments of overseas investment in manufacturing, they made separate calculations

on the basis of these three different sets of assumptions and obtained very different results. Their assumptions and the designations they used were as follows:

Classical. U.S. investment abroad adds to capital formation in the host country; i.e., it supplements investment by rival firms there. At home it causes capital formation to decline. (These assumptions were called "classical" because they follow the thinking of the classical economists of the early 19th century.)

Reverse classical. U.S. investment abroad does not change total capital formation either in the host country or in the United States. In other words, it substitutes for local investment abroad and leaves domestic investment unchanged.

Anticlassical. Foreign direct investment adds to capital formation abroad but leaves it unchanged at home.

Balance of Payments Effects

Foreign direct investments by U.S.-based firms affect the U.S. balance of payments in a number of ways:

(a) At the time of such investment (or prior to it) there is normally an outflow of capital from the United States. While such investment is sometimes financed in large part out of funds obtained abroad, even in these cases there is usually some accompanying transfer of capital from the parent company.

(b) In subsequent years, there is normally a return flow of income to the parent company in the form of dividends or remitted earnings. There may also be other types of income payments, such as fees and royalties, from the foreign investment.

(c) Foreign direct investments affect U.S. exports in a number of ways: The investment may take the form of, or result in the export of, capital equipment from the United States to be used in the productive facilities being established abroad. There may also be continuing exports from the United States of materials, parts and components for further processing or assembly in these plants abroad. In addition, foreign affiliates commonly serve as sales outlets for goods exported from the United States, mainly by their parent companies but to some extent also by other U.S. companies. Foreign direct investment may also stimulate U.S. exports in indirect ways, partly by raising income in the host country and thereby enabling the local population to buy more from other countries, including the United States,

and partly by stimulating greater interest in and awareness of U.S. products in general. On the other hand, U.S. exports may be adversely affected by such investment to the extent that sales from the new plants abroad substitute for sales of U.S.-source goods that would otherwise have been made. Such displacement of U.S. exports may occur either in the countries where the investments are located or in third countries.

(d) U.S. imports may be increased by foreign direct investment if some of the resulting output is shipped to the United States and if such products would not otherwise have been imported.

(e) There may also be effects on other items in the balance of payments -- e.g., travel and transportation, other services related to the investments, and payment of interest on foreign borrowings -- but these are likely to be relatively minor.

(f) A few foreign investments of U.S. firms may some day be sold to foreign purchasers and the proceeds repatriated to the United States, to the benefit of our balance of payments. Any such transfers of funds, however, will be included in the data on direct investment capital flows, which are shown on a net basis.

(g) A number of major multinational corporations are based abroad, and some of these invest in the United States. Such reverse direct investment also affects the U.S. balance of payments, the effects being more or less the opposite of those listed above in connection with the foreign direct investment of U.S.-based firms. Although of secondary importance quantitatively, this direct investment in the United States by foreign firms should be considered in any full analysis.

Each of these balance of payments effects is discussed below, preliminary to an attempt to assess the overall effects of investment on the balance of payments.

Capital outflows.--Data on foreign direct investment by U.S. firms are shown in Table 9. The first column presents direct investment data taken from the balance of payments accounts. These figures exaggerate somewhat the actual capital outflows, since they include not only funds originating in the United States but also funds utilized for direct investment that are borrowed abroad by U.S. parents and their domestic subsidiaries or raised abroad through security issues sold by finance subsidiaries in the Netherlands Antilles and initially transferred to the U.S. parents. Rough estimates of these funds raised abroad are presented in the second column. Estimates of actual capital outflows from the United States (obtained by subtraction) are shown in the third column.

Table 9  
Long-term Private Capital Flows for  
U.S. Direct Investment Abroad  
(in millions of dollars)

	Direct investment flows (net)	Of which, funds raised abroad*	Leaving funds from U.S. for direct investment
1960	1674		1674
1961	1598		1598
1962	1654		1654
1963	1976		1976
1964	2328		2328
1965	3468	52	3416
1966	3661	445	3216
1967	3137	278	2859
1968	3209	785	2424
1969	3254	631	2623
1970	4445	378	4067

\* New issues of securities sold abroad by U.S. corporations. (Excludes most securities issued by subsidiaries incorporated abroad. Also excludes bank borrowings and other credits.)

Source: Survey of Current Business: June 1971, pp. 32, 62; October 1970, p. 26.

This table reveals several important changes in U.S. foreign direct investment during the past decade. From 1962 to 1965, capital outflows more than doubled; it was this sharp rise that led to the adoption of voluntary restraints on such capital movements early in 1965. As a result, U.S. firms began to borrow abroad on a substantial scale to finance their foreign direct investments, a practice which had previously been less common. At the same time, direct investment outflows of funds originating in the United States declined for several years. In 1970, however, following some liberalization of the (now mandatory) restraints on foreign direct investment, such capital outflows increased sharply. It is clear that the Department of Commerce capital restraint programs have greatly affected the volume of funds flowing abroad to finance foreign direct investment.

Capital outflows are a negative item in the balance of payments. Hence, any reduction in such outflows improves the balance of payments at the time. But,

of course, there are also longer-run consequences of importance which will be considered in succeeding sections.

Income from direct investments abroad.--The United States receives a large and rapidly growing income from its foreign direct investments. Such income is shown in the U.S. balance of payments accounts (in the new format) under two headings: "direct investment interest, dividends and branch earnings" and "direct investment fees and royalties." Only remitted income is included; earnings retained by foreign affiliates do not benefit our balance of payments directly, although they may do so indirectly by being reinvested and adding to future earning capacity of the affiliates.

Data on remitted income from direct investments abroad are given in Table 10 for the years 1960-70. Such income totalled \$7.9 billion in 1970, about \$5 billion more than in 1960, and has been a major source of strength in the U.S. balance of payments position during the latter part of the past decade.

Table 10  
Receipts of Income on U.S. Direct Investment Abroad  
(in millions of dollars)

	Fees and royalties	Interest, dividends and branch earnings	Total
1960	590	2355	2954
1961	662	2768	3430
1962	800	3044	3844
1963	890	3129	4019
1964	1013	3674	4687
1965	1199	3963	5162
1966	1329	4045	5374
1967	1438	4518	5956
1968	1546	4973	6519
1969	1682	5658	7340
1970	1880	6026	7906

Source: Survey of Current Business, June 1971, p. 32.

Nearly all of the income received from foreign direct investments in a given year is the result of investments made abroad during preceding years. During the year that a particular investment is made, it is likely to produce little

or no income. In subsequent years, however, it will normally yield a significant and gradually growing benefit to the balance of payments. In the long-run, the accumulated income from a given investment should exceed the original capital outflow. Hence, it is sometimes asserted that foreign direct investment is necessarily beneficial to our balance of payments. However, this ignores other possible effects of such investment, e.g., on exports and imports. Moreover, it may be a decade or two -- depending on the nature and location of the investment, its profitability and the remissions policy of the company -- before the accumulated return from it exceeds the original capital outflow.

The preceding paragraphs refer to the income remitted over time from a single investment. But there is a steady stream of capital outflows from the United States for new investment purposes. If that stream increases rapidly year after year -- as happened during 1962-65 and might have continued longer had it not been for the restraints adopted in 1965 -- capital outflows may remain larger than remitted income for a good many years. This is an additional factor that must be considered in assessing the view that foreign direct investment inevitably tends to improve the U.S. balance of payments within a fairly short period.

Effects on U.S. exports.--Although the data are imperfect, it is clear that there is a significant relationship between foreign direct investment and foreign trade. A large share of total U.S. exports are directed to foreign affiliates of U.S. firms, mainly by their parent companies. Department of Commerce data for 1965 (the latest year for which such data are available) show that U.S. exports to the foreign affiliates of 330 reporting U.S. firms amounted to \$5.1 billion, of which \$4.5 billion were from the parent companies and \$0.6 billion from other U.S. exporters. An estimate for all U.S. firms is not available. For the preceding three years, 1962-64, more complete estimates had been made by the Office of Business Economics indicating that nearly one-fourth of total U.S. exports and nearly one-third of non-agricultural exports had been directed to the foreign affiliates of U.S. firms. 18/

Of the \$5.1 billion of U.S. exports channeled through foreign affiliates of the reporting firms in 1965, \$4.2 billion were purchased by them from their parent companies, \$0.6 billion were purchased from other U.S. suppliers, and nearly \$0.3 billion were sold by the affiliates on a commission basis. Table 11 gives a detailed breakdown of the total.

These figures are impressive. However, it should not be assumed that all of these exports are entirely dependent on the existence of the foreign affiliates. No doubt some of them would be lost if the affiliates did not exist, but some part of the exports would probably be made anyway and sold through other channels, including domestic distributors in foreign countries.

Capital equipment exports.--Direct investment abroad often takes the form of, or is associated with, the export of capital equipment needed in the new productive facilities. In addition, such investment may lead to subsequent exports of capital equipment for replacement purposes. In some cases, the foreign affiliates purchase U.S. equipment because it is supplied directly by the parent company, but more often it is purchased from other U.S. suppliers for reasons of cost, quality or familiarity.

Actually, the amount of such exports seems relatively small. The foreign affiliates covered by OBE's survey for 1965 were reported to have purchased only \$356 million of U.S. capital equipment, of which \$274 million came from the parent companies. There is probably considerable understatement here, with many purchases from nonparents being unreported. But even allowing for that possibility, it is clear that the foreign affiliates obtained a relatively small part of their equipment from the United States. Total plant and equipment expenditures abroad by U.S. firms came to about \$7500 million in 1965, so that reported purchases from U.S. sources were less than 5% of the total.

The propensity of U.S. affiliates to buy U.S. capital equipment varies by region, being particularly low in Europe, where alternative sources of supply are usually available, and much higher in Latin America and other less-developed countries, where the equipment is often not produced locally. There is also variation by industry, with affiliates needing advanced technology equipment more likely to buy it in the United States than those using simpler equipment that is widely produced. Where the purchases are made also depends at times on the source of financing. Capital equipment is commonly bought on medium- and long-term credit, and when such credit is obtained abroad it is likely to be tied to sales of local products. Since the adoption early in 1965 of Commerce's voluntary restraint program covering foreign direct investment, U.S. firms have resorted to large-scale foreign borrowing, long-term as well as short-term, to finance their operations abroad. This may have deflected some of their procurement from the United States to foreign sources.

Exports of parts and components.--A large part of U.S. exports to foreign affiliates consists of raw materials or semi-manufactured goods, such as parts and components, intended for further processing or assembly. In 1965, such exports amounted to \$1728 million or about one-third of total U.S. exports to the affiliates covered by the OBE survey. Of this amount, \$1497 million went to manufacturing plants abroad and \$231 million to non-manufacturing affiliates.

Unlike capital equipment, parts and components are often produced by the parents, who therefore have a direct interest in selling them to their foreign affiliates. Indeed, such sales are one of the factors considered in setting up production facilities abroad.

Table 11

Exports Channeled Through Foreign Affiliates, 1965  
(in millions of dollars)

	<u>Total</u>	<u>Exports by 330 parent companies</u>	<u>Exports by other Suppliers</u>
Total exports channeled through foreign affiliates:	<u>5092</u>	<u>4474</u>	<u>618</u>
Purchased by foreign affiliates:			
Total	<u>4819</u>	<u>4200</u>	<u>618</u>
For further processing or assembly	1728	1515	213
For resale without further mfg.	2247	2203	44
Capital equipment	356	274	81
Other and unallocated	487	209	279
Sold on commission by affiliates	273	273	--
Total	<u>5092</u>		
From manufacturing parents	4599		
From non-manufacturing parents	493		
To manufacturing affiliates	3193		
To non-manufacturing affiliates	1899		

Source: Survey of Current Business, May 1969, p. 40.

Exports of goods for further processing are highly concentrated. Nearly half of the reported total went to automotive plants abroad, mainly in Canada, and most of the rest went to affiliates in the machinery, chemicals and rubber product industries. Four U.S. firms accounted for half of the total, whereas 105 parents did not report any such exports. Goods for further processing are more likely to be bought from the parent companies by affiliates located in areas where the United States has a dominant or long-established trading position (such as Latin America and Canada) and by affiliates in less-developed areas than by affiliates located in Western Europe where parts and components are more readily available. There are also differences between industries, some requiring highly specialized parts and components available only from the parents and others using more standardized goods that are widely available.

In general, U.S. affiliates abroad are more likely to obtain from the United States the goods they need for further processing than are their counterpart local firms. To this extent, foreign direct investment increases U.S. exports. However, it seems likely that this advantage diminishes with the passage of time and that the buying practices of U.S. affiliates generally tend to become more like those of local firms, particularly where cost considerations favor purchase outside of the United States.

Exports for resale.--Foreign affiliates of U.S. firms not only produce goods but also sell goods produced in the United States. U.S. exports intended for resale without further manufacture amounted to \$2247 million in 1965, about 44% of total exports to foreign affiliates. Surprisingly, perhaps, more of these went to affiliates engaged in manufacturing than in trade or distribution. An additional \$273 million of U.S. exports were sold through the affiliates on a commission basis. The importance of foreign affiliates as distributors of U.S. products may be somewhat overstated by these figures because some of the sales may have been made directly to foreign buyers and merely credited to the affiliates for accounting purposes. Nevertheless, it is evident that U.S. foreign affiliates play an important role in selling U.S. products, not only of their parents but also, to a small extent, of other U.S. firms.

It is not clear how necessary foreign affiliates are as sales agents for U.S.-made products. On the one hand, it must be assumed that a large part of the exports sold through them could have been sold through other channels, such as foreign distributors, were the affiliates not available. Other industrial nations have managed to expand their exports rapidly, for example, without comparable foreign affiliates. On the other hand, there are various reasons why the affiliates might be more effective salesmen than non-affiliated distributors: they have a greater interest in promoting sales of their parent companies' products; they may be able to fill out

their product lines with complementary products of their parents; their mere presence in other countries may stimulate interest in U.S. goods; the parent companies may become more interested in exporting and more aware of the opportunities in foreign markets after setting up affiliates abroad; and the fact that sales facilities, warehouses and trained personnel are already on the spot must facilitate the sales of not only the affiliates' own products but their parents' as well. On the whole, therefore, it seems reasonable to conclude that a considerable part of the U.S. exports sold through U.S. foreign affiliates would not have been sold without their presence, and that the U.S. balance of payments benefits to that extent.

Indirect effects on exports.--Foreign direct investment also serves to stimulate U.S. exports in indirect ways that are very difficult to assess but seem potentially important. The presence abroad of U.S. firms is likely to increase foreign interest in, and awareness of, American-style products, thereby leading to greater demand for goods made in the United States as well as for those made abroad by U.S. affiliates. Such demand may affect sales of products quite unrelated to those handled by the affiliates themselves. While this kind of secondary impact is impossible to measure, businessmen generally attribute considerable importance to it.

Economists have often stressed the income effects of foreign direct investment. Such investment, it is held, expands the economic base and increases local incomes, thereby creating a greater demand for products from other countries, including the United States. This argument has much validity for investments in less-developed countries, particularly those with close trade ties to the United States. Investments in these areas usually do yield increases in national product and income that would not otherwise occur, which, in turn, leads to increases in purchases from the United States. With respect to investments in developed areas like Canada or Western Europe, the consequences may be quite different because such investments will often be made by local firms if not made by U.S. firms. However, in view of the enormous amounts of U.S. capital, technology, and management know-how that have poured into Canada and Western Europe in the past decade, it does not seem possible that those areas could have developed so rapidly with only their own resources. It is probable, therefore, that U.S. investment in these areas has significantly raised their national incomes and thereby led to increased purchases from the United States. The effects on U.S. exports cannot be estimated with any precision although they are probably substantial.

Displacement of U.S. exports.--Production abroad by affiliates of U.S. firms may displace similar goods that would otherwise have been exported directly from the United States. The affiliates may be better able to adapt

the products to local tastes or standards, or may simply enjoy a significant transportation advantage. Such displacement may take place in the local markets of the affiliates or in other countries.

The extent to which such export displacement actually occurs is a controversial question. On the one hand, it is asserted that there is little displacement of U.S. exports by the output of foreign affiliates. U.S. firms set up production facilities abroad, in this view, only when they are on the verge of losing their export markets anyway. If they do not produce the goods abroad, non-U.S. firms would do so and the United States would lose both the exports and the income. Foreign direct investment is regarded as "defensive" in the sense of being aimed at the retention of foreign markets.

On the other hand, it is maintained that some U.S. production abroad is at the expense of U.S. exports. According to this view, many products of U.S. firms could not readily be produced by non-U.S. firms for lack of the needed capital, technology or management know-how. Much foreign investment is undertaken because lower wage rates abroad promise higher profit margins and/or in order to defend foreign markets against foreign competition or against other U.S. firms. There is an export of capital, jobs and technology, it is asserted, at the expense of the U.S. economy and trade balance.

An intermediate position taken by some analysts is that some displacement of U.S. exports occurs as a result of direct investment abroad but only for a limited period of time. Foreign firms would eventually be able to take over U.S. markets abroad, it is held, even if they are not ready to do so at the time that U.S. firms set up facilities overseas. Hence, while U.S. investment abroad may displace U.S. exports for a time, it will in the end preserve foreign markets for U.S. goods, and exports lost will be more than offset in the long-run by earnings from the investments and by U.S. exports that are stimulated by such investment.

Judgments on these matters depend largely on the assumptions made about substitution possibilities. Those who stress the displacement of U.S. exports implicitly adopt the classical assumptions of Hufbauer and Adler; namely, that foreign direct investment by U.S. firms will increase total capital formation abroad but reduce it in the United States as compared to what capital formation would be without this investment. For both reasons, but mainly because of the additional production overseas, U.S. exports will decline. Those who minimize export displacement implicitly adopt the reverse classical assumptions; namely, that U.S. investment abroad merely substitutes for investment that would otherwise be undertaken by foreign firms and that net capital formation is not changed either at home or abroad. On these assumptions, U.S. exports will be equally displaced by



investment of non-U.S. firms if U.S. firms do not undertake such investment abroad. The most realistic assumptions undoubtedly lie somewhere between the two extremes but opinions differ as to precisely where.

An elaborate effort to measure export displacement by manufacturing affiliates was made by Hufbauer and Adler, using statistical data relating to a number of countries and product groups for the years 1957, 1959-64. Under reverse classical assumptions (U.S. direct investment abroad merely substitutes for native investment in the host country), Hufbauer and Adler find that U.S. exports in this category were increased somewhat by direct investment in Canada, Latin America and Europe but not in the Rest of the World category. The beneficial effects in the first three regional categories reflect the fact that U.S. affiliates abroad appear to displace fewer U.S. exports and to buy more associated U.S. exports than domestic firms.

Under classical or anticlassical assumptions (according to both of which U.S. foreign direct investment is additional, and hence increases net capital formation in the host country), U.S. exports are greatly displaced by investment in Canada and in the Rest of the World category, moderately displaced by investment in Latin America, and to a smaller extent displaced by investment in Europe. The authors find the Rest of the World figures doubtful but the others in line with expectations. The large displacement of exports to Canada they consider not to be surprising, since a large proportion of Canada's imports come from the United States.

While these conclusions seem plausible, they should not be accepted uncritically. The authors in fact state that their examination "reveals a considerable degree of uncertainty surrounding all export displacement estimates." Indeed, some of their export displacement figures were so large that they swamped the other trade effects. Hence, the authors felt compelled to scale them down rather arbitrarily in estimating the overall balance of payments effects of foreign direct investment. Nevertheless, these estimates are probably the best presently available.

This brief description of the Hufbauer-Adler study reveals the complexity of the problem, the limitations of existing analytical techniques, as well as the real difficulties of measuring and reaching definitive judgments as to the extent of export displacement resulting from foreign direct investment.

It should be recalled, moreover, that the Hufbauer-Adler study covers only investment in manufacturing. Foreign direct investment of other types, e.g., in mining, petroleum, utilities or trade, is not likely to displace U.S. exports significantly.

Imports.--Production abroad by U.S. affiliates may compete with U.S. exports not only in the host countries and in third countries; it may also

compete with U.S. products in the United States. In other words, some of the output of these affiliates may be shipped back to the United States, to the detriment of our trade balance. In considering this possibility, it is necessary to distinguish between investment in manufacturing affiliates and investment in mining and petroleum affiliates. The latter types of investment may well result in increased U.S. imports, but for the most part these are raw materials needed because they are not produced in the United States or because they can be produced here only at high cost or with the danger of exhausting domestic reserves. Investment of this sort does not adversely affect the U.S. trade balance. Thus, insofar as increased imports from foreign affiliates are a problem, the problem relates primarily to manufacturing affiliates.

U.S. purchases from manufacturing affiliates abroad amounted to only \$1789 million <sup>19/</sup> or 8.3% of total U.S. imports in 1965. Because of the relatively small amounts involved, such imports were generally considered in the past not to constitute a serious weakness in the U.S. balance of payments. They are held down, it was thought, by marketing arrangements or qualitative differences in the kinds of goods produced, if not by cost considerations.

However, purchases from U.S. manufacturing affiliates abroad have increased rapidly in recent years, and by 1968, amounted to \$4741 million or 14.3% of total U.S. imports. U.S. firms are now producing abroad automobiles, electronics equipment and a long and growing list of other commodities for shipment back to the United States. It should be noted, however, that 80% of these imports were from Canada, largely products covered by the U.S.-Canadian Automotive Agreement of 1965. Excluding transportation equipment (mainly automotive) imported from Canadian affiliates, only about 8% of U.S. imports came from foreign manufacturing affiliates in 1968. This provision had increased but slightly since 1965. While data are not available for years since 1968, imports from foreign manufacturing affiliates still seem to be relatively small and it is not clear whether they constitute a growing threat to the U.S. balance of payments.

Moreover, the rapid growth of U.S. imports in recent years has not been due solely, or even mainly, to the multinational corporations. Most of the increase has come from sources other than the foreign affiliates of U.S. firms. German, Japanese and other foreign exporters of automobiles, steel, textiles, footwear and electronic goods have very successfully entered the American market without the benefit of ties with U.S. corporations.

It is sometimes maintained, therefore, that if U.S. foreign direct investments were restricted in order to hold down imports, non-U.S. firms would step in to fill the gap and hence total imports would be unaffected. If,

for instance, U.S. electronics manufacturers were prevented from producing and assembling equipment abroad for sale in the United States, they would be unable to compete with foreign producers because of high domestic costs of production and the U.S. market would be lost to imports anyway. Undoubtedly, this is true in a great many cases. In other cases, however, non-U.S. firms might be unable to substitute fully for foreign affiliates of U.S. firms because they lacked the necessary capital, technology, marketing know-how, distribution facilities in the United States or other requisites for penetrating the U.S. market. Still, as time goes on, non-U.S. firms appear to be acquiring these capacities more and more and becoming increasingly close competitors of and substitutes for the foreign affiliates of U.S. firms. Hence, the potential for curtailing U.S. imports by restricting foreign direct investment has, if not disappeared completely, at least greatly diminished.

Foreign direct investment in the United States.--Many of the world's multinational corporations are based in other countries, some of which have important investments in the United States. Such investments have effects on the U.S. balance of payments which are, to some extent, opposite to those of U.S. investment abroad.

Foreign investment in the United States has in the past been relatively small -- although it amounted to \$11.8 billion in 1969. During the years 1960-66, annual capital inflows averaged less than \$100 million a year. Since then, however, they have grown rapidly, and in 1970 amounted to \$969 million. (The figures refer only to net capital inflows for direct investment in the United States and exclude reinvested earnings.) It seems likely that such investment will continue to grow.

Capital inflows of this sort improve the U.S. balance of payments for the year in which they occur. At the same time, income payments to other countries from these investments in the United States have also been rising, although more gradually. In 1970 such payments amounted to \$552 million, of which \$111 million consisted of fees and royalties and \$441 million of interest, dividends and branch earnings. Such payments of income to foreign investors had exceeded new capital inflows for direct investment during the period 1960-68, but during 1969-70 the inflows were much larger than the income periods.

This type of direct investment has some effect on U.S. exports and imports, too. Exports may be stimulated somewhat by shipment abroad of part of the output of these foreign-owned enterprises. Imports may be increased if foreign equipment or foreign-made materials and parts are brought in for use by these plants. The latter may also serve as sales outlets for imported goods or may indirectly stimulate U.S. purchases of foreign-made articles. On the other hand, U.S. imports may be reduced if these plants manufacture

in this country goods which would otherwise be imported. Very little information is available on these balance of payments effects. Moreover, they are subject to the same kinds of substitution uncertainties as have been discussed in connection with direct investment abroad by U.S. firms. To determine the net balance of payments effects, it would be necessary to know, for instance, whether U.S. firms would have made similar investments in the United States if foreign-based firms had not done so. However, in view of the small amount of such reverse investment until recent years, it seems likely that their effects on U.S. exports and imports have been small.

The principal effects on the U.S. balance of payments have derived from the capital inflows themselves and from the payments of various types of income to the foreign investors. These two items taken together had adverse effects on our balance of payments prior to 1969, beneficial effects during 1969 and 1970, and adverse effects again during the first quarter of 1971. If further increases in such reverse direct investment could be stimulated, it could provide a significant plus for our balance of payments for some years, although eventually the income payments to the foreign investors could exceed the inflows of new capital.

Overall balance of payments effects.--It might seem that the simplest way would be to assess the overall effects of foreign direct investment on the balance of payments would be to compare the capital outflows with the sum of the other related items for a given period and see whether there was a net gain or loss for the balance of payments. This is not a very meaningful procedure, however, for most of the relevant balance of payments items in a given year are related to investments made during prior periods rather than during the time period in question. Accordingly, the question to be asked is: How long does it take for a foreign direct investment to pay off, not in terms of profits to the firms involved, but in terms of balance of payments benefits to the nation. The attempt to answer this question involves the difficult estimating problems for individual items outlined in the preceding paragraphs.

Using statistical data and mathematical techniques, Hufbauer and Adler made estimates of the various types of balance of payments effects occurring over a 20-year period as a result of a hypothetical foreign direct investment made in the first year. Separate sets of calculations were made for investment in four broad areas of the world -- Canada, Europe, Latin America, and Rest of the World -- and for their three different sets of substitution assumptions (classical, reverse classical and anticlassical). From these estimates, the authors computed payout recoupment periods for each of these regions and each of the substitution assumptions. Because their original results seemed implausible (long recoupment periods or in many cases no

full recoupment at all), the authors arbitrarily reduced the amount of export displacement in most cases, since this factor seemed to be the primary cause of the unlikely results. Both their initial and adjusted results are shown in Table 12. The authors suggest that these might be regarded as "plausible maximum and minimum estimates."

The econometric model employed by Hufbauer and Adler has come in for a good deal of criticism from Professor Raymond Vernon <sup>21/</sup> and others. Vernon considers that their study is "the best exercise of its kind" but "still very far removed from providing a relevant basis for policy." The essential difficulty is that the problem to be solved is too complex to be handled with present econometric tools.

The Hufbauer and Adler approach is deficient, according to Vernon, because it assumes that each dollar of U.S. investment abroad will continue to be used in association with the same amount of borrowing abroad as in the past and that demand in the host country for the product in question is fixed and is not affected by the new investment. With regard to substitution assumptions, Vernon points out that a hybrid assumption may be the most plausible one; that is, that U.S. investment abroad substitutes for rival investment in the long run but that it tends to displace U.S. exports during an initial period. Hybrid assumptions of this sort would give very different results from those derived using the Hufbauer-Adler assumptions.

Perhaps most important, Hufbauer and Adler use a static model which assumes that all of the basic relationships remain unchanged. In the real world, investment may set in motion changes in a firm which will markedly affect its performance in the future; e.g., by attracting more competent and aggressive personnel, strengthening its credit rating and perhaps leading to broader social and economic changes in the country.

Professor Vernon concludes that the range of plausible estimates that can be derived from the available data and the various sets of assumptions is much wider than the already wide range of results produced by Hufbauer and Adler. An approach that yields such a wide range of possible answers, he concludes, is not able to provide a satisfactory basis for policy. Consequently, one has to fall back on experience and judgment in seeking a basis for policy.

In a parallel study of United Kingdom foreign investment and balance of payments relationships, Prof. W. B. Reddaway and his associates at the University of Cambridge obtained results that were fairly similar to the Hufbauer-Adler reverse classical estimates. <sup>22/</sup> Their results imply an average recoupment period for U.K. investment overseas of about 14 years, as compared to about 9 years obtained for U.S. investment abroad. This difference may be due partly to differences of methodology and coverage and

Table 12

Balance of Payments Recoupment Periods

<u>Substitution assumptions</u> <u>and regions</u>	<u>Recoupment period in years</u> <sup>1/</sup>	
	<u>Initial estimates</u>	<u>Adjusted estimates</u>
Classical Assumptions: <sup>2/</sup>		
Canada	--	--
Latin America	--	--
Europe	18.8	7.5
Rest of World	--	22.2
World	--	--
Reverse Classical Assumptions: <sup>3/</sup>		
Canada	10.2	10.2
Latin America	9.8	9.8
Europe	6.5	6.5
Rest of World	--	6.7
World	9.2	8.1
Anticlassical Assumptions: <sup>4/</sup>		
Canada	--	--
Latin America	--	--
Europe	--	10.8
Rest of World	--	--
World	--	--

<sup>1/</sup> The recoupment period represents the number of years required for a single direct investment outflow to produce a cumulative balance of payments surplus equal to itself.

<sup>2/</sup> Classical assumptions: A unit of direct investment makes a unit net addition to capital formation in the host country, and causes a unit net decline in capital formation at home.

<sup>3/</sup> Reverse classical assumptions: A unit of direct investment makes no net addition to capital formation in the host country, and causes no net decline in capital formation at home.

<sup>4/</sup> Anticlassical assumptions: A unit of direct investment makes a unit net addition to capital formation in the host country, but causes no net decline in capital formation at home.

Note: A blank space indicates that full recoupment of the initial balance of payments drain does not occur.

Source: Hufbauer and Adler, op. cit., pp. 67-68.

partly to differences in actual investment experience. Perhaps the main reason why U.K. investment overseas shows long recoupment periods is its limited stimulative effects on British exports.

Reddaway's study is similarly open to criticism on a number of counts: His data were based on information from a very small number of firms; there are large gaps in the data, which cover only 10 industries and 15 foreign countries; respondents, knowing the purpose of the study, may not have been entirely objective in their replies; and, in any event, respondents could not really know what would have happened if they had not made their investments. Reddaway's results varied widely as between industries and firms, so that his overall averages may not be very significant. His assumption that if the British investments overseas had not been made, rival firms would have made similar investments is extreme and implausible; non-U.K. firms would doubtless have filled the gap to a large extent but not fully.

These criticisms illustrate -- as do the previous criticisms of the Hufbauer-Adler study -- the inherent difficulties in grappling with a problem of this sort. Clearly, the results obtained by such studies are crucially dependent on the assumptions made concerning substitution possibilities, effects of investment on the levels of demand, and other matters. In fact, results are largely inherent in the assumptions made at the outset. Consequently, conclusions as to the effects of foreign investment on the balance of payments, for all their apparent mathematical precision, are really no better than the rather intuitive judgments made at the outset concerning the assumptions that underlie the analysis.

### Conclusions

There are two major policy issues concerning foreign direct investment and the balance of payments: (1) Should such investment be encouraged or discouraged in order to improve the U.S. balance of payments? (2) To what extent should foreign direct investment, or more broadly, the activities of multinational corporations, be judged by their effects on the balance of payments?

The foregoing discussion has been directed primarily at the first question. The above-cited studies of the effects of foreign direct investment by both U.S. and U.K. firms suggest that in the very long run such investment usually benefits the balance of payments of the investing country but that in the short run the net balance of payments effects may be adverse. The dividing line between short run and long run in this connection varies considerably, depending on such considerations as the type of investment, the industry, the location, and similar factors.

Thus, in assessing whether foreign direct investments (or restrictions on it) are likely to improve or worsen the balance of payments, one has to have some time period in mind. The period will depend on the problem at hand -- i.e., the probable duration of balance of payments difficulties. If these difficulties are expected to last only a year or two, investment restrictions during that time will probably help to improve the balance of payments, since the initial capital outflows will be prevented while few supplementary gains will be foregone. If the restrictions are expected to last five years or more, there is still likely to be a balance of payments gain, although the calculation may be fairly close in some cases. If the restrictions are expected to last 10 years or so, there is a fair likelihood that the balance of payments losses will exceed the gains. And if the restrictions are expected to last more than 10 years, the probabilities are strong that they will be self-defeating insofar as the intention is to improve the balance of payments.

The time period envisaged is thus a crucial factor in deciding whether to encourage or discourage foreign direct investment in order to improve the balance of payments. Of course, the duration of a balance of payments problem is never clear at the outset, and in many cases there is a tendency to discount the seriousness of the problem. Hence, there is the danger that investment restrictions will be adopted in order to deal with a balance of payments problem that is thought to be short-run but that turns out to be protracted. Even in balance of payments crises that are clearly short-run, it may not be necessary or desirable to curb foreign investment if better alternatives are available.

Although only the balance of payments effects of foreign direct investment have been discussed, it is obvious that this is not the only, or necessarily the most important, criterion for judging the impact of multinational corporations. The investment activities of these corporations have had enormous consequences by diffusing capital, technology and management know-how around the world. In so doing, they have contributed greatly to the prosperity and rapid economic growth of the free world and to closer relationships among the developed nations. It is natural and proper for U.S. firms to lead in the development of international business operations, since the United States is a capital-rich nation and the world leader in modern technology and management techniques. Perhaps the benefits to the host countries from such investment are the most obvious. But the United States also derives considerable benefits from foreign direct investment -- remitted earnings; export markets; a return flow of technology and skills from the foreign affiliates; and, most importantly, the intangible but vital benefits of living in a more prosperous and closely-knit world.

There is a general presumption, therefore, that inhibiting foreign direct investment reduces social welfare in the long run. Hence, any decision to restrict such investment should be taken only after careful consideration of the balance of payments consequences, long-run as well as short-run, and of the broader effects, such as those relating to economic growth, efficiency in the use of resources, and relationships between the countries involved. The short-run balance of payments effects, although important, need not always be overriding.

Moreover, restrictions on foreign direct investment are an inherently unsatisfactory way of dealing with balance of payments deficits because they merely treat one of the many superficial causes rather than getting at the basic cause. In the recent past, the basic cause was the fact that U.S. prices had gotten out of alignment with prices in other countries, given existing exchange rates. Or, putting it the other way around, the exchange rate between the dollar and other leading currencies had not been in equilibrium, given existing relative price structures. As a result, U.S. exports had been hampered, U.S. imports had been stimulated, U.S. investment abroad had been encouraged, and foreign investment in the United States had been discouraged -- all of which contributed to the U.S. balance of payments deficits. Thus, while it can be said in a sense that foreign direct investment by U.S. firms has been "excessive," the real fault has lain in the relative overvaluation of the dollar rather than in any overly expansive tendencies of the multinational corporations.

Recent changes in U.S. foreign economic policy will, of course, greatly affect the balance of payments situation. At the present time, the consequences of these changes cannot be fully foreseen. But whatever the final outcome, they are bound to influence U.S. policies regarding the balance of payments and foreign direct investment. If the end result is to solve the U.S. balance of payments problem, it should then be feasible and desirable to eliminate present restrictions on foreign direct investment.

## VI. THE POLITICAL IMPACT OF THE MULTINATIONAL CORPORATION

Professor C. P. Kindleberger of MIT has compared the development and spread of the multinational corporation to the role of the domestic corporation in developing a national market within the United States. In the course of its development, it has broken down regional barriers and has led to a more equal and wider distribution of economic benefits and to an impressive surge in overall economic growth. But it has also produced political problems to which adjustments have yet to be worked out. A good deal of the visibility which the multinational company has attained in recent years is a direct consequence of the political impact it has had on national governments attempting to adjust to its economic impact.

In a fundamental sense, the international company with its world outlook is a challenge to the nation-state. Despite the proliferation since 1945 of international organizations which are directed toward harmonizing national differences, the decisions taken in these bodies nevertheless reflect national decisions by member states bent on preserving their sovereignties. It is generally agreed that the initial surge of national governments toward interdependence, multilateralism and regional formations has probably spent its force for the immediate future, and the following decades will probably be devoted to absorbing the economic impact into the body politic. The attendant tensions will not subside, and adjustments to the new situation will continue until an acceptable system of juridical and political arrangements is worked out.

The ambivalence of nation-states toward the multinational corporation has tended to blur their formulation and articulation of policy. In the case of many European countries, it has been estimated that the multinational corporation has contributed from 2% to 10% a year to overall capital formation and 5% to 15% a year to the growth of industrial capital. It has also increased employment in depressed areas and has contributed to national welfare. For these contributions, it was welcomed. But the multinational corporation has also sharpened competition and has tended to lock host countries into relationships with other national economies. International companies have often taken decisions which have interfered with national economic development plans, and they have introduced an element of "foreignness" into national decision-making which has often been resented. Because of its mobility and flexibility, the international company can quickly, and without reference to national objectives or policies, change technology,

product mix or markets. Host countries have not decided how much they like, what they do not like, and what they should do about this supernational independence enjoyed by companies operating within their borders.

This uncertainty and ambivalence have often led to complaints about foreign ownership when the real question is one of control. Proposals to dilute control of the international corporation by the head office through use of joint ventures is a technique favored in many countries which want the capital and know-how these companies bring in but prefer to retain policy control within their countries.

In the less-developed countries, the success of the multinational corporation is both a source of its strength and weakness. It has proven itself to be a most efficient mechanism for deploying financial resources, technological know-how, managerial expertise and the latest scientific organizational techniques to maximize production and profit. In the process, it has tended to disturb old cultural patterns and antiquated economic practices while bringing many benefits in the way of new industries; social infrastructure; more employment; a more skilled labor force; as well as increased taxes, revenues and exports to the host country. The adjustment process occasioned by these changes has led to frictions with indigenous economic interests and with host governments. Nationalistic tendencies have often led to an anti-foreign investment bias, to advocacy of quasi-socialistic development plans and to espousal of nationally owned public sector enterprises or joint ventures where the foreigner holds a minority interest. These conflicting cross-currents have come at a time when the possibility for developing an integrated world economy based on a more rational allocation of world resources, which the multinational corporation is uniquely equipped to bring about, run counter to the inward looking, essentially nationalistic and statist biases of many less-developed countries.

In fact, the future role of multinational corporations in assisting the development of the less-developed world hinges on the possibility of working out a modus vivendi between the companies and the national governments which preserves enough autonomy and profitability for both parties. The international company has played and can continue to play an important part in their economic development if a favorable investment climate can be fostered.

Even among developed countries this ambivalence toward the international company is an issue. In Canada, where foreign capital (principally from the United States) controls close to half of the manufacturing industry and generates almost half of the nation's GNP, there has been active controversy over what should be done to limit activities of foreign companies. A government task force appointed to study the problem has tried to spell out a code of

corporate behavior. While acknowledging the benefits of American capital in developing the economy, there is nevertheless keen resentment over imposition of U.S. policies on the operation of resident American corporations, viz., bans on trade with Communist China, application of U.S. antitrust laws, and similar restraints.

In Japan, the policy is more clearly expressed: it is to keep control of the economy in Japanese hands, a policy that is consistent with the country's historic posture in this area. Development of the Japanese economy was accomplished by a close alliance between government and business which has deliberately excluded foreign capital and control. The success of this policy has confirmed to its proponents the wisdom of this approach. The Japanese have preferred instead to pay large sums for licenses and patents (over \$1 billion a year in recent years) rather than permit the entrance of foreign companies. U.S. attempts to persuade the government to liberalize its investment policies have been only partially successful. Economic negotiations, including setting a new parity for the yen will presumably continue to include discussions aimed at a more rapid reduction in Japan's trade and investment controls. To date, Japan has benefitted from free access to U.S. markets without offering similar access to U.S. business in the growing Japanese market.

Similar instances of ambivalence have occurred in Europe. In France, the government has looked askance at the penetration of American companies in advanced technology fields (computers, nuclear energy, electrical machinery, etc.) and in a number of cases has intervened to prevent pending mergers. Even in the United Kingdom, one of the major recipients of American capital (about 10% of GNP and 17% of U.K. exports are accounted for by American companies), there have been rumblings over foreign control and the need to preserve national sovereignty. Professor John Dunning, an economist of international stature with a well-articulated liberal trade and investment outlook, has, while acknowledging the benefits of foreign investment to Britain, stressed the importance of retaining control over economic policy in British hands.

The United States, too, has not been immune. Recent experience with the British Petroleum-Standard Oil of Ohio which led to intimations of anti-trust actions by the Department of Justice (but which were, however, never carried out), have stirred rumblings in Europe over our real commitment to unhampered international investment in the United States.

What the foregoing illustrations reveal is a general uncertainty and uneasiness on the part of political authorities as they try to grapple with, and adjust to, the facts of economic life wrought by the growth of international corporations. Thus, while there may be active controversy over

the impact of the multinational corporation on the economies of the capital exporting and recipient countries, the political impact is unambiguous. In this arena, a whole range of proposals have been made -- from forcing joint ventures on new investors to outright expropriation of old ones -- in an attempt to exert political sovereignty over a field increasingly revealing characteristics of economic internationalism. In a number of countries, U.S. investments have been nationalized; in others, proposals verging on confiscation have been approved by national parliaments; and, in still others, disinvestment schemes are under consideration. As indicated above, the anti-foreign investment climate is not confined to the less-developed world; more subtle schemes to hamper the future growth of foreign direct investment are under consideration in a number of developed countries as well, with pressures arising from disaffected labor in the investment-originating country and from political factors on the side of recipients.

It was to a certain extent inevitable that the rapid growth of the multinational corporation in the last two decades should have evoked the kinds of reactions that have been experienced in many countries. It is equally clear that a modus operandi needs to be worked out between investing and recipient countries in which new ground rules for future investment are articulated and accepted. The conclusion that one is led to from recent experience is that purely national solutions to investment disputes only serve to exacerbate rather than solve them. An international mechanism for setting conventions of conduct and for settling investment disputes has been advocated by knowledgeable observers as a way out of the presently developing impasse in this area. A number of organizations already exist which can be utilized and expanded for these purposes: The World Bank, the OECD, UNCTAD, and the GATT. Without the requisite arrangements for balancing national and corporate objectives, the unique contribution which international investment, and, in particular, the multinational corporation, can make toward advancing world living standards and building a world economy would be jeopardized.

FOOTNOTES

1. Data on U.S. and other international investment cited below are for direct investment activities of international corporations although they also include data for companies that do not satisfy the criteria of the definition. The figures on total investment cover all forms of investment, direct and indirect.
2. Even the use of the word "multinational" is in dispute. Some writers prefer the word "international" or "transnational" corporation as more descriptive of the phenomenon.
3. "International Trade and Investment in the 70's: A New Challenge for Management and Labor." Chamber of Commerce of the United States, undated.
4. Business Week, July 17, 1971, pp. 63-64.
5. Business Week, December 17, 1970.
6. Dr. N. R. Danielian, President, International Economic Policy Association, to the Subcommittee on International Trade of the Senate Finance Committee, May 1971.
7. D. Keesing, "The Impact of Research and Development on United States Trade," Journal of Political Economy (February 1967), pp. 38-48.
8. M. Boretsky, "Concerns About the Present American Position in International Trade," in Technology and International Trade, National Academy of Engineering (1971), pp. 18-66. Dr. Boretsky has also prepared several other papers for use within the Department of Commerce.
9. R. Vernon, "International Investment and International Trade in the Product Cycle," Quarterly Journal of Economics (May 1966), pp. 190-207; and Sovereignty at Bay: The Multinational Spread of U.S. Enterprise, Basic Books, N.Y. 1971.
10. Gaps in Technology: General Report, Organization for Economic Cooperation and Development (1968).
11. J. Tilton, International Diffusion of Technology: The Case of Semiconductors, Brookings Institution (Forthcoming).

12. See: T. Ozawa, "Imitation, Innovation, and Japanese Exports," in The Open Economy: Essays on International Trade and Finance, (Kenen and Lawrence ed.), Columbia University (1968).
13. R. Hellmann, The Challenge to U.S. Dominance of the International Corporation, Dunellen (1970).
14. "Foreign Direct Investment Controls," U.S. Congress, House, hearings before the Subcommittee on Foreign Economic Policy of the Committee on Foreign Affairs, 91st Congress, 1st Session, 1969, p. 222.
15. Sanford Rose, "Capital is Something that Doesn't Love a Wall," Fortune, February 1971.
16. Jack N. Behrman, "Foreign Investment Muddle: The Perils of Ad Hocery," Columbia Journal of World Business, fall 1965, p. 54.
17. G. C. Hufbauer and F. M. Adler, Overseas Manufacturing Investment and the Balance of Payments (U.S. Treasury: 1968).
18. Samuel Pizer and Frederick Cutler, "U.S. Exports to Foreign Affiliates of U.S. Firms," Survey of Current Business, December 1965, p. 12; and Marie T. Bradshaw, "U.S. Exports to Foreign Affiliates of U.S. Firms," Survey of Current Business, May 1969, Part 1, p. 40.
19. R. David Belli, "Sales of Foreign Affiliates of U.S. Firms, 1961-65, 1967 and 1968," Survey of Current Business, October 1970, p. 20.
20. Philip W. Bell, "Private Capital Movements and the U.S. Balance-of-Payments Position," in Joint Economic Committee, 87th Congress, 2nd Session, Factors Affecting the United States Balance of Payments (Washington: 1962), pp. 395-481.
21. Raymond Vernon, U.S. Controls on Foreign Direct Investments -- A Reevaluation (Financial Executives Research Foundation: 1969), pp. 39-64.
22. W. B. Reddaway, Effects of U.K. Direct Investment Overseas (interim and final reports), Cambridge University Press, 1967 and 1968.





JAN 10 1972

SCIENCE COUNCIL OF CANADA

Report No. 4

Towards a  
National Science Policy  
for Canada

OCTOBER 1968

October, 1968.

The Right Honourable PIERRE ELLIOTT TRUDEAU, P.C., M.P.,  
Prime Minister of Canada,  
House of Commons,  
Ottawa 4, Ontario.

Dear Mr. Prime Minister,

In accordance with the provisions of sections eleven and thirteen of the Science Council of Canada Act, I have in the past forwarded to you reports from the Council covering a number of specific areas of Canadian science. I now take pleasure in forwarding to you the Council's recommendations on some broad goals and emphases for the future development of Canadian science in the report entitled "Towards a National Science Policy for Canada". It is the Council's hopes that these recommendations will lay a firm basis for the evolution of a comprehensive national science policy for Canada.

The report lays special emphasis on the role of science in helping to solve several of the important social and economic problems that now confront the nation.

Yours very truly,

O. M. SOLANDT,  
*Chairman.*

## CONTENTS

	PAGE
SUMMARY.....	1
SECTION	
1. Introduction.....	3
2. Some definitions and concepts.....	7
3. National Goals as a Framework for Policy.....	13
4. Past Trends in Funding R&D in Canada.....	19
5. General Consideration of the Organization of Science and Federal Support Programs.....	23
6. The Concept of Major Programs.....	29
7. Specific Areas for Action.....	35
(a) Prototype Major Programs.....	36
(b) Areas for Immediate Planning.....	38
(c) Areas for Continuing Consideration.....	46
8. Manpower.....	49
9. Expenditures.....	51
APPENDIX: Notes and References.....	55

## SUMMARY

In publishing this report, the Science Council is attempting to lay down broad guidelines for the future use and development of science and technology in Canada. The recommendations made represent the first steps toward the formulation of a comprehensive national science policy and pay particular attention to the role which mission-oriented programs can play in shaping the growth of Canadian science. In this document the Science Council has elected to concentrate on science and technology as they are harnessed to serve the nation, and consequently little is said of the important positions which basic research and "Little Science" must continue to play in Canada. It should also be noted that the action proposed has far-reaching implications for the development of the social sciences and the Council would support all efforts to promote expansion of the nation's activities in these sciences.

Science and technology affect society and the economy in two different ways. On the one hand they are all pervasive and can affect almost every activity in some way, and the health of our economy will depend partly on how widely science is used in this broad way. On the other, they can be highly concentrated and can give impetus along some chosen line of action. It is this latter aspect which receives most attention in this report.

It is the opinion of the Science Council that the application of science and technology will make significant contributions to the solution of economic and social problems in Canada and in so doing will contribute to the realization of the goals of the nation. In order to have this happen, changes are necessary. In particular, more emphasis in future must be placed on development and innovation—on using science and technology to produce new or improved goods and services—and more research and development must be done close to the point where innovation will be initiated. This argument leads the Science Council to expect that an increasing share of Canadian R & D will be performed outside government laboratories, by the universities and by all levels of Canadian industry—primary, manufacturing and service.

Throughout the report it is stressed that expenditures on science and technology must compete with many alternatives in the allocation of national resources. It is argued that even on this directly competitive basis the expenditures on science and technology will be selected because of the social and economic benefits that will result.

The report recommends that comprehensive, mission-oriented "major programs" be set up to co-ordinate the efforts of all sectors of the economy and to bring a multi-disciplinary approach to the solution of important national problems. Within these programs the role foreseen for the Federal

Government is predominantly that of initiator, co-ordinator and provider of funds for much of the research and development while the other sectors will be mainly performers of research and innovators.

An existing major program deserving special mention and continuing support is that in Nuclear Power. Two prototype programs, covering Canada's interests in Space and Water Resources management and development, are ready to start immediately and should be supported. The Science Council is establishing task forces to prepare detailed plans for major programs in four areas—Transportation, Urban Development, Computer Applications, and Scientific and Technical Aid to Developing Areas. The report lists other areas which are expected to figure prominently in the next round of planning activities.

The Council has had preliminary investigations made into the supply of manpower expected in Canada and the possible expenditures on research and development over the next decade. These indicate that the demands on Canada's manpower and financial resources which will be made by the major programs should not be excessive and that they could be met if the nation decides to do so.

## Section 1

### INTRODUCTION

The rapid growth of science and technology in today's world is clearly recognized as one of the major forces leading to change in contemporary society. It is becoming rapidly more evident that in an era when science and technology are expanding so quickly, change becomes the natural state of human society, and that the institutions and patterns of social organization which characterize that society must either adapt to this change or disappear.

Not many years ago, the average citizen and most people in government and industry regarded science as an interesting and important phase of human activity, but one which did not touch their lives closely. Today almost everyone recognizes that many of the changes, both for better and for worse, which have come about in their lives have been initiated by science. People everywhere have come to fear the growth of science as the source of new weapons to destroy them, of automation which will leave them unemployed and in poverty, and of a technologically-dominated social structure that will leave scant room for man's nobler aspirations. Nonetheless, these same people hail science as a benefactor contributing in a major way to better health, to the removal of drudgery, and to many improvements in the quality of life. With this realization of the way in which science and technology permeate almost every aspect of modern industrial society has come a need for understanding the actual and potential roles of science in society and for evolving policies to guide its use and development. The task of the Science Council is to try to evolve such general policies for Canada.

Obviously, a complete and coherent policy for the use of science in Canada would be almost as complex as a similar statement of policy for the development of Canadian society as a whole. Consequently, what the Science Council, with the support of the Science Secretariat, has done is to attempt first to obtain a broad general picture of how science is in fact being used in Canadian society, and then to seek ways in which this use could be improved or supplemented. The results to date of this study are summarized in the present report.

This first policy report does not catalogue all of the ways in which science can be effectively used in Canada, nor does it attempt to provide any comprehensive list of priorities. Its emphasis is on those directions in which change is obviously needed and it recommends action which can be expected to induce the desired alterations.

In this report, the Science Council will make scant reference to two important aspects of science. First, science challenges and satisfies man's

creative intellectual urge to explore and to understand his environment and as such is one of man's greatest cultural expressions. Second, there is "Little Science"—the individual scientist pursuing his interests in research in areas of his own choosing. The number of scientists who follow this course in any generation is small, but their contribution to knowledge has been high and the cost of supporting them, modest. No nation can afford not to support these people.

This policy statement is concerned principally with the major areas in which society has a need to know more and therefore is looking to the scientist to provide answers to questions which, themselves, are at times poorly articulated. The absence of emphasis on the two aspects mentioned above should not be taken as a denigration of their importance but as an acknowledgment of the greater need which Canada has for a policy for the rational development of those areas of applied science on which our society depends.

The Science Council is quite conscious of the fact that many members of Canada's scientific community expect that this first policy report will seek to establish short-term priorities for Federal scientific programs which in turn will give specific guide-lines for planning and budgeting. It must be clearly understood from the outset that the Council has not attempted to do this but rather has sought to provide strategic advice on the development of science on a national, rather than simply Federal Government scale. If the recommendations of this report are followed, then officials in the Federal Government responsible for science will be able in future to decide upon short-term priorities in the light of the long-term goals proposed by the Science Council.

A study of Canada's record in the use of science indicates that there is no need to be apologetic about past performance or to be revolutionary about the approach to the future. Rapid evolution rather than revolution should be the keynote.

Experience and analysis indicate that Canada's past major concentration of the performance of research and development in government laboratories is no longer necessary. In future a role of growing importance for government should be the initiation, co-ordination and financing rather than the performance of research. New scientific activities should no longer automatically first appear in government departments or agencies; a detailed consideration of the ultimate aims and time scale of each program will indicate how the activity will best be divided between the sectors of the scientific community.

In the past there has been a tendency to fail to carry work through from research and development to production and use. This report proposes the initiation of a series of major mission-oriented programs to be guided, financed and co-ordinated by the Federal Government, but to involve every appropriate sector of the scientific community and to be planned so that they will culminate in the production and use of goods and services. Major



emphasis must be placed on the importance of using science and technology effectively in support of the nation's social and economic goals. Applied research has become an indispensable activity of modern industrial society but, unlike fundamental research, it must never be regarded as an end in itself. Applied research, development and innovation are complex and costly activities which make great demands on public financing, and can only be justified to the extent that they contribute to the realization of the aspirations of those providing the support. The *First Annual Report*<sup>1</sup> of the Science Council contained the warning that

"we must be sure that enough of our research and development effort is successfully directed toward profitable projects to ensure the continuity of the production which supports all our research. Research is an exploration into the unknown, and many of its activities must necessarily prove to have little immediate applicability. However, if our industry becomes unprofitable there will be no money for any kind of research. Therefore, where the results of research are not expected to be tangible or immediate, the advisability of investing in it will have to be scrutinized with greater care. It is one of the main jobs of the Science Council to see that the balance in Canada's research effort is such as to keep the economy healthy and growing, and the scientific community strong and active."

This concern for the social and economic uses of much of Canada's science has led the Science Council to its belief in the need for the establishment of comprehensive mission-oriented programs, aimed at solving some nationally important problem. While the programs will have significant research elements, their fundamental aim will be the implementation of solutions to national problems, and not simply the performance of research. This emphasis however does not mean that these programs are more important than basic research, but rather highlights the Science Council's opinion that changes are more urgently needed in Canada's applied science than in its efforts in the field of basic research. The Science Council would recommend that basic research continue to be supported at an expanding rate, as it has been in the past, and to have it flourish both as "curiosity-directed research" and as "mission-oriented basic research" in fields of general interest and importance to the major programs proposed.

As will be seen, the course of action proposed in this report has major implications which spread far beyond the boundaries of the scientific community. The major programs proposed will call on the talents of social scientists, financial experts and management specialists, as well as natural scientists and engineers, and the programs must be supported by aggressive marketing if they are to realize the full potential of their contributions to the nation's economy. It must therefore be understood that the Science Council's emphasis in this report on science and technology is in no way intended to diminish the importance of the contributions which will be needed from these other areas. Indeed, it may well be the case that in some areas, for example in the fields of "social technology" or in the enhancement of the quality of management, there may be as great a need to strengthen Canada's national resources and capacities as in the areas discussed at length in this report.

## Section 2

### SOME DEFINITIONS AND CONCEPTS

Throughout this report "science" is taken as meaning "man's accumulated and systematically arranged knowledge about himself and his world and the research by which he continually adds to this body of knowledge" and "technology" as "the body of scientific knowledge that has been effectively adapted to practical use and is fully available to meet man's immediate needs".

The activities which either generate this knowledge or seek to implement it, and that are most often discussed in this report, are:

- (1) *Basic or Fundamental Research* which is a generalized search for new knowledge without specific application in mind, and which is one of man's crowning cultural achievements. Any piece of basic research is judged on the contributions which it makes to the conceptual development of science.
- (2) *Applied Research* is the search for new knowledge to provide a solution to a specific problem which is defined at the outset of the research program. It does not differ radically from basic research in methods or scope, but in motivation. Applied research programs must be judged by their relevance to the pre-selected objective.
- (3) *Development* is really a final stage of applied research which is most clearly seen in the evolution of new goods or services. It is a costly activity in as much as the building of prototypes, the construction of pilot-plants or the conduct of full-scale trials are costly undertakings.
- (4) *Innovation* is the practical implementation of the results of research and development to provide new or improved goods or services. Innovation is often a capital-intensive activity since new production facilities are often required. In deciding to undertake programs of development and innovation, the expenditures foreseen must be weighed against the probability of achieving economic gain or social benefit.

These activities have no distinct boundaries, but merge into each other and are part of what could be considered a "spectrum of scientific activities". A further component of this spectrum, which is barely referred to in this report, consists of the "*scientific services*" such as geological surveying or meteorological services. Because of Canada's great size, the peculiarities of her geography, and the importance of natural resource development to her economy, these scientific services are more important to Canada than they

are to many other nations. The usual definitions of research and development exclude these activities and this has left them outside the scope of many research and development incentive schemes. It would be unwise of Canada to continue this practice and to ignore the importance of these services.

This report lays stress on the value of comprehensive *mission-oriented programs* as necessary parts of the development of Canadian science. Each must contain healthy components of fundamental research, applied research, development and innovation. Fundamental research should be undertaken in fields generally allied to the principal mission, supported not only as a possible source of new and vital discovery, but also as a means of comprehending and absorbing advances made elsewhere in the world; the components of applied research, development and innovation should emphasize the full deployment of the new technology throughout the economy, to ensure maximum benefit from each program.

Scientific and technological activities within a single nation do not exist in a vacuum. They are parts of an international system and the knowledge which they generate flows remarkably freely within the system. Because only a small fraction of all the world's research and development will be performed in Canada, Canada must import much of the scientific and technical information which will be used here. This calls for an efficient and highly developed scientific and technical information system and a study of Canada's needs in this respect, being carried out under the auspices of the Science Secretariat, is already at an advanced stage. This however is part only of the larger problem of providing all types of information—on business, finance, education, in fact on all facets of organized life—since modern society is dependent upon information. A specific and important task of any information system will be to serve the needs of industry, and in this one must never forget the vast number of commercial, manufacturing and service organizations in Canada which at present do not support any research or development activities at all. However, no system, no matter how sophisticated, will be of any use unless industry is prepared to utilize the information that the system provides.

While much information flows freely in the international scientific community, the volume of "proprietary" information being generated annually is increasing, and in some cases foreign technology can be obtained only by trading and not by purchase. One reason for supporting R&D in this country is therefore to place Canada in a favourable bargaining position in this "information" market.

The problem of defining the costs and benefits of any applied scientific activity is complex, since both costs and benefits can have economic, social and cultural dimensions, but the problem is central to any science policy.

The initial economic cost of a program of research and development—in terms of the funds, facilities and manpower invested—is perhaps the least difficult component of the total cost to evaluate, but other costs are equally

real. Technological change has its corollary in obsolescence and so there are the continuing costs of that obsolescence which follow on the heels of successful innovation.

The rate of modern technological change is itself the source of an important social cost. Society and its institutions do not appear able to evolve rapidly enough to keep pace with technology—they respond to technological change too slowly to avoid the strains imposed on our civilization by new inventions. Too often organizational changes are made to redress the mistakes of the past instead of being designed to cope with the progress of the future. When a nation embarks on a course designed to promote scientific activity, it cannot expect to use yesterday's institutions to direct tomorrow's programs.

The benefits generated by scientific activities are many and diverse; they can be intellectual and cultural, economic or social; they can influence the health or security of the nation; they are often interrelated and to most can be ascribed some economic measure, no matter how indirect, but caution should be exercised in attempts to evaluate all benefits in solely economic terms.

Discussions on costs and benefits of scientific activities are useful in their proper context, but tend to lead to too narrow a consideration of the way in which science affects society as a whole and the economy in particular. From the broader point of view, science affects the economic and social life of the nation in two ways. On the one hand it is all pervasive and is diffused throughout the fabric of society and the economy, while on the other it can be concentrated and can provide strong direction along a particular course of action. These have been characterized as the "horizontal" and "vertical" effects of science.

From the "horizontal" aspect, science can become an important factor in every imaginable endeavour and probably every endeavour can be improved by the better application of science. However, there are few programs of national importance which can be considered solely from the point of view of science and therefore, if such undertakings are to be as effective as possible, it is important to ensure that science is not only well used but also well integrated with the other activities encompassed by the program. To have science deployed to best advantage in Canada it is important that all Canadians, whether scientist or not, appreciate the value of science, that scientists better recognize and accept the large economic role and responsibility of science and that government and industry in particular recognize the value of scientists in many activities which stretch far beyond the research laboratory.

From the "vertical" point of view, science can provide the focus for concentrated attempts to solve many of society's pressing problems, and it is this aspect which is particularly discussed in the present report. One objective of the programs proposed now by the Science Council is to emphasize the improvements required for the effective development and use of science

throughout the economy and to demonstrate how this can be achieved. It is important to remember that the effectiveness of science in fields outside the "missions" proposed must remain of equal concern to Canada.

In seeking solutions to the nation's economic and social problems, the policy-maker should always consider scientific research and development as one possible allocation of the resources available for the tackling of these problems, and the costs and benefits of a scientific approach must be weighed against those of any alternative means of seeking the desired solution. The extent to which science can provide the solution will vary with the problem, but the Science Council believes that research and development, followed by innovation, will be useful and often indispensable for the attack on almost every major problem.

When it has been decided to allocate funds to science in a given program, one further important question of policy must be resolved. The level of investment in original research and development within any particular program should be evaluated against the comparative economic and policy value of borrowing or buying technology from external sources. However, from the national standpoint, it must be recognized that a degree of independence may be worth some added financial cost, and from a practical viewpoint, it is important for the buyer to be knowledgeable in the related technology in order to purchase intelligently.

The Science Council has had a series of background studies carried out to examine some important questions which underlie policy for science and technology. Brief reports on three of these studies—on manpower, on expenditure projections, and on the inflation/sophistication factor as an element in rising R&D costs—are being published separately<sup>2</sup>.

Another difficult problem which has been studied by both the Science Council and the Economic Council is that of identifying any firm relationship between the performance of research and development and economic growth. One apparent correlation which has been suggested<sup>3</sup> relates the export performance of particular industries to their level of R&D activity, whether measured as a function of the manpower employed or the money spent, but this argument has been challenged<sup>4</sup> by those who argue that government support of R&D is a subsidy to the industries involved. While those economists interested in this complex question continue to search for a means of quantifying the contributions to economic growth which stem from R&D, the Science Council believes that it would be unwise at present to lean too heavily on what at best are partially-evaluated theories. Since economic studies to date provide no detailed prescriptions for science policy the Science Council has had to rely on its own informed judgement in arriving at the recommendations in this report.

The Science Secretariat, with expert economic assistance, is continuing a study of the relationship of R&D to economic growth and will publish any significant findings but, in the interim, the layman who seeks an introduction to the complexities of the question can consult the chapter on "Science,

Technology and the Economy" in the *Fifth Annual Review* of the Economic Council.

A continuing study of these basic problems which underlie the formulation of a science policy will remain an important part of the Science Council's future program. The Council is encouraged to see that a number of Canadian universities have embarked on studies of this kind and it is hoped that these activities will continue to receive the necessary support.

### Section 3

## NATIONAL GOALS AS A FRAMEWORK FOR POLICY

Before the Science Council could construct a sound policy for the use and development of science in Canada, it had first to erect a frame of reference for this policy. Starting with the axiom that the value of any scientific enterprise to a society is determined by the social, cultural and economic goals that that society seeks, such a framework could be built in four stages, following in logical order:

- (1) identifying a set of goals which, while not comprehensive, appeared to contain the main aspirations of most Canadians;
- (2) identifying the various factors on which the ultimate attainment of each goal will depend; in most cases these factors can equally well be considered as elements of the main goal;
- (3) identifying the contributions that science and technology can make towards the attainment of the goals; and
- (4) identifying the conditions that will permit these contributions to be made.

*Six goals* were chosen to provide this focus for policy discussions:

- National prosperity.
- Physical and mental health and high life expectancy.
- A high and rising standard of education, readily available to all.
- Personal freedom, justice and security for all in a united Canada.
- Increasing availability of leisure and enhancement of the opportunities for personal development.
- World peace, based on a fair distribution of the world's existing and potential wealth.

It is not suggested that this list is in any way complete, nor that the short notes which follow make up an essay on national goals; the comments on each goal are provided only as a brief outline of the frame of reference for the recommendations which are made later in this document.

### GOAL 1: NATIONAL PROSPERITY

#### *Elements of the Goal*<sup>5</sup>

- High rate of economic growth.
- Reasonable price stability.
- Equitable distribution of rising income.
- Viable balance of payments.

- Full employment.
- Reduction of regional economic disparities.

*Contributions of Science and Technology*

- Increased industrial productivity, without which the nation will not be able to afford to expand its attempts to deal with mounting social problems. Contributions to productivity in manufacturing industry are perhaps the most obvious, but improvements in productivity in Canada's primary industry should release manpower to still more productive sectors of the economy, and increased productivity in non-profit service industries (health care, education) is also needed to reduce costs.
- Innovation, in selected manufacturing and specialized service industries that have inherent comparative advantages in a Canadian setting to improve their competitive position in international trade.
- Continued improvement in the management practices in Canadian industry, for example by more extensive and effective utilization of computers by management.
- Improvement of the efficiencies of the services industries, particularly in distribution systems.
- Development of sound programs for the use, conservation and replenishing of resources.
- Development of techniques for rational decision-making on complementary activities, such as the balancing of different kinds of food production against each other, or in the choosing between the exporting of raw materials and the processing of those materials in Canada.
- Reduction of costs of many basic elements, such as energy, housing, transportation, communications, as a contribution to improving the standard of living and to the maintenance of overall price stability.
- The development and application of new technology, for example in improving communications and transportation systems, as a contribution to efforts being made to reduce regional disparities of productivity and income levels.
- Better understanding of motivational factors that influence industrial productivity.

GOAL 2: HEALTH

*Elements of the Goal*

- Provision of medical services of rising quality and efficiency.
- Improvement of the environment in which Canadians live.
- Development and improvement of practices conducive to public health.

*Contributions of Science and Technology*

- Continued medical research to ensure that the standards of training and practice in Canada's health professions are of a quality that is high by world standards.



- Application of systems science to the provision of medical and other health services, particularly hospital care, to improve the efficiency of these services and to reduce their relative costs.
- Studies of individual and group behaviour in relation to physical and mental health.
- Improvements in the conditions of urban and rural life, to remove threats to both physical and mental well-being.
- Control of existing and threatened health hazards already created by the misuse of science and technology—e.g. pollution.

### GOAL 3: EDUCATION

#### *Elements of the Goal*

- Opportunities for education of high quality, at all levels from elementary through to post-doctorate and including all forms of post-secondary training, should be readily available to all Canadians, to the limit of their individual abilities.
- Opportunities should be available for upgrading the education of adults, to assist those who have been by-passed in their youth and to allow others to keep pace with advances in their specialized fields.

#### *Contributions of Science and Technology*

- The continued provision of opportunities for first-class basic research in the universities as a vehicle for graduate teaching.
- Improvements to the quality of teaching at all levels.
- The application of the scientific method to studies of the current system of providing education.
- The introduction of a scientific curiosity-directed approach into all levels of education as a means of stimulating thought and creativity, and as a substitute for teaching by rote.
- The application of systems science and other techniques to the process of education, to increase its productivity.
- The development of advanced, computer-based educational aids, to increase the quality of the education being provided.
- At the secondary and higher levels, better understanding of student motivation, to allow educational procedures to be modified so that education can be seen as being directed to attaining appropriate goals for the individual and society.
- The provision of better information services for education.

### GOAL 4: FREEDOM, SECURITY AND UNITY

#### *Elements of the Goal*

- Promotion of better understanding and co-operation between the different parts of Canada and between Canada and other nations of the world.

- Continued defence of the rights and safety of the individual.
- Improvements in the methods of crime prevention, detection and control.

*Contributions of Science and Technology*

In this case, much more than in the others, science and technology pose threats to society as well as conferring benefits. On the positive side lie contributions to:

- supporting Canada's national defence by providing the necessary military technology;
- expanding man's capacity to travel, to learn to co-operate, to foresee and guard against dangers and to summon help in case of need;
- improving communication between groups or regions of the country;
- the development of new techniques in criminology and forensic science as a contribution to the battle against crime.

On the negative side, science makes possible coercion, intrusion into privacy and concentration of power on an unprecedented scale. Strong political, moral and personal safeguards against these misuses of science are needed, and technology can contribute to these safeguards.

GOAL 5: LEISURE AND PERSONAL DEVELOPMENT

*Elements of the Goal*

- Reduction in hours of work and removal of need to perform menial tasks.
- Development of Canada's two principal cultures and of understanding between them to create an attractive and stimulating environment.
- Provision of opportunities for culture, recreation and challenging personal endeavour.

*Contributions of Science and Technology*

- Satisfaction of man's compelling urge to explore, to know and to understand himself and his universe, which has long been a great source of cultural development, by the promotion of fundamental scientific research as one of man's highest intellectual and cultural achievements and as an expression of creativity of a sophisticated kind. It must be acknowledged that, to many scientists, this idea in itself would rank as a major goal.
- Increased Automation.
- Development of devices to perform menial tasks.
- Development of efficient, inexpensive transportation systems to permit easy travel.
- Development of advanced communications media, which will permit man to widen his horizons immeasurably.

- Development methods to facilitate more widespread Canadian bilingualism.
- Development of the accessories and hardware of modern leisure.

## GOAL 6: WORLD PEACE

### *Elements of the Goal*

- International peacekeeping and maintenance of world order.
- Contributions by the wealthy nations of the world to the development of less fortunate nations, particularly by the elimination of poverty and hunger in the short term, and by facilitating the development of self-generating and self-sustaining growth forces in the long term.

### *Contributions of Science and Technology*

- Increasing effectiveness of foreign aid by bringing a complete range of scientific techniques to bear on the problems of specific developing areas.
- Increased understanding of the dietary needs of people in different areas of the world, linked to improved methods of producing the right kinds of food for the hungry of the world.
- Increased understanding of the problems and aspirations of other peoples of the world, through the increasing links in the scientific community such as the international agencies, societies and "International Years" for study of specific problems.

There are undoubtedly many contributions which science and technology can make to these goals which are not listed here, and there are some contributions which affect all of the goals. Among this latter group, one would include contributions to the understanding of population growth and of individual and group behaviour. Given this framework of goals and the need to apply science and technology to their realization, Canada needs an appropriate scientific infrastructure or environment. The Science Council believes that some of the basic prerequisites for success in achieving these goals are:

- an increasing awareness, on the part of the public, government and industry, of the value to society of science and technology, as important means of attacking economic and social problems;
- the effective application of existing scientific knowledge;
- a high level and standard of scientific and technological education as a precondition for upgrading the technical competence of all levels of the Canadian workforce;
- effective participation in the international scientific community, as a means of tapping a vast supply of knowledge;
- effective use of modern information technology and systems.

Having set out a list of Canadian goals and having noted a number of the prerequisites for establishing the kind of scientific environment in which Canada could hope to realize these objectives, the Science Council must add

a note of economic caution. The resources necessary to realize these goals will be substantial and there will be competition between the goals for both manpower and funds in the foreseeable future. The maintenance of a prudent balance of the resources assigned to the various goals will be important. For example, if the allocation of money outstrips the available trained manpower in a particular area, money will be wasted. The reverse is also true. In addition, if health services are developed at the expense of education, the supply of trained minds to support all of the goals would be truncated. However, education must not only be a consumer of resources but must, on the long term, be an investment in the training of the kinds of manpower which will be needed. The Science Council will be considering this problem of resource allocation on a continuing basis.

#### Section 4

### PAST TRENDS IN FUNDING R&D IN CANADA

Much work has been done by various Federal departments and agencies, including the Dominion Bureau of Statistics, the National Research Council, the Department of Industry and the Science Secretariat, in an attempt to provide a picture over time of the way in which funds for research and development are expended by the principal sectors of the Canadian economy. To provide background information for this report the Science Secretariat has produced a compilation of the principal statistics for the period beginning in the fiscal year 1957-58, and ending with the most recently published data. The important trends emerging from this compilation are depicted in Figure 1.

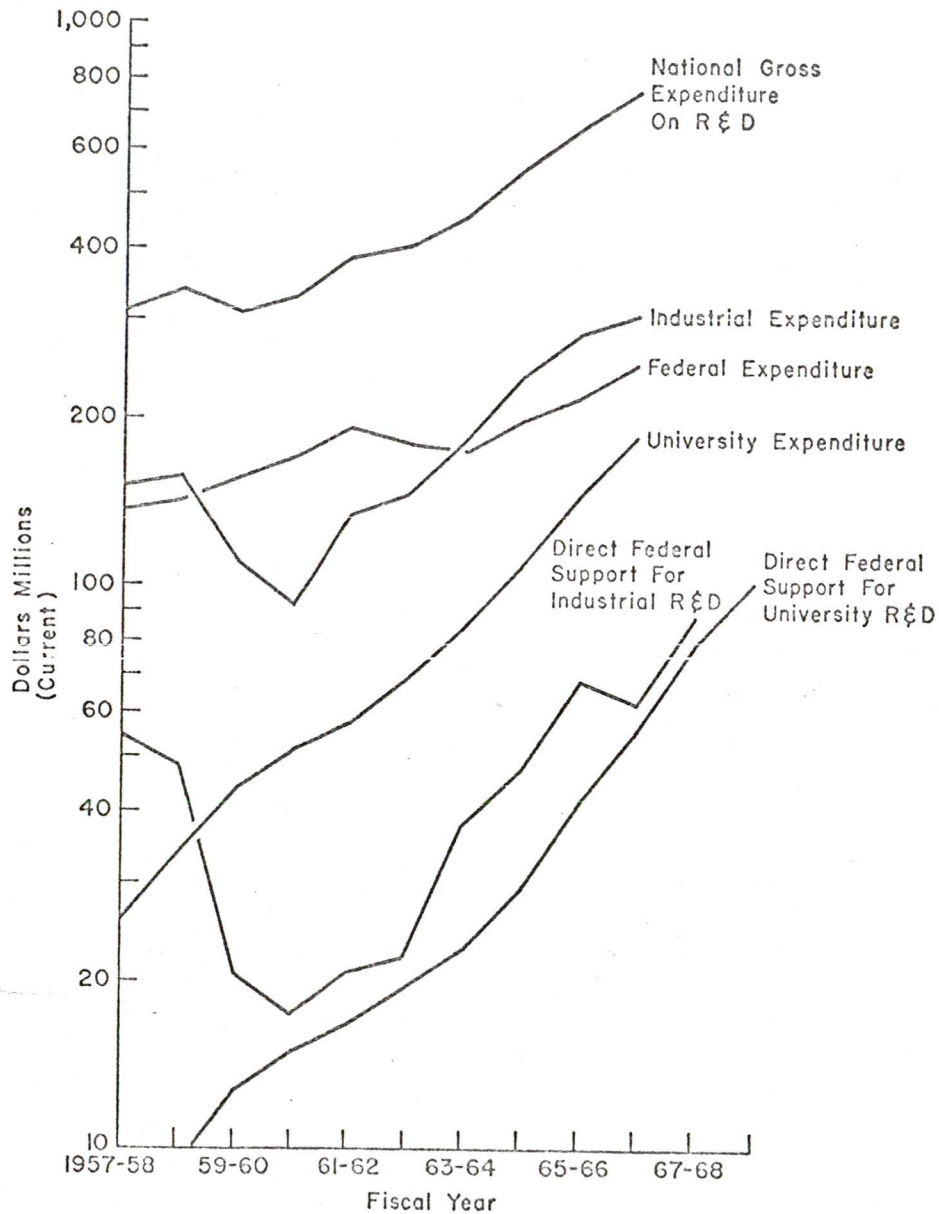
Considering first the expenditures by sector of performance of R&D, the effect on gross industrial expenditures of the cancellation of the Arrow program on February 20, 1959, is obvious. Expenditures on R&D in the "transportation" segment of Canadian industry, which contains virtually all activity associated with aircraft development, made up some 51 per cent of all industrial R&D expenditures in the fiscal year 1958-59. In 1961-62 this share had plunged to 9.9 per cent and the latest data, for 1966-67, show that it has recovered somewhat, to become 21.2 per cent of the total. In contrast, the sum of R&D expenditures by all other segments of industry showed increases, of varying proportions, in every succeeding fiscal year subsequent to 1957-58, but these were insufficient to compensate for the drastic cut-backs in R&D in the aircraft industry in the years immediately following the Arrow cancellation.

In contrast to the picture presented by the industrial expenditures, the Federal Government's expenditure on its own programs did not show an absolute decline until the days of austerity, starting in 1962. Concern has been expressed that data, presented as in Figure 1, fail to take account of some important contributions by government organizations to industrial R&D, in that some major government procurement contracts, charged as "in-house" expenditures, may well stimulate R&D within the contractor's organization. An example would be the fixed-price purchase by Atomic Energy of Canada Limited from Canadian industry of the WR-1 Reactor for the Whiteshell Nuclear Research Establishment in Manitoba which, under the present system, would be labelled an "in-house" capital expenditure. Insufficient information is at present available to permit the identification of all such expenditures which appear to fall in a category which is neither "federal in-house" nor "direct federal support" as this latter category is currently defined.

The "Direct Federal Support for Industrial R&D," consists of grants and contracts to perform specific programs of R&D, provided by the departments and agencies of the Federal Government. No estimate is made of the cost to

the Federal Government of the various tax-exemption programs of the early 1960s which were used as incentives to promote industrial R&D. Once again the cancellation of the Arrow program was the single biggest factor which influenced the total Federal support program. In the fiscal year 1966-67 a cut-back by the Department of National Defence in its R&D procurement

Figure 1  
GROSS EXPENDITURE (CURRENT PLUS CAPITAL) ON R & D  
BY SECTOR OF PERFORMANCE AND DIRECT FEDERAL  
SUPPORT FOR R & D IN INDUSTRY AND THE UNIVERSITIES<sup>6</sup>



program accounts for the drop in the total, while the upsurge in the following year is in part due to the effects of the conversion of the Industrial Research and Development Incentives Act (I.R.D.I.A.) program from being a tax exemption to a granting program.

Two factors have strongly influenced the growth of university expenditures on research. Enrolments in Canadian universities have been increasing rapidly and the proportion of undergraduates who subsequently enter graduate school has also been rising. This combination of factors has led to the rapid expansion of the research activities of the graduate schools that is reflected in the data on university research expenditures in Figure 1. The Federal Government contributes to the support of this activity in two distinct ways. The direct support, shown in Figure 1, is provided as grants or contracts by the National Research Council, the Medical Research Council and the departments of government with scientific interests. Indirect Federal support, through the fiscal transfer to the Provinces of amounts equal to Provincial expenditures on education, must already pay for a significant fraction of the costs not met by the direct support system.

Figure 1 shows how Canada's Gross Expenditures on Research and Development (GERD) have risen over the period 1957-67. Table 1 records these expenditures as a percentage of the Gross National Product (GNP).

While much attention is often paid to the division of activities among the sectors of the economy, relatively less attention is paid to the way in

Table 1.—GERD as a Percentage of GNP for Canada<sup>a</sup>, 1957-67

Item	Fiscal Year									
	1957-58	58-59	59-60	60-61	61-62	62-63	63-64	64-65	65-66	66-67
GERD as a Percentage of GNP	0.95	1.00	0.89	0.89	1.05	1.00	1.08	1.19	1.30	1.33

Table 2.—Current Expenditures on R&D, by Sector of Performance and by Type of R&D Activity (Percentage Distribution)<sup>a</sup>

Sector of Performance	Type of Activity			
	Basic Research	Applied Research	Development	Total
Government (All levels).....	7	23	6	36
Industry.....	2	12	30	44
Higher Education.....	13	5	1	19
Private Non-Profit.....	—	1	—	1
<b>Total.....</b>	<b>22</b>	<b>41</b>	<b>37</b>	<b>100</b>

which the national expenditures on R&D are divided between basic research, applied research and development. In 1965-66, Canada's *current* expenditures on R&D amounted to some \$524.4 million, or 1.01 per cent of the G.N.P. The percentage distribution of these funds, by sector of performance and by type of activity is shown in Table 2. For fiscal 1964-65, the current expenditures in the United States on basic research, applied research and development were respectively 12 per cent, 22 per cent and 66 per cent of that country's total.

While Table 2 is subject to considerable uncertainties in the allocation of expenditures to the different types of activity, it is nevertheless sufficiently accurate to support the argument that Canada has in the past tended to support research but to neglect development and innovation. It is acknowledged that development is the most expensive part of the R&D spectrum; but it is development and innovation which generate benefits. Knowing how to solve a problem is a poor substitute for solving it in practice. In the opinion of the Science Council much more of Canada's future investment in scientific activities must be channelled into development and innovation.



## Section 5

### GENERAL CONSIDERATION OF THE ORGANIZATION OF SCIENCE AND FEDERAL SUPPORT PROGRAMS

A major past failing in Canadian science has been the performance of too much basic research remote from the training of new scientists and the performance of too much applied research far from the point of innovation. This latter shortcoming has been aggravated by a recurrent tendency in Canada to terminate research programs short of the point of innovation, thereby preventing the reaping of any substantial benefits from investments in research.

It is recommended that in future every new research or development activity be critically examined at its outset to identify the appropriate organization to carry through the project to its final conclusion. For extensive programs that encompass many individual projects, the distribution of these projects among the sectors of the economy must be carefully considered. Such a procedure may well lead to the universities and industry performing a larger share of the research and development in Canada than has occurred in the past.

A major aim of the policy being proposed is not to establish more research programs, simply for the sake of doing research, but is rather to choose programs directed to the long-term needs of society and to ensure that those programs which are undertaken, whether new or existing, are carried through to the point of innovation and application in practice. It is recognized that the final stages of development and innovation may involve heavy investment in prototypes or pilot schemes, but the benefits of a program come only from the fulfilment of objectives and the application of results. To reap the benefits that have been missed in the past, Canada must first be prepared to increase its expenditure on innovation. The Science Council is convinced that emphasis on innovation will be a wise investment, and that Canada should be prepared to see the proportion of the nation's total resources allocated to scientific activities increase steadily. However, the allocation of this or that percentage of GNP to research, development and innovation will not, on its own, bring about the answer to all problems or ensure future prosperity. Money invested in research, development and innovation must be wisely spent, and new activities must be established in the appropriate sector of the scientific community. Success in realizing economic returns or social improvements by innovation based on active research and development will depend in large measure on the participation of Canada's primary, manufacturing and service industries.

Throughout this report, emphasis is given to economically-oriented science and technology, especially that related to secondary industry, but this does not mean that other areas, because less extensively discussed, are less important. Science and technology in support of Canada's resource industries, or oriented towards problems in health or welfare, or related to national and international security must be maintained and fostered. They, too, need detailed consideration within any realistic policy.

Canadian industry should give the greatest possible attention to creating for itself a position of comparative advantage over its competitors by imaginative innovation and exploitation of the results of research. By innovation, new markets, particularly export markets, may be captured, productivity can be increased and more advantage may be derived from natural resources. If industry is to do all of this on an appropriate scale, it will require the active assistance of the Federal Government, which must create and stimulate an environment in which commercial initiative can flourish.

**It is recommended that the Federal Government**

- (a) support Canadian industrial enterprise by improvement and expansion of existing R&D incentive programs, by simplifying where possible the administration of the programs, and by deliberately increasing the share of management responsibility placed on the companies involved;
- (b) further encourage industrial involvement by contracting out Federal programs where participation is likely to increase the technological or innovative capacities of the companies concerned. The underlying objectives should be to upgrade the overall capabilities of those involved, and ultimately to develop self-supporting research organizations in Canadian industry;
- (c) through its mission-oriented departments actively seek to promote industrial and university work in support of each mission as well as responding to initiatives from the private sector;
- (d) use government procurement contracts as an additional means of upgrading the technological level of Canadian industry. The provision of modest sums of money, in addition to the cost of the item procured, to be used for either the upgrading of the contractor's productive capability or the funding of continued development of the product being purchased, could be a significant assistance to industry.

There will certainly arise cases where 100 per cent funding by the Federal Government of research programs carried out by industry will be necessary, especially where Canada's competitors for world markets are so funded by their own governments. However, two cautions must be added. Firstly, the Federal Government cannot be expected to be the sole source of funding for all research and development;

if industry is to profit from this scientific activity then there is an obligation on industry to make substantial investments of its own funds in research, development and innovation. Secondly, the incentives and contract programs proposed are intended as spurs to the successful, not as crutches for the failing.

The Science Council is anxious to ensure that all important areas of scientific activity are considered for support, so that available funds are used as wisely as possible. As the mission-oriented programs, proposed later in this report, develop they will require the services of and thus provide support for many elements in the scientific community, in the universities, industry and government. However, the mission-oriented agencies will not cover the entire field of science. Complementary sources of funding will be needed to ensure that science as a whole is being developed in a balanced way and that spontaneous originality is encouraged.

The Science Council and Canada Council have together established a committee to review a report on the support of research in the universities which is in preparation. When this report has been studied, the Science Council will be in a position to make more specific recommendations on the co-ordination of mission-oriented and general support for science.

Yet another problem in the development of science in Canada is the tendency of organizations whose missions have been realized, or which have demonstrably failed to reach their objectives, to follow programs which are diffuse and self-perpetuating. There is often a marked reluctance to terminate such programs, even when they are of little priority, as long as the least justification can be found. On the larger scale there is almost inevitable reluctance to close down institutions which are no longer needed, or even to provide them with some new goal which is of real significance. This problem is by no means unique to Canada. A. M. Weinberg, the Director of the Oak Ridge National Laboratory in the United States recently summed up his opinion in the words:

“What happens to the laboratory when the job of the agency is no longer as important as it was when the laboratory was established? If the government makes a commitment of support to its laboratories as institutions and delegates to the management the responsibility of allocating resources within the institution, it is natural that as the laboratory loses its sense of mission, the management will ensure survival of the institution by drifting into basic research. I believe that this is a phenomenon which one can see in government laboratories in many parts of the world. This drift toward basic research in a mission-oriented laboratory, if allowed to proceed unchecked, could destroy the laboratory's taste and capacity for getting on with practical missions”.<sup>8</sup>

This is not attack on the value of fundamental research, which has an important and growing role to play in the universities and as a component of comprehensive mission-oriented programs, but is a criticism of applied research that is labelled as “basic” either because it was initiated with inadequate consideration of its ultimate application, or because circumstances have changed and left its application pointless without bringing an end to the program.

The Science Council has considered the particular status of research and development within government, in the light of the foregoing general criticisms, and *recommends some general principles for the future.*

- (1) All Federal Government scientific organizations should be mission-oriented and should be engaged principally in applied research and development, but any development based on government programs which is likely to give rise to marketable products should be transferred to industry at the earliest possible stage. This general principle should apply equally to departmental organizations and to non-departmental agencies. Where this is not the present case, the department or agency should be given a specific long-term mission in which its particular competence can be brought to bear on a problem of economic or social significance.
- (2) Federal scientific organizations should have a particular responsibility for fostering the growth of the scientific community within the fields encompassed by their respective missions. They should actively seek to collaborate with industrial and university groups and to an increasing extent should be the initiators and co-ordinators rather than the performers of R&D.
- (3) All of the scientific programs of government should be subject to a regular "technical audit" by an appropriate body which should include the users of the information generated by the program. These users will come from government departments, universities and industry. In dealing with departments of government the "auditors" could form an Advisory Committee to the Minister, while for the non-departmental agency they could form either a Board or Council. Irrespective of the organizational structure chosen for any particular case, all of the scientific programs of government should have the benefit of such informed scrutiny.
- (4) All scientific organizations, and particularly those with applied missions, must possess an internal flexibility which allows for the easy reallocation of resources in the face of changing program requirements. Each must be capable of maintaining a continuing review of the way in which its allocation of resources matches its goals. Full exploitation of the advantages of the program budgeting system recently introduced by the Federal Government should facilitate this continuing review of internal needs and priorities.
- (5) A good mission-oriented program will certainly contain an element of fundamental research in fields closely related to the mission, but there is no formula that can provide the precise proportions in which all mission-oriented programs should be divided between fundamental and applied studies. In many cases the allocation of a few percentage points of the total effort to fundamental science will suffice while in a few special areas, such as nuclear energy, where the frontiers of knowledge are rapidly advancing, a larger allocation can be justified.

- (6) The future of all government laboratories at present devoted principally or entirely to fundamental research must be carefully considered, since they constitute a national resource that must not be destroyed by precipitate action. It is the belief of the Science Council that fundamental science must continue to flourish at an appropriate level in Canada.

The Science Council has instructed each of its Special Committees to give particular attention to the role and organization of government scientific activities in its area of interest, in the light of these general principles.

The expectation that industry and the universities will in future perform an increasing proportion of all research and development in Canada in no way denies the need of government departments to perform research and to maintain a scientific expertise. Departments must retain the competence to guide and evaluate scientific programs being carried out by others on their behalf and to perform those tasks which are unsuited to the other sectors. However, it must be recognized that traditional government departmental structures and procedures were not designed to accommodate scientific activities, and that there are administrative complications inherent in operating a research establishment within a public service environment. Policy changes are needed to permit easy redeployment of resources, both of money and staff, in the face of changing program objectives and requirements. The difficulties which at present can be encountered in moving men and funds from old to new programs have only served to stiffen the resistance to change which has been mentioned.

In government, just as in industry and the universities, the quality of R&D programs depend on the quality of leadership and staff involved, and on the freedom for good leaders to pursue their objectives. In the past, semi-autonomous agencies within government, such as Boards or Crown Companies, have had a good record in providing the environment in which these leaders could flourish but no form of organization can be guaranteed to provide the right environment and every form tried in government has had some successes and some failures. There exists a real need for close study of the factors which tend to create the necessary environment.

The Economic Council of Canada has observed, in a comparison of the economies of Canada and the United States, that a significant relationship exists between the level of productivity and the national average level of education. It is suggested that an increasing average level of education in Canada could contribute to narrowing the "productivity gap" between Canada and the United States. Canada must make a concerted effort to encourage the training of her manpower to the highest levels.

The Federal Government already makes a significant direct contribution to university research, which is closely linked to the training of graduate and professional students, and the trends in this funding over the past decade are shown in Figure 1. This particular Federal support program is highly impor-

tant to the development of science and technology in Canada. At present the Science Council and the Canada Council are jointly sponsoring a study of the mechanisms of support of research in Canadian universities. This study is nearing completion and detailed recommendations will be published in the near future.

While the supply of university-trained manpower is important, it does not represent the sole need of science and technology. The Science Council is happy to note the rapid growth of post-secondary Institutes of Technology and vocational centres across Canada, for these bodies have valuable contributions to make to the development of the technological infrastructure which the nation needs.

As research in the universities expands, two factors must be considered. First, the universities must be selective in their efforts to expand their research programs. It would be disastrous if every campus were to attempt to plunge into every new area of research which opens up. The joint consultations held by the universities, both of Ontario and of the Atlantic Provinces, respecting the future development of research on their campuses are a welcome indication that this problem has already been recognized. Second, basic research is not the only form of scientific activity suited to the universities and to the training of new scientists. The increasing emphasis on application in research and development programs outside the universities would argue for a greater emphasis on applied research in graduate schools, and in particular in the professional faculties.

## Section 6

### THE CONCEPT OF MAJOR PROGRAMS

The greatest concern of the Science Council is to see that the growth of science and technology in Canada is channelled in appropriate degree towards specific broad objectives as they are defined.

To permit this channelling it is proposed that most new undertakings in Canadian science be organized as large, multidisciplinary, mission-oriented projects having as a goal the solution of some important economic or social problem and in which all sectors of the scientific community must participate on an equal footing. This report refers to these initiatives as major programs.

Research and development will naturally play leading roles in these major programs, but it always must be remembered that the objectives will be the implementation of solutions to problems or the fulfilling of needs and that the programs will be concerned with the production of new goods and the initiation of new services.

Major programs are not new to Canada and some successful examples, such as the atomic energy program, have contributed notable achievements in their field. What is new in this policy is that these programs are envisaged as the principal instrument for the growth and development of Canadian science and technology.

A most important, but by no means sole, reason for the major program approach to organization is that it seeks to provide a national focus for efforts aimed at solving national problems. Ideally each program will give cohesion to the efforts of all levels of government, of industry and of the universities as they work towards a common goal.

Many other arguments can be advanced in favour of the major program approach. First, a concerted, co-ordinated and co-operative program is the most efficient way to make progress toward the solution of large-scale practical problems where many technical disciplines are involved. Traditionally, research and development for the needs of national defence has been carried out on a national scale, and no one would suggest that it would be effectively accomplished by leaving it to small-scale efforts by local units. The example makes it plain that the massive, centrally guided and funded approach may be called for, either because of shared interest, an overriding social goal, or because an effective solution to the problem requires a scale of funding beyond the resources of small jurisdictions. Today it should be a measure of a nation's maturity that it can apply its problem-solving resources on the national scale to progress on matters affecting the public interest other than the defence of sovereignty by military means.

A major program approach is also called for by the increasing degree of organization that technological advance brings to society. In the past, problem-solving could be piecemeal, the goals of society were those of the individual, and the more government stayed aloof the better. Nowadays, with the gathering of people into urban concentrations, with the high degree of interdependence created by technology and with increasing demands for efficiency in transportation, communications, energy supply, manufacturing, distribution of food and goods, waste disposal, etc., society has closed in upon itself. One man's effluent is another man's intake. It has become clear that there is a public interest which is not always coincident with or optimized by the pursuit of private interests. The problems which stand in the way of realizing the optimum conditions for life in contemporary society, as a society, will not necessarily be solved in an optimum way, or may not even be soluble at all by private or piecemeal approaches. A total "systems approach" may be essential.

Frequent references are made in many sections of this report to the need for "a systems approach". The Science Council considers such an approach to involve the systematic and rational analysis and design of an object or policy, in which every possible effort is made to ensure consideration of all reasonable alternatives and in which attempts are made to provide objective quantitative measures of the consequences of alternate courses of action as a basis for decision. It is in effect an optimization technique.

Major national programs of scientific research and technological development could provide a powerful stimulus to industrial innovation, not only of new products and processes, but also of new types of industry and new forms of industrial organization. This has been amply demonstrated both by defence and space programs in the United States, and by past Canadian programs of geological survey, railroad building, agricultural research, and atomic energy. Public funding of research with an industrial payoff, particularly when the payoffs are long-term or diffuse, has its justification in the uncertainties of research, the spreading of risk, and the capture of many and various benefits. The probabilities of capturing and keeping to oneself the benefits of one's own research improve with the size and diversity of one's organization. Thus the largest science-based industrial corporations support research laboratories of their own. The argument extends to society as a whole. The benefits of research often accrue to industry in total, and thus to the health of the economy, even when the results do not find their best or eventual use in the company in which the research was done.

For Canada major national programs are particularly desirable in relation to industry because they will result in the shaping and stimulation of new industrial growth in directions determined by national needs and related to Canadian goals. This problem is of special importance to Canada because of the extensive foreign ownership of our manufacturing industry. Some of the foreign-owned subsidiaries are leaders in doing R&D and applying new technology but many merely operate branch plants, manufacturing familiar



products for the Canadian market. Obviously in many cases industries of this kind are very useful but it is hoped that well-conceived long-range major programs will add to Canada's existing industrial base new industries which will have evolved through the finding of unique new solutions to unique Canadian problems. Past experience indicates that novel products of this kind are quite likely to find markets in less-developed countries where similar problems are encountered but where the resources for finding solutions are not as good as they are in Canada.

The problem of establishing priorities for new major programs is complex: the priorities must take account of many and sometimes conflicting factors. The goal of a major program must be of social or economic significance; it must aim to advance significantly the current state of knowledge, but in so doing the choice of objective must be influenced by the opportunities afforded by present knowledge; it must aim to exploit efficiently the available resources of manpower and money, but again the availability or shortage of manpower with particular specialized training will affect the timeliness of the program. Despite these complexities, *a number of criteria can be established which must be met.*

- (1) The objective selected for each major program must be of real importance to Canada, and perhaps even peculiar to Canada. Each should be such that the solutions would cope with problems posed by Canadian conditions—of climate, of organizational structure, or of availability of resources—and some of them should offer prospects of being more generally applicable in other areas of the world.
- (2) No major program should duplicate work already under way in other developed nations. Rediscovering technology is expensive and pointless. If a problem for example is of great importance to another nation which has already set out to find a solution, Canada should attempt to learn from the other efforts by importing the technology being developed rather than squander much-needed resources by repeating work already done elsewhere.
- (3) There must be some demonstrable prospect of direct social or economic benefit which in an overall view would be commensurate with the resources invested. The concept of social needs can be extended to encompass Canada's obligation to contribute usefully to the progress of the world's developing nations.
- (4) The scientific and technological challenges must be fundamental and far-reaching enough, that they will not be quickly exhausted, and yet in general not so far-out that there is little hope of tangible progress with time spans of ten or twenty years. The challenge must stimulate genuine innovation, and it must be sustained consistently over a long enough period that manpower training sources respond and adapt, and new industries both come into being and get established on a viable footing.

- (5) The unpredictable quality of research and the openendedness of the future must be clearly recognized. The programs should be regarded as campaigns to open up new opportunities. They should therefore challenge technologies over a broad, varied and open frontier rather than proceeding down a narrow and confining lane. Skills, capabilities, and organizations will thus be brought into existence in readiness to exploit breakthroughs and inventions, made in Canada or elsewhere, in the most opportune ways. Particular projects within the broad program areas should be chosen more as stepping stones to future positions of advantage or readiness, than as fixed goals not subject to revision.
- (6) Not only does a program need to be sufficiently sustained in time, if it is to be effective in building new industry and in supporting new ideas through the complete cycle to practical innovation, but it must be mounted on a sufficiently large financial scale that the various R&D groups formed to attack the special problems will be of above-critical or viable size, and will have reasonable prospects of a steady diet of challenging projects within their range of competence.
- (7) The choice of a program should be based on a conjunction of need, and of scientific or technological opportunity. Thus a major program to develop atomic energy for power generation would have been premature in 1920, when there was no felt shortage of power from hydro plants or coal, and before the necessary basic discoveries in nuclear physics had been made. Further, the potential innovative fertility of the program area must be considered, since the benefits from the unexpected and unpredicted discoveries and opportunities may well exceed the benefits from those outcomes that could be predicted at the start.

The major programs will flourish or perish depending on the level of co-operation which is achieved in running them. All elements in the scientific community—in government, industry and the universities—must be integrated in each program, efforts in different laboratories must be co-ordinated and a truly multidisciplinary approach must be taken, for only when all these elements are present will there be real progress towards the program objectives.

For each major program which receives substantial levels of Federal funding it will be necessary to designate or create a body which will be made responsible for co-ordinating the program, for actively promoting the involvement of all of the scientific community in all phases of the program, from initial planning through to execution and for administering the Federal support for the university and industrial components of the program.

When the objective of a given major program is clearly the responsibility of a single department of the Federal Government, the

appropriate body could be a widely representative Advisory Committee, established to advise the Minister involved. In cases in which the objective is of equal interest to a number of departments, a central agency should be established to perform this co-ordinating role.

These recommendations are developed more fully in Section 7.

## Section 7

### SPECIFIC AREAS FOR ACTION

Many of the programs required for Canada's scientific and technological development are already under way in one form or another, although not always on the necessary scale, with the most effective organization or in the best environment. A rational and systematic consideration of priorities will have the effect of strengthening the important programs of existing organizations, as well as co-ordinating or integrating their activities where necessary. Much of the work being done in these "de facto" major programs is of high quality and can serve as a nucleus for increased and better co-ordinated efforts in the future.

Canada's nuclear power program is one existing major program which has been particularly successful and which has secured for Canada a prominent position in the world market in this highly-competitive field. It is vital that this program receive continuing generous support. The future for Canada in nuclear power looks bright provided that this support is given and that basic research, applied research, development and innovation in this field continue to be closely coupled.

The arrangements being proposed are so large in scale and so new in type for Canada that they should be approached experimentally and pragmatically, though energetically. It is recommended that three categories of fields of interest be distinguished. These three categories represent a time priority (although there is no priority established within each category), partly determined by circumstance, and partly by present importance. The first category contains two fields in which specific plans for major programs are now in existence and which will provide very useful proving grounds for the concepts to be applied in later programs. The second category consists of four fields of indisputable primary importance to Canada, in which it is very likely that the need for a major program will be identified, and in which detailed study should begin immediately so that concrete proposals for specific action can be advanced at an early date. The third group consists of a larger number of areas of importance, each very little different in level of significance from those in the second group, but with their immediate appropriateness and limits less clearly determined. These last areas can be regarded as forming a list within which the necessity of starting additional major programs may be identified within a short span of years as planning and implementation of the first two groups of major programs proceed. The list of the third group of program-areas should not be considered as exclusive. Further, the limits of any program defined within the second or third group of areas should not necessarily be bound by the discussion in the present report.

Here, it must be pointed out that individual major programs, like any program, must not last indefinitely. As time passes there will be a continuing shifting of priorities and programs started soon will eventually fulfill their objectives and come to a natural end or will lose their priority and be terminated.

#### A.—Prototype Major Programs

The Science Council recommends that two prototype programs be set in motion immediately, to test the systems of organization and co-ordination which have been proposed. The two programs should cover:

- (1) Canada's Interests in Space, and
- (2) Water Resources Management and Development.

#### *A Space Program for Canada*

The scientific and technological aspects of space have drawn increasing attention in Canada over the last few years. The extent of the present effort was examined in a report issued under the title of "Science Secretariat Special Study No. 1, *Upper Atmosphere and Space Programs in Canada*" (February, 1967). In turn the Science Council Report No. 1, *A Space Program for Canada* (July, 1967), called for:

"the establishment of a broadly conceived central agency responsible to the Government of Canada for the advancement of Canadian capability in the science and technology of the upper atmosphere and space; for furthering the development of Canadian industry in relation to the use of the upper atmosphere and space; and for the planning and implementation of an overall space program for Canada".

In March 1968, the Minister of Industry issued a "White Paper on a Domestic Satellite Communications System for Canada", and the Federal Government has since proposed the formation of a Department of Communications which would, among other tasks, assume responsibility for co-ordinating the design and construction of a satellite communications system.

The Science Council feels that these new developments have not reduced the need for the establishment of a Space Agency to deal not only with scientific and technological matters concerned with a satellite communications system, but also with all other areas of research of concern to Canada involving the upper atmosphere and space. Two of the latter might involve weather survey satellites and resources survey satellites, which are of potentially great importance to other Federal departments, particularly the Department of Transport and Department of Energy, Mines and Resources. The work under the direction and control of the proposed Space Agency would constitute a major program. The various existing functions in government concerned with upper atmosphere and space might be gradually transferred to the Space Agency, but the policy direction and control for all aspects of the major program, wherever located, should come from the agency from the outset.

### *Water Resources Management and Development*

The Science Council has conducted a study of water resources research in Canada and published its findings in Science Council of Canada Report No. 3<sup>o</sup>, in which the Council recommends that water resources research be organized as a major program.

Water resources research exhibits all the desirable characteristics of a major program. It is multidisciplinary, requiring the skills of hydrologists, meteorologists, engineers, physicists, chemists, economists, social scientists and life scientists and no doubt of other disciplines as the program takes shape. It is mission-oriented, aimed at making efficient use of our water resource, at the development of methods for managing and controlling water pollution, and at the development of techniques for efficient, minimum-cost design, construction, and operation of engineering works required to implement the water resources development program. It is important from both the economic, and social point of view. The economic significance may be judged by the two billion dollar estimated yearly expenditures on construction and repair of water control, treatment and conveyance structures by the mid-1970s, while the social significance relates to the problems caused by water pollution, particularly as they affect recreational facilities dependent upon water. It finally is a field in which all sectors of the scientific community, government, universities, and the private sector, must take part.

The Science Council has suggested that the main co-ordinating and advisory function be delegated to the National Advisory Committee on Water Resources Research which has already been established to advise the Minister of Energy, Mines and Resources. This committee should be broadly representative of all sectors of the economy, Federal and provincial public services, universities and industry, and should reflect the range of disciplines contributing to water resources research. The present terms of reference of the National Advisory Committee on Water Resources Research call for it:

1. to provide continuing advice to the Minister of Energy, Mines and Resources on needs and priorities for research on water resources in Canada, including water pollution research;
2. to assist in the co-ordination of water resources research;
3. to review and make recommendations on applications for grants-in-aid of research from the Department of Energy, Mines and Resources.

The Science Council recommends that the mandate of the Committee be expanded by requiring it

4. to provide continuing advice to the Minister of Energy, Mines and Resources on the use and application of science to water resources management and development.

With this change in its terms of reference and with some increase in its responsibility for the allocation of Federal funds to industry and to the universities, as outlined in the Science Council's report, the National Advisory

Committee could become the effective co-ordinating body for the major program.

While research on the problems associated with Canada's water resources is important, the need to apply science to the management of these resources is urgent. The Federal Government, as a sponsor of the research in this area, should also be concerned with assisting the Provinces in bringing up-to-date technology and science to bear on water management. One positive move recommended by the Council is the designation of the National Advisory Committee on Water Resources Research as the scientific arm of the proposed Canada Water Advisory Board, whose creation is soon to be discussed by Parliament, one of those principal roles is envisaged as being the co-ordination of all aspects of water management in Canada.

#### **B.—Areas for Immediate Planning**

The second category of important fields referred to consists of:

Transportation

Urban Development

Computer Applications, and

Scientific and Technological Aid to developing areas of the world

At the present time, the detailed information required to make specific recommendations for action on programs in these areas has not been prepared and considered in the manner used in arriving at proposals in the case of both the space and water resources programs. In order to develop this information and to prepare detailed proposals on organizational structures and specific objectives for each of these programs, *the Science Council is now setting up a task force of appropriate experts for each of the proposed areas; once each task force has reported, the Science Council will make public the detailed recommendations developed.* At present the Council can only give a broad picture of the scope envisaged in these new ventures.

#### *Transportation*

Canada's large land mass and its peculiar population distribution make the problems of transportation in this country quite different from those experienced elsewhere. The needs and expectations of a modern society require rapid and efficient transfer of goods and people between urban centres as well as access to remote areas. For Canada, this means meeting the challenges created by a varied terrain and a wide range of climatic conditions. As the population and the prosperity of the country increase, the transfer of goods will tend to grow. Further, the population of the world's industrial nations is becoming more mobile, and this means, for Canada, that the transportation needs of its people will tend to increase more rapidly than the population. It seems apparent that this country, with its particular geographic and demographic structure, can reasonably expect to find only some of the solutions to its transportation problems abroad. The rest will have to be worked out in Canada.

Transportation research has had a chequered history in Canada. As indicated earlier, in the fiscal year 1958-59 it made up 51 per cent of all of Canada's industrial R&D expenditures, at a time when aircraft development was at its peak in Canada. Today transportation research is fragmented. While different groups are involved in the development of specific pieces of hardware, few if any are looking at Canada's total needs.

A co-ordinated major program on transportation would aim at developing a rational, national system. Setting up such a system would involve consideration of all of the necessary subsystems, of the inter-faces between subsystems (e.g. what is the best way of linking an interurban passenger airline service with an efficient urban transportation system?) and would consider specific hardware development where the demands of the Canadian situation indicate that such is needed.

The two principal features which will determine many of the constraints on a Canadian transportation system are geography and climate. Canada must consider the problems of transportation across Arctic terrain since this will be one of the important factors which determines the extent of the economic future of the North of this country. Canada's size poses other problems. The costs of transportation represent a sizable portion of the costs of manufactured goods whether distributed in Canada for domestic consumption or shipped abroad as exports. Any lowering of transportation costs would be advantageous from the view point both of the internal standard of living and of the nation's competitive position in export markets. Thus it would appear essential to Canada to improve the efficiency and convenience of transportation on a large scale basis through the implementation of a major program in this field.

The urban aspects of transportation are also important, since most Canadians are city-dwellers. The growing problems of urban transportation in the United States have contributed significantly to the decay of their city centres and, to a lesser extent, some of the same problems are already apparent in the large urban centres in Canada. These problems, if not properly attended to, could become equally critical.

In Canada, as in many industrial nations, many of the transportation utility companies are publicly-owned and operate as monopolies. This situation, although often necessary, tends to create inefficiencies and conservative attitudes towards innovation. In view of this, it might be necessary and reasonable for the Federal Government, in conjunction with the provincial and municipal governments, to play a strong entrepreneurial role in this field through a major program in transportation, in order to encourage increased efficiency and innovative approaches to problem-solving. This does not mean that the Federal Government will directly carry out a major portion of the entire program or of the R&D part of the program. Some of the R&D side of the program should be carried out in government organizations, largely to provide the government with the expertise necessary to evaluate the progress of the entire program, but the central role of the Federal Government should



be as a director, co-ordinator and provider of funds for much of the major program. The universities must perform some of the research, to provide a mechanism for producing an adequate number of scientists and engineers with a strong interest in transportation problems. However, the largest proportion of the R&D part of a major program in transportation should be located in industry where it would be closest to the most direct and efficient mechanism of innovation. The producers of transportation hardware and the operators of transportation systems must be deeply committed to the realization of the aims of this major program.

#### *Urban Planning and Human Environment*

Two important, problem-creating trends in Canada are the growth of population and the increasing urbanization of that population. Canada's population at the 1941 census was little more than 11.5 millions; in the census of 1961 it had grown to 18.2 millions<sup>10</sup> and it has been estimated<sup>11</sup> that the population will reach 21.5 millions by 1970. In 1961 some 70 per cent of all Canadians lived in urban areas with populations of more than 1,000, while about 25 per cent lived in three major metropolitan areas—Montreal, Toronto and Vancouver. While this in itself has given rise to many problems, the future holds prospects of much greater ones. In its *Fourth Annual Review*<sup>12</sup> the Economic Council clearly demonstrated what the future holds for Canada's cities:

"The projected increase of some 5.8 million people in total urban population by 1980—and more particularly the 60 per cent rise anticipated for the largest centres—provides a broad measure of the urban growth problem ahead. Clearly, however, it is a minimum measure only. Even if these major cities were already functioning models of urban efficiency and attractiveness, growth of this magnitude would itself involve substantial new investment and threaten severe strain and potential social cost. In reality, of course, there has long been widespread concern about the mounting deficiencies of our cities and the heavy backlogs of essential improvements. Shortages and inadequacy of urban housing, traffic and transport problems, air and water pollution, the confused jumble of conflicting land uses, decaying neighbourhoods and monotonous suburbs, urban poverty and social disturbance, steadily rising property tax burdens, and the frustrations of municipal administration—these are familiar problems to the average Canadian city dweller today. Yet it is against this background that our larger cities must face up to the continuous pressures of accommodating and fulfilling the wide-ranging needs of a further period of rapid expansion".

What are the demands which this growth will place upon Canada's economy? In 1965 Canada devoted 19 per cent of her GNP, some 9.9 billion dollars, to building and engineering construction, of which nearly 2.8 billion dollars went on the construction and repair of residential housing<sup>13</sup>. The proportion of GNP so spent has remained fairly constant in the decade up to 1965; if it remains at this level in the decade 1968-1979 and if the Economic Council's projections of GNP hold good, then Canada will spend about 184 billion dollars on new building and engineering construction over that period. This then is some measure, however inadequate, of the magnitude of one of the tasks ahead, though it still gives no indication of the costs of resolving the existing social problems of the cities.

An important cause of the social and physical decay in urban areas is the great congestion in city centres, which has induced the middle and high income groups to move out to suburban areas, thus further aggravating the decay through the loss of tax dollars and leaving the poor trapped in slums. This congestion has emphasized other problems which reflect on the quality of life within urban society—those of air pollution, noise, waste disposal, urban transportation and traffic control, crime, the shortage of educational and recreational facilities and so on. The fragmented efforts of the past to alleviate our basic environmental problems have not been successful, simply because the complex nature of the total human ecology requires a co-ordinated approach to the solution of its problems. Congestion is far from the only cause of our environmental problems—and decongestion alone will not solve the basic problems (and it may create new ones).

**It is recommended that a systems approach to community planning and human environment, applying the techniques of science, technology and the social sciences to the total ecology, be undertaken as soon as possible. This might best be done through a major program in this area.**

To any observer the problems of the cities in the United States are far more serious at present than the problems of the cities in Canada. With this in mind one can reasonably ask why does Canada not wait to see what solutions to various urban problems are adopted in the United States and follow this lead—why should a major program in community planning and human environment receive high priority in Canada? The answer to this, in part, lies in the lesser state of decay of the Canadian cities on one hand, and in the more rapid growth of the Canadian population on the other. The problems besetting the cities in the United States are so urgent and so immediate that the United States has little choice but to tackle the problems at the pressure points—to attempt to stop the urban decay and social unrest through urban renewal and social programs, through tearing down and rebuilding. This approach is not only very expensive, it is extremely difficult because it will tend to get entangled by the existing bureaucratic procedures and jurisdictions that are found in most urban centres. Canada, on the other hand, can afford to work initially to a larger extent with the margin of growth, since the nation's cities are in a lesser state of decay physically and socially, thereby avoiding some of the many complications and lowering the initial costs of such a program.

Canada must start now on a concerted effort to build a new future for Canadians and the attack on the problems must be bold. Many possible and intriguing solutions are already talked about. Should Canada build new cities instead of creating a vast megalopolis around each of the already sprawling major cities? Can the population of the North be expanded on an economic basis or are most Canadians to be forever found in a narrow belt close to our southern border? And finally, what more can be done to cope with Canada's winter?

Many diverse efforts are presently being made in the urban centres in Canada in order to improve them as places for people to live and work, and it is acknowledged that the practical solution of today's problems should serve as guide posts to the future. However, these efforts are often diffuse and unco-ordinated and often insufficiently imaginative. A major program in community planning and human environment would have the advantage of co-ordinating and augmenting these efforts effectively to the benefit of the cities and of all levels of government in Canada.

Obviously such a complex major program could only be carried out successfully through the mutual co-operation and involvement of industry, the universities, and Federal, provincial and municipal governments. However, it seems apparent that the various levels of government, and the Federal Government in particular, must take a leading role in directing and financing the program in order to provide both impetus and appropriate management. The Science Council is encouraged by the decision of the Federal Government to take the initiative in this vital area, by setting up a task force under the Minister of Transport to advise on early legislation. The Council has offered its assistance in mobilising the scientific community to participate in the attack on Canada's pressing urban problems.

#### *Computer Applications*

In his widely-publicised book, *Le défi américain*, Servan-Schreiber summed up the position of the computer in today's industrial age by saying "dans la guerre industrielle, la bataille centrale est celle des calculateurs électroniques, dits ordinateurs".<sup>14</sup>

The electronic computer may well be the basis in the 1970s of the world's third largest industry, after petroleum and automobiles, and just as these existing industrial complexes have wrought innumerable changes in contemporary society, so the computer industry will play a major role in shaping the society of tomorrow. The computer is already bringing about a revolution in industrial processes and management. Its influence is being felt in education. It offers a potential solution to some of the problems arising out of the increasing flood of information, particularly scientific and technical, and its use in the storage, manipulation, and retrieval of data promises better opportunity for mastering the complex problems of our society in the future.

The present state of Canada's indigenous computer industry stands as a monument to the nation's lack of entrepreneurial initiative and to the past failure to turn successful research into successful innovation. Canada has repeatedly demonstrated great competence in the design of digital computers but for every successful development there has been a corresponding failure to capitalize on the opportunity provided. Even today, large Canadian corporations still show no faith in Canada's ability to design computer systems.

A Canadian program on computer applications should not now set out to challenge the position of the huge international corporations which design

and manufacture successive generations of general purpose digital computers. While the program might well lead to the development of some peripheral hardware needed for a particular application, or even to the development of specialised computers, the primary aim should be the promotion of the intelligent use and application of computers throughout Canada's economic framework.

There are many ideas already being put forward, and one question which must receive early study is that of the feasibility and desirability of establishing nation-wide computer communication utilities. It has been suggested that such a utility would provide the foundation for an information transfer system, that it would permit the extensive introduction of computers into education and that it would make available powerful computer systems to individual users in scattered areas, providing them with facilities whose cost they alone could not justify. This far-reaching question must be examined carefully and critically.

The combination of computers and the techniques of systems science can be applied to many previously intractable problems. The provision of health care and of education have been two segments of the service industry where past pressure has always been directed towards upgrading the quality of the service being provided. The absence of the pressures of a competitive market has meant that there has been little attention paid to the efficiency with which these vital services have been provided. The spiralling costs of hospital care and the swelling numbers of students in our educational system both demand that serious effort be made to improve the productivity of these services.

The attempts to improve the quality of these services will naturally continue and the application of computers to medical diagnostics and to the provision of educational aids both seem to be potentially rewarding.

It has earlier been emphasized that a basic requirement of modern society is a highly developed information system, and this is one sphere where computers have already made spectacular contributions. The masses of data and information which now are generated and which must be retrieved demand that the speed and reliability of the electronic computer be harnessed as a vital part of modern information services.

Because of the pervasive and national importance of computers a major program is required to give focus and body to the many interests in industry, universities and government. The action must be commensurate with the economic and social implications of the topic. Such a program should be designed to encourage individual research, innovative and entrepreneurial initiative, and to provide a system within which policy, co-operation and co-ordination may develop.

One must ask why the Federal Government should become involved in a major program in this field. Two reasons are particularly important. First, the scope of such a program should be vast. The use of computers, as an aid to increasing productivity, should permeate all of Canadian industry. It is in

the national interest to encourage the rapid application of computerized techniques in industry, but such a large undertaking should not proceed in a random fashion. There must be concerted leadership, and the Federal Government should seek to provide it. Second, the Federal Government itself invests large sums annually in the purchase, rental and maintenance of computers, either for its own use or for use by the universities, and it must be concerned that this investment be wisely used.

#### *Scientific and Technological Aid to Developing Areas*

Widespread poverty and hunger, the lot of the underprivileged millions throughout the world, demand that the developed nations of the world make a concerted effort to better the conditions of life for all mankind. Failure to respond could condemn the world to complete ruin and universal misery.

The scientific community in all nations must meet the challenge posed by the plight of the starving poor. Full use of the enormous growth potential of the tropics, watering of arid lands, and on a less dramatic scale the development of economically marginal or depressed areas in general, could aid immeasurably in alleviating problems of overpopulation, of poverty, famine and dwindling world resources, and of national and regional disparities in economic advantages. The problems are closely akin to those of colonizing uninhabited regions, though they are less extreme. In each case the objective is to develop a prosperous community in the absence of or inadequate local supply of one or several of the necessities of economically developed life. The problem is in part social, but it depends in large part on providing locally an adequate source of the missing factors or of developing economical transportation links with complementary regions. Science and technology may contribute also to the intelligent choice and effective development of specializations that will stimulate such regional economies. Some such areas exist in Canada. There are many more in the developing countries, where the solution of population problems, the development of productive economies and the reduction of tensions would be highly beneficial to Canada.

Foreign aid will always be primarily motivated by the simple charitable urge to lessen the suffering of the less privileged, but the modern view recognizes that too simple an approach can be misguided; true charity in the long run consists not in leading the poor to depend on free bread, but in teaching them how to make bread for themselves. Dealing with the short-run emergency must be backed up by a long-range program designed to solve the root problem.

In the field of foreign aid, Canada has particular reasons for enlarging its activities and for bringing research and development to bear to improve their efficacy.

Canada has made a pledge to match the performance of other advanced nations in contributing one per cent of national income to foreign aid. The total net flow of official and private financial resources from Canada to the

less developed countries has risen from 0.38 per cent of national income in 1962 to 0.66 per cent in 1966. Assuming that Canada reaches and maintains its annual target through the 1970s, the annual financial flow to foreign aid may exceed \$900 million by 1978. Such a magnitude of financial allocation justifies a significant expenditure for research and development related to the problem which the foreign aid is trying to solve.

Canada has much to offer to the less developed countries, since in comparison its own scientific, technological, and industrial establishment is well developed while, at the same time, it has its own problems of regional development. As those problems are overcome, valuable experience will be gained for application elsewhere.

Canada, through its foreign policy, is finding its own role to play in world affairs. As an intermediate power without imperial design, Canada can often play a more effective role in assisting the less developed countries than can the larger powers, whose motives are suspect or whose freedom to act is compromised by their involvement in complicated manoeuvres for political power.

To contribute usefully to the solution of the problems of the developing nations, it appears to the Science Council that Canada should decide that it can do most by bringing a wide range of aid to a small number of areas, rather than making token efforts all over the globe.

A major program in this field would have as its aim the development of a specific area of the world. Given the size of the resources Canada has for this program, the area selected will necessarily be small. However, having chosen an area, Canada should offer to share all her scientific and technological expertise. The program should set about improving education to create the infrastructure for a developed economy. It should set about establishing efficient industry to capitalize on whatever resources offer most advantage to the nation being helped, and to employ those being educated—an education alone does not fill empty stomachs. It must emphasize developments in agriculture to make the recipient nation as self-sufficient for food as possible and, finally, Canada must be willing to serve as a good market for the produce of the area supported.

The Science Council is convinced that Canada's scientific community is anxious to become deeply involved in the nation's foreign aid program and that a major program of assistance to a specific area is the way to make best use of the aid available.

Discussions are currently in progress within the Government, concerned with the proposal to set up a Canadian Center for International Development, to support and carry out research and development for just the purposes set out above. The Science Council is encouraged by the proposal and awaits with interest the details of the policies and programs, and form of organization proposed for the Center. Pending the results of this work in progress, the Science Council will be happy to offer its advice and services wherever they may be useful.

### C.—Areas for Continuing Consideration

Setting up the two prototype major programs and identifying programs in the four areas in which immediate action is recommended will constitute the beginning of a continuing program of investigating problems, highlighting objectives and initiating new action.

Once the first programs are successfully launched the Science Council proposes to give serious consideration to the need for action in a number of areas, including the following.

#### *Health Care Delivery Systems*

The entire health care system, involving general practitioners, nurses, specialists, clinics, hospitals, sanatoria, has evolved over the years in essentially a random way. One result of this is the rapidly increasing cost per day of keeping a patient in hospital. The application of the techniques of systems science and of computer technology hold out the promise of increasing the efficiency of the whole service and this could at least prevent costs from rising any further. The total expenditures on health care in Canada (about \$4 billion annually) are so large that any increase in the "productivity" of the service could yield large dollar savings.

#### *Economic Development of Canada's North*

Most Canadians live in a narrow strip of territory close to the United States border, leaving the vast expanse of land to the North sparsely populated. If this vast area is to be developed and its resources fully tapped, much more has to be done. Science has much to offer in the quest to make sure that the full economic potential of Canada's North is realized and that the cultural life of the population of this area is enriched.

#### *The Development of Energy Sources*

Low cost energy is a fundamental requirement of this industrial age. To obtain it, Canada has made substantial investments in the exploitation of hydro-electric power and has become one of the world's leaders in the development of nuclear power. A major program would seek to build on the successes of the past and to exploit the systems which have already been developed, while at the same time branching out into new fields to keep Canada abreast of emerging technologies such as those associated with power reactor development.

#### *Integrated Resource Management*

Canada's development has been tied to the exploitation of its resources, and the R&D programs with the longest histories here have been associated with agriculture and mining. The time has now arrived when a piecemeal approach to the development of the nation's resources is no longer adequate and when science should be applied to the problems of resource management.

### *Oceanography, and Marine and Undersea Technology*

Canada has thousands of miles of coastline, touching on three oceans, and the resources which could be tapped on the continental shelf may be vast. However, science and technology have many problems to solve before this potential wealth can be exploited.

### *Weather Prediction, Modification and Control*

To the wheat farmer on the Prairies who sees his crop ravaged by hail and to the municipal treasurer who sees Canada's cities spend about a quarter of a billion dollars annually on snow removal, the attractions of weather control are great. There are however major scientific problems to be solved in the development of the necessary skills. There is ample scope and need for a major program first to improve our understanding of the mechanisms which determine our weather and then to improve our ability to predict, modify and control it. The objective should be to maximize the advantages which Canada's climate offers and to minimize its deleterious effects.

Two important topics, one of great public concern and the other of much current scientific interest, do not appear as items in their own right in three categories presented. These are Pollution and Materials Science. Research seeking the causes of and cures for the pollution of Canada's waters is already an important part of the proposed program on Water Resources Management and Development, while the proposed program on Urban Development will naturally be the place where work on air pollution and noise abatement receive most attention. As for Materials Science, the Science Council believes that this will be the subject of intense activity in many of the major programs and that it must be closely linked with the mission of each program. The needs of each major program will define the important questions in materials science which must be resolved.

In all attempts to organize major programs, efforts must be made to co-ordinate and build upon existing successful programs. Canada's atomic energy activities would be a leading component of a program on Energy Sources, while existing programs in Agriculture, Fisheries and Forestry will necessarily be major segments in a program of Renewable Resource Management. The Science Council is planning to consider Canada's current Medical Research program, to see the extent to which it requires support to develop as a successful and expanding major program.



## Section 8

### MANPOWER

A perennial cause of concern in Canadian science has been the "shortage of qualified manpower". However, this concern in general has not distinguished between a "shortage in the manpower which would permit every organization to embark on all of the programs of interest to it" and the much more serious problem of a "shortage in the manpower required to tackle all of the problems which Canada must solve".

The Science Secretariat has conducted a study<sup>15</sup> of the expected supply of scientists and engineers in Canada up to 1978. The starting point was the data available up to 1963 and an estimate was then made of the net annual input from university graduations, from the upgrading of people already in the workforce and from immigration, less an attrition rate due to deaths, retirements, and job changes. An attempt was made to take into account, as far as possible, shifts which might occur in demand, in student motivations and in immigration patterns. The results of the study—given all the many necessary qualifications—indicate that the total number of qualified scientists and engineers in Canada's work force will rise from a level of slightly over 104,000 in 1965 to a little more than 304,000 in 1978. In gross numbers this supply seems entirely adequate to meet the needs of the major programs which are recommended.

However, one important limitation on the usefulness of this projection does exist in that the study gives no information on the supply within specific disciplines and cases are already known where supply and demand are seriously mismatched. If shortages exist in some disciplines, then in a situation where total numbers appear adequate, there must be oversupplies in others. The study was concerned only with university trained manpower, but it is to be feared that similar problems may well exist or be forming in the new and expanding Institutes of Technology.

The Science Council is now consulting the appropriate authorities to organize detailed studies by discipline of the manpower now in training and to have realistic forecasts made of the expected supplies of the various specialists. The results of such efforts should provide the basis for any corrective measures—preferably in the form of incentives—which may have to be applied as a step towards ensuring that Canada will have the appropriate talents available to carry out the essential programs. The traditional effects of the market place are diminishing and the long lags in the education system hinder the supply from keeping pace with rapidly changing demands; other means must be employed to balance supply and demand. It is important that the universities, colleges, technical institutes and the student bodies become aware of and understand the problems to be faced.

While supply by discipline is important, it is not the only concern. Special attention must be given to creating the scientifically stimulating environment which will attract and retain the relatively small percentage of top-level people—the scientists and engineers, the managers and entrepreneurs, who can lead, perform and link up Canada's efforts in research, development and innovation—for they make up the nucleus around which a sophisticated and dynamic scientific or technological enterprise can develop.

## Section 9

### EXPENDITURES

In the preceding sections of this report it has been proposed that Canada embark on a number of major programs and it has been asserted that the manpower appears to be available to staff them. This leaves one last and important question—that of the cost of these programs.

The only real way of obtaining an estimate of the annual costs of these programs would be to take each individually and, by laying out detailed plans and estimates for each project within the program, compute an aggregate annual cost. The major programs being recommended are in general in too early a stage of organization to permit this to be done, hence some other way of coping with this vital question must be found.

The Science Council first sought an indication of an appropriate level of investment in R&D for Canada by searching for some quantitative economic theory which would relate the level of investment in R&D to some corresponding rate of economic growth. The Council has found no such theory. The effects of science, both positive and negative, are extremely difficult to quantify and often do not come in an orderly progression starting from any given program of R&D. As indicated earlier, the Council is continuing its studies of this important question.

A second attempt to find some guidelines was made by comparing Canada's record of performance of R&D with those of other nations, particularly those within the OECD. However the Council could find no good reason to believe that the past record of any other country, given that country's goals, aspirations, problems and conditions, should be of particular value as an indicator of what Canada should do in the future.

The Council has had two exercises carried out to see what the results of particular policy decisions, if made now, would be within the next decade. The first of these<sup>16</sup>, carried out as part of the evaluation of the then proposed Intense Neutron Generator project, postulated a series of large programs, many of which appear in the Council's present recommendations for major programs, and sought to evaluate the proportion of the nation's resources which would be required to permit each of them to receive substantial levels of funding. The second exercise, whose results are reported<sup>17</sup> in a companion volume to this present report, sought to relate the growth of expenditures on R&D in Canada over the next decade to the growth of the manpower involved in R&D, and was based on the manpower projections discussed earlier.<sup>15</sup>

The limitations on the value of the results of these two exercises must be clearly understood. They provide complementary views of what might

happen in future provided that certain policy decisions are followed and provided that the assumptions used in each case turn out to be valid. While they provide interesting pictures of a "surprise-free" future they do not give prescriptions for desirable, adequate or necessary levels of future expenditure, nor can they be used as justifications for any particular level of expenditure.

At this point it should be plainly stated that the Science Council does not believe that there exists any particular proportion of the Gross National Product which, a priori, should always be allocated to R&D. Canada should not fall into the trap of allocating this or that percentage of GNP to R&D and then dividing up this "budget for R&D" between the contenders for funds. The funds which are allocated to scientific activities annually should be granted, program by program, in face of competition from other potential uses of these funds, with each program justifying its expenditures on economic, social or cultural grounds. The "R&D budget" would then become the sum of the allocations of funds to individual programs and activities.

Given this reservation on the budget for R&D, the Science Council does firmly believe that annual expenditures should and will rise rapidly in future and that the popularly discussed target level of around 2 per cent of GNP will prove to be over cautious and will be surpassed. The justification for these foreseen increases in expenditure will come in large measure from the major programs which are undertaken. These programs will be justified on economic and social grounds and their costs will not be thought of as expenditures on R&D but as economic investments or as social expenditures.

The Science Council has argued in this report that much more effort in future must be devoted to development and innovation than has been the case in the past. Whether the end-product is a product or service, the costs of prototypes, pilot-plants, the installation of new productive capacity, or the testing and introduction of new services—the costs of all these will mean that total expenditures on the major programs will be high. It is therefore to be expected that expenditures on these activities will constitute a growing share of the Gross National Product.

While much of the increase in future expenditures will be due to the costs of innovation there is another observable factor which causes escalation of R&D costs. The rising costs of scientific programs, due to the increased sophistication of the equipment used, are of much concern to all organizations which support research and development. The "sophistication factor" has been the subject of studies in the United Kingdom and the United States; the Science Secretariat paper<sup>18</sup> on this factor reviews experience in these countries and has reached the conclusion that, in Canada, the best estimate of the combined effects of sophistication plus inflation, implies an annual 6 per cent escalation in costs. This means that to maintain any given level of manpower effort in a research and development program, the budget of the program, over a number of years, would have to increase by an average of 6 per cent per annum. In these present

days, when attempts are being made to hold the line on expenditures, many programs will find that their level of effort is diminishing over time. When budgets are tight, those responsible for research and development within mission-oriented agencies should be wary of applying across the board cuts in efforts to reduced expenditures, but rather should decide which programs are most vital to the objectives of their organizations and recognize the need of these programs to have access to increasing levels of funding. To make the best use of available resources, important programs must take precedence in questions of funding. An extension of this principle leads to consideration of the fate of new, proposed program in days of financial stringency. When decisions are made on the programs to receive the funding available, the importance of all programs, new and old, must be considered. The expediency of adopting the attitude that "no new programs will be undertaken" fails to take account of the fact that some new programs may be more urgently needed than many of the older, on-going ones. In cases like this, resources should be reassigned so that the program of each organization reflects the priorities of the tasks assigned to it.

---

## APPENDIX

### REFERENCES AND NOTES

- <sup>1</sup> Science Council of Canada, *First Annual Report* (Ottawa: Queen's Printer, June 1967) page 19.
- <sup>2</sup> Special Study No. 6, *Background Studies in Science Policy: Projections of R&D Manpower and Expenditure* (being published as a companion document to this report).
- <sup>3</sup> See Keesing, *The Journal of Political Economy*, 73, 38 (1967) or Gruber, Mehta and Vernon, *ibid.*, 75, 20 (1967).
- <sup>4</sup> Kaliski, *ibid.*, 75, No. 5, page 761 (1967), "The R&D Factor in U.S. Trade, a comment".
- <sup>5</sup> The first five of the "elements" are the economic goals for Canada postulated by the Economic Council. See Economic Council of Canada, *First Annual Review* (Ottawa: Queen's Printer, December 1964, \$3.50), page 1.
- <sup>6</sup> Figure 1 and Table 1 are derived from data taken from DBS, DOI and NRC and other sources in an exercise undertaken by M. Eliesen of DOI and G. T. McColm of the Science Secretariat. The figures for the R&D expenditures in universities were arrived at by estimates based on NRC publication No. 9196 and other material. Those for industry include an estimate for intramural research not regularly reported.
- <sup>7</sup> Table 2 is taken from a document "Statistical Data on Industrial R&D in Canada", by J. L. Orr, presented to the Science Council by the Department of Industry in March, 1967. The comparison with the United States is taken from the same source.
- <sup>8</sup> A. M. Weinberg, "The philosophy and practice of national science policy", in *Decision Making in National Science Policy: A Ciba Foundation and Science of Science Foundation Symposium*, edited by de Reuck, Goldsmith and Knight: J. A. Churchill Ltd., London, 1968.
- <sup>9</sup> Science Council of Canada, Report No. 3, *A Major Program of Water Resources Research in Canada* (Ottawa: Queen's Printer, Sept. 1968, 75 cents).
- <sup>10</sup> Dominion Bureau of Statistic, *Canada Year Book, 1966* (Ottawa: Queen's Printer, 1966, \$5.00) pages 177 and 188.
- <sup>11</sup> *OECD Observer*, No. 24, October 1966, page 20.
- <sup>12</sup> Economic Council of Canada, *Fourth Annual Review* (Ottawa: Queen's Printer, 1967, \$2.75), page 191.

- <sup>13</sup> DBS, *Canada Year Book, 1967, op. cit.*, pages 713 and 715.
- <sup>14</sup> *Le défi américain*, by J. J. Servan-Schreiber (Denoël, 1967), page 151.
- <sup>15</sup> Special Study No. 6, Paper 1, "The projected supply of scientists and engineers in Canada". (In press).
- <sup>16</sup> Special Study No. 4, *The Proposal for an Intense Neutron Generator, Scientific and Economic Evaluation* (Ottawa: Queen's Printer, 1967, \$2.00).
- <sup>17</sup> Special Study No. 6, Paper 2, "Gross Expenditures on R&D in Canada projected to 1978". (In press).
- <sup>18</sup> *Ibid.*, Paper 3, "The Inflation-Sophistication Factor".
-