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THE ECONOMIC SITUATION AND PUBLIC POLICY

by
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The burden of my remarks today is to discuss the recent economic situation and the role of public policy. To put things in perspective, I would first like to review briefly business and financial developments of the past year or so—that is, since the last meeting of this group—and then evaluate where the economy stands today. Against this backdrop, I will discuss the role of monetary and fiscal policy.

You will recall that, at the time of our meeting last May, the economy was producing and consuming at an exceptionally high level, and, most importantly, had been moving forward strongly. You will also recall that a year ago a general consensus was emerging—the so-called standard forecast—that the economy was unlikely to do so well in the period immediately ahead. To be specific, most observers were expecting the rate of growth of economic activity to slacken in the second half of 1965.

The standard forecast a year ago was conditioned by the widespread expectation of a serious setback in steel production following the settlement of wage negotations. Although steel production and steel shipments had been chalking up all-time records because of inventory building in anticipation of a possible strike, the settlement of wage negotiations was expected to set off an extended period of inventory liquidation, resulting in substantial cutbacks in steel production. The effects of the cutback in steel were expected to be widely diffused and, along with other lagging sectors of the economy, such as housing, to impose a restraining influence on economic activity in the second half of the year. The fact that actual cutbacks in steel after the September settlement proved to be of shorter duration and smaller magnitude than anticipated is not important for our purpose here. What is important is that economic forecasters and policymakers a year ago were expecting

steel to serve as a sizable drag on the economy in the latter months of 1965.

Policymakers—and the economic forecasts on which they were operating—were also influenced a year ago by the fact that Federal spending looked as though it was leveling, and would not supply much of a boost to economic activity in the months ahead. The key assumption underlying the outlook for a leveling in Federal spending was that the war in Vietnam would not heat up.

The outlook for steel and Federal spending —and other weak sectors—was such as to raise concern about the staying power of the economy, and about the types of monetary and fiscal policy needed in the latter months of the year to offset the anticipated slack. As you know, concern was so widespread that the Administration sought and obtained a reduction in excise taxes on a variety of consumer goods at midyear so as to encourage private spending; moreover, for the same reason, it also obtained higher social security benefit payments in the fall.

What about monetary policy? Largely because of the standard forecast, monetary policy remained moderately accommodative from May through early October in order to permit further expansion of bank credit and the money supply and thus stimulate consumer and business spending.

If the assumptions of a year ago about the economic outlook had held up, everybody would have been right, and the policy actions then would have been appropriate. But almost everything went wrong: the assumptions were wrong and the policy actions were wrong. They were wrong because at this time a year ago we did not—and could not—anticipate the sizable step-up of the military undertaking in Vietnam. The sharp and unexpected escalation of the war effort in July set off an acceleration of defense spending that in turn made fiscal policy extremely stimulative. In fact, if the step-up in our defense effort had been foreseen a year ago, there would have been no need for the reduction in excise taxes, and for the early step-up in social security benefit payments. And, logically, monetary policy would not have remained as accommodative, but would have shifted towards the side of greater restraint.

Higher defense spending stimulated more rapid advances in private spending and investing than had been expected; in addition, steel negotiations dragged on through the summer, permitting a longer buildup in steel inventories than had been anticipated in the spring. As a matter of fact, the inventories built up in anticipation of a steel strike, following the September settlement, were in part used up to accommodate the expanded defense effort. Thus, gains in economic activity not only failed to slacken after midyear, but actually accelerated. Indeed, as the year unfolded, it no longer was a question of how well the economy was doing. It was more a question of how the economy could be held in check; in other words, prevented from overheating.

Indications of overheating began to appear in the fall in the form of increasing pressures on available resources—both human and physical. Unemployment, which had averaged 4.7 percent from March through June of 1965, dropped to 4.5 percent in July and August, and then to 4.1 percent by year-end. Utilization of manufacturing plant capacity edged above 90 percent, a level usually associated

with rising prices. Growing pressures on the labor force and plant capacity were reflected in expanding order backlogs and stretched out delivery times, developments typical of an overheated economy.

The Consumer Price Index showed little change from June through September, but began to move upward in October and has continued to advance strongly up to the present time. Industrial wholesale prices also began to accelerate in the fall, posting in most months year-to-year and monthly gains of a magnitude not experienced since the mid-1950's. When wholesale prices of farm and food products began to rise in the winter, the total Wholesale Price Index literally spurted upward in late 1965 and early 1966.

On the financial front, interest rates rose sharply after midyear, as expectations changed and as burgeoning demands for credit by businesses and consumers began to press on relatively limited supplies of loanable funds. Faced with the realities of accelerated defense spending, more than expected strength in capital spending, declining unemployment, increasing utilization of capacity, expanding backlogs, rising prices, and burgeoning credit demands, the Federal Reserve took the major step in December of raising the discount rate from 4 to 4½ percent. In view of the incomplete and imperfect knowledge available to the Federal Reserve at that time, the discount rate action must be considered as an extremely difficult decision. As you know, the vote by the Board of Governors on the recommendations made by the regional banks was far from unanimous; in fact, the margin of decision—a 4 to 3 vote—was as close as it could possibly have been. When the step was taken, there was a major question as to whether the discount rate action was timed appropriately, because the Administration's economic program for 1966 was still in the process of being formulated. In retrospect, the timing and the appropriateness of the action have now been resolved beyond doubt; with the benefit of hindsight, the discount rate action was obviously the right step to take.

The Administration's approach reflected the uncertainty about the economic outlook and the familiar and fundamental problem of formulating public policy for the future before all of the facts are in. In this case, both the Administration and the Federal Reserve had incomplete and imperfect information on major components of aggregate demand, including defense spending, inventory investment, and capital spending, and the influence of all of these on future prices. But given the same information, the Administration's approach was to wait, whereas the Federal Reserve's was to act.

The Council of Economic Advisers, however, did plan for restraint if things did not work out as anticipated. Thus, the Council stated in its "Annual Report" published in January 1966 (p. 61):

> *If military needs should prove to be larger than is anticipated...or if private expenditures should advance sharply so as to endanger price stability — further fiscal or monetary restraints would be necessary to prevent the rise in total demand from outpacing the growth in productive capacity.*

I think it is a fair statement to say that the

economic advance since the turn of the year has been too strong, that is, more exuberant than anyone had hoped for or wanted. Thus, the Gross National Product during the first quarter of 1966 increased by $17 billion, the largest quarterly increase since the Korean War, with over one-third of the rise attributable to price inflation and less than two-thirds to growth in real output. Industrial production has surged ahead, unemployment has edged down even further, capacity utilization rates have drifted even higher, and order backlogs have continued to expand. Under these conditions, prices at both the consumer and wholesale levels have continued to move up, with announcements of industrial price increases far outnumbering price decreases.

To combat these inflationary pressures, monetary policy up to now has largely had to go it alone, without too much help from fiscal policy. To put the matter differently, it seems to me, speaking as an individual and not for the Federal Reserve System, that more fiscal restraint would have been desirable in 1966; in other words, higher taxes and less Federal nondefense spending.

I do not mean to imply that useful efforts have not been made in the fiscal area to control inflation, although they do seem to me to have been inadequate thus far. Higher social security tax payments, the reinstatement of excise taxes that had been reduced earlier, and the acceleration of corporate and personal income tax payments have all provided some restraint. In addition, the Administration has urged industry and labor to hold the line on prices and wages, and businessmen have been asked to defer capital spending. These steps were all to the good. But what was really needed, in my opinion, was an increase in income taxes, and higher income taxes were not forthcoming.

All of this is history—water over the dam, so to speak. It does, however, contain an important lesson for the future—one that I hope we will learn well. To be specific, in a period of general economic overheating, I think most would agree that the roles of fiscal and monetary policy should be more balanced than they have been in the past six months. Monetary policy can be applied promptly, but it works only at the margin, and mainly influences spending decisions in the future. In an economy operating at forced draft, tighter money—plus shortages of manpower and materials—will have little or no effect on construction projects already underway, due to the high costs of postponing commitments. The influence of tighter money—plus the shortages of manpower and materials—will have an effect primarily on new capital projects planned for the months and years ahead. The effects of monetary policy are thus largely delayed effects, which cumulate, and which may even lead to future slack in the economy if pressed too far. In contrast, fiscal policy, although it is not so flexible as monetary policy in the first instance, in the sense that it cannot be put into effect so quickly, can be better tailored to the desired effect on income and spending.

Having reviewed the lessons of history, what should be the posture of monetary and fiscal policy today? Since we are dealing with uncertain future responses to present actions, any decision is hazardous and must in the end largely reflect personal judgment. It is my

opinion that further monetary restraint is still needed, although it should be moderate, since the restraint we put into effect earlier in the year is already having some influence in cooling off future spending plans. To be fully effective, a tax adjustment should have occurred earlier—around the first of the year. In any event, higher taxes at the moment are probably not politically feasible. If defense spending does not level off in the second half of 1966, then political considerations may be forced to give way.

Now, what is the moral to be drawn from this brief review of economic developments and public policy over the past year? The first lesson is that we still have a lot to learn about economic processes, and that a great deal more information than we now have is needed before we can formulate policy accurately and effectively. A second lesson is that fiscal policy has its political problems even if we were able to foretell economic events with great accuracy. A third lesson is that—under present political, social, and economic arrangements—monetary policy must usually carry a large share of the load, at least initially, in cooling off overheated situations. A fourth and final lesson, which follows from the foregoing, is that a strong, independent central bank is the nation's bulwark against price inflation.

Those who think the Federal Reserve should be made a part of the Federal administrative machinery should ponder well the lessons learned from the experience of the past six months. An independent central bank can move quickly in any direction; it can continue to tighten credit if the economy overheats further, or it can move toward the side of ease if signs of slack begin to appear. Flexible monetary policy alone is not the ideal instrument of public policy, but major reliance will have to be placed on it until we can learn to make fiscal policy a more flexible tool.

DEFENSE SPENDING IN FOURTH DISTRICT STATES

PART III: SELECTED DEFENSE-RELATED INDUSTRIES

Previous articles in the *Economic Review* discussed defense spending at the national level and the implications of such spending for Fourth District states (Ohio, Pennsylvania, Kentucky, and West Virginia).[1] Among other things, the articles showed that defense procurement is concentrated in a few major product areas with the result that defense spending affects directly only a few industries and usually the large firms within those industries.

Increased emphasis on missile and space products and electronic and communications equipment (which are integral components of missiles and advanced aircraft) has led to a shift in the composition of defense procurement. Prime contracts awarded for missile and space systems and electronic and communications equipment constituted 37.2 percent of all military prime contracts awarded during fiscal years 1962-65. (If all aircraft and aircraft-related procurement were included, the figure would be raised to 60.2 percent.)

As was shown in an earlier (the second) article, the types of industrial capacity required to produce aerospace and electronics equipment are not common in Fourth District states, with the possible exception of Pennsylvania. The lack of appropriate production facilities, for whatever the reasons, has contributed to a decline in prime contract awards to Fourth District firms.[2]

[1] See "Defense Spending in Fourth District States, Part I: National Background," *Economic Review*, Federal Reserve Bank of Cleveland, Cleveland, Ohio, February 1966, and "Defense Spending in Fourth District States, Part II," *Economic Review*, Federal Reserve Bank of Cleveland, Cleveland, Ohio, March 1966.

[2] "Defense policy stresses awards on merit. Local initiative seeking defense business must direct itself to the creation of capability responsive to the exacting needs of modern warfare. Communities which fail to recognize this fact, and which fail to energize and mobilize their institutions to adjust to it, cannot reasonably anticipate a major role in future defense procurement." Office of Secretary of Defense, *The Changing Patterns of Defense Procurement*, 1962, p. 11.

Since the missile and space products and electronic and communications equipment industries also have many developed (as well as undeveloped) civilian uses, it is appropriate to examine these industries and their relationship to Fourth District states in some detail. The implications are clear: these industries have already grown rapidly, and their development—or lack of it—in Fourth District states would be an important factor in the future economic status of these states. The purpose of this article, then, is to consider these more significant areas of defense procurement—including research and development as well as the aerospace and electronics industries.

AEROSPACE AND ELECTRONICS INDUSTRIES

In view of the implications of the concentration of defense procurement, it seems appropriate first to take stock of the aerospace and electronics industries in the Fourth District states against the background of national patterns and national statistics.[3] The combined aerospace industry is the largest manufacturing employer in the U. S. The bulk of missile and space employment is outside aircraft plants, although many aircraft firms have shifted some of their operations to the missile and space field along with the change in procurement. Missile component production occurs in approximately 20 different industries, but between 70 and 80 percent of total production falls in three industries—aircraft and aircraft parts, ordnance, and electrical machinery.[4]

With the major changes in defense procurement in the 1950's, a shift from aircraft to missile and space activity became manifest in 1957 and 1958. Thus, both aircraft procurement and employment in aircraft plants began to decline in 1958, although most of the latter decline was offset by increased missile activity as aircraft firms switched over to meet the new demands.

Aerospace employment in general exhibited an upward trend from 1958, until it leveled off in 1963, and then dipped sharply in 1964. In 1965, it appears to have climbed back to approximately the 1963 level. The changes in overall aerospace employment are the result of occasionally diverging trends of aircraft and missile and space employment. While missile employment was experiencing

[3] While meaningful data are difficult to come by, several industry manpower surveys are available for the aerospace industry as is a 1963 study of employment and shipments in electronics manufacturing.

U. S. Department of Labor, *Aerospace Employment*, Industry Manpower Survey No. 112, May 1965; *Aerospace Employment*, Industry Manpower Survey No. 111, June 1964; *Missile, Spacecraft, and Aircraft*, Industry Manpower Survey No. 105, May 1963; *Missile and Aircraft*, Industry Manpower Survey No. 95, April 1960; *Manpower in Missile and Aircraft Production*, Industry Manpower Survey No. 93, August 1959. Bureau of Labor Statistics, U. S. Department of Labor, *Employment Outlook and Changing Occupational Structure in Electronics Manufacturing*, Bulletin No. 1363, October 1963.

[4] Herman O. Stekler, *The Structure and Performance of the Aerospace Industry*, Berkeley and Los Angeles, University of California Press, 1965. Aside from a history of the aircraft industry, Chapter 2 discusses the problems involved in defining the aerospace industry and the various definitions that have been used. This study uses the definitions and data cited in the previous footnote, which are close to Stekler's analysis and have the additional advantage of providing some geographic detail.

a substantial gain from 1958 through 1962, aircraft employment was undergoing a decline. The strong rise in missile employment more than offset the decline in aircraft employment, however, so that there was an overall increase in aerospace employment. Both aircraft and missile employment leveled off in 1963 and both experienced declines in 1964, although missile employment exhibited a much greater fall.

The leveling off and subsequent decline in missile employment reflected the completion of work on many contracts and the achievement of an adequate missile strike force. With production and procurement of missiles declining, emphasis shifted to testing, updating, and improving various missile systems. The change in missile procurement is also reflected in the changing composition of missile employment, with technological advances and improvement objectives resulting in a shift from production to nonproduction workers. Indications for 1965 are that missile employment underwent further declines although total aerospace employment increased somewhat due to expanded commercial and military demands for aircraft.[5]

Missile employment tends to be highly concentrated. Approximately 40 percent of missile and space employment is in California with well over half located in the Los Angeles-Long Beach area. Among Fourth District states, Pennsylvania missile workers constituted 3.4 percent of all such workers in the U. S. in 1958, 2.8 percent in 1959, 3 percent in 1962, 4 percent in 1963, and 2.9 percent in 1964. Ohio had 1.5 percent of missile employment in the U. S. in 1959. Approximately four-fifths of the estimated 5.5 thousand missile employees in Ohio in 1959 were located in aircraft plants in the Cleveland area. Missile employment in Ohio jumped to 4.4 percent of the total in 1962, and then maintained that share in 1963 and 1964.

Missile employment also tends to be concentrated within Ohio and Pennsylvania. Virtually all missile employment in Pennsylvania is located in the Philadelphia area. Approximately two-thirds of Ohio missile employment in 1962 was in the Dayton area. While the proportion has declined somewhat in recent years, the bulk of Ohio space employment is still in the Dayton area. The Akron area also has a significant concentration of missile workers.

The implications of these survey figures are interesting: Ohio has a much larger share of missile employment than would be indicated by its share of military prime contracts for missile and space systems, suggesting that firms in Ohio obtain a considerable amount of subcontracting.[6]

The electronics industry is closely related to missile and space activity, although there are separate data on electronic sales, ship-

[5] See footnote 3 and Harold Gold, "Missile Employment Trend Reverses Itself," *Journal of Commerce*, September 10, 1965. Also, Richard Rutter, "Emphasis Shifts in U. S. Missile Program," *New York Times*, October 15, 1965, and "Should U. S. Reshape its Strategic Might," *Business Week*, July 17, 1965, p. 33.

[6] This is also suggested by the NASA's subcontract reporting program which, for fiscal 1965, indicates that the subcontracts *originating* in Ohio (and Pennsylvania) are considerably less than the subcontract work *performed* in Ohio (and Pennsylvania). National Aeronautics and Space Administration, *Annual Procurement Report, Fiscal Year 1965*, Washington, D. C., pp. 44-46.

ments, and employment.[7] The Federal Government is the primary customer of the industry. This is borne out by Table I, which presents figures on total sales and shipments of electronic products and sales and shipments to the Federal Government primarily for military and space uses. Department of Defense expenditures for electronic products (content) are presented on a fiscal-year basis. The differences in the figures are due to broader coverage in Electronic Industries Association data and revisions that were made subsequent to the Bureau of Labor Statistics' study.

Most studies break electronics manufacturing into four categories: Government (or military and space), industrial products, consumer products, and components. The first three categories represent final products while the fourth represents parts and accessories that go into the end products. The first category is of primary importance to this article, although the last one is of some significance since replacement components may also flow into military or space work. On the basis of EIA data, total sales of electronic products increased approximately sixfold from 1950 to 1964. Sales to the Government, however, increased almost 14 times from 1950 to 1964, and constituted over 50 percent of all electronic sales after 1951. While not shown in the table, replacement components were less than 10 percent of sales in all years covered in the table, and the ratio has been declining.

The bulk of electronic sales to the Government are for military and space uses although the Federal Aviation Agency has been a marginal purchaser of civilian electronic products. It is estimated that, during fiscal years 1963-66, military and space products accounted for 98.5 percent of Government electronic purchases, and that the DOD accounted for 85.9 percent of all military and space purchases.[8] While prior to 1958 the DOD was the only purchaser of military and space products, since the establishment of the NASA in 1958, the DOD share has been reduced to over 90 percent of military and space purchases.[9] These estimates suggest that as the NASA completed basic construction and planning programs, its share of military and space purchases increased. This development again reflects the shifting emphasis from aircraft to missiles, and the fact that electronic equipment represents a smaller proportion of

[7] Bureau of Labor Statistics, U. S. Department of Labor, *Employment Outlook and Changing Occupational Structure in Electronics Manufacturing*, Bulletin No. 1363, October 1963.

Electronic Industries Association, *Electronic Industries Year Book, 1965*, Washington, D. C., 1965 Edition.

United States Arms Control and Disarmament Agency, *The Implications of Reduced Defense Demand for the Electronics Industries*, Washington, D. C., September 1965. This publication defines the electronics industry "as the facilities and manpower necessary for research, development, design, production, testing, marketing, and servicing of 'electronics' items. 'Electronics' items include components and parts, subassemblies, complete assemblies or systems, and services used primarily for generation, transmission, control, conversion, and manipulation of intelligence by electrical means," p. 3.

[8] Electronic Industries Association, *Electronic Industries Year Book, 1965*, Washington, D. C., 1965 Edition, p. 31.

[9] Bureau of Labor Statistics, U. S. Department of Labor, *Employment Outlook and Changing Occupational Structure in Electronics Manufacturing*, Bulletin No. 1363, October 1963, p. 15.

TABLE I
Estimates of Sales and Shipments of Electronic Products, 1950-1966

	Electronics Industries Association			Bureau of Labor Statistics			Department of Defense
	In Millions of Dollars			In Millions of Dollars			In Millions of Dollars
Year	Total Sales	Sales to Government	Government Sales as % of Total	Total Shipments	Military and Space Shipments	Military and Space Shipments as % of Total	Expenditures for Electronic Content*
1950	$ 2,705	$ 655	24.2%	$ 2,600	$ 500	19.2%	$ —
1951	3,313	1,193	36.0	3,250	1,050	32.3	—
1952	5,210	3,100	59.5	4,250	2,050	48.2	—
1953	5,600	3,230	57.7	5,150	2,650	51.5	—
1954	5,620	3,100	55.2	5,400	2,700	50.0	—
1955	6,107	3,332	54.6	5,800	2,800	48.3	3,225
1956	6,715	3,595	53.5	6,850	3,450	50.4	3,440
1957	7,845	4,130	52.6	8,000	4,100	51.3	3,878
1958	8,265	4,725	57.2	8,260	4,420	53.5	4,382
1959	9,581	5,373	56.1	9,240	4,740	51.3	4,940
1960	10,677	6,124	57.4	9,950	5,100	51.3	5,670
1961	12,173	7,190	59.1	10,690	5,490	51.4	6,238
1962	13,886	8,080	58.2	11,820e	6,220	52.6	7,071
1963	15,143	8,841	58.4	—	—	—	7,649
1964	16,135	9,095	56.4	—	—	—	7,820
1965	—	—	—	—	—	—	7,499
1966	—	—	—	—	—	—	7,351

* DOD expenditures are on a fiscal-year basis.

e Estimate.

Sources: Electronic Industries Association, *Electronic Industries Yearbook, 1965,* Washington, D. C., 1965, p. 2 and pp. 32-33; Bureau of Labor Statistics, United States Department of Labor, *Employment Outlook and Changing Occupational Structure in Electronics Manufacturing,* Washington, D. C., Bulletin No. 1363, October 1963, p. 18

TABLE II
Employment in Electronics Manufacturing and in Military-Space and Industrial-Commercial Electronics Manufacturing, United States and Fourth District States, 1958 and 1961

	Electronics Manufacturing				Military-Space and Industrial-Commercial Electronics Manufacturing			
	Number		Percent		Number		Percent	
Area	1958	1961	1958	1961	1958	1961	1958	1961
United States	458,405	616,860	100.0%	100.0%	153,590	293,197	100.0%	100.0%
Ohio . . .	12,000	11,052	2.6	1.8	1,979	4,763	1.3	1.6
Pennsylvania	40,788	57,771	8.9	9.4	4,628	15,591	3.0	5.3
Kentucky . .	4,936	4,403	1.1	0.7	*	*	*	*
West Virginia	*	*	*	*	*	*	*	*

* Less than 1.0 percent of employment in both 1958 and 1961.

Source: Bureau of Labor Statistics, U. S. Department of Labor, *Employment Outlook and Changing Occupational Structure in Electronics Manufacturing,* Bulletin No. 1363, October 1963, Table 2, pp. 8-9

the cost of aircraft than of missiles.

Estimates of employment in the electronics industry for 1958 and 1961 provide some basis for judging the significance of the industry in Fourth District states. As shown in Table II, 8.9 percent of electronics employment in the U. S. in 1958 was accounted for by Pennsylvania, with the figure increasing to 9.4 percent in 1961. In contrast, Ohio and Kentucky contributed only 2.6 and 1.1 percent, respectively, of electronics employment in 1958; in both states, such employment then experienced absolute and relative declines, falling to 1.8 and 0.7 percent of the total, respectively, in 1961. It is clear that the electronics industry has not been significant in three of the four Fourth District states.

Pennsylvania also leads other Fourth District states in employment in military-space and industrial-commercial electronics products. In that area, Pennsylvania increased its share of total employment in the U. S. from 3.0 percent in 1958 to 5.3 percent in 1961; Ohio also experienced some growth, from 1.3 percent of the total to 1.6 percent in 1961. Kentucky and West Virginia did not have significant employment in this category.[10]

Thus, with the possible exception of Pennsylvania, Fourth District states do not appear to be significant participants in the electronics industry. This in turn may be a factor in future defense contract awards, especially since the electronics area has been a major procurement area for the DOD and NASA.

In short, the data on aerospace and electronics employment further support what has been suggested earlier, namely, that Ohio, Kentucky, and West Virginia do not have available the integrated type of industrial complex required by the major defense-space procurement programs.

RESEARCH AND DEVELOPMENT

One of the most significant growth areas within the economy is that of research and development (R & D), which is both a stimulant and by-product of growth in other areas. Since Federal funds play a major role in R & D spending, it is appropriate to consider some of the details of Federal research programs. Data on DOD military prime contracts for research, development, test and evaluation work (RDT & E) are available on a state basis by type of contractor, as well as on a program basis (but, unfortunately, not on a cross-classification basis). While DOD research is a limited segment of total R & D spending, it is one sector for which relatively detailed data are available. Also, as will be apparent, research procurement by NASA is similar to DOD research, and the combined research of DOD and NASA constitutes a substantial proportion of total R & D (51 percent in 1963).[11]

[10] More recent estimates of electronics employment on a regional basis by Battelle Memorial Institute, using census regions, indicates a roughly similar employment pattern to that suggested here. The Battelle estimates indicate that a greater concentration of defense electronic employment has occurred in the middle Atlantic states (New York, New Jersey, and Pennsylvania). See *The Implications of Reduced Defense Demand for the Electronics Industries*, United States Arms Control and Disarmament Agency, Washington, D. C., September 1965, p. c-18.

[11] Estimates by the Federal Reserve Bank of Cleveland based upon: National Science Foundation, "Research Funds Used in the Nation's Scientific Endeavor, 1963," *Reviews of Data on Science Resources*, Washington, D. C., Vol. 1, No. 4, May 1965, pp. 2 and 10; and *Special Analysis, Budget of the United States, Fiscal Year 1967*, Washington, D. C., U. S. Government Printing Office, p. 113.

TABLE III

Military Prime Contract Awards and Military Prime Contract Awards for Research, Development, Test and Evaluation Work, by Type or Contractor, Fiscal Years 1958-1965

Fiscal Year	In Millions of Dollars		Research, Development, Test and Evaluation Awards as Percent of Total	Awards by Type of Contractor As Percent of Total Research, Development, Test and Evaluation Awards		
	Total Military Prime Contracts*	Research, Development, Test and Evaluation Work*		Business Firms	Other Nonprofit Institutions†	Schools and Their Affiliates†
1958 . . .	$21,009	$4,056	19.3%	—	—	—
1959 . . .	21,919	5,207	23.8	—	—	—
1960 . . .	20,407	5,221	27.1	—	—	—
1961 . . .	22,112	6,027	27.3	92.9%	1.7%	5.4%
1962 . . .	25,039	6,113	24.4	92.0	2.3	5.7
1963 . . .	25,234	6,199	24.6	91.1	2.8	6.2
1964 . . .	24,417	5,765	23.6	88.7	3.6	7.7
1965 . . .	23,268	4,708	20.6	85.4	6.7	7.9

* Includes awards of $10,000 or more that are distributed by states.

† Beginning with 1965, awards to research foundations and nonprofit corporations associated with universities are included in the category of "other nonprofit institutions." In previous years, this category was included in schools and their affiliates.

Sources: Office of Secretary of Defense, Department of Defense, *Five-Year Trends in Defense Procurement, 1958-1962*, June 1963, and *Military Prime Contract Awards by Region and State, Fiscal Years 1962, 1963, 1964, 1965*, January 1966

TABLE IV

Military Prime Contract Awards to Business Firms for Experimental, Developmental, Test, and Research Work by Programs,* 1960-1965

Program	1960	1961	1962	1963	1964	1965
TOTAL (in millions of dollars)*	$5,234	$5,650	$5,670	$5,687	$5,145	$4,070
	As Percent of Total EDTR Awards to Business					
Major Hard Goods	91.2%	90.5%	90.4%	91.7%	91.0%	87.8%
Aircraft	9.3	8.9	8.0	9.4	12.5	17.6
Missile and Space Systems	62.2	60.3	60.9	63.1	60.5	50.4
Ships	3.0	4.9	3.6	3.5	2.8	1.5
Tank-automotive	0.4	0.3	0.2	0.6	0.4	0.7
Weapons	0.5	0.4	0.2	0.5	0.8	0.9
Ammunition	1.9	1.8	1.3	2.0	1.5	1.3
Electronic and Communication Equipment	14.0	13.9	16.2	12.6	12.6	15.3
Services	4.6	5.5	5.6	6.4	8.0	10.8
Other	4.2	4.0	4.0	1.9	1.0	1.5
Subsistence	†	†	†	†	†	†
Textiles, Clothing, and Equipage	0.1	†	†	†	†	0.1
Fuels and Lubricants	0.3	0.1	0.1	†	†	†
Miscellaneous Hard Goods	3.2	3.5	3.3	1.3	0.6	0.6
Construction	†	†	†	†	†	0.1
All actions less than $10,000	0.6	0.4	0.5	0.5	0.3	0.7

* This total differs from the one used to compute the percentages in Table III and, consequently, is abbreviated as EDTR in recognition of the differences. The total in this Table (IV) apparently covers all R & D contracts and possibly some such contracts awarded by DOD for NASA. The business category in Table III covers only awards of $10,000 or over that are distributed by states.

† Less than 0.1 percent.

Sources: Office of the Secretary of Defense, Department of Defense, *Military Prime Contract Awards and Subcontract Payments or Commitments, July 1964-March 1965 and July-September 1965*, p. 25

Federal research programs, which are dominated by DOD and NASA, tend to influence the general character of total research and development programs.

Table III presents data on both total military prime contract awards and awards for research and development. RDT & E contracts are included in total prime contract awards, and exhibit a pattern similar to that of total prime contracts distributed by state. Both types of awards generally climbed to a peak in fiscal 1963 and then fell in both 1964 and 1965. It is interesting to note that between one-fifth and one-fourth of the prime contract awards in the period shown in the table were for RDT & E work. (The average was 23.8 percent for fiscal years 1958 through 1965.

The major portions of RDT & E awards went to business firms, as distinguished from educational or nonprofit institutions. This is not surprising since the bulk of R & D expenditures are for development purposes (see Appendix). Thus, during fiscal years 1961 through 1965, business firms received approximately 90 percent of all DOD research contracts, although within that short time span, schools and nonprofit research organizations increased slightly their share of R & D contracts at the expense of business firms.[12]

[12] A large percentage of NASA prime contracts are also placed with business firms either directly or indirectly through other Government agencies or the California Institute of Technology (Jet Propulsion Laboratory). For fiscal 1964, approximately 95 percent of NASA contract awards went to business. See *NASA Annual Procurement Report, Fiscal Year 1964,* reproduced in *1966 NASA Authorization, Hearings Before the Subcommittee on Manned Space Flight of the Committee on Science and Astronautics,* U. S. House of Representatives, 89th Congress, First Session.

The programs accounting for the bulk of experimental, developmental, test, and research awards to business firms are shown in Table IV (see first footnote in Table IV). EDTR expenditures are highly concentrated in a few major programs (though undoubtedly flowing to many subprograms), with approximately 90 percent of EDTR awards to business firms for major hard-goods programs. In turn, three such programs—aircraft, missile and space systems, and electronic and communications equipment—account for the bulk of EDTR awards (85 percent during fiscal years 1960-65). From fiscal 1960 through 1965, EDTR awards for missile and space systems alone accounted for 60 percent of all such awards to business firms.

Table V provides some additional insights by showing the research proportion of various procurement programs. The figures represent prime research contracts for any one program, as a percent of total prime contracts to that program. For fiscal years 1960 through 1965, over one-half (55.4 percent) of the prime contracts awarded to business firms for missile and space systems were EDTR awards. Slightly less than one-fourth (24.2 percent) of the contract awards for electronic and communications equipment were EDTR awards, as were approximately 10 percent of the contracts for various aircraft programs. The economic significance of research and development is readily apparent when it is recognized that 60 percent of all prime contract awards from fiscal 1962 through 1965 were for various aircraft systems, missile and space systems, and electronic and communications equipment. Over one-half of the $23.9 billion of contracts for missile and space systems dur-

ing fiscal 1962-65 were for EDTR work, as were almost one-fourth of the $12.5 billion of electronic and communications equipment contracts and one-tenth of the $22.6 billion of contracts for various aircraft systems.

As would be expected from the discussions in the earlier articles, R & D awards tend to be concentrated among a relatively few major firms.[13] Thus, the top five firms in the U. S. received 32 percent of Department of Defense RDT & E awards in fiscal 1965; the top ten firms, 48 percent; the top 15 firms, 58 percent; and the top 20 firms, 65 percent.[14] This indicates a slightly greater degree of concentration than in the case of total military prime contracts.

The bulk of Department of Defense RDT & E contracts are awarded to business firms, with a concentration of research contracts among the larger firms. Much of the concentration is due to the fact that the bulk of DOD research contracts are for a few major programs —aerospace systems and electronic and communications equipment (in fiscal 1965, 83.4 percent of all RDT & E awards of $10,000 or more to U. S. business firms went for work related to missile and space systems, aircraft, and electronics; see footnote 10). Furthermore, a large proportion of total contracts to these programs are RDT & E contracts, particularly for missile and space systems and electronic and communications equipment. These programs are also the programs that constitute the bulk of prime contract awards so that a considerable portion of the *major* procurement programs, with special reference to the fiscal 1962-65 period, are for research.

As would be expected from the program emphasis of R & D, there is a considerable degree of concentration among the states receiving RDT & E contracts although the degree of concentration appears to have decreased in recent years (see Table VI). California alone accounted for 38.1 percent of the $22.8 billion of RDT & E contracts from DOD during fiscal 1962-65, and 39.2 percent of the $20.4 billion of such contract awards to business firms. California also received 58.8 percent of the $835 million of RDT & E awards to nonprofit institutions. With respect to educational institutions, Massachusetts is the leader, receiving 33.6 percent of the $1.5 billion of RDT & E contracts awarded to schools during fiscal years 1962 through 1965 (in fiscal 1965, Massachusetts Institute of Technology was the tenth largest DOD research contractor in the U. S.), while Maryland was a distant second with 14.9 percent. Concentration is greater for schools and nonprofit institutions, although they constitute a small proportion of the dollar volume of R & D awards.

Given the foregoing perspective on the program concentration and geographic concentration of R & D, it is interesting to examine the role of DOD research and development

[13] See footnote 1.

[14] Directorate for Statistical Services, Office of Secretary of Defense, "500 Contractors Listed According to Net Value of Military Prime Contract Awards for Research, Development, Test and Evaluation Work, Fiscal 1965," December 13, 1965. A fiscal 1965 decline of about $1.5 billion in missile and aircraft contracts that generally go to the large firms implies that the concentration figures cited above are lower than they were in previous years. It should be noted that total dollar value of RDT & E contracts of $10,000 or more cited in "500 Contractors . . ." is about $54 million over the figure cited in *Military Prime Contract Awards*.

TABLE V
Military Prime Contract Awards to Business Firms for Experimental, Developmental, Test, and Research Work by Programs, 1960-1965

Program*	As Percent of Total Prime Contract Awards to Business Firms for Each Program					
	1960	1961	1962	1963	1964	1965
TOTAL	24.6%	24.6%	21.7%	21.0%	19.6%	16.1%
Major Hard Goods	32.2	30.8	27.3	27.4	26.5	21.8
Aircraft	10.1	10.1	8.9	9.8	10.6	12.4
Missile and Space Systems	65.3	57.9	51.6	53.6	55.8	48.5
Ships	15.6	20.3	13.7	11.8	9.5	3.5
Tank-automotive	4.9	2.5	1.2	3.4	3.0	3.2
Weapons	20.3	16.0	5.6	12.2	18.7	12.9
Ammunition	20.9	18.5	8.3	12.9	11.6	7.1
Electronic and Communication Equipment	24.3	24.9	27.7	23.4	22.2	22.4
Services	18.3	28.5	29.4	24.1	22.8	25.2
Other	4.2	4.3	3.6	1.7	0.8	0.8
Subsistence	0.1	0.1	†	0.1	0.1	0.1
Textiles, Clothing, and Equipage	2.0	0.5	0.3	0.7	0.4	0.7
Fuels and Lubricants	1.9	0.6	0.9	0.2	0.2	0.1
Miscellaneous Hard Goods	18.1	22.1	16.8	6.7	3.0	2.2
Construction	†	†	†	†	0.1	0.2
All actions less than $10,000	2.1	1.4	1.5	1.1	0.7	1.0

* See footnote one, Table IV.

† Less than 0.1 percent.

Sources: Office of the Secretary of Defense, Department of Defense, *Military Prime Contract Awards and Subcontract Payments or Commitments, July 1964-March 1965, and July-September 1965*, p. 25

TABLE VI
Concentration of Military Prime Contract Awards for Research, Development, Test and Evaluation by Top Five and Top Ten States of Each Category, Fiscal Years 1962-1965

Fiscal Year	As Percent of Total For Each Category							
	Top Five States				Top Ten States			
	Total*	Business	Schools	Nonprofit	Total*	Business	Schools	Nonprofit
1962	69.5%	70.4%	75.5%	87.0%	86.3%	87.0%	87.3%	99.3%
1963	65.4	66.1	75.6	84.7	82.5	83.1	87.5	95.9
1964	63.0	63.1	74.6	84.8	81.8	82.0	87.2	96.5
1965	61.3	60.8	71.0	80.4	80.1	80.1	85.4	94.2

* The concentration of total awards is generally less than the concentration among the component categories because the same states are not the leading states in each category (business, schools, nonprofit).

Source: Office of Secretary of Defense, Department of Defense, *Military Prime Contract Awards by Region and State, Fiscal Years 1962, 1963, 1964, 1965*, January 1966, pp. 60-74

TABLE VII
Military Prime Contract Awards for Research, Development, Test and Evaluation Work, United States and Fourth District States, Fiscal Years 1958-1965

Fiscal Year	Millions of Dollars: United States	Millions of Dollars: Fourth District States	As Percent of United States: Fourth District States	Ohio	Pennsylvania	Kentucky	West Virginia
1958 . .	$4,056	$428	10.6%	3.4%	6.8%	*	0.3%
1959 . .	5,207	442	8.5	3.3	4.9	*	0.2
1960 . .	5,521	386	6.7	3.3	3.4	*	0.3
1961 . .	6,027	405	6.7	2.3	3.7	*	0.7
1962 . .	6,113	432	7.1	2.2	3.9	*	1.0
1963 . .	6,199	349	5.6	1.5	4.1	*	0.5
1964 . .	5,765	297	5.2	1.5	3.4	*	0.3
1965 . .	4,708	356	7.6	2.8	4.5	*	0.2

* Less than 0.1 percent.

Sources: Office of Secretary of Defense, Department of Defense, *Five Year Trends in Defense Procurement, 1958-1962,* June 1963, pp. 56-58 and *Military Prime Contracts Awards by Region and State, Fiscal Years 1962, 1963, 1964, 1965,* January 1966, pp. 60-74

funds in the Fourth District states. Even though the dollar magnitudes may not be large, research represents an investment in the future and thus could be significant for the future economic growth of these states.

Table VII presents data on RDT & E awards to Fourth District states. The shares of RDT & E contracts to Ohio and Kentucky are less than their respective shares of total prime contract awards. Pennsylvania and West Virginia receive about the same share of RDT & E awards as of total prime contracts. However, only Ohio and Pennsylvania receive a significant *dollar* volume of DOD research contracts.

In view of the changes in defense procurement and the heavy concentration of R & D in the major procurement programs, it is not surprising that Fourth District states, particularly Ohio, have suffered a decline in their share of prime contract awards and prime RDT & E contract awards.[15] Since Ohio does not participate to any great extent in the industrial complex producing for the major procurement programs (as determined by program ranks on the basis of prime contracts), it should not be expected that Ohio (or Kentucky and West Virginia) would derive a large volume of R & D contracts.

[15] James Webb, Administrator of NASA has commented: "During the years ahead, industries will survive, and regional economies will grow and prosper, substantially in proportion to their utilization of scientific and technological progress. This utilization will come more easily, more naturally, and with greater certainty in those areas where basic research is valued and supported." James E. Webb, "The Economic Impact of the Space Program," *Business Horizons,* Vol. 6, No. 3, School of Business, Indiana University, Fall 1963, p. 20.

For a recent study bearing on this subject, see "Seeding Science-Based Industry," *Business Review,* May 1966, Federal Reserve Bank of Philadelphia.

TABLE VIII

Major Department of Defense Research, Development, Test and Evaluation Business Contractors in Fourth District states, Ohio, and Pennsylvania, Fiscal Year 1965

FOURTH DISTRICT STATES*			OHIO			PENNSYLVANIA		
Contractor†	DOD RDT & E Contract Awards (in thousands)	Cumulative Percentage Distribution‡	Contractor†	DOD RDT & E Contract Awards (in thousands)	Cumulative Percentage Distribution‡	Contractor†	DOD RDT & E Contract Awards (in thousands)	Cumulative Percentage Distribution‡
General Electric Company	$146,242	49.2%	General Electric Company	$53,427	47.9%	General Electric Company	$92,491	51.8%
Western Electric Company	27,530	58.5	North American Aviation Inc.	19,229	65.2	Westinghouse Electric Corp.	22,378	64.3
Westinghouse Electric Corp.	23,283	66.3	Western Electric Company	6,045	70.6	Western Electric Company	21,485	76.3
North American Aviation Inc.	19,229	72.8	Goodyear Aerospace Corp.	5,489	75.5	Burroughs Corporation	8,506	81.1
Burroughs Corporation	8,506	75.7	Clevite Corporation	4,525	79.6	Philco Corporation	8,131	85.5
Philco Corporation	8,130	78.4	General Motors Corp.	3,415	82.7	HRB Singer Incorporated	3,623	87.5
Hercules Powder Company	7,194	80.8	Thompson-Ramo-Wooldridge Inc.	3,275	85.6	General Atronics Corp.	3,195	89.3
Goodyear Aerospace Corp.	5,489	82.6	Union Carbide Corporation	3,034	88.3	American Optical Company	2,112	90.5
Clevite Corporation	4,525	84.1	Monsanto Research Corp.	2,246	90.3	Bendix Corporation	1,876	91.5
HRB Singer Incorporated	3,623	85.3	Data Corporation	1,492	91.6	Radio Corporation of America	1,794	92.5
General Motors Corp.	3,415	86.4	Avco Corporation	1,311	92.8	American Electronic Labs Inc.	1,507	93.3
Thompson-Ramo-Wooldridge Inc.	3,275	87.5	National Cash Register Company, Inc.	1,303	94.0	Richardson Merrell Inc.	1,276	94.0
Union Carbide Corporation	3,034	88.5	Technology Incorporated	1,131	95.0	Technitrol Engineering Co.	953	94.5
Monsanto Research Corp.	2,246	89.3	Westinghouse Electric Corp.	905	95.8	Auerbach Electronics Corp.	869	95.0
American Optical Company	2,112	90.0	B. F. Goodrich Company	869	96.6	Giannini Controls Corporation	818	95.5

* West Virginia and Kentucky had contracts of $7.5 million of which $7.2 million were for Hercules Powder Company in West Virginia.

† These are contractors with plants in Fourth District states receiving RDT & E awards. The dollar amounts are not the total awards to these contractors, but only the amounts awarded to the plants falling in the Fourth District states.

‡ The totals for the cumulative distribution for each state were extracted from the publication listed in the source. Since the publication only covers 500 contractors (97.8% of all prime contract awards of $10,000 for RDT & E work), it may slightly understate the total for each state and hence slightly overstate the degree of concentration.

Source: Directorate for Statistical Services, Office of Secretary of Defense, Department of Defense, *500 Contractors Listed According to Net Value of Military Prime Contract Awards for Research, Development, Test and Evaluation Work, Fiscal Year 1965*, December 13, 1965

TABLE IX
Major Department of Defense Research, Development, Test and Evaluation Nonprofit Contractors in Ohio and Pennsylvania, Fiscal Year 1965, In Thousands of Dollars

Ohio		Pennsylvania	
Contractor*	RDT & E Contract	Contractor*	RDT & E Contract
Battelle Memorial Institute	$6,230	Pennsylvania State University	$8,469
Dayton University	3,069	Franklin Institute of Pennsylvania	8,090
Ohio State University Research Foundation	3,002	University of Pennsylvania	5,317
Ohio State University	1,069	Carnegie Institute of Technology	3,012
Cincinnati University	921	University of Pittsburgh	656
Western Reserve University	559	U. S. Interior Department	90
Case Institute of Technology	485	U. S. National Aerospace Administration	25
Southwest Research Institute	95		
Illinois University (Dayton Branch)	44		

* See footnote two, Table VIII.

Source: Directorate of Statistical Services, Office of the Secretary of Defense, Department of Defense, *500 Contractors Listed According to Net Value of Military Prime Contract Awards for Research, Development, Test and Evaluation Work, Fiscal Year 1965*, December 13, 1965

Ohio tends to excel in the production of conventional warfare goods and has suffered from the shift to missile, space, and electronic products. As seen earlier, a greater proportion of Government research funds is allocated to aerospace and electronics programs, rather than to research on tanks and other vehicles (although the latter do receive some funds). Pennsylvania participates more in supplying goods and services to major DOD programs and consequently receives a larger share of RDT & E contracts than Ohio (although Ohio has generally received a larger share of total prime contract awards).

Table VIII presents the major business RDT & E contractors for Fourth District states. While it is difficult to determine exactly what are the specific activities of the various contractors, it does seem fairly clear that the bulk (if not all) of RDT & E contracts awarded to Fourth District contractors are for aerospace or electronics programs. Within these programs a relatively few major firms receive the bulk of RDT & E awards. In fiscal 1965, General Electric was the leading RDT & E contractor in both Ohio and Pennsylvania, receiving 47.9 percent of such contracts in Ohio and 51.8 percent in Pennsylvania.[16] The top five contractors in Ohio received 79.6 percent of the RDT & E contracts awarded to Ohio, and in Pennsylvania the top five received 85.5 percent of the contracts.

Major nonprofit RDT & E contractors for Ohio and Pennsylvania are listed in Table IX. Universities play the major role in both states, although they are less prominent in Ohio where the major contractor is Battelle Memorial Institute, a nonprofit research organization.

[16] Table VIII is based on the leading 500 contractors in fiscal 1965. These contractors received 97.8 percent of the RDT & E contracts. The remaining contractors presumably received RDT & E awards of less than $10,000 each. The totals for the Fourth District states were derived by totaling the awards for all contractors falling in the Fourth District states as reported in the "500 Contractors." These totals may consequently understate by a relatively small amount the total awards to each state.

CONCLUDING COMMENTS

It is clear that defense procurement is heavily concentrated in a few major programs, and that a substantial proportion of these programs are devoted to research and development. In other words, in major defense programs such as aerospace systems and electronic and communications equipment, associated research and development activity is an integral part of the overall program. Such programs require an integrated production and research complex with individual firms, in many cases, involved in both aspects of the complex, especially at the prime contract level. Ohio, Kentucky, and West Virginia do not produce extensively for the major defense programs at the prime contract level because they lack the integrated industrial complex required to produce aerospace and electronic and communications equipment. In other words, since these industries receive the bulk of Government contracts (both research and production), states lacking an extensive industrial aerospace-electronics-research base cannot expect to receive a large share of the contracts.

A fundamental question immediately comes to the fore: which comes first, the contracts or the facilities? This, of course, cannot be answered definitively, but as one observer has noted, NASA contracts, which are similar to DOD contracts in terms of emphasis on missile, space, and electronics procurement, generally have been awarded to those areas having suitable facilities.[17] While of recent origin, the growth of NASA contracts has been substantial. Since R & D contracts of NASA currently rival those of DOD in dollar amount, their distribution to existing facilities is perhaps a significant point.

Much the same point can be made about the distribution of scientific personnel. The distribution of scientific personnel by industry is roughly similar to that of R & D funds.[18] Given the industrial distribution, the regional distribution of scientific personnel would also be similar to DOD prime contract awards for RDT & E (since such scientists are concentrated in industries performing the most R & D and receiving the most Government research money). The Midwest, which is the largest producer of Ph.D.'s (a narrower measure of research-oriented personnel), has not had much success in retaining its educational products. The Ph.D.'s tend to go where the opportunities are, which is generally to the research and associated facilities. The widely recognized "brain drain" from the Midwest has been sufficiently documented over a number of years and needs little further comment.[19] It is sufficient to note that, regardless of how and why the facilities originated, contracts and funds are usually awarded to those

[17] Murray L. Weidenbaum, "Shifting Composition of Government Spending: Implications for the Regional Distribution of Income," paper presented to the Regional Science Association, Philadelphia, Pennsylvania, November 14, 1965.

[18] National Science Foundation, "Research and Development in American Industry, 1963," *Reviews of Data on Science Resources*, Vol. 1, No. 4, May 1965, pp. 1-3.

[19] Ralph E. Lapp, "Where the Brains Are," *Fortune*, March 1966, p. 154; National Science Foundation, "Summary of American Science Manpower, 1964." National Academy of Sciences and National Research Council, "Profiles of Ph.D.'s in the Sciences," *Summary Report on Follow-up of Doctorate Cohorts, 1935-1960*, pp. 6-7, Career Patterns Report No. 1. Prepared for the National Institutes of Health under contract PH 43-62-853, publication 1293.

areas with adequate facilities to meet the demands, which in turn provide additional resources and additional opportunities to attract research personnel.

When the implications for an area's future economic growth are considered, research assumes considerable significance. To the extent that the basic structure of the economy at large is shifting from goods production to a service orientation, the goods industries that supported growth in the past will not provide the same impetus to growth in the future. Research and development, and the industries investing heavily in this area, will generate the knowledge and capabilities that lead to new products and services. Regions that continue to depend on a traditional heavy industry base without investing in the "knowledge" industries will not only sacrifice potential economic growth in the future, but will probably lag considerably behind those areas of the country that do make such an investment.

APPENDIX: PERSPECTIVE ON RESEARCH AND DEVELOPMENT

The term research and development actually covers several areas such as basic research, applied research, and development. While the differences are not always distinct, basic research has been defined to cover "research in which the primary aim of the investigation is a fuller knowledge or understanding of the subject, rather than, as is the case with applied research, a practical application thereof." "Development is the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes."[1]

Expenditures for development have historically constituted the bulk of research and development spending while basic research expenditures have been the smallest of the three components. Using 1963 as an example, the proportion of total research and development spending allocated to basic research

[1] National Science Foundation, "Research Funds Used in the Nation's Scientific Endeavor, 1963," *Reviews of Data on Science Resources*, Washington, D. C., Vol. 1, No. 4, May 1965, p. 2 and p. 10. A similar definition of development is that it covers expenditures to "design, fabricate, test, and evaluate prototypes of materials, devices, systems, or processes to accomplish specific agency missions." See *Special Analysis, Budget of the United States, Fiscal Year 1967*, Washington, D. C., U. S. Government Printing Office, p. 113. It should be emphasized that the purpose of this discussion is not to evaluate the adequacy of these definitions, nor to consider the broader nature of the "knowledge industry." The discussion is also not intended to indicate what the proper role of research and development should be.

For an interesting comparison of U. S. R & D with European R & D, see "Research and Development: A Major Atlantic Issue," *European Community*, No. 90, March 1966, pp. 8-11.

was 10 percent, while applied research constituted 24 percent, and development 66 percent.[2] As indicated in the article, this distribution is largely dependent upon the focus of Federal Government research programs. The allocation pattern has apparently remained relatively stable in recent years, although from 1953 to 1963 basic research grew slightly more than did applied research and development. From 1953 to 1963, basic research expenditures grew at an average annual rate of 16 percent while both total research and development expenditures grew 13 percent. From 1953 to 1958, both basic and total R & D grew at about the same annual rate (16 percent), but from 1958 to 1963 the growth rate of total R & D spending gradually declined until it reached 10 percent in 1963.

Appendix Table I presents a summary of total research and development spending, as estimated by the National Science Foundation, both by sources of funds and by performance of R & D work.[3] It is seen that over one-half of total R & D funds flow from the Federal Government, and that this share has increased over the years covered in the table so that by 1963 the Federal Government supported almost two-thirds of total R & D work. In terms of performance, or use of funds, the business sector is the most significant, accounting for over 70 percent of R & D work.

Within the Federal Government sector, three agencies or departments—the Department of Defense (DOD), the National Aeronautics and Space Administration (NASA), and the Atomic Energy Commission (AEC)—have been responsible for the bulk of Federal research expenditures, accounting for almost 95 percent of such Federal expenditures in fiscal 1954.[4] This percentage has declined in recent years as the Federal Government has extended support for health and health-related research, research funds for educational institutions, conservation, etc. Estimates for fiscal 1966 place the combined research expenditures of the DOD, NASA, and AEC at 88 percent of total Federal research spending. Among these three agencies, the DOD historically has been the most significant. In fiscal 1954, the DOD accounted for roughly 80 percent of Federal research expenditures (about 40 percent of total R & D expenditures). While absolute R & D expenditures of the DOD have continued to grow, its relative share declined to an estimated 43 percent of Federal R & D expenditures in fiscal 1966. NASA's share, on the other hand, has grown from 5 percent of Federal R & D in fiscal 1960 to an estimated 35 percent in fiscal 1966.

The heavy emphasis of Federal R & D expenditures on a few programs (aerospace and electronics) is also reflected in total research

[2] See footnote 1 in this Appendix, referring to the National Science Foundation. Data on research and development are taken from this report unless otherwise indicated.

[3] The National Science Foundation data on Federal Government expenditures differ slightly from data published in the budget (see footnote 1 in this Appendix). It is not clear as to why there is a difference, although the budget figure covers R & D plant and equipment spending which is apparently not included in NSF data. Anyone using the data in Table I should consult the original source for limitations of data, etc.

[4] *Special Analysis, Budget of the United States*, p. 131. Percentage computed by the Federal Reserve Bank of Cleveland. Prior to 1958 the NASA was the NACA—National Advisory Committee for Aeronautics.

APPENDIX TABLE I
Sources of Research and Development Funds and Performance of Research and Development Work by Sector, 1953-1963

Year	Total R & D (in millions)	Sources of Funds As Percent of Total*				Performance As Percent of Total*			
		Federal Government	Industry	Colleges and Universities	Other Nonprofit Institutions	Federal Government	Industry	Colleges and Universities	Other Nonprofit Institutions
1953	$ 5,160	53.5%	43.4%	2.3%	0.8%	19.6%	70.3%	8.1%	1.9%
1954	5,660	55.1	41.8	2.3	0.8	18.0	71.9	8.0	2.1
1955	6,200	56.4	40.5	2.2	0.8	15.3	74.8	7.7	2.1
1956	8,370	57.6	39.8	1.8	0.8	13.0	79.0	6.3	1.7
1957	9,810	62.2	35.2	1.8	0.7	13.0	78.8	6.6	1.5
1958	10,810	63.3	34.2	1.8	0.7	13.3	77.6	7.2	1.8
1959	12,430	64.9	32.7	1.5	0.8	13.9	77.4	6.8	1.9
1960	13,620	64.4	33.3	1.5	0.8	13.4	77.2	7.3	2.0
1961	14,380	64.1	33.4	1.5	1.0	13.1	75.9	8.3	2.6
1962†	15,610	64.3	33.2	1.5	1.0	14.2	73.9	9.0	2.9
1963†	17,350	65.4	32.1	1.5	1.1	13.8	73.3	9.8	3.0

* Totals may not add to 100.0 percent due to rounding.

† Preliminary.

Sources: National Science Foundation, "Research Funds Used in the Nation's Scientific Endeavor, 1963," *Review of Data on Science Resources*, Vol. 1, No. 4, May 1965, tables 2a and 2b; computations by the Federal Reserve Bank of Cleveland

APPENDIX TABLE II
Funds for the Performance of Research and Development for Selected Industries, 1956-1963

Year	Total*	Percent of Total				
		Aircraft and Missile	Electrical Equipment and Communication	Chemical and Allied Products	Motor Vehicle and Other Transportation Equipment	All Other†
1956	100.0%	32.4%	23.0%	9.7%	10.4%	24.5%
1957	100.0	33.3	23.3	9.1	9.1	25.2
1958	100.0	31.1	23.5	9.4	10.2	25.8
1959	100.0	32.3	23.6	9.3	9.0	25.8
1960	100.0	33.9	22.9	9.4	8.5	25.3
1961	100.0	35.8	21.1	10.2	8.7	24.2
1962	100.0	38.9	20.6	10.3	8.8	21.4
1963	100.0	38.0	19.5	9.8	8.7	24.0

* Totals used in this industry breakdown differ slightly from those reported in the NSF publication cited in text footnote 3 and Table 1.

† The industries in this category are: food and kindred products; textiles and apparel; lumber, wood products, and furniture; paper and allied products; petroleum refining and extraction; rubber products; stone, clay, and glass; primary metals; fabricated metals, machinery; professional and scientific instruments; other industries.

Sources: National Science Foundation, "Research and Development in American Industry, 1963," *Reviews of Data on Science Resources*, Vol. 1, No. 1, December 1964, p. 6; computations by the Federal Reserve Bank of Cleveland

and development spending by industries, as reported by the NSF. Appendix Table II presents a percentage distribution of research and development funds by selected industries. The figures include funds for the performance of research by industry and exclude research performed by educational and nonprofit institutions. The selected industries are ranked (from left to right) in terms of dollar volume of R & D. The aerospace and electronic and communication industries, similarly to DOD research, account for over one-half of all industrial research and development, suggesting that Department of Defense RDT & E contracts may provide a fairly representative pattern for total public and private research and development.

Much of the heavy emphasis of industrial R & D on missiles, aircraft, and electronics is largely due to Federal Government funds flowing into these areas through DOD and NASA contracts. As indicated earlier, over 50 percent of total R & D funds originate with the Federal Government and the bulk of these funds are channeled through the DOD and NASA. It is not unusual to expect that a large proportion of research and development in the aerospace and electrical industries is Government financed. In 1963, for example, 90.4 percent of the R & D performed in the aircraft and missile industries was Federally financed, and 62.9 percent of the R & D funds for electrical and communications equipment originated with the Federal Government.

CAPITAL SPENDING PLANS IN CINCINNATI AND CLEVELAND

In today's environment of a fast moving economy, capital spending by business firms is being watched closely for possible signs that such spending may be expanding at an excessive rate. As a major factor affecting the pace and direction of economic activity, excessive capital spending can overtax the capacity of capital goods producers, thus creating bottlenecks, shortages, price pressures, and the like. On the other hand, capital spending, if carried too far, can result in overcapacity and a subsequent snapback with accompanying adverse effects on economic activity in general. The possible problems resulting from excessive capital spending in the environment of a fast moving economy were brought into sharp relief earlier this year when the Administration urged business firms to re-evaluate and slow down capital investment programs.

In 1965, business firms throughout the nation spent 16 percent more for new plant and equipment than during 1964; manufacturing firms increased such spending by 21 percent. The latest Federal Government estimates indicate that total capital spending in 1966 will exceed that of last year by about the same margin—or by an even higher margin, according to estimates of several private sources.

Against this national background, the results of this bank's regular semiannual surveys of capital spending plans in two major areas of the Fourth Federal Reserve District, conducted in April 1966, are presented in the following pages. In comparing local data with national figures, it is important to remember that the large national aggregates tend to conceal regional differences resulting from variations in coverage, response rate, industry mix, as well as timing and geographical distribution of spending by individual firms.

CINCINNATI

According to this bank's April survey, business firms in the seven-county Cincinnati metropolitan area expect capital outlays for 1966 to exceed those for 1965 by an even larger margin than they had anticipated last fall—56 percent versus 41 percent (see Table I). Manufacturing firms reporting in the survey (accounting for more than 50 percent of manufacturing employment in the Cincinnati area) now plan to spend 72 percent more for new plant and equipment this year than last year (last October's survey had indicated a 42 percent rise). Public utilities plan to increase capital outlays in 1966 by 35 percent, a slight reduction from the estimate of last fall.[1]

[1] Capital outlays of the entire reporting group, including some expenditures outside the seven-county area by the utilities firms, are expected to exceed $180 million in 1966.

TABLE I
Capital Spending by Cincinnati Area Firms
Year-to-Year Percent Changes

	Fall 1965 Survey	Spring 1966 Survey	
	1965 (planned) to 1966 (planned)	1965 (actual) to 1966 (planned)	1966 (planned) to 1967 (planned)
MANUFACTURING	+ 42%	+ 72%	+ 1%
Durable goods	+ 60	+103	+10
Primary and fabricated metals*	+ 61	+ 24	+13
Machinery	— 7	+ 27	—21
Electrical equipment	— 22	— 13	—22
Transportation equipment	+194	+219	+20
Other durables†	n.a.	+ 1	—22
Nondurable goods	+ 20	+ 45	—13
Food and kindred products	+ 28	+ 52	+26
Textiles; apparel; leather	— 20	— 66	—34
Paper and allied products	— 40	— 48	+ 1
Printing and publishing	+234	+180	—43
Chemicals	— 13	+ 47	—24
PUBLIC UTILITIES	+ 39	+ 35	+ 3
TOTAL	+ 41%	+ 56%	+ 2%

* Primary and fabricated metal industries combined in order to preclude disclosure of individual establishment data.

† Includes miscellaneous manufacturing, furniture, and stone-clay-glass industries.

n.a. Not available.

Source: Federal Reserve Bank of Cleveland

Upward revisions of last October's estimates for 1966 were widespread, involving both large and small firms and all major industries. Sixty percent of the manufacturing concerns participating in both surveys raised their figures between last fall and this spring; 40 percent of the firms either reduced their estimates or left them unchanged. While actual 1965 expenditures of more than 40 percent of the participating firms have now turned out to be lower than last October's estimates, the shortfall does not fully explain the upward revisions in spending plans for 1966 between the two survey dates.

The large rise in spending for capital equipment in 1966 in the manufacturing group, and the even larger increase in the durable goods sector, is dominated by the spending plans of transportation equipment manufacturers (see Table I). That industry's expected outlays for 1966—an increase of 219 percent—dwarf most other industries both in percentage increase and in total dollars. Increased spending in the nondurable goods sector in 1966 reflects substantially enlarged spending plans of chemicals and food, the two largest industries in that sector, with each expecting to spend about 50 percent more in 1966 than in 1965. The large rise in nondurable goods outlays for 1966 also reflects the planned purchase of several million dollars' worth of new printing equipment by the printing and publishing industry.

Early plans show a slight increase in total capital spending in 1967, with most industries currently expecting to spend less than this year, however. The major exceptions are the transportation equipment, food, and metals industries, whose increased spending would offset the reduced spending of other industries and keep total expenditures for the area from dropping below the estimated level for 1966.

The impact of the sharp increase in spending by the transportation equipment industry on the distribution of outlays among major industries can be gauged from Table II. Nearly one dollar out of every four that will be spent this year by all participants will come from that one industry; the industry's share of total spending in 1966 will thus be twice that of 1965.

About one dollar in four in 1966—a some-

TABLE II
Capital Spending by Cincinnati Area Firms (Spring 1966 Survey)
Percent Distribution of Total Spending by Industry

	1965 (actual)	1966 (planned)	1967 (planned)
MANUFACTURING	55.5%	61.4%	58.9%
Durable goods	26.4	34.3	38.1
Primary and fabricated metals*	2.7	2.1	2.4
Machinery	4.8	3.9	2.9
Electrical equipment	4.2	2.4	1.9
Transportation equipment	11.8	24.0	29.7
Other durables†	2.9	1.9	1.2
Nondurable goods	29.1	27.1	20.8
Food and kindred products	8.3	8.1	7.9
Textiles; apparel; leather	0.6	0.2	0.1
Paper and allied products	2.8	0.9	0.7
Printing and publishing	1.8	3.2	1.8
Chemicals	15.6	14.7	10.3
PUBLIC UTILITIES	44.5	38.6	41.1
TOTAL	100.0%	100.0%	100.0%

* Primary and fabricated metal industries combined in order to preclude disclosure of individual establishment data.
† Includes miscellaneous manufacturing, furniture, and stone-clay-glass industries.

Source: Federal Reserve Bank of Cleveland

what smaller proportion than in 1965—is earmarked for new structures in the manufacturing sector (see Table III), with the remaining three dollars being used to purchase equipment. As usual, the proportion of total spending for new construction is larger in the nondurable than in the durable goods industries. The proportion for the latter is reduced because nine-tenths of this year's and all of next year's large outlays in the transportation equipment industry are for new equipment rather than structures.

An unusually high proportion of total expenditures—six out of every ten dollars—will be for expansion of present manufacturing facilities, with the remainder to be spent for replacement of present plant and equipment. The emphasis on expansion is slightly stronger in the durable than in the nondurable goods industries. Most industries in the durable goods group plan to spend more for expansion in 1966 than in 1965, in contrast

TABLE III
Capital Spending by Cincinnati Area Firms (Spring 1966 Survey)
Percent Distribution of Total Spending by Type* (Between Structures and Equipment and Between Expansion and Replacement)

	Structures†			Expansion‡		
	1965	1966	1967	1965	1966	1967
MANUFACTURING	28%	24%	20%	58%	60%	65%
Durable goods	16	12	4	46	66	69
Primary and fabricated metals§	23	21	25	25	24	29
Machinery	5	15	5	69	82	76
Electrical equipment	20	8	6	32	61	61
Transportation equipment	17	10	0	34	65	73
Other durables#	18	25	18	72	83	78
Nondurable goods	38	38	39	68	56	61
Food and kindred products	48	39	46	39	41	34
Textiles; apparel; leather	58	27	50	65	35	46
Paper and allied products	20	18	9	49	38	10
Printing and publishing	20	6	3	78	26	41
Chemicals	37	46	43	83	71	85
PUBLIC UTILITIES	31	29	41	72	74	76
TOTAL	29%	25%	25%	62%	64%	68%

* Based only upon returns in which these breakdowns were supplied.
† Spending for equipment equals 100% less the percentage shown for structures.
‡ Spending for replacement equals 100% less the percentage shown for expansion.
§ Primary and fabricated metal industries combined in order to preclude disclosure of individual establishment data.
# Includes miscellaneous manufacturing, furniture, and stone-clay-glass industries.

Source: Federal Reserve Bank of Cleveland

to the nondurable goods group where most industries expect to reduce the proportion of spending for expansion this year (see Table III).

A special question on capital spending for research and development purposes, which was answered by three-fourths of the respondents, indicated that about 6 percent of total capital outlays this year will be for R & D, up from 4 percent last year. Three out of five firms answering the question showed no capital spending for R & D.[2] Of those spending on R & D, a number of industries, notably chemicals, food, and machinery, show R & D spending for 1966 as high as 7 and 8 percent of total capital outlays. In some cases, an individual firm's R & D expenditures, which may be as high as 15 percent of its total capital outlay, accounts for virtually the entire amount of R & D capital spending in the industry.

Over half of the manufacturing firms reported that existing or planned capacity was adequate to meet expected near-term needs. One firm out of three indicated insufficient capacity, except for the machinery, electrical equipment, and chemical industries where relatively more firms seem to be operating at ceiling capacity.

Manufacturing firms in the Cincinnati area financed 95 percent of capital outlays in 1965 out of internal funds; they expect to finance 90 percent of 1966's expenditures, and 95 percent of 1967's, in a similar way. Only the nondurable goods industries used external financing in 1965; durable goods manufacturers did not resort to external funds last year and expect to rely almost 100 percent on internal financing in 1966 and 1967.

CLEVELAND

Manufacturing firms and public utilities in the Cleveland metropolitan area, taken together, expect to increase capital spending by 14 percent in 1966 (13 percent and 14 percent, respectively) and to raise outlays still further in 1967 (see Table IV).[3] The new estimates for 1966, which were obtained from this bank's spring survey, reveal considerable changes from the plans for 1966 as reported last fall. At that time, manufacturers had planned to spend 7 percent more in 1966 than in 1965, while public utilities had expected to spend 14 percent less than in 1965; when combined, the resulting total figure showed no change for capital spending in Cleveland during 1966, compared with 1965.

It should be emphasized that the now expected 14 percent increase in plant and equipment expenditures in 1966 over 1965 does not mean that more dollars will be spent this year than had been anticipated last October. The increase for 1966 over 1965 is due to the fact that *actual* capital outlays in 1965 came in at a lower figure than had been estimated. (The actual 1965 figure is used as the base for comparing estimated 1966 expenditures.) Interestingly, more than half of the returns in the latest survey indicated that

[2] Some of the largest national firms apparently did not answer the question because their R & D work is performed at one central location rather than at different local establishments.

[3] Total capital outlays have been reported by manufacturing firms employing about 45 percent of all employees in manufacturing and by major public utilities, and are estimated to exceed $260 million in 1966.

TABLE IV
Capital Spending by Cleveland Area Firms
Year-to-Year Percent Changes

	Fall 1965 Survey	Spring 1966 Survey	
	1965 (planned) to 1966 (planned)	1965 (actual) to 1966 (planned)	1966 (planned) to 1967 (planned)
MANUFACTURING	+ 7%	+ 13%	+20%
Durable goods	+ 7	+ 10	+22
Primary metals	+ 8	— 7	+55
Metal fabrication	+ 31	+ 43	— 3
Machinery	— 8	+ 45	+25
Electrical equipment	+111	+140	—32
Transportation equipment	— 5	+ 5	— 6
Other durables*	n.a.	+ 6	+49
Nondurable goods	+ 6	+ 45	+ 2
Textiles; apparel	+ 17	+ 59	—59
Printing and publishing	— 12	— 30	+20
Chemicals	+ 6	+ 73	+23
Other nondurables†	n.a.	+ 51	— 6
PUBLIC UTILITIES	— 14	+ 14	+11
TOTAL	‡	+ 14%	+17%

* Includes ordnance, stone-clay-glass, instruments, and miscellaneous manufacturing industries.

† Includes beverages, petroleum, and rubber industries.

‡ —0.3%.

n.a. Not available.

Source: Federal Reserve Bank of Cleveland

actual spending in 1965 was below the amounts estimated last October; this was more than enough to offset actual spending that turned out to be higher than estimated by one-third of the participating firms.

Also worthy of note is the fact that last October's estimates for 1966 were revised upward in six out of every ten cases—one-third of which appear to reflect carry-over from 1965 into 1966. But these increases were offset by reductions in planned spending for 1966 as reported in other returns, so that estimated 1966 dollar outlays remained unchanged between the fall and spring surveys.

The numbers in Table IV clearly reflect the revisions in estimates during the six-month interval between surveys. For example, in the machinery industry the estimate for 1966 has now changed from a slight decline in spending—as reported last fall—to a substantial increase, reflecting both downward adjustments in last year's spending and upward revisions in estimates for this year. On the other hand, in the primary metal industries last October's estimate of an 8 percent increase in outlays for 1966 has now turned into a 7 percent decline, due to a downward revision in 1966 outlays, which, as the large estimated increase for 1967 suggests, apparently results from a postponement of some planned spending until next year.

The industrial composition of the Cleveland area is mirrored by the distribution of total capital outlays among the different industries (see Table V). The figures show that two-thirds of total spending is accounted for by manufacturers of durable goods. There has been little variation from year to year in the proportions of spending by the manufacturing group (including its two major subdivisions) and by public utilities. The changes in the shares of individual industries—for example, electrical equipment and primary metals—reflect special situations such as a large construction project scheduled for this year by a manufacturer of electrical equipment, or the apparent postponing of spending plans until 1967 in a portion of the primary metal industries.

The distribution of outlays between structures and equipment (indicated by the proportion of spending for structures in Table VI) is remarkably stable for the manufactur-

TABLE V
Capital Spending by Cleveland Area Firms (Spring 1966 Survey)
Percent Distribution of Total Spending by Industry

	1965 (actual)	1966 (planned)	1967 (planned)
MANUFACTURING	72.7%	72.6%	73.9%
Durable goods	66.4	64.6	67.0
Primary metals	32.4	26.5	34.4
Metal fabrication	3.8	4.8	3.9
Machinery	6.2	7.9	8.4
Electrical equipment	2.8	5.9	3.5
Transportation equipment	19.0	17.5	14.2
Other durables*	2.2	2.0	2.6
Nondurable goods	6.3	8.0	6.9
Textiles; apparel	1.3	1.8	0.6
Printing and publishing	1.4	0.9	0.8
Chemicals	3.0	4.6	4.9
Other nondurables†	0.6	0.7	0.6
PUBLIC UTILITIES	27.3	27.4	26.1
TOTAL	100.0%	100.0%	100.0%

* Includes ordnance, stone-clay-glass, instruments, and miscellaneous manufacturing industries.

† Includes beverages, petroleum, and rubber industries.

Source: Federal Reserve Bank of Cleveland

ing group as a whole. This is so despite year-to-year fluctuations within individual industries as, for example, in the electrical equipment industry, where the construction of a new plant shows up as a temporary rise in the percentage of outlays earmarked for structures in 1966.

Table VI also shows the distribution of capital outlays between expansion and replacement (the proportion for replacement is the difference between 100 percent and the figure for expansion). Two out of every three dollars of total spending in 1966 (and 1967) are planned for expansion of present facilities, a slight increase over 1965. The proportion is even higher in most of the nondurable goods industries. The large proportion of spending for expansion is perhaps surprising in that less than one-half of the responding manufacturing firms consider present facilities to be "less than required."

Some observers believe that capital spending plans for 1966 and 1967 are to be moderated, at least in part, by lack of funds. But this is not confirmed by the information supplied by Cleveland manufacturing firms who ap-

TABLE VI
Capital Spending by Cleveland Area Firms (Spring 1966 Survey)
Percent Distribution of Total Spending by Type* (Between Structures and Equipment and Between Expansion and Replacement)

	Structures†			Expansion‡		
	1965	1966	1967	1965	1966	1967
MANUFACTURING	16%	16%	15%	62%	66%	67%
Durable goods	15	14	13	60	64	64
Primary metals	12	11	10	74	77	76
Metal fabrication	19	8	7	31	61	70
Machinery	27	11	33	46	44	50
Electrical equipment	15	47	9	65	62	62
Transportation equipment	18	9	6	48	59	51
Other durables§	9	7	23	35	58	66
Nondurable goods	29	33	43	75	77	85
Textiles; apparel	34	49	21	91	93	90
Printing and publishing	35	11	8	86	78	83
Chemicals	29	36	58	69	76	90
Other non-durables#	5	6	7	47	43	51
PUBLIC UTILITIES	26	24	20	70	68	69
TOTAL	19%	18%	17%	64%	67%	67%

* Based only upon returns in which these breakdowns were supplied.

† Spending for equipment equals 100% less the percentage shown for structures.

‡ Spending for replacement equals 100% less the percentage shown for expansion.

§ Includes ordnance, stone-clay-glass, instruments, and miscellaneous manufacturing industries.

Includes beverages, petroleum, and rubber industries.

Source: Federal Reserve Bank of Cleveland

parently anticipate no obstacles in financing capital expenditures. A vast majority of those replying to the question on financing expect to have sufficient internal funds to satisfy all capital outlays in 1966 and 1967. The use of external funds, which financed less than 2 percent of total expenditures in 1965, is expected to rise only to 6 percent for 1966 and to 5 percent for 1967. If financing pressures were to develop, they would probably be felt first in raising external funds. If such funds were less available, the influence on actual capital spending at this juncture would appear to be only marginal.

Fourth Federal Reserve District