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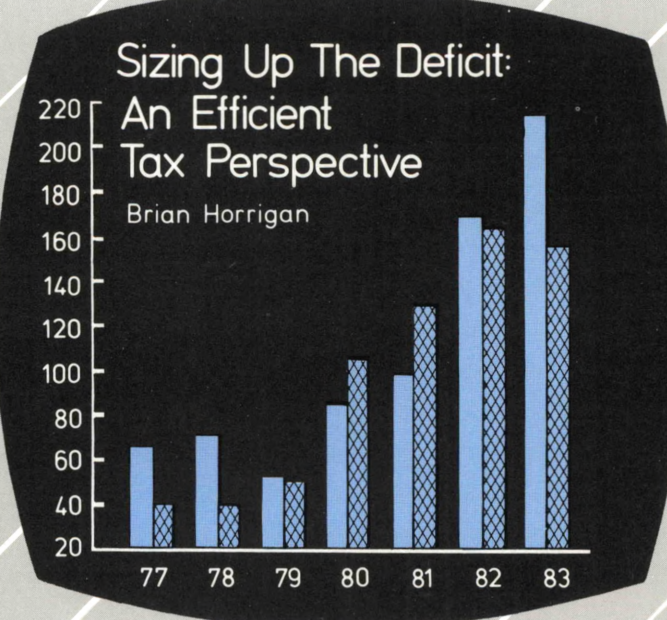

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Targeting High Tech In The Delaware Valley

*John M. L. Gruenstein**

Around the country and around the world, economic development officials are trying to jump on a speeding bandwagon called high tech. Places with high tech concentrations like California's Silicon Valley, the Boston area's Route 128, and North Carolina's Research Triangle have become the new models for job creation efforts. Targeting technological frontrunners—like computers, robotics, and genetic engineering—has become a new gospel of development strategy for planners from Peoria to Paris.

In the Delaware Valley, as elsewhere, however, there is a broad range of opinion about development efforts that focus on industries at the leading edge of rapid technological change. Some view the game as not worth the candle, because of the relatively few jobs that high tech industries are expected to produce and the intense competition involved. Others say it's how you play the game that matters for success—for instance, whether you try to lure branch plants of giant firms like IBM, or whether you nurture local entrepreneurs who might be able to create the IBMs of the future in your own backyard. To analyze the local prospects for success, it is useful to look at examples of how high technology industries have developed

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in the places where they have grown fast, and then to make a more systematic comparison of the factors which promote high tech growth with the strengths and weaknesses of the region.

CHARACTERIZING HIGH TECH

Before anyone can figure out whether to take aim at high tech, the first thing that has to be settled is, what is "high tech." In general, high technology industries are usually taken to mean those at the leading edge of rapid technological change. Such a definition by its very nature produces a list of industries that changes over time—Philadelphia's Baldwin Locomotive Works was a high tech firm in the nineteenth century, and robotics could become a "smokestack" industry of the twenty-first. Using research and development (R & D) spending and the proportion of technical workers as criteria, the U.S. Bureau of Labor Statistics (BLS) has proposed three different definitions of high tech industries (see DEFINING HIGH TECH). The six industries in the most narrowly defined group—office equipment and computers, communications equipment, electronic components, aircraft, guided missiles, and drugs—are included in virtually all lists of high tech industries. Therefore they provide a good starting place for discussing the characteristics that make these industries attractive to economic development planners.

One attractive feature is fast-growing sales. Recent studies predict larger average annual growth rates for sales and shipments in most high tech industries over the next five years than for industry in general (see TABLE 1). Projections are particularly strong for computers and electronics. Fast-growing sales means fast-growing employment, although not usually on a one-to-one ratio. The narrowly defined group of six high technology industries showed job growth of 39.8 percent between 1972 and 1982, compared to 20.1 percent for all wage and salary workers. For 1982-95, the BLS projects that employment in these industries will register growth between 34 and 38 percent, while employment in all industries grows between 25 and 31 percent.

A particular advantage of high tech industries is that a high proportion of the goods and services they produce are sold in national and global markets—that is, outside the region where they are produced. This is important to state and local economic development planners because it means that money spent to stimulate local growth of high tech firms has the potential to generate a net gain of jobs for the region. A plant manufacturing

DEFINING HIGH TECH

A number of researchers have drawn up lists of high tech industries, which are usually based on the percentage of revenues allocated to research and development (R&D), the proportion of technical or scientific workers in the industry's employment, or a combination of these factors. A recent study by the U.S. Bureau of Labor Statistics laid out three alternate definitions of high tech industries.[a] The broadest definition includes those industries with at least 1.5 times the average proportion of technology-oriented workers (engineers, life and physical scientists, mathematical specialists, engineering and science technicians, and computer specialists) compared to the average for all industries.[b] This wide-ranging group contains 48 industries, not all of which would be commonly thought of as high tech. The next broadest group is defined to include

> manufacturing industries with a proportion of technology-oriented workers equal to or greater than the average for all manufacturing industries, and a ratio of R&D expenditures to sales close to or above the average for all industries. Two non-manufacturing industries which provide technical support to high tech manufacturing industries are also included.

This definition brings the list of included industries down to 28, eliminating such mature industries as heavy construction, tire production, motor vehicles, and household appliances. The criterion for inclusion in the third group, the most narrowly defined, is a ratio of R&D expenditures to sales at least twice as large as the average across industries. Only six industries meet this criterion—drugs, office equipment and computers, communications equipment, electronic components, aircraft, and guided missiles.

[a]Richard W. Riche, David E. Hecker, and John U. Burgan, "High Technology Today and Tomorrow: A Small Slice of the Employment Pie," *Monthly Labor Review,* (November 1983), pp. 50-58.

[b]Industries as defined by three-digit Standard Industrial Classification (SIC) codes.

TABLE 1

GROWTH PROJECTIONS FOR HIGH TECH INDUSTRIES

Industry Shipments, 1983 - 1988
(Adjusted for Inflation)

Industry	Annual Average Compound Rate of Growth[a]
Computers	17 %
Electronics	14.5%
Telecommunications Equipment	
Radio and Television	8 %
Telephone and Telegraph	5 %
Drugs	4 %
Aerospace	3 %
All Manufacturing	4.8%[b]

[a]U.S. Bureau of Industrial Economics, *1984 U.S. Industrial Outlook*, (Washington, D.C.: U.S. Department of Commerce, 1984).

[b]Estimated average annual growth rate of output, adjusted for inflation, 1983-88. Source: Interview with Gorti Narasimham, U.S. Bureau of Industrial Economics, March, 1984.

computers, for instance, will likely sell well over 90 percent of its products outside the area where it is located. If such a plant is stimulated to operate in a region, the revenues it generates to pay its employees will generally be a net gain to the region. Even if the new sales cut into competitors' revenues, those competitors are likely to be hundreds or thousands of miles away. In contrast, if economic development funds are expended to help firms in industries which provide goods and services only to local consumers—for instance, grocery stores, dry cleaners, or beauty parlors—the net effect on local jobs is most likely to be near zero, because by and large the firms which are helped can expand employment only by taking sales away from other local firms in the same industry, who will therefore have to cut employment.[1]

On the other side, however, even though high tech industries are fast-growing, the absolute number of jobs they will provide over the next ten years will probably be relatively small for most regions, because the number of current high tech jobs is small. High tech industries will likely contribute far fewer jobs than the much larger service industries, for instance. Overall, the BLS projects that only about one million of the new jobs created between 1982 and 1995 will be in the six narrowly defined high technology industries, representing about 3 percent of all new jobs created over that period. Of course, it is true that high tech industries also indirectly stimulate job growth in other sectors through local purchases of goods and services by high tech firms and their employees. Some of the growth in business service industries, for instance, is attributable to the growing demand from the high tech sector. But even taking direct and indirect effects together, high tech industries alone will not be a panacea for regions that have been hard hit by losses in traditional manufacturing sectors.

Balancing the pros and cons, state and local economic development officials around the country have opted in many cases to make high tech targeting a substantial part of their overall strategy. One strong motivating factor in their decisions has been that, despite the statistics suggesting relatively small overall job growth, some particular places have benefited greatly from high technology growth. Planners point to these examples of success as possible models for the development of their own regions.

HIGH TECH SUCCESS STORIES

State and local planners who look with enthusiasm toward high technology industries are encouraged to do so by several well-known places where fast employment growth has been fueled by high technology development. Three areas in particular stand out—Silicon Valley (Santa Clara County, California), Route 128 (the highway ringing the Boston-Cambridge metropolitan area), and

[1]It is true that some services do constitute part of the export base of many regions. See John Gruenstein and Sally Guerra, "Can Services Sustain a Regional Economy?" this *Business Review* (July/August 1981) pp. 15-24.

Research Triangle, North Carolina. These areas have similarities and differences which provide useful information about the possibilities and prospects for regional high tech targeting.[2]

Historical studies of the development of Route 128 and Silicon Valley indicate that much of their growth came from new high technology ventures started up by engineers and scientists who were already working for other technology-oriented companies or for universities in the same geographic area. A good deal of the impetus for these new ventures came from defense spending by the U.S. government for research and new product development. The excellence of the engineering and science faculties at M.I.T. and Harvard (in Cambridge) and Stanford and Berkeley (in the San Francisco area) drew a large proportion of technologically-oriented defense spending to these universities, and created opportunities for faculty members to start new firms based on research they were pursuing under federal grants. State and local government incentives for high tech development in these two areas, however, were largely nonexistent during their first few decades of growth, although in recent years, both Massachusetts and California have initiated programs to promote the development of high tech industries. Rather than reflecting the success of local targeting efforts, the development of Route 128 and Silicon Valley reflected the entrepreneurial response of scientists, engineers, venture capitalists, and real estate developers to the stimulus of demand for high technology products by the federal government and subsequently by firms in other industries. This entrepreneurial response took place in geographically concentrated areas around the universities which provided the initial impetus. It became self-sustaining as other resources needed for its further growth—like capital, skilled manpower, and office and production space—were made available in the same area.

By contrast, the Research Triangle Park in North Carolina was the result of a deliberate effort by academic, private sector, and government leaders to target the attraction of scientific research facilities as a way of stimulating local economic development. In 1958, a committee organized by the state governor, Luther H. Hodges, and including prominent businessmen, bankers, and university presidents, raised about $2 million in private contributions to buy the 5500 acres of pineland in the triangle formed by Duke University, the University of North Carolina, and North Carolina State University that was to become the park. The committee then formed the non-profit Research Triangle Foundation, the owner and manager of the development. The Foundation's sole asset is the land inside the park, and its only source of revenue is from leasing and selling the land.[3]

While the park is not run by the state, there has been strong indirect state government support for the development. In 1963, North Carolina set up the first state agency in the U.S. directed at encouraging scientific research and technological applications. State funds have been forthcoming for educational programs that tie into the activities of prospective park tenants. In 1980, for instance, the state allocated $24 million to fund microelectronics research at the three universities surrounding the park, which helped to attract a $100 million General Electric Microelectronics Research Center.[4] Another way government has helped the park grow is through salesmanship—for instance, James Hunt, the current governor, has visited Silicon Valley to try to induce firms there to relocate or open branches in North Carolina.

Unlike Route 128 and Silicon Valley, Research Triangle Park has grown principally through the attraction of outside establishments instead of through the start-up of indigenous firms. The majority of the 20,000 jobs currently located in the park are in research or manufacturing facilities of corporations headquartered elsewhere, such as IBM and Monsanto, and of federal agencies, such as the Environmental Protection Agency. The presence of the park has also lured some heavy manufacturing branch plants of companies like

[2]A good overview of the development of Route 128, Silicon Valley, and Research Triangle is in Robert Premus, "Location of High Technology Firms and Regional Economic Development," Joint Economic Committee of Congress, (Washington, D.C.: Government Printing Office, 1982), Appendix A.

[3]See Paul Horvitz, "A Park That's Always in Season," Raleigh, N.C. *News and Observer,* (February 27, 1977), p. 1.

[4]See Roger Lopata, "Research Triangle: A Far Out Concept That Worked," *Iron Age,* November 23, 1981.

General Electric and SCM Glidden Metals to locations just outside the park's boundaries. By and large, however, relatively little employment has been generated in the area through start-ups of small high tech companies.

These three examples show two alternative ways in which high tech concentrations have grown: through civic efforts to attract branch facilities of large multi-establishment organizations, as in North Carolina, or through largely private initiatives leading to the growth of new high tech ventures, the type of development that has characterized the Boston-Cambridge nexus and Silicon Valley. Both components of employment growth probably generate a sizable proportion of new high tech jobs.[5] Both branch plants and new firms can expand over time, adding to the third important source of job growth, expansions of existing firms. Both can themselves spin off still more new firms, as employees with a desire to run their own business and the technological know-how to create a new product decide to become entrepreneurs. Since traditional economic development activities have emphasized attracting facilities from outside, success stories like Research Triangle's have prompted many states and localities to adapt their programs to attracting branch facilities of high tech firms.

GOING AFTER BRANCHES

As high tech markets expand, and high tech firms expand to meet the demand, they often set up new branch establishments. This growing pool of new high tech branches is a tempting prize for regions to compete for. States and localities have a variety of instruments at their disposal to try to attract high tech branches, including low interest loans, tax abatements, providing land at below market value, and other potentially costly programs. For any region, the amount they want to spend depends on the probability of success, which, in turn, depends on the number of competitors and the comparative advantage of the region.

Stiff Competition. While high technology markets are growing fast, so is the number of state and local initiatives aimed at high technology development. Before 1981, the U.S. Office of Technology Assessment (OTA) reported nine state programs. Ten more were started in 1981, fifteen in 1982, and by May 1983, there were 38 state programs in 22 states exclusively dedicated to high technology development—including Pennsylvania's Ben Franklin Partnership Fund.[6]

Two aspects of the pursuit of high tech branches deserve to be noted. First, regions are unlikely to be able to induce firms to make a decision to branch; they can only try to induce firms to locate establishments in their area once the firms themselves have decided to branch. So the number of branches that regions are competing for is largely a result of macroeconomic and industry conditions, and therefore out of the control of regional policymakers. Second, the competition for those branches is stiff, and such strong competition among regions means that high tech firms looking to construct a new branch plant can do a lot of shopping around to get the best deal from local economic development agencies. Officials in one region are under great pressure to match the interest rate subsidy, tax break, site price, or special training programs that other localities are offering. Thus, competition pushes up the costs of putting

[5] A substantial percentage of total employment growth in all industries—not just high tech—comes from start-ups and branches. Researchers at M.I.T. have estimated that between 1979 and 1980, 4,275,000 million net new jobs of all types were added in the U.S. by start-ups, and 1,903,000 net new jobs of all types were added through new branch plants. See David Birch and Susan MacCracken, "The Small Business Share of Job Creation: Lessons Learned from the Use of a Longitudinal File," M.I.T. Program on Neighborhood and Regional Change, March 1983 (mimeo), Table 8. Researchers from the Brookings Institution using the same data base had previously come up with smaller totals for the number of jobs generated by new ventures and a larger proportion for the number generated by branches for 1976-1980, but the percentages are still large for both components. See Catherine Armington, "Further Examination of Sources of Recent Employment Growth: Analysis of USEEM Data for 1976 to 1980," Business Microdata Project, The Brookings Institution, March 1983 (mimeo). It is likely that job growth in high tech industries follows roughly the same pattern as total employment growth.

[6] U.S. Office of Technology Assessment, *Technology, Innovation, and Regional Economic Development*, Background Paper #1 (May 1983) and Background Paper #2 (February 1984). The state programs described in these publications include ones directed at stimulating high tech entrepreneurship and technology transfer to firms in older industries, as well as high tech branch plant attraction.

together a winning hand in the game of attracting branches.

To a large extent, the costs of attracting branches depend on a region's initial comparative advantage—the underlying structure of cost and market factors that an incoming firm faces. A poker player may improve his hand by drawing new cards, but the probability of winding up with a winning hand depends a lot on how good his hand was to begin with. So, in assessing the prospects for improving the Delaware Valley's chances for attracting high tech branch plants, it is important to know what factors are the most significant to high tech location decisions and how the region stacks up on these factors.

High Tech Location Factors. Three recent studies, one by the Joint Economic Committee (JEC) of Congress, one by the Fantus Company, a consulting firm, and one by a research group at Berkeley, have attempted to find out what factors are important to location decisions of high tech firms. In June 1982 the JEC released a study of high technology manufacturing industries based on a survey sample of almost 700 high tech firms.[7] The respondents were asked what were the most significant factors influencing a firm's choice of region. Highest rated was the availability of skilled labor: about 90 percent of the respondents stated this was a "significant" or "very significant" factor. The next most important factors were labor costs and taxes, followed by the presence and quality of academic institutions, cost of living, transportation, and access to markets. Some factors associated with more traditional manufacturing concerns, such as energy costs and access to raw materials, were ranked fairly low. Somewhat surprisingly, climate and cultural amenities, which are sometimes described in the popular press as quite important to high tech firms, were also rated low.

The second report, undertaken by the Fantus Company (a consulting firm which specializes in helping firms find sites for new facilities), reviews 86 location studies for high technology facilities, and it supports and refines the JEC results.[8] The Fantus study divides high technology facilities into three categories based on the stage of product development, with the two later stages most relevant to branch plant location decisions.[9] In the second stage of development, the facility is described as *product-driven.* In this stage, the product is commercially viable, but without strong competition. Close monitoring of production to assure quality control is important, and there may be a need to modify individual units to meet customer specifications. Here, the main location factors are availability of technicians and skilled workers, accessibility to the R&D facility of the parent firm, attractive living conditions, and a favorable business climate. At the third stage of the high tech product life-cycle, the *market-driven* phase, price competition from other firms pushes the location choice toward the lowest cost location. At this stage, the most important locational criteria are the availability of low cost labor, low cost utilities, and government incentives.

A third study, conducted by researchers at the University of California at Berkeley in 1983, found a very different pattern.[10] Instead of relying on survey data, the Berkeley study analyzed actual concentration and growth patterns of high technology employment and plants across regions during the period 1972-1977. In contrast to the JEC study, the Berkeley group found virtually no relationship between labor costs (as measured by average manufacturing wages in 1977) and high technology activity. In fact, after examining a wide range of variables, the Berkeley group found very little explanatory power from most of the common hypotheses concerning high tech location factors, and found conflicting results from different sorts of tests. In general, high defense spending and

[7] Robert Premus, "Location of High Technology Firms and Regional Economic Development," Joint Economic Committee of Congress, June 1, 1982.

[8] Robert M. Ady, "High-Technology Plants: Different Criteria for the Best Location," *Economic Development Commentary,* (Winter 1983), pp. 8-10.

[9] Facilities in the first stage of development, described as *theory-driven,* are primarily embryonic firms doing advanced theoretical research. As the discussion of new high tech ventures in the next section points out, most firms at this stage of development do not make an explicit location decision, but rather start up wherever the founders happen to be.

[10] Amy K. Glasmeier, Peter Hall, and Ann R. Markusen, "Recent Evidence on High Technology Industries' Spatial Tendencies: A Preliminary Investigation," Institute of Urban and Regional Development, University of California, Berkeley, Working Paper No. 417, (October 1983).

good access to major airports were most consistently related positively to growth of high technology industries. Less consistently, the presence of major universities with good engineering or business schools was also found to be associated with high tech activity.

From the point of view of an economic development planner trying to assess the attractiveness of his region for high tech branch plants, the Fantus and JEC studies are probably better guides than the Berkeley study. It is true that the latter has the advantage of looking at the results of actual location decisions, rather than merely asking respondents before the fact what they would do, as the JEC study does. But this advantage is counterbalanced by the fact that the Berkeley study analyzes aggregate employment changes, which include employment increases due to new start-ups and expansions of existing firms, as well as those due to branch plant openings, along with employment decreases due to facility lay-offs and closings.[11] Thus, the lack of significance for most location factors found by the Berkeley study, and its lack of consistency with the more narrowly focused surveys, may very well be a good indication that different factors influence these different components of change—a point that relates closely to the Fantus study's finding that facilities at different stages of production respond to different location factors.

Delaware Valley's Climate for Branch Plants. Because the relatively consistent results of the Fantus and JEC studies likely provide a good indication of factors important to high tech branch plant location decisions, they are useful for analyzing the strengths and weaknesses of a particular region for branch plant attraction. In general, the Delaware Valley seems to rank about average on factors that the two studies found most significant, such as labor skills and costs and taxes (see TABLE 2 page 10). Some of the area's stronger attributes, such as the presence of high quality academic institutions and a major airport, lie in the middle range of high tech facility location attributes as described by the JEC study. In some cases, what are perceived to be Delaware Valley strengths, like the presence of strong arts and cultural institutions, seem to be relatively unimportant to high tech firms. (Separating branches into the two categories of the Fantus study indicates that the area does somewhat better on factors affecting product-driven facilities than on factors for market-driven facilities, but even so, the pluses and minuses are relatively equal.)

The overall impression is that in terms of competing for high tech branches, the Delaware Valley's advantages compared to other areas are balanced by factors on which the region rates no better than average. Given the stiff competitive environment, these results suggest that while some benefits can be gained by targeting branches, it is likely to be a costly, uphill battle. But this need not mean that an emphasis on high technology has little place in local economic development efforts. An alternative to targeting high-tech branch plants for economic development is to focus instead on stimulating start-ups of new high technology firms by local entrepreneurs.

TARGETING HIGH TECH START-UPS

An advantage of targeting start-ups is that an entrepreneur's decision to set up a business very rarely involves a location decision. Most people who decide to produce and market a new product or service usually start up wherever they happen to be at the time—the decision is *whether* to set up the firm, not *where*. Because of this, one region's gain in an additional new venture isn't necessarily another region's loss, as it is in the case of high tech branches. So local efforts to increase the rate of start-ups may actually be able to expand the total number of new ventures nationally, creating a larger overall pot for regions to go after, as well as increasing the probability of getting a share. Thus, economic development activities directed at start-ups run into less direct competition with other areas than those directed at branches.[12]

[11] Employment changes due to all these other components combined have been shown by other researchers to be far larger than the changes due to branch location. Birch and MacCracken, in "The Small Business Share of Job Creation . . .," found employment changes for all industries (not just high tech) due to new branch plants were only 12 percent of *gross* employment change from all components and only about 39 percent of *net* change, for 1979-80.

[12] Regions attempting to stimulate start-ups would be competing indirectly, however, in the sense that an entrepreneur in one region could be competing with a firm in another.

TABLE 2

DELAWARE VALLEY RANKING ON HIGH TECH LOCATION FACTORS

Factor	Effect on Firms		Attractiveness of Delaware Valley
	JEC	Fantus	
Good Labor Skills	High	Strong	Medium
Low Labor Costs	High	Strong	Medium
Good tax climate	High	Strong	Low to Medium
Academic Institutions	Medium	Strong	High
Low Cost of Living/ Low Housing Prices	Medium	Strong	Medium
Good Access to Markets	Medium	Not Strong	High
Good Regional Regulatory Practices	Medium	Strong	No good measure
Low Energy Costs/ Availability	Medium	Strong	Low
Cultural Amenities	Low	Strong	High
Climate	Low	Strong	Medium
Access to Raw Materials	Low	Not Strong	Medium

NOTE: This table summarizes the JEC and Fantus studies results. In the JEC study, respondents were asked to rate each factor as "very significant, significant, somewhat significant, or no significance," with respect to location choices. The percent of "very significant" and "significant" responses were added together to obtain a ranking of overall importance. "High" represents 70-90 percent response, "Medium" represents 40-60 percent response, and "Low" represents under 40 percent response. The Fantus study rankings are relevant for product-driven or market-driven stages of firm development.

The Delaware Valley rankings were constructed by using variables corresponding to the JEC and Fantus categories that were available either for SMSAs, states, or cities (Delaware Valley is defined here as the Philadelphia SMSA, including Philadelphia, Bucks, Chester, Delaware, and Montgomery counties in Pennsylvania, and Burlington, Camden, and Gloucester counties in New Jersey). In some cases the ranking among the largest states or the largest cities was used. "High" indicates best third, "Medium," middle third (or, in some cases, within 10 percent of the U.S. average), and "Low," bottom third, where order reflects attractiveness to high tech branches.

The labor skills variable was measured as percent of high school graduates and percent of college graduates in population aged 20-64.[a] The labor costs variable was measured as average hourly earnings of production workers in manufacturing.[b] The tax climate variable was based on a study comparing state and local taxes paid by a model manufacturing corporation in various cities.[c] Academic institutions, cultural amenities, and climate variables were measured among SMSAs.[d] Cost of living/housing was also measured among SMSAs, and was chiefly determined by the median value of owner-occupied homes.[e] Energy costs were measured as the average prices of residential utility, gas, electricity, and fuel oil #2.[f] Objective measures for the remaining variables were not available, and those rankings reflect the author's judgment.

[a]U.S. Bureau of the Census, *U.S. Summary of Census of Population, 1980,* (Washington, D.C.: Government Printing Office, 1982).

[b]U.S. Bureau of Labor Statistics, *Employment and Earnings* (Washington, D.C.: Government Printing Office, March, 1984).

[c]Pennsylvania Economy League, *Taxes in Philadelphia Compared to Other Large Cities.* Report No. 415 (Philadelphia, 1980).

[d]Richard Boyer and David Savageau, *Places Rated Almanac: Your Guide to Finding the Best Place to Live in America* (N.Y.: Rand McNalley & Co., 1981).

[e]Ibid., and U.S. Department of Commerce, *State and Metropolitan Area Data Book* (Washington, D.C.: Government Printing Office, 1982).

[f]U.S. Bureau of the Census, *Statistical Abstract of the U.S., 1982 - 1983* (Washington, D.C.: Government Printing Office, 1984).

Targeting start-ups involves risks for a community as well. Many new firms fail in the first few years of business. To expand employment significantly, regions need to create conditions which increase both the probability that people will choose to start new high tech firms and the probability that their ventures will succeed. A number of studies have investigated the factors important to new ventures. In general, these studies have found that the needs of start-up firms are very different from those of new branch plants.[13]

Factors Important to Start-Ups. One factor important to a region's probability of generating start-ups is the *pool of potential entrepreneurs.* Entrepreneurs are often people in existing technology-oriented firms who have an idea which the company is unwilling or unable to develop. Such people may be tempted to start up a new firm if entry into the particular field is not too difficult for a small firm. (Some fields, like pharmaceuticals, are harder for small firms to compete in because of high development, testing, and market costs, while others, such as electronics, are easier to enter.) Faculty and students in universities in the area also are potential business founders. How large the pool is depends partly on numbers of businesses and local academic institutions, but size isn't everything. Different places seem to have different *entrepreneurial climates*—that is, cultures encouraging or discouraging entrepreneurship. A positive climate, which feeds on demonstrations of previous successes, can encourage people to take the risks and endure the hardships associated with start-ups.

A very important factor for new ventures is the *availability of capital.* New firms need different types of financing at different stages of development. In the earliest phase, prototypes of the product or service are typically being developed, a management team is being assembled, and business plans are being formulated. Financing for this stage, commonly called seed money, is often provided by informal sources, family and friends, or through personal resources. At the next stage, in which a high tech firm gears up for commercial production levels, financing is often provided through venture capital—fairly risky equity financing that is unsecured by assets. Decades ago, venture capital, if available at all, was usually provided by wealthy individuals through private placements. Since World War II, formal organizations devoted to providing venture capital, mainly limited partnerships and small business investment corporations (SBICs), have provided increasing amounts of such financing. At a later stage of development, when assets have been acquired and the firm is operating close to or at profitability, capital may be available from a wider variety of sources, ranging from ordinary commercial loans from a bank to a public stock offering.

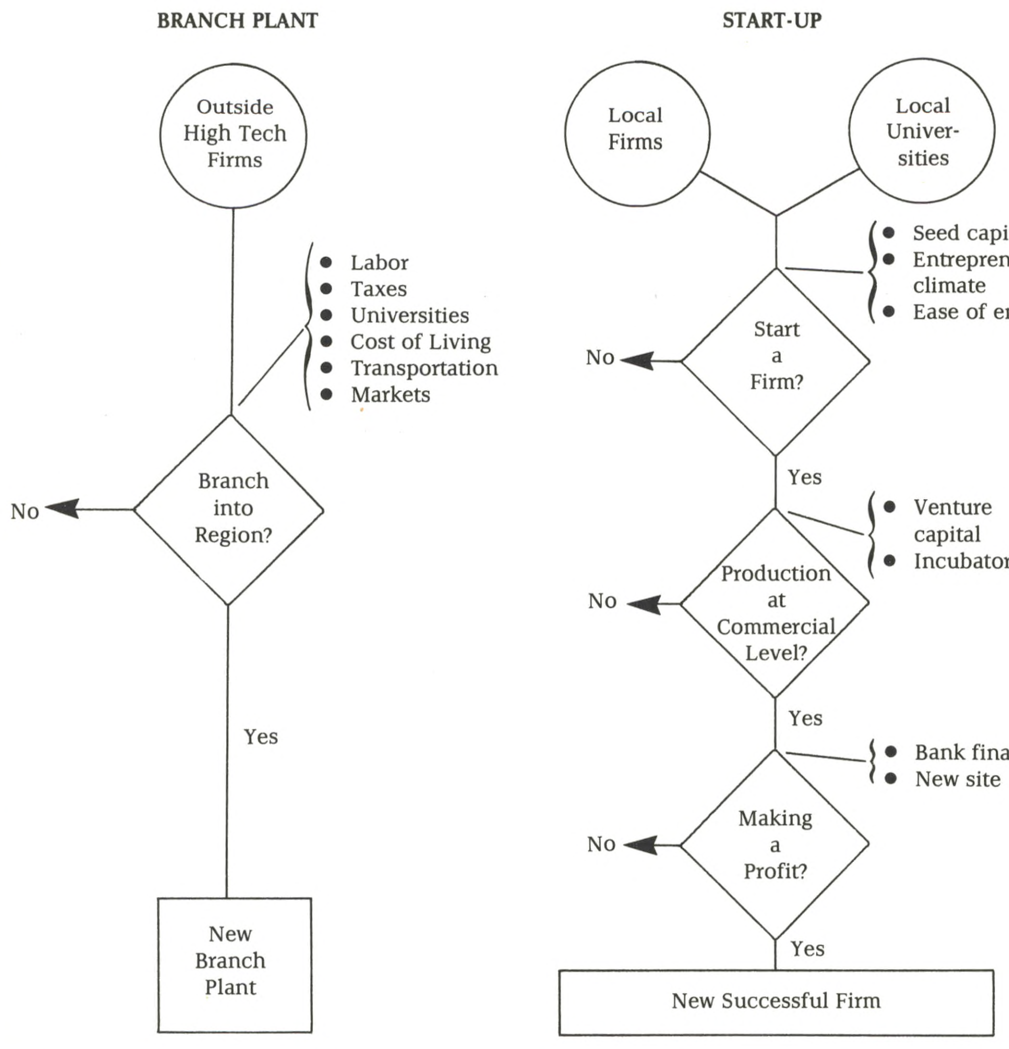
The existence of *suitable sites* for operations is another factor in the start-up process. The site requirements of a new venture are typically very different from those of a branch plant of a large firm. Low-rent space is usually vital to hold down costs in the beginning. Sometimes it is important for such a site to be close to a university or research facility—for instance, if specialized laboratory equipment or professional libraries available on campus can be used, if the founders are still faculty members or students, or if consulting help is needed. Access to shared business services, like photocopying or a receptionist, can be another useful feature of an incubator site. Only at a later stage of growth will a new company often be able to afford the large new facility in a suburban light industrial park setting that a branch plant may prefer.

Most of the factors influencing the development of new firms are quite different from those affecting branch plant location decisions (see FIGURE 1 page 12). Capital—particularly venture capital—the entrepreneurial climate, and low-rent sites foster start-ups, but are relatively unimportant for branch plant location decisions. Labor quality, labor cost, and taxes probably play a role for branches, but have little likely effect on entrepreneurial vigor—at least at an early stage. Universities affect both kinds of decisions, because

[13]Studies describing the factors important to high technology start-ups include Edward B. Roberts, "How to Succeed in a New Technology Enterprise," *Technology Review* (December, 1970); Karl H. Vesper, *New Venture Strategies* (Englewood Cliffs, NJ: Prentice-Hall, 1980), Arnold C. Cooper and John L. Komines, eds., *Technical Entrepreneurship: A Symposium* (Milwaukee, Wisconsin: The Center for Venture Management, 1972), and Elizabeth P. Deutermann, "Seeding Science-Based Industry," this *Business Review,* (May, 1966).

FIGURE 1

DIFFERENT FACTORS INFLUENCE HIGH TECH BRANCH LOCATION DECISIONS AND THE SUCCESS OF NEW VENTURES



they provide a pool of technical people who can become either employees of high tech branches or entrepreneurs themselves.[14] Because of these differences, a region's comparative advantage in fostering new high tech ventures could be quite different from its comparative advantage for at-

[14]Universities probably attract branches and stimulate start-ups in some other ways as well, for example, by providing possibilities for further study or teaching for branch employees or by sharing equipment and libraries for start-ups.

tracting high tech branches.

Delaware Valley's Climate for Start-Ups. The Philadelphia metropolitan area has a large pool of potential entrepreneurs. The region has many existing technology-based firms, several high quality universities, six medical schools, and many other research facilities, which serve as a breeding ground for new high tech ventures. Researchers from the University of Pennsylvania, for example, have founded several biotechnology companies in recent years, including Centocor, Biological Energy, and Phospho-Energetics. SMS Corporation of Malvern, Pennsylvania, a software company with revenues over $200 million, was started in 1969 by three locally-based salespeople for IBM. SMS has itself been the source of more local spin-offs, including fast-growing Rabbit Software, founded in 1982.

Despite this large pool of potential company founders, the entrepreneurial climate of the Delaware Valley has been described as being somewhat weaker than that of other parts of the country that have experienced fast high tech growth.[15] Assessing anything so hard to quantify as a cultural factor of this sort is a risky business, of course, and systematic studies are hard to come by, but a general feeling that this is true has persisted. Over the past few years, a group of new regional organizations—including the Technology Council of the Greater Philadelphia Chamber of Commerce, the Delaware Valley Venture Group, and the Advanced Technology Center of Southeastern Pennsylvania—have worked to improve the climate for high tech entrepreneurship through the provision of free legal and accounting services, technology transfer conferences, the publication of a technology newsletter, and other means.[16]

Capital availability—particularly venture capital—has been a problem in the past, but conditions have changed greatly in the last year. As recently as 1982, a report on venture capital in the area stated that

> the net impression is that there is little money currently available in the Philadelphia area which is oriented toward start-up and first-stage venture financing and virtually no "organized" money available in the seed financing category.[17]

The same report pointed out that Pennsylvania, New Jersey, and Delaware ranked low on the number of venture capital limited partnerships, compared to states like California, Massachusetts, and New York. But in the last year, conditions have changed. One local venture capital partnership, capitalized at $20 million, has started up, and a half dozen other funds are in various stages of development locally.[18] Although probably not all of these partnerships will get off the ground, the supply of venture capital in the area coming from organized sources is definitely increasing.

Site availability for high tech start-ups in the area is good. In addition to having a stock of older buildings, which provide low-rent space, the region has at least three facilities explicitly designated as incubators—the University City Science Center and the Business Technology Center in West Philadelphia, and the Technology Center in Montgomery County. The Route 202 Corridor near King of Prussia and Malvern has provided another fertile area for start-ups, like Rabbit Software, and for relocating firms, like Centocor, which began elsewhere in the area and needed more space.

Because the requirements of new high tech ventures are harder to quantify (aside from capital) than those of high tech branches, assessing how the Delaware Valley ranks in this area is more of a judgment call. As with high tech branch location factors, the metropolitan area probably falls somewhere in the middle range compared to other regions. But in some ways the possibilities for improving the conditions for high tech entrepre-

[15]Digby Baltzell, in *Puritan Boston and Quaker Philadelphia* (New York: Free Press, 1980), puts forth a form of this thesis.

[16]These organizations are also working actively to promote the transfer of new technologies to mature industries in the region as another way of spurring economic development.

[17]Robert Mittelstaedt and Thomas A. Penn, "Venture Capital (or Lack Thereof) in the Philadelphia Area," A Report of the Venture Capital Ensemble Group: Philadelphia, Past, Present and Future Project (Philadelphia: Wharton Innovation Center, University of Pennsylvania, August 1982).

[18]Although capital in general is a very mobile resource, venture capitalists often like to finance nearby deals or have a local partner in a syndication, because the early stage of the venture requires a large information flow and much face-to-face interaction. So having locally based venture capital firms increases the probability that local entrepreneurs will secure financing and reduces their costs (time and money) of getting it.

neurs are better than for improving the conditions for branch location. Improving labor skills, lowering labor costs, and creating a better tax climate—the factors conducive to branch location—involve very broad institutional changes, whereas setting up a venture capital partnership, while difficult, requires the cooperation of far fewer people.

IN SUM

Motivated by success stories in other regions, Delaware Valley policymakers are turning to high tech industries as a component of an overall regional growth strategy. Competition is stiff—other regions are wooing electronics, biotechnology, and computer firms with great vigor—and stiff competition means that the potentially large payoff from attracting a high tech branch plant can be offset by the increasingly high cost of trying. The Delaware Valley ranks about average on the factors which influence high tech location decisions, so the probability of attracting high tech branches, particularly those for which cost competition is extremely important, is somewhere in the middle range.

An alternative to trying to attract high tech branches is trying to stimulate high tech entrepreneurship. The Delaware Valley has the advantage of a large pool of potential entrepreneurs. While many regions also are striving to promote high tech entrepreneurship, competition in this sphere has less of an effect on the probability of success and the net payoff. As with branches, the Delaware Valley's underlying conditions for fostering entrepreneurship are about average, but it may be easier to change features of the area, such as a lack of venture capital, which hold down new venture formation, than to change those factors which make it less attractive for high tech branches. So if Delaware Valley planners decide to play a "high tech" game, they have a better chance to score with start-ups than with branches.

FURTHER REFERENCES

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W. Gene Wilson and Gene D. Sullivan," The Advent of Biotechnology: Implications for Southern Agriculture," Federal Reserve Bank of Atlanta, *Economic Review*, (March 1984).

In the ongoing debate about the size of federal deficits, views vary widely among economists. In the following article, the author uses a particular framework to assess the size of the federal deficit in light of concerns about economic efficiency. Other views about the deficit based on alternative frameworks may appear in the *Business Review* from time to time.

—Editor

Sizing Up The Deficit: An Efficient Tax Perspective

*Brian Horrigan**

It seems that everyone is talking about the size of recent and projected federal government budget deficits these days, and many believe that deficits should be very low or zero. A number of politicians, journalists, and pundits seem to worship at the shrine of the balanced budget. The popular view is epitomized by Shakespeare's dictum: "Neither a borrower nor a lender be." Contrary to popular belief, there are good reasons why a fiscally responsible government should sometimes run budget deficits, even large budget deficits for several years in a row. Deficits and surpluses perform an important economic function, namely, to promote economic efficiency. Indeed, if efficiency is the main criterion in deciding how to finance government expenditures, then the budget will typically be in a deficit or surplus position. From this point of view, the question in the deficit debate should focus not on whether there should be deficits, but instead on whether deficits are "too large" or even "too small" to further efficiency.

WHY DEFICITS? SOME BUDGET BASICS

In many ways, the government is no different from any of us. People do not typically run a balanced budget year in and year out; neither does the government. Because their receipt of cash is rarely synchronized with their spending desires, people sometimes spend more than they receive in income (by using their savings or by borrowing),

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and other times they spend less than they receive (saving the difference). As with individuals, the government sometimes borrows and sometimes saves because it is inefficient —it wastes resources— to synchronize perfectly its income (tax revenues) with its spending plans.

In other ways, the government is radically different from the individual. In particular, the government is "immortal." An individual, for example, can borrow only up to his expected ability to repay the principal and interest on his loans within his own lifetime. Since the government's "lifetime" is indefinite, it can refinance its debt year after year, so long as its capacity to raise tax revenues to pay the interest on the debt is assured.[1]

Some economists hold the view that government deficits play no major role in economic activity unless they are so big that, if they continue, it would be doubtful that the government could raise taxes to service its debt. (Indeed, the weight of economic research has not indicated a strong relationship between government deficits, or debt, and economic activity.) If we adopt this view of government deficits, which is an unsettled issue in macroeconomics, and if we emphasize eliminating waste in financing government spending, then some judgments can be made about whether projected deficits are too large. (See *Debt Neutrality* in A THEORY OF DEFICITS.) The logic involves a notion of "efficient taxation," which suggests a rule for financing government expenditures while minimizing tax-related inefficiencies in the economy.

HOW TO SET TAXES TO MANAGE THE DEFICIT

Judgments about how to finance government spending, and, therefore, to manage deficits, are very different from judgments about the proper size of government or the level of expenditure on particular items. Unfortunately, these two issues have been confounded in much of the discussion about the size of the deficit. Economists who apply the principles of efficient taxation to the problem of financing government spending take the level of government spending as given, and ask: what is the best way to finance current and future government spending?

The government could keep the budget balanced (or nearly so), if it so desired, by raising tax rates whenever tax revenues fell below expenditures, and by reducing tax rates whenever tax revenues were larger than expenditures. Many economists do not think such a policy is sensible because it is inefficient. They argue that a policy which frequently raises and lowers tax rates imposes unnecessary costs on the economy. Instead, they claim, it is preferable to stabilize tax rates, and to let deficits and surpluses occur.

The theory underlying this notion rests on two propositions: first, taxes cause inefficiencies—waste—in the economy. For example, income taxes discourage work and investment, change the allocation of resources among industries, generate administrative and collection costs, and encourage tax avoidance and tax evasion. Economists call the economic inefficiencies caused by these distortions the "deadweight loss due to taxation." Second, as tax rates rise, these deadweight losses rise more than proportionately. If tax rates increase twofold, for example, then the deadweight loss more than doubles.[2] Resources are wasted adjusting to the changes in tax rates.

Taken together, these two propositions imply a tax "rule" that sets the tax rate as low as possible (given projected government spending and tax base changes) and that stabilizes the tax rate, that is, that minimizes fluctuations in the tax rate. Following a rule based on the importance of effi-

[1]The government, like each individual, faces an intertemporal budget constraint: the present value of all tax revenues equals the present value of all government non-interest spending plus the value of the national debt. The constraint can only be violated by declaring bankruptcy.

Throughout this paper, I ignore the possibility that some government revenues come from the creation of money—"seignorage," in economic jargon. If the present value of spending plus the national debt exceeds the present value of tax revenues, the government presumably must print money (with inflationary consequences) to close the gap.

[2]For a discussion of the theory and evidence concerning the inefficiencies caused by the tax system, see A. Protopapadakis, "Supply Side Economics: What Chance for Success?" this *Business Review*, (May/June) 1981. There is a large literature on the economic theory of efficient taxation. Standard references are: A. Harberger, *Taxation and Welfare*, (Boston: Little, Brown and Co., 1974), Chapter 2, and A. Atkinson and J. Stiglitz, *Lectures on Public Economics*, (New York: McGraw-Hill Book Co. 1980), Chapters 11 to 14.

cient taxation suggests that there will be deficits (indeed, that there ought to be deficits—see *Principles of Efficient Taxation* in A THEORY OF DEFICITS) whenever there are changes in economic conditions. And economic change, of course, is typical of our world: GNP and the tax base grow over time, there is inflation, GNP fluctuates with the boom and bust of the business cycle, and government expenditures fluctuate during the business cycle and between wartime and peacetime.

WHY THERE SHOULD BE DEFICITS

...With Economic Growth... A somewhat surprising implication of the efficient-tax rule is that, if real (inflation-adjusted) GNP grows steadily, then the debt should grow with it, which means, of course, that there will be continuing deficits. (Recall that the efficient tax principle presumes that deficits have no macroeconomic impact save these financing considerations.) For example, take an economy in which real GNP, the tax base, and government expenditures (excluding debt service—interest payments on the debt) are expected to grow at the same fixed rate indefinitely. If the tax *rate* were set so that the budget was balanced now, then in the future the government would show increasing surpluses as the economy continues to grow. The surpluses come about because tax receipts grow as the tax base grows. However, the debt service component of the budget remains constant, because the debt is not growing. Thus, total government expenditures (non-interest expenditures plus debt service) will grow more slowly

A THEORY OF DEFICITS

Some economists have worked out a theory which attempts to find the optimal combination of deficits and taxation necessary to finance a given pattern of government spending plans. The theory of optimal deficits rests on two pillars: first, the proposition that government debt is neutral, and second, the theory of efficient taxation.

Debt Neutrality

The proposition that debt is neutral recognizes that government spending must be paid for and suggests that government debt is nothing more than a means of substituting future taxation for current taxation. If people are rational, they realize that real deficits today imply higher taxes in the future. Knowing that higher future taxes will reduce their future after-tax income, people will save more when there is a deficit to maintain a constant level of consumption. In other words, people base their consumption plans on the present value of their after-tax income. Suppose the government were to reduce taxes by $1 billion today, issue a bond (that is, run a deficit) worth $1 billion bearing an interest rate of, say, 6 percent, and announce that it will raise taxes by $1.06 billion next year to pay the debt plus interest. Then rational taxpayers would save the $1 billion from the deficit caused by the tax cut, invest it in a bond earning 6 percent, and use the principal and interest from the bond to pay off the tax increase in the following year. By acting in this way, they are better off than not saving the $1 billion today and having to consume $1.06 billion less the next year when taxes are raised. Deficits (surpluses) raise (reduce) savings, dollar for dollar, according to the theory of debt neutrality.

When debt is neutral, deficits do not raise interest rates, crowd out borrowers, reduce investment, appreciate the dollar on foreign exchange markets, or cause inflation, because deficits automatically generate enough extra savings to fund the deficit.

Principles of Efficient Taxation

Deficits redistribute the tax burden from year to year. But is there a unique pattern of taxes better than any other? If all taxes were lump-sum (fixed amounts) in nature, then as long as debt is neutral it would not matter how or when the government ran deficits. But what if taxes are not lump-sum, but instead are proportional to income? This is where the theory of efficient taxation plays a role. As long as debt is neutral, the only consideration necessary in setting the level of deficits is the goal of minimizing the deadweight loss due to taxation. Efficient taxation requires that tax rates be set so that they are *expected* to remain constant, given forecasts of future GNP and government spending. If new information is obtained, the tax rate must be revised to reflect the new information. The new tax rate must be set such that, once again, the expected tax remains constant in the future. (More technically, the tax rate follows a random walk.) If tax rates are set efficiently, then the deficits that result are "efficient" deficits.

than tax receipts. In fact, as the government shows surpluses, the debt will shrink, reducing the debt service. If the government wished to maintain a balanced budget *over time*, it would have to keep reducing the tax rate. But, according to the efficient tax rule, a strategy of continuously falling tax rates is inefficient, because resources would be wasted adjusting to the changes in tax rates. Deadweight losses would be lower if taxes were lower to begin with and set so people expected them to remain unchanged. The efficient tax rate is set to allow deficits which, on average, grow in real terms at the same rate as real GNP. Deficits will not show steady growth, however, because they will fluctuate with inflation and business cycles.

...With Inflation... Inflation leads to higher deficits when the government follows the tax-rate stabilization rule, yet such deficits have no impact on the economy because they do not add to the real value of the debt. The link between inflation—a general rise in prices—and interest rates is the key to this argument. Workers understand that if wages double while the price level also doubles, then *real* wages haven't increased at all. Similarly, investors who buy bonds know that inflation means that a dollar in the future buys less than a dollar in the present. So, investors demand higher interest rates to offset the expected decline in the dollar's purchasing power. This rise in interest rates increases the dollar size of the deficit.

Suppose, for example, that initially the government budget is balanced, and that the inflation rate is zero. If the interest rate is 2 percent and the national debt is $1 trillion, then the interest expenditures of the government are $20 billion. If the expected inflation rate were to rise from zero to 10 percent, then interest rates would rise from 2 percent to 12 percent (because investors demand compensation for inflation). The annual interest expenditures of the government would rise to $120 billion, and the nominal deficit would automatically rise from zero to $100 billion. The deficit rises, even though tax rates, real governmental purchases of goods and services, and real GNP do not change. The nominal value of government spending and taxes rises in step with inflation, as does the total stock of government debt. But, since the price level also rises by 10 percent, only the nominal value of the debt changes, not the real value of the debt. So, if one assumes that all inflation that actually occurs has been correctly anticipated, then the real value of the debt does not increase—that is, there is no real deficit—and therefore, there is no need for additional future *real* tax revenues to service it.

The difference inflation makes between real deficits and nominal deficits can be dramatic. In the last half of the 1970s, nominal deficits were high, but this was due largely to inflation; in 1979, for example, the nominal deficit was $56 billion, yet the real deficit was not a deficit at all, but rather a real surplus of $7.5 billion.[3] Inflation can have a substantial effect on the dollar value of the deficit, but it does not affect real deficits. Business cycles, however, do affect the size of real deficits.

...And During Business Cycles. Much of the variation in real deficits is accounted for by the responses of tax revenues and government spending to business cycles and wars. The business cycle is the fluctuation of real GNP around its trend growth path, and is composed of a recession (a significant and prolonged fall in real GNP below its trend), and a boom (a rise in real GNP above its trend). When real GNP falls during a recession, tax revenues necessarily fall also, while at the same time, government expenditures rise (relative to trend) due to increased spending on unemployment compensation, public works, and welfare programs. Unless the tax rate is changed, the real deficit automatically rises in a recession and shrinks in a boom. For example, if GNP falls $300 billion below its trend value during a recession, and if the tax rate on GNP is 20 percent, tax revenues will automatically fall $60 billion dollars. At the same time, government spending on unemployment compensation and other programs may rise $20 billion above its trend. Then the real deficit will be $80

[3]Real deficits are calculated as changes in the real national debt. The national debt is defined as interest-bearing debt outstanding plus agency debt whether owned by the public, foreigners, or the Federal Reserve System. This debt is divided by the Implicit GNP Deflator (1929=1.0) to generate the real debt. The annual change in the real debt is the annual real deficit. Further analysis of the relationship between the measured deficit and inflation can be found in: *Economic Report of the President*, U.S. (Washington, D.C.: Government Printing Office, 1982), Chapter 4, and B. Horrigan and A. Protopapadakis, "Federal Deficits: A Faulty Gauge of Government's Impact on Financial Markets," this *Business Review*, (March/April 1982), pp. 3-16.

billion higher than if there were no recession.

Temporary fluctuations in government spending around its trend occur not only over the business cycle, but also during wars, and other kinds of national emergencies (because civilian spending is never reduced enough to offset completely increases in military or emergency spending). Just as the government finances its expenditures with debt when tax revenues are unusually low during recessions, so the government should finance unusually high expenditures with debt.[4] In fact, running real deficits during recessions and wars and running smaller real deficits or real surpluses during booms and peacetime has been the pattern of deficit behavior in the U.S.

Figure 1 plots the ratio of the real deficit to real GNP for the U.S. from 1790 to 1983. Examining the graph reveals that large deficits are associated with wars and recessions, and peace and prosperity bring smaller deficits or surpluses. The U.S. started in 1790 with a national debt, the financial heritage of the deficits which financed the American Revolutionary War. The new government almost always ran surpluses (except for some large deficits during the War of 1812) until Andrew Jackson paid off the national debt in 1834. The Civil War produced deficits which drove the deficit-GNP ratio to as high as 6.6 percent in 1865. After the war, the ratio was virtually zero—except for a few brief rises during the 1870s and 1890s—until World War I raised the deficit-GNP ratio to 17 percent by 1918. There were surpluses in the years following the war until the Great Depression produced some real deficits over 8 percent of real GNP, and World War II pushed real deficits over 27 percent of real GNP in 1944. Since then, the real deficit-GNP ratio has been low—except during a few recessions in this period. The ratio was less than 1 percent in 1980. The recession of 1981-1982 produced a real deficit-GNP ratio of 5.7 percent, the highest value of that ratio in the post World War II period. Historically, a high real deficit-GNP ratio is associated with the real deficits caused by large wars and recessions; in the intervening period, the real deficit-GNP ratio is low.[5]

The behavior of the government over business cycles and during wars is exactly analogous to the behavior of families with fluctuating incomes. During hard times, families borrow or dip into their savings to maintain their standard of living, and in good times, families pay off loans and rebuild savings. It would be unwise for the government to slash spending on, say, national defense, education, and health merely to keep a balanced budget in a recession or during a war. And most economists agree that it is destabilizing and inefficient to raise taxes during a recession (which would reduce private spending and discourage work precisely when employment is low) to maintain a balanced budget. Tax rates should be changed only when government spending is changed permanently or when the path of real economic growth changes.

HOW LARGE IS TOO LARGE?

Assuming agreement about the size of government spending relative to the economy, the theory of efficient taxation and of the resulting deficits suggests that the higher real economic growth and inflation are, the larger deficits should be. Furthermore, during recessions the year-to-year deficits should rise above the level implied by economic growth and fall below that level during booms.

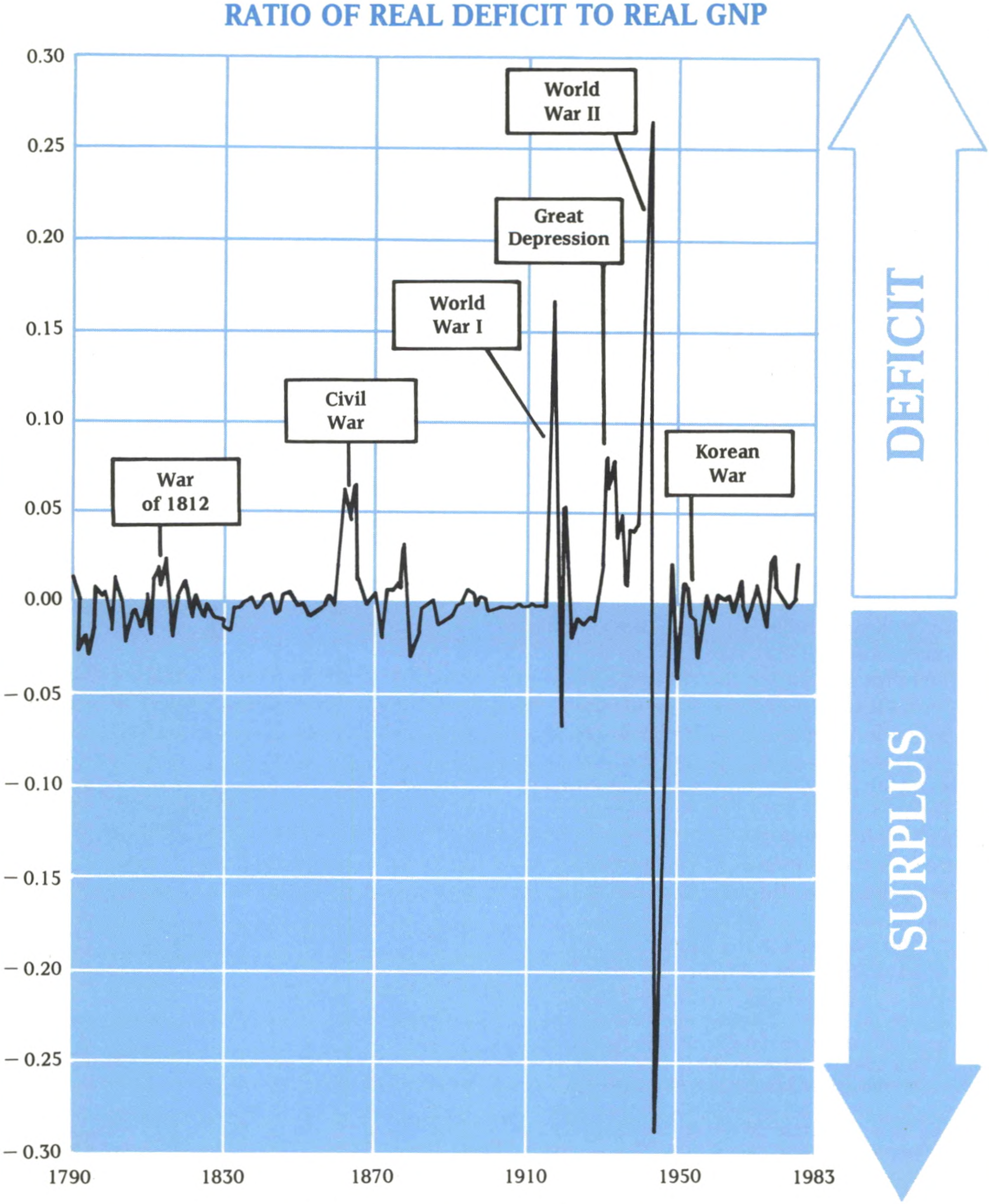
By interpreting the U.S. historical experience in terms of the efficient taxation theory, and by using this interpretation of history, we can get a rough

[4]If government expenditures as a share of national income rose permanently to a new higher level, tax rates would have to be raised immediately. If taxes were not raised and the permanently higher government spending were all financed by deficits, the national debt would balloon out of control, ultimately forcing the government into bankruptcy (but only if the after-tax interest rate on government debt exceeded the growth rate of GNP). If debt plus interest is paid off by issuing more debt, which is paid off with more debt, and so on forever, the national debt would grow more rapidly than national income. That would amount to a government-run perpetual chain letter, a Ponzi game—it cannot work. Once the interest bill on the national debt exceeds the tax capacity of the government, the government reaches insolvency.

[5]The experience of Britain parallels the experience of the United States. The financing requirements of the Napoleonic Wars drove the British real deficit-GNP ratio to very high levels. The following century witnessed low real deficit-GNP ratios (with only a few blips) until 1914. World War I, the Great Depression and World War II all produced major increases in the real deficit-GNP ratio, but the ratio fell following all of those unfortunate occurrences. Indeed, despite all of the talk about Britain's deficits during the 1960s and 1970s, the ratio of real deficits to real GNP was low.

FIGURE 1

RATIO OF REAL DEFICIT TO REAL GNP



The graph displays annual values of the ratio of real deficits to real GNP from 1790-1983. Footnote 3 describes how the real deficit is calculated.

idea of whether present and projected deficits are out of line with historical experience.[6] This approach involves estimating the historic relationship between real deficits and the economic variables suggested by efficient taxation considerations. Given forecasts of real GNP, real government spending, and inflation, it is possible to estimate what deficits *would be* if the U.S. economy continues to perform as in the past. We call these estimated deficits "efficient deficits" to distinguish them from the deficits predicted by various economists and by government sources. The calculated "efficient deficits" are *not* predictions. Rather, they should be regarded as benchmark figures that incorporate both the efficient taxation considerations and the historical performance of the U.S. economy. By comparing the actual deficits from 1975 to now, and the projected future deficits to these "efficient" deficits, we have a rough and ready way to judge whether the deficits have been or will be "too large." In particular, if the projected deficits are consistently larger than the efficient deficits, then this suggests that tax rates are not set at their "efficient" levels and should be raised. The formula for calculating efficient deficits and the economic assumptions underlying the estimates are explained in the Appendix.

Table 1 presents actual and efficient deficits for 1975 through 1983, and projections of actual and efficient deficits for 1984 through 1990. The projections assume no change in government fiscal policy and are based on forecasts of the economy from Data Resources, Inc. (DRI). Projected actual deficits exceed $200 billion in 1984 and beyond, rising to over $300 billion by the end of the decade. Efficient deficits are also substantial for the entire time period, and after 1980, they never drop below $100 billion. One reason the efficient deficits are so high is inflation. For example, the contribution of inflation to the deficits in 1983, 1984, and 1985 is about $50, $62, and $73 billion, respectively. The high unemployment currently troubling the American economy is another reason for high efficient deficits. If real GNP equaled its trend value in 1983, 1984 and 1985, the efficient deficits in those years would be lower by $105, $78, and $85 billion, respectively. (Projected deficits would

TABLE 1

ACTUAL AND EFFICIENT FEDERAL DEFICITS NO FISCAL POLICY CHANGE

Year	Federal Deficits		Difference Between Actual or Projected Deficits and Efficient Deficits
	Actual and Projected[a]	"Efficient"	
1975	$ 83.9	$ 71.3	$ 12.6
1976	76.9	45.1	31.8
1977	65.4	40.8	24.6
1978	70.3	40.8	29.5
1979	55.9	54.0	1.9
1980	85.1	105.3	- 20.2
1981	98.5	128.2	- 29.7
1982	168.4	163.2	5.2
1983	213.6	155.1	58.5
1984*	252.4	141.7	110.7
1985*	246.0	160.2	85.8
1986*	271.4	186.7	84.7
1987*	297.0	211.7	85.3
1988*	292.0	228.8	63.2
1989*	306.7	249.6	57.1
1990*	324.9	277.9	47.0

All numbers are in billions of dollars.

*Projections based on forecasts prepared by Data Resources, Inc.

[a]Actual deficits, defined as the end-of-year to end-of-year change in the gross public debt outstanding, are from various issues of the *Federal Reserve Bulletin*. The deficit measured this way is nearly always higher than the deficit measured by the National Income and Product Accounts or by the Unified Budget, the result of off-budget financial transactions.

[6]Barro and others have used statistical methods to determine how well American deficit behavior conforms to the predictions of the theory of efficient deficits. Barro (1979) found that the data neither strongly accept nor strongly reject the predictions of the theory. Barro's conclusions were verified using different data by Horrigan (1982, 1984). Benjamin and Kochin (1980) and Barro (1981) tested the implications of efficient taxation theory using American tax data and did not reject the theory. The theory of efficient taxation as applied to deficit behavior is new, but the results of early tests indicate that it does provide a plausible description of deficit behavior.

fall by a comparable amount.) Efficient deficits remain high in the 1980s (exceeding $200 billion after 1987) because real GNP returns to trend very slowly and inflation rises to 6 percent in the DRI forecasts used here.

A balanced budget, or even a small deficit, then, is far from efficient in the 1980s. In 1980 and 1981, the actual deficits were *smaller* than their efficient levels, while the deficits for 1983 and 1984 are well above efficient levels. Because the projected deficits for 1984-1990 are consistently above the calculated efficient deficits, these figures lend some support to those who argue for tax or expenditure actions to reduce future deficits. But this approach also suggests that such a fiscal policy package should not be aimed at producing a deficit substantially lower than the efficient deficit—in particular, not a zero deficit.

In fact, tax increases that would appear modest to many analysts may result in future deficits that are "too low" relative to efficient deficits. For example, DRI also has a long-term forecast of the economy that is based on what it considers to be a likely change in fiscal policy effective in 1985. It involves a gradual rise in tax rates and modest expenditure reductions. (See Appendix for details.) The impact of this fiscal policy on projected deficits is shown in Table 2, which presents the difference between the deficits projected on the basis of this policy and efficient deficits. As the negative numbers after 1987 show, projected deficits actually fall below efficient deficits, and, over time, the gap between the two widens. This result is caused primarily by the gradual increase in tax rates that occurs under DRI's assumption about changes in fiscal policy.

From the efficient tax viewpoint, having projected deficits consistently lower than their efficient levels implies that tax rates move too high, and deadweight losses are unnecessarily large. So, a better strategy, by the standards of tax efficiency, would be a one-time, smaller tax increase imposed immediately.

The estimates of efficient deficits depend on the estimates of trend real GNP and trend federal government expenditures as well as forecasts of real GNP and government expenditures. Economists who have different estimates of these trends or different forecasts of these variables will necessarily have different estimates of efficient deficits. There is room for disagreement in making these estimates. Indeed, there is substantial disagreement about the usefulness of this approach to analyzing deficits. In particular, some economists would contend that deficits affect the economy *aside* from financing considerations (see ALTERNATIVE VIEWS OF THE DEFICIT). These effects need to be addressed in assessing policy actions concerning deficits, in their view.

TABLE 2

DIFFERENCE BETWEEN PROJECTED AND EFFICIENT DEFICITS WITH FISCAL POLICY CHANGE[a]

1984	$ 95.3
1985	83.1
1986	51.5
1987	24.9
1988	- 4.3
1989	- 25.7
1990	- 53.0
1991	- 77.4
1992	- 94.3
1993	- 111.9
1994	- 132.4
1995	- 160.8

[a]See Table 1 for notes. For details of the fiscal policy change, see the Appendix.

CONCLUSIONS

According to the efficient taxation approach, deficits may not present a problem unless they are consistently different from their "efficient" levels. If the deficit is smaller than its efficient level, the government is squeezing the economy with excessive taxation or depriving the economy of useful government spending. If the deficit is consistently larger than its efficient level, tax rates must be raised eventually (or future spending reduced) to finance the excessive debt.[7]

The estimates of efficient deficits presented here show that, without a policy change, current

[7]Alternatively, if neither expenditures are reduced nor taxes raised, the only way left to finance deficits will be for the Federal Reserve to "monetize" the deficits, thereby creating inflation.

ALTERNATIVE VIEWS OF THE DEFICIT

There are schools of economic thought that deny the economic reasoning or the political relevance of the theory of debt neutrality. Keynesian economists believe that the economy is inherently so unstable that it needs strong doses of monetary and fiscal stimulation to remain near full employment. Keynesians recommend—among other policies—tax cuts to stimulate the economy when it falls below full employment, and tax increases when the economy "overheats." Keynesians assert that the improvement in well-being due to having an economy nearer full employment on average justifies the relatively minor—in their opinion—deadweight loss caused by changing the tax rate. Under Keynesian fiscal policy, budget deficits during recessions should be even *larger* than the efficient deficits calculated here, and the deficits during economic booms should be smaller.[a]

Other economists are more interested in using fiscal policy to stabilize inflation than they are in using fiscal policy to stabilize employment. They believe that deficits are always monetized to some extent; that is, when the government issues more debt, the Federal Reserve purchases more of it, which creates bank reserves, thus expanding the money supply and ultimately raising the price level. Monetization turns deficits into an engine of inflation. These economists recommend raising taxes or cutting expenditures to reduce inflation when the inflation rate is too high. During inflationary periods, these economists recommend deficits smaller than those advocated by efficient deficit theorists.[b]

The "neoclassical" school asserts that the higher real deficits are relative to real GNP, the higher are real interest rates, which crowd-out private investment: too high real deficits result in too little investment and eventually in a too small capital stock. These economists do not believe that debt is neutral and recommend that the deficit-GNP ratio be kept low, on average, in order to increase the capital stock. These economists agree with efficient deficit theorists that deficits should fluctuate over the business cycle and with war and peace, but they recommend that the average level of the deficit should be smaller than that advocated by efficient deficit theorists.[c]

Some balanced-budget advocates, on the other hand, are not concerned with the deficit *per se* but with the size of the government relative to the entire economy. They believe the government has a tendency to grow larger than it should and that there is less political opposition to governmental growth when government spending is financed by deficits instead of taxes. When the government is forced to pay for its spending with taxes, the government will be smaller, in their opinion. They believe that the benefits of tax stabilization are small relative to the benefits of having less government.[d]

[a]For an exposition of Keynesian deficit theory, see: A. Blinder and R. Solow, "Analytical Foundations of Fiscal Policy," in *The Economics of Public Finance*, (Washington, D.C.: The Brookings Institution, 1974), pp. 3-118.

[b]This traditional point of view is being defended with rigorous (though controversial) economic analysis by: P. Miller, "Deficit Policies, Deficit Fallacies," Federal Reserve Bank of Minneapolis *Quarterly Review*, 4 (Summer 1980), pp. 2-4; and T. Sargent and N. Wallace, "Some Unpleasant Monetarist Arithmetic," Federal Reserve Bank of Minneapolis *Quarterly Review* 5 (Fall 1981), pp. 1-18.

[c]This "neoclassical" point of view has been discussed and defended in many publications. A good example is M. Feldstein, "Fiscal Policies, Inflation, and Capital Formation," *American Economic Review*, 70 (September 1980), pp. 636-650.

[d]This point of view is strongly argued in J. Buchanan and R. Wagner, *Democracy in Deficit: The Political Legacy of Lord Keynes*, (New York: Academic Press, 1977). The authors recommend a constitutional amendment to prohibit deficit spending except during declared national emergencies. Critical evaluations of Buchanan and Wagner's work can be found in a symposium published by the *Journal of Monetary Economics*, 3 (August 1978).

and projected deficits are larger than efficient, given the state of the economy over the remainder of the 1980s, and should be reduced. Yet, the analysis of one projected change in fiscal policy—which is similar to many other proposals—shows that deficits can be reduced too much for efficiency purposes, producing unnecessary deadweight losses for the economy.

Although newspapers and magazines are packed full of warnings about the dire consequences of deficits, and opinion polls show that deficits are about as popular as heroin addiction, there is an alternative perspective on deficits. If economic efficiency is the criterion driving fiscal policy, then having some level of deficits—the efficient level—can actually be viewed as beneficial.

APPENDIX

The formula used to calculate efficient deficits is derived from Barro's equation for the determination of the optimal (or efficient) growth rate of the public debt (Barro (1979)):

$$(1) \qquad (B_t - B_{t-1})/B_{t-1} = 0.0006 + 1.00\,\pi_t^a + 0.40\,\frac{P_t(G_t - \bar{G}_t)}{B_{t-1}} - 1.57\left\{\left(\frac{Y_t - \bar{Y}_t}{Y_t}\right)\left(\frac{P_t\,\bar{G}_t}{B_{t-1}}\right)\right\}$$

where

B_t = publicly held federal debt, measured at par value, at time t

B_{t-1} = publicly held federal debt at time t-1

π_t^a = anticipated inflation rate (the percentage change in P_t)

P_t = price level, measured by GNP deflator

G_t = real value of federal expenditures (NIPA definition)

$\bar{G}_t$ = trend value of G_t

Y_t = real GNP

$\bar{Y}_t$ = trend value of Y_t

The parameters in equation (1) were estimated using annual American data for the time period 1948 through 1981. The parameters are similar to the ones Barro estimated. In the estimation, the coefficient on anticipated inflation was restricted to unity, the theoretical value of the coefficient. (Unconstrained, the coefficient on anticipated inflation was 1.47. The data did not reject the restriction to unity.)

Trend growth in real GNP and real federal expenditures for the time period 1948 to 1981 are 3.5 and 4.5 percent per year, respectively. The trend growth in real GNP is determined by the growth of the labor force, of productivity, and of natural resources. Based on the expected slowdown in labor force growth, DRI forecasts trend GNP to grow at about 2.8 percent for 1982 to 1990, 2.6 percent for 1991 to 1995. The trend growth in real government spending is determined by fiscal policy. Ultimately, government spending cannot grow faster than GNP, but it is possible for spending to grow faster than GNP for long periods of time, as it did for the post-World War II era. I assume that the ratio of trend real federal expenditures to trend real GNP is 23 percent in the time period 1982 to 1995, the value of the ratio in 1980 and 1981. The definition of debt used in Barro's theory and in estimating equation (1) excludes all federal debt held internally by federal government agencies and trust funds, and the Federal Reserve System. However, no forecasts are available for how much of newly issued debt will be held internally by the government, so projections of efficient deficits are made using the gross public debt. But note that as long as the percentage of gross public debt held internally by the government remains constant, these definitional issues cause no error in the analysis.

To use equation (1) to make estimates of efficient deficits, I assume that the inflation rate is correctly anticipated (both within and outside of the sample period), and that the DRI forecasts of real GNP, the GNP deflator, real federal expenditures, and the gross debt are accurate.[a] The estimates of efficient deficits are generated dynamically, meaning that in each year, the *efficient* value of the previous year's debt is used as the base for calculating that year's efficient deficit.[b]

[a] I derived my projections of inflation, real GNP, real federal expenditures, and the size of the gross debt from the U.S. long-term forecast of Data Resources, Inc., as of April 1984. The issue is not whether these forecasts are accurate but rather how close projected deficits are to efficient deficits, where both projected and efficient deficits are calculated using the same set of economic assumptions. Different economic assumptions would change estimates of both efficient and actual deficits in a similar manner.

[b] Similar results were obtained from estimates of efficient deficits generated statically—that is, by using the projected value, not the efficient value, of the previous year's debt as the base for calculating that year's efficient deficits.

DRI assumes a small tax increase and a small expenditure cut take effect in fiscal year 1986, which reduces the deficit by $49 billion (under static assumptions) in that year. A modification in tax indexation is included in the tax package. In 1981, Congress revised the tax code, providing that as of 1985, the code would be indexed to the Consumer Price Index (CPI). That way, purely nominal increases in income would not cause "tax bracket creep." In DRI's simulation of a new fiscal policy, the tax code will be indexed only to the extent that the CPI rises more than 2 percent per year.

DRI assumes that nominal GNP grows at approximately 9 percent per year for the remainder of the decade—about 6 percent inflation and 3 percent real growth. Real GNP returns to trend slowly in the DRI forecast; by 1990, real GNP is still 4 percent below trend.

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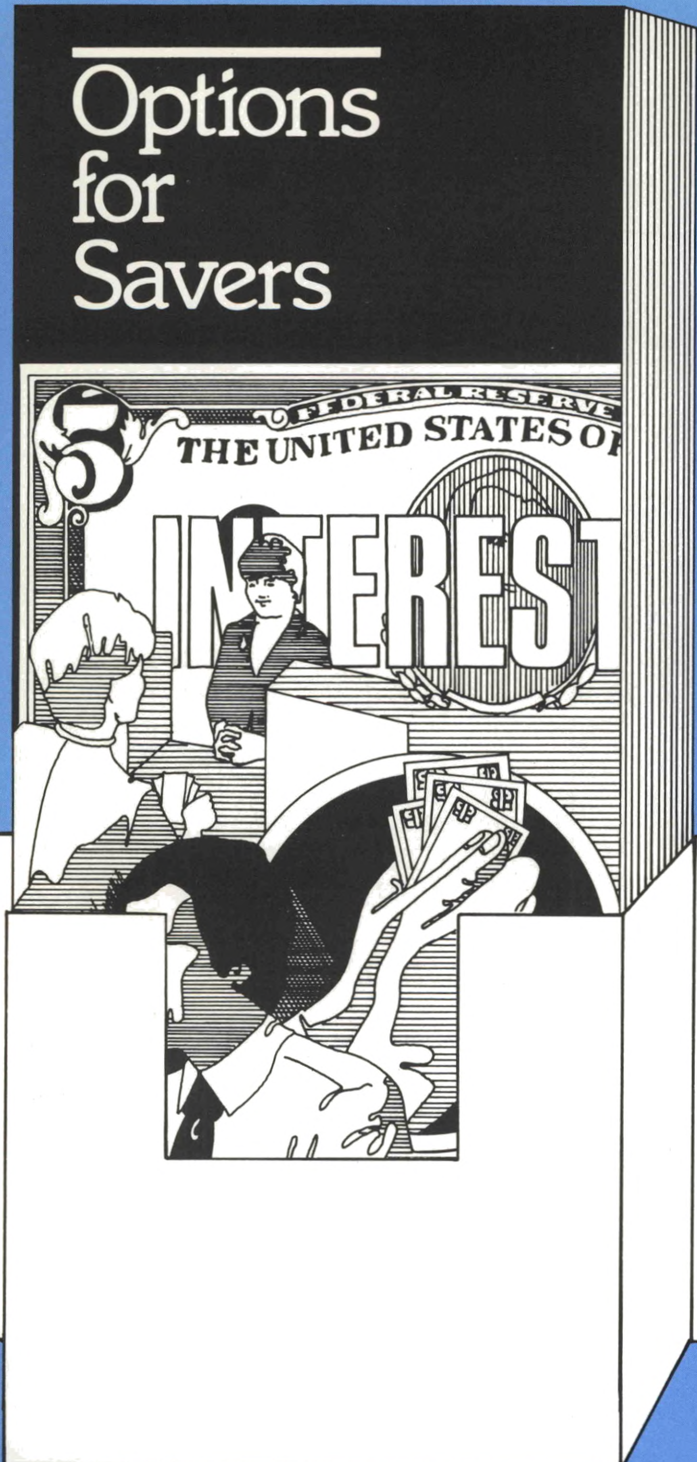

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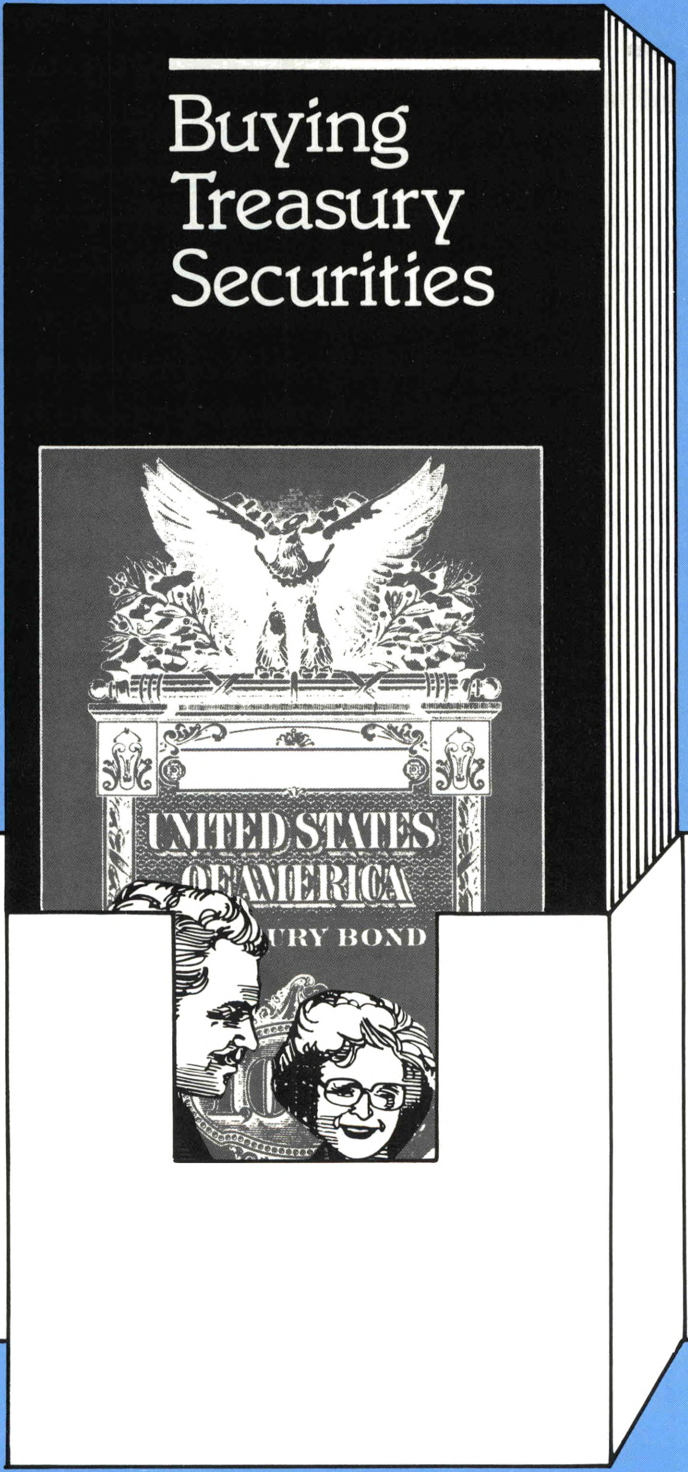

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