Technology, Capital Formation, and the Twin Deficits

by Ralph Landau

We hear much about the lack of competitiveness of the U.S., but seldom is this term defined. It is obvious that this country could be more competitive if we reduced the wages and living standards of the American working population to the level of the Korean or Brazilian, but of course, this is not what we mean. The real goal of economic policy is to sustain an acceptable *growth* in the standard of living of the population as a whole, while providing employment for substantially all but the unemployable or temporarily unemployed, and doing so without reducing the growth in the standard of living of future generations. The latter condition thus constrains borrowing from other nations, or incurring future tax or spending obligations, to pay for the present generation's growth. And finally, economic policy seeks to assure that the fruits of growth and competitiveness are not unfairly distributed within the population.

During the 20-25 years after World War II, the U.S. enjoyed an essentially unlimited economic horizon. Since 1950 real U.S. gross domestic product (GDP) has tripled and income per capita has almost doubled, while the real GDP of the world has quadrupled and world trade has grown sevenfold.

Despite this impressive growth record, it is clear that the world of U.S. firms and farmers has irrevocably changed, and not only because other nations have caught up. International capital flows have become global and virtually instantaneous, while technology flows are not far behind. On the other hand, national policies with regard to fiscal and monetary matters, as well as trade, legal, tax, financial, and other practices, vary widely among countries. Such domestic freedom to control national destinies is, however, increasingly constrained by the discipline of the international capital markets, and by the trade in goods and services.

At the same time, the world now sees the availability of extraordinary new technologies that promise to raise global living standards more than ever. The age of the computer has only just begun. Telecommunications via satellite and fiber optics are binding the world together at an ever-increasing rate. The biotechnology revolution has hardly begun, but already its potential to affect human health and improve productivity in farm and factory is immense. Superconductivity is certain to play a major role in the 21st century; new materials are penetrating realms as diverse as medicine and aerospace; new catalysts and pharmaceuticals are improving the efficiency of industry and the human body. Many of these developments are American. To be a scientist or technologist today is to be at the frontier of human explorations and aspirations, but we must be cognizant of the economic and social limitations of these exciting prospects.

Then why are we worrying about our competitiveness?

The growth rate in real income per person in the U.S. has been almost 2 percent per year since the Civil War. With this growth rate, standards of living nearly doubled between generations, despite a simultaneous huge increase in population. Thus, from 1870 to 1984, the country's average real growth rate in gross domestic prod-

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uct (which differs from GNP by omitting international transactions) was about 3.39 percent per year; from 1948 until recently it exceeded this level. The U.S. surpassed the United Kingdom, at one time the leading industrial power, which grew at a per capita income increase of only 1 percent per year (a level about half that of the U.S.). Great Britain is now one of the poorer members of the Common Market. On the other hand, since 1868 Japan has surpassed even the high American growth rate. With an annual GDP growth rate of over 5 percent since 1930, it has become the second largest economy in the world.

Such is the power of compounding over long periods of time. Differences of a few tenths of a percentage point, which may not appear very significant in the short term, are an enormous economic and social achievement when viewed in the long term. Thus it is of concern that since 1979 the U.S. real annual GDP growth rate has dropped to about 2.2 percent despite a long five-year economic recovery. Will the U.S. follow the fate of the United Kingdom, while Japan and the Far East eventually outdistance it? Or can it maintain a prominent position of economic, and hence strategic, leadership?

To achieve this goal, the promise of the new technologies must be realized, but this cannot be accomplished without taking into account the realities under which new technology is applied. Here, history is a guide.

The role of technological change

The United States could have achieved its growth in per capita income in two very different ways: 1) by using more resources, or 2) by getting more output from each unit of resource (increasing the productivity). How much of the long-term rise in per capita incomes is attributable to each? The first serious attempts at providing quantitative estimates came only during the 1950s, and the answers were a big surprise to the economics profession.

What seemed to emerge from these studies was that long-term economic growth had not come from simply using more and more resources, that is, capital and labor, but rather, overwhelmingly (85 percent) from using resources *more efficiently*. Many ascribed this increase in productivity to "technological change," although certainly many social, educational, and organizational factors, as well as economies of scale and resource allocation, also affect productivity.

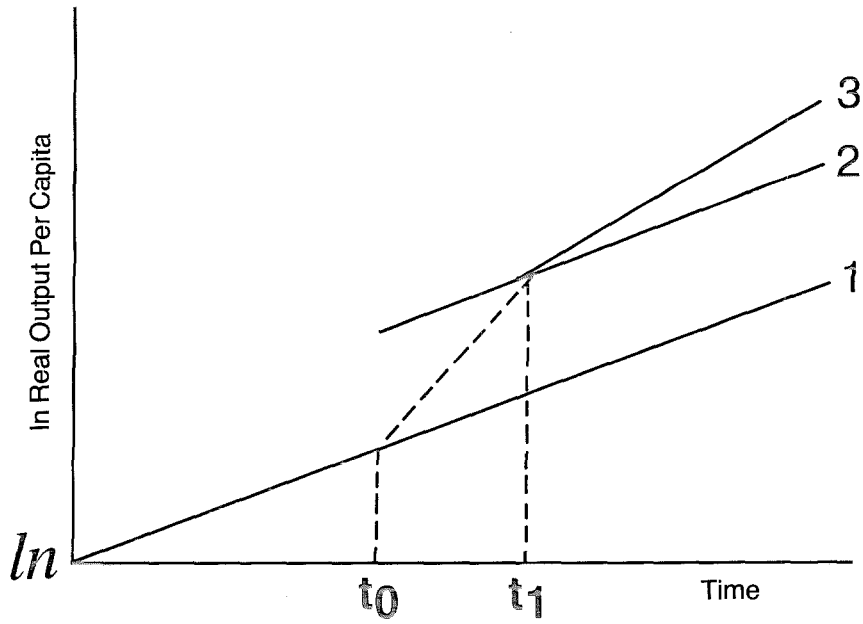
This neoclassical growth theory was developed by Robert Solow at M.I.T., and out of it came the growth accounting studies of the 1960s and 1970s. But recently other economists, including my colleagues at Stanford's Program in Technology and Economic Growth as well as at Harvard's Program in Technology and Economic Policy, have begun to examine more critically the limitations inherent in this theory.

In particular, we perceive that there are in actuality two key departures from Solow's neoclassical equilibrium theory: 1) that it does not apply for periods less than perhaps half a century, because the economy is in a dynamic transition disequilibrium stage almost continuously; and 2) technology in a mature society like the U.S. is largely endogenous (that is, new technology is generated by internal forces) and not, as assumed, exogenous (imposed from outside the economy). In a mature society it may well take 20 to 30 years to fully utilize important new technologies, but meanwhile GDP may double.

Since 1966 productivity increases in the U.S. economy have greatly diminished from previous levels. From 1964 to 1973, the labor productivity growth of the U.S. economy was 1.6 percent per year; from 1973 to 1978, it fell to −0.2, and in 1979-1986 revived to only 0.6. (The Japanese labor productivity growth rates for the same period were 8.4, 2.9, and 2.8 percent per year respectively.) In much of the later part of this period, the growth of total GDP was brought about almost entirely by increases in capital and labor, especially (in the seventies) the latter, as the baby boom peaked. While the explanations for the collapse in American productivity vary, it seems clear from extensive recent studies of the two economies by Dale Jorgenson of Harvard and his colleagues, that the comparative performance of the U.S. and Japanese labor productivity growth rates has been heavily influenced by the *much higher rate of Japanese capital investment* in a number of their industrial sectors. Coupled with very high savings rates, this helped fuel the rapid adoption by Japanese industry of the latest available technologies from abroad. The rate of Japanese investment was twice as high as the rate for many U.S. industries, which in some cases were not adopting new technology with the same urgency.

Other data also suggest a very high correlation between national investment and economic growth rates; for example, Germany and France, with investment rates roughly twice those of the U.S., also had about twice the productivity growth rate. These higher investments were due in part to higher labor costs relative to capital costs and to more rigid markets.

Jorgenson also found that capital formation



According to Michael Boskin of Stanford, the economic growth rate (1) can be temporarily kicked up to a higher level (2) by encouraging capital formation. It then continues, however, at the same pace as before. But the growth rate is accelerated (3) if technological change, capital, and labor quality are interacting so that improvements in one sphere stimulate improvements in the others.

has contributed far more significantly to long-term economic growth than earlier estimates had suggested—that it accounts for about 40 percent of economic growth in the post-war era. And technological change constitutes less than 30 percent, rather than the earlier 85 percent estimates; labor factors were the remainder.

The important point of these new studies is that there is a priority list for improving growth rates over the medium term of 20-30 years: first, capital investment, then R&D and technology, and last, although not unimportant, improvement in labor quality. There is a further complication in understanding the causes of growth, however; quantitative measures of productivity do not fully describe the performance of any economy. Quality is also of great importance but is very difficult to measure.

How growth rates can be increased

Insight into the key relationships is provided by the figure above. According to Michael Boskin of Stanford University, the fundamental variables that increase the growth rate of a country in the long term are the rate of technical change and the increase in quality of the labor force. Increasing just the capital/labor ratio will lead to only a *temporary* increase in the rate of growth (moving from growth path 1 to growth path 2). As mentioned, such an increase in capital formation occurred during the 1960-1979 period in Japan. These large growth rates have proved difficult to sustain, but permanent advantages for many industries and for the population have been created.

Measurements of productivity growth alone are not, however, a complete expression of the role of technology in economic growth. In the original formulations, the inputs of labor, capital, and productivity were deemed essentially independent of each other. However, in our experience, R&D is seldom performed all by itself—but rather only when it is expected to be employed in new or improved facilities and in superior operating modes. So technological change is not only embodied in capital investment, but it is also a powerful inducement to it, since the availability of superior technology is a major incentive to invest. Likewise, improvements in labor quality (human knowledge, skill, and training) are both a requirement of and a spur to technological change and are another form of investment—human capital. Thus technology now often takes an embodied form within each of the basic factors of production—labor and capital—to a far greater extent than ever thought before. And when workers, managers, and technologists utilize such capital investment, they are also learning from and drawing upon an expanded store of human knowledge, which yields continuing improvements in efficiency and output.

Boskin's growth path 3 in the graph above illustrates that if these interactions between technological change, capital, and labor quality are in fact occurring, then a higher rate of capital investment *can* move the economy to a higher rate of medium-term economic growth, as well as an upward shift in the level at any given time. This is especially true when it comes to exploit-

ing the results of "breakthrough" R&D, which requires large new investments. This increased growth path may be viewed as a series of transitions in a dynamic economy never really at equilibrium because of continuing, unpredictable, endogenous technical changes. If technical change is not exogenous, embodiment and learning by doing interact with capital investment to improve growth rates, and capital investment is critical in reaching a higher equilibrium at a faster rate.

Hence, in view of the substantial number of really novel technologies now becoming available and the effects of continuing R&D efforts, the need for totally new facilities, new capital investment, and the closing down of obsolete units is becoming much greater—a version of "catch-up" for the U.S. The revival of interest in growth economics has been further aided by the award of the 1987 Nobel Prize in Economics to Solow.

The table on the opposite page compares employment (civilian millions) in the U.S., Europe, and Japan. The first column includes the 12 EEC countries, while the second column shows figures for the original 10. In comparison, the U.S. did very well in job formation in the last three decades.

Solow has recently expressed his own reconsideration of the role of capital formation in long-term growth. He stated that he feared that the implications of his theory—which downplayed the importance of capital by making his long-term growth equation independent of savings—might have been carried too far, resulting in a severe underinvestment in the nation's physical infrastructure. "You can't take an old plant and teach it new tricks," he said. Such growing recognition of the critical role of capital investment leads to a study of its availability and cost relative to other countries.

My colleagues and I believe that earlier distinctions between technology, capital, and labor inputs to economic growth need to be modified in favor of a view that sees them as intertwined parts of the *same process*. It is only in this broad sense that it is correct to say that technological change has been responsible for perhaps 70 to 80 percent of U.S. economic growth in recent decades. In the past, *the successful entrepreneurial exploitation of new technologies to create new products, processes, and businesses has been a distinctive American characteristic and comparative advantage*, requiring a favorable economic climate for long-term, steady growth, and a balance between current consumption and investment for more future consumption. Do we have such a climate today?

The climates for productivity and growth

Postwar experience has indeed confirmed that long-term growth is established in the microeconomy—the world of firms and individuals who do the investing, the learning, the researching, and the conducting of the numerous businesses. Solow has termed the study of these activities the true supply-side economics. On the other hand, short-term cyclical effects are stabilized by macroeconomic policies (primarily fiscal and monetary), and these relate to the demand side of economics.

Nevertheless, the microeconomy is also adversely or benignly affected by short-term macropolicies, and may be favorably or unfavorably influenced by second-tier macropolicies such as tax, regulatory, trade, labor, and financial policies. Sometimes, these effects may be long-lasting:

- The tight monetary policy of the 1979-82 era to subdue inflation led to the hard dollar and a huge trade deficit, permanently closing down many businesses and injuring the competitiveness of many more.
- The high inflation of the seventies left a residue of high, long-term interest rates because of the negative expectations of investors, and it reduced spending by firms and individuals for capital investments by raising the cost of capital. This has had a long-term depressing effect on the competitiveness of American firms.
- The rapid succession of tax bills in the eighties has made long-term business planning more hazardous than ever, although the low marginal rate trend may eventually be beneficial if left alone for some years.
- The high government budget deficits of the eighties have reduced private savings in the U.S. and have compelled the import of capital primarily for consumption and not for investment. These deficits, plus the increasing indebtedness of firms and individuals, have led to an extraordinary expansion in money and credit growth. This growth, however, flowed into the financial markets and not into the real economy, creating excessive liquidity and speculative fever.
- The ad hoc mix of all these policies has, however, provided the large number of the jobs required to meet the demographic increase in the work force. The table above shows how well the U.S. did relative to Europe in job formation, which was a factor in mitigating social unrest here. But this extraordinary U.S. job machine, based in large measure on its unique ability to generate many new small and medium-sized companies, has had the inevitable effect of lowering its productivity increase compared with its competitors. Thus, Europe has indeed had a higher productivity growth, but at the cost of unemployment rates over 10 percent (vs. the U.S. rate of 5.5 percent), which would be totally unacceptable in the U.S. Since our criterion of

	EEC	EEC	USA	JAPAN
1955	–	101.4 Est.	62.2	41.9
1965	–	104.8 Est.	71.1	47.3
1975	121.8	105.4	85.8	52.2
1985	121.0	106.5	107.2	58.1
1986	121.5E	107.1E	109.6	58.5
Net Increase		5.7	47.4	16.6

9/14/87 Courtesy: *The Economist*

true competitiveness includes adequate job formation, the U.S., in view of its declining demographics, can have *both* if it adopts the policies advocated later in this article.

But, in addition to the domestic climate (set largely by the federal government), there is now an international climate—that of trade in goods and services, in capital, and in technology. Capital flows (say $50 trillion per year), however, dwarf trade flows ($3 trillion per year). Thus, it seems clear both from current perceptions of growth theory and from the realities of today's international climate that the driving force of international exchange is in capital flows, with trade in goods and services its derivative mirror image. So I intend to lay special emphasis on capital.

The capital formation problem

The international accounting systems provide a basic identity that illuminates the problem underlying America's uncompetitiveness in capital flows: current account balance (the net of international trade and invisible flows) is equal to domestic investment minus domestic savings. At present, the current account balance is approximately −3.5 percent of our GDP. This means that either domestic investment is too high or domestic savings too low. In view of the aging of American plants and the new technologies available, American domestic investment cannot be too high. The only rational explanation is that savings are too low and that the cost of capital is, therefore, too high.

Since it is obvious that changing the private savings rate is not easy, the U.S. has become dependent on foreign savings. This has happened to the U.S. before, and to other countries at certain stages of development, but not to fund consumption, which seems to be the current U.S. pattern. Global investors are necessarily wary of committing capital to a nation with an overconsumption problem, and interest rates must rise to tempt them to do so, which, of course, also raises the cost of capital.

As a result, control over American macroeconomic and other policies is no longer firmly in U.S. hands, and the cost of borrowing from abroad will become an increasing burden on future generations.

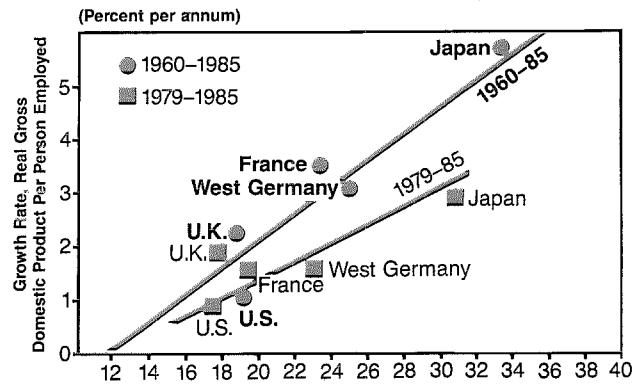
The quickest and most manageable step toward putting America's destiny back into its own hands is to reduce the government's net budget deficits. By so doing, savings available for investment would rise by 3.5 percent of GDP, and future generations would not be increasingly burdened by the growing foreign debt.

Unfortunately, there is another major obstacle to improved long-term growth: the *extreme volatility* in the seventies and eighties of government policies, resulting in wide swings in inflation rates, dollar exchange rates, interest rates, tax rates, and the like. There is a continuing threat of devaluation of the dollar staring every investor in the face and increasing prospects of excessive protectionism. These threats have also pushed up interest rates, because expectations of sudden, unhedgeable, and unpredictable changes add a real risk premium to interest rates, and this in turn limits investment rates. Such an increase in interest rates also directly raises the cost of capital to American industry. In a recent conference at Harvard University on the cost of capital, three speakers from the U.S. and Japan confirmed that hurdle rates to justify a proposed industrial investment for investors in the U.S. are 15 percent at a minimum, while in Japan they are 8 to 10 percent.

Figures 1 and 2 on the following pages present a summary of what these obstacles have done to reduce American competitiveness. Both in savings rates and investment rates, we are near the bottom. There is, however, an important element inherent in these international comparisons: the technology level of our principal competitors in 1960 was well below ours. For the investment curve in figure 2, the 1979-84 data show the declining slope due to a more nearly uniform level of technology among the nations.

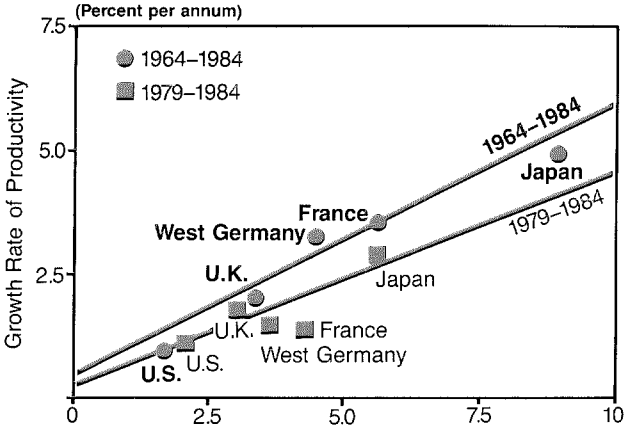
Nevertheless, the truly significant fact is that for these five mature economies, the effect of

Figure 1



*Personal, business and government savings.
Source:OECD (Courtesy U.S. Dept. of Treasury)

Figure 2



Source: OECD (Courtesy of Stephen Brooks)

The U.S. had one of the lowest rates of savings and productivity growth over both the longer and the shorter term, as seen in Figure 1 above. The flatter slope of the short-term data (1979-85) reflects the general decline of world growth rates during that period. Figure 2 shows national productivity vs. the capital-labor ratio, that is, the average annual growth rate of capital per worker. Again the slope of the more recent data is flatter; this indicates a more uniform international level of technology.

capital investment per worker on productivity is substantially higher than neoclassical theory would indicate, for some of the reasons indicated above.

The findings of figure 2 relate directly to our studies of the cost of capital. In the U.S. it has been and continues to be from two to three times as high as it is in Japan. Combined with the high availability of capital (Japan, unlike the U.S., is an exporter of capital), this permits a much longer investment horizon—a patient money approach—which is the hallmark of the Japanese company.

Thus, inevitably, we keep returning to the problems of inadequate domestic savings and investments. A budget deficit that declines to zero or close to it over perhaps a four-year period must be the primary tool to increase the savings rate of the U.S. This, in turn, would reduce the current account balance to close to zero, or at least to a modest and manageable level. Policies should be *steady*, predictable, and not subject to sudden change. Simultaneously, with this increase in savings, consideration must be given to increasing the incentives to invest, including in particular the reduction in the risk premiums. As suggested below, the possibility of accomplishing these goals is really much better than one might suppose—relatively little here and there will probably be enough to cut $150 billion a year from the deficit by 1992.

The social climate

There is another stream of economic research that deals with the social capabilities or climate for a nation to grow over the long term—including such factors as education, labor relations, the legal system, and many others. For optimum growth, a cooperative social climate is required. The preeminent example of a favorable social climate is, of course, Japan. But the Japanese have many unique advantages not open to the U.S.—high savings rates; friendly stock ownership with no takeover threats; close relations between companies, suppliers, and governments, all of whom get their returns by continuing business from growing corporations; one-party government; cooperative company-oriented trade unions; tight discipline; better secondary education; and so on. The U.S. has a different culture, and must adopt its own set of solutions, taking advantage of the unique risk-taking entrepreneurial nature of its private sector, its extraordinary research university system, its huge domestic market, its extremely broad range of manufacturing and service industries, and its many natural resources. Yet, if the problems of

the high cost and inadequate amount of capital persist in the U.S., the concept of the MBA instead of the engineer as CEO will become the accepted tradition, with fatal results for our own competitiveness in an increasingly technological era.

In view of the problems cited above, priorities for policy actions must be set. The U.S. cannot solve all of its problems at once. I would divide them into the three "R's"—recession, reinvestment, and redistribution.

Recession: the short term—two to four years

The present recovery of more than five years is widely deemed to be tired. The next president must be prepared to deal with a recession; *but it should not paralyze decisive action to plan for long-term growth, which should start as soon as he is inaugurated.*

A sudden constriction of demand by budget deficit reduction is undesirable. It might even deepen and accelerate the recession, and could possibly drown the rest of the world. This is why I advocate a definitive four-year program for deficit reduction. On the other hand, if a favorable climate for long-term investment is created, an anti-Keynesian, investment-cum-export boom could cushion the reduction in demand that a recession or simply slow growth imply, and we may conceivably be able to avoid much of a decline altogether. Modern Keynesian economics no longer takes the simple view that a dollar of demand stimulation gives a dollar of results. The reason lies in the realization of the greater role expectations have come to play. We cannot run deficits without raising interest rates. The real purpose of future economic policy is to shrink imports, to make investment and saving a high priority, and to increase exports to a world that must not be thrown into recession either. Unfortunately, our ability to increase exports may increasingly bump up against domestic capacity constraints, as well as the ability of other nations to absorb more. This is a major reason to encourage an investment boom. This has already been occurring in basic industries such as paper, chemicals, light metals, etc. If properly managed and with proper understanding of other nations' interests, the foreign capital now coming to the U.S. will stay home instead, and add to domestic demand there, including demand for our exports. I believe the following are major ingredients of such a strategy:

a. If the budget deficit is thus gradually but definitively reduced to zero, it is still not fully predictable what the ultimate value of the dollar will be at equilibrium. There really are two equilibrium values for the dollar, one set by capital flows, and one by trade flows. In the long run, perhaps many years, these should be the same; but not in the next several years, at least, when the capital market transactions will dominate the exchange rates. Thus, if the reduced interest rates cause foreigners to lose their appetite for U.S. investments, then a side effect would be a lower dollar, and the trade deficit would disappear. At the same time, it is conceivable that, despite the reduction in interest rates, the U.S. could still be a desirable place to invest because of the perception that a stable national policy and higher potential returns are now in place in the world's largest economy. Then some dollar inflow might continue indefinitely with, of course, a continuing trade deficit and possibly even a higher value of the dollar. But because the domestic savings rate would then be 3.5 percent of GDP higher, this inflow gives a higher savings rate than is now possible. And it is mostly self-liquidating since it would only go into investment to raise productivity and increase the capital stock, and not into consumption. This was the situation of the U.S. in the 19th century.

If the budget deficit is not clearly headed toward a manageable level, the financial markets will impose a solution of their own, perhaps in the form of a more severe "crash." On the other hand, a sharply lower dollar can only temporarily accomplish the same objective as a cut in the budget deficit. Ultimately, if policies do not change, the fundamentals of exchange rates (savings and investment, inflation, productivity rates) will reassert themselves, and the dollar will resume its fall. This is a recipe for progressive impoverishment, and the American economy would be permanently damaged.

Some political solution is required to avert real irreversible damage to Japanese and European industries, before the trade deficit turns around, bringing with it rising anti-Americanism. There is a world demand shortage, and the U.S. has been the world locomotive of growth in the eighties. Greater investment possibilities offer the best way to raise world growth. In this way, it beomes possible to reap the rewards of the new technologies described above.

There are American observers who feel that any such coordinated measures, however, cannot or should not be put in place *before* the trade deficit disappears. It is my feeling that, in view of the genuine effects abroad, as described above, such a policy is unrealistic. *It is not necessary to establish a stable exchange rate too soon if we*

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address the budget deficit problem along the lines I support; the markets will set the exchange rates.

b. Monetary policy should, therefore, continue to seek reasonable stability for the dollar so that the large stock of dollar assets held in international currency portfolios does not immediately flee and depress the dollar exchange rate too much further—and worse, increase the incentives for the "buying out" or "selling" of America. A falling dollar raises the cost of capital in the U.S. This would really happen if a "free-fall" of the dollar occurs, and probably lead to attempts at capital controls, trade wars, and world depression. But unless the budget deficit reduction plan is clearly implemented, attempts to stabilize the value of the dollar will fail as market forces push it even lower.

c. Although many economists find some features of the 1986 tax reform act to be anti-investment and anti-growth, nevertheless I insist that for the best growth policy, the government should leave the basic income tax structure alone. Business needs 5 to 10 years without new bills to adjust its activity and grow. *Volatility of economic policy is the biggest enemy of long-term strategy.*

- Even in the event of a recession or growth slowdown, we must start the process of reducing the *structural* full employment deficit in a gradual but definitive direction so as to reduce this deficit to zero by 1991-1992. But we must first address the spending side by doing some of the following:

a. Reduce all unnecessary budget expenditures that do not affect long-term growth favorably. These include removing subsidies to large farmers (much of the $20 billion spent on agriculture), which will also benefit consumers; continuing the gradual reversal of defense spending increases (the new 1989 budget shows a real decrease for the first time), but with care not to give the wrong signals; eliminating, delaying, or sharing the costs with other nations of the big-ticket "show" items of big science, such as the superconducting supercollider, the space station, and sequencing the human genome (but using a portion of the savings for more basic scientific and engineering research); applying means tests to many entitlement programs, such as bringing transfer payments within the income tax system; and considering a one-year freeze of indexations on entitlements. A two-year freeze on the spending programs would eliminate the deficit entirely, but may not be needed if all or most of the measures suggested here are adopted. The real gain in long term growth would come from spending reductions, thus freeing more resources for investment. At least half of the burden of reducing the budget deficit must and can be drawn from these measures.

b. Firmly reject a value-added-tax system, because it adds complications and uncertainties; it is an engine to fuel new spending programs that may be economically undesirable but politically attractive; it preempts state sales taxes; and it adds to inflation.

c. Add a higher gasoline tax of 25 cents/gallon at once, rising to 50 cents-$1.00 in four years. Those who must drive long distances can be aided by providing a threshold level of tax applicability. The price of oil will inevitably rise in the nineties, and everyone will be paying more for gasoline in due course. In 1988 crude oil imports are expected to be 7 million barrels per day, up from 4.9 million in 1985. Such imports account for 37 percent of the total U.S. trade deficit. As we become bigger importers, the price of oil will rise. Americans pay no more than a third to a half of the European price of gasoline. The U.S. does not require such low prices—in real terms gasoline now costs barely half as much as it did in 1980. By biting the bullet now, we can start the process of energy-saving reductions in consumption without hurting investment, encouraging more fuel-efficient cars, and reducing highway congestion and pollution. As the price of gasoline rises, the tax can be reduced.

d. Raise tobacco and alcohol taxes.

By a combination of these methods, with increased taxes also contributing about half of the money needed to resolve the budget deficit, it is quite feasible that by 1992, the structural deficit as a percentage of GDP will have been reduced to a manageable level.

- We must address the debt problem of the less-developed countries by writing much of it off at market prices. Many customers for our products cannot be restored to health without some such step. It is mostly fiction now that these debts are carried at nominal value on bank balance sheets.
- No new major spending programs that have consumption characteristics should be undertaken in this period, or the discipline of the budget will be lost, long-term interest rates will go through the roof, and inflation will come back. The time for new spending programs should come only when recovery is firmly in place, and always so as to allow a zero or slightly positive budget balance.

It is during this short period of recession that

the ground must be laid for the reinvestment plan that is to come next.

Reinvestment: the middle term—a decade

- Reducing the structural budget deficit is the first and quickest step, although savings do not equal investment.
- Increasing corporate cash flow comes second. This can be changed by allowing much faster depreciation, so as to equalize more nearly the tangible and intangible investments and allow deductibility of dividends on new issues of preferred stocks so as to render neutral the choice of financing between debt and equity. This latter provision would also favor new investment and would reduce takeover risks. The ideal is to allow first-year depreciation of all kinds of assets, and to eliminate the double taxation of corporate income.
- Restoring and broadening the IRA system is the most likely method of raising personal savings.
- Interest rates will move downward with greater stability of policy and reduction of the need for borrowing abroad. While lower interest rates reduce incentives for foreign investors to send capital to the U.S., they increase the incentive for domestic investors to invest, by lowering the cost of capital. Thus, it is by international adjustments in interest rates, coupled with reduction of American "dis-saving," that a relatively longer term exchange rate stability can be sustained.
- Incentives for investment are even more important than those for R&D. The capital/labor ratio must go up as the growth of the work force diminishes, so that while job loss is minimized, productivity is raised. If productivity is raised sufficiently, we can finance our debts, hardly notice the decline in living standards, and grow our way out of the present impasse. Ultimately, the capital gains differential and the investment tax credit for certain types of investment must be restored, the former for longer-term riskier stock holdings in productive enterprises.
- The inhibition of innovation by the legal system must be attacked: problems of product liability, takeover laws, regulation, and waste disposal. There's no question that technology has a dark side, and we have to deal with it. But we must find more efficient ways of doing it than we've found so far.
- We must improve our educational system in the secondary schools, by setting national standards but allowing traditional local control.

A budget deficit that declines to zero or close to it over perhaps a four-year period must be the primary tool to increase the savings rate of the U.S.

- The adversarial atmosphere between government, industry, and labor must be changed. While we are most unlikely to adopt the Japanese policies that consistently favor the producers over the consumers, we can move away from our almost completely opposite pro-consumption policy, which has prevailed since the war. This does not mean industrial policy, which is not politically feasible because it will always become clout-based instead of merit-based.
- Management in both manufacturing and service industries must work harder and smarter at raising their productivity and quality. We need a new type of manager—more technically sophisticated, internationally minded, and conversant with other languages.
- We must deal with the drug problem, which is seriously affecting productivity.
- We must eschew protectionism. It is a negative sum game. There are those who still advocate "fair" or managed trade, but it benefits only the companies affected, injures the consumer, and slows growth. Who in the government can resist the pressure of the "losers" for favored treatment, and who will speak for the "winners" yet unborn or for the consumer?
- A serious long-term energy policy is essential.
- Some mechanism must be found to improve fiscal policymaking by the government, particularly by the Congress. While monetary policy is set by the Federal Reserve Board, no one really sets fiscal policy as a whole. Our competitors do much better at this, which is one of their great comparative advantages.

Redistribution: the long term—a generation

The underclass needs to be brought into the mainstream. This term does not mean all persons within the poverty level, but those who have essentially dropped out of the economy altogether. This is the principal area where redistribution may be feasible. In a recent article in *The New York Times*, Solow said, "Redistribution is not something that Americans are good at." Greater growth is his remedy, and my colleagues and I agree.

What remains to be done?

The influence that the federal government has on the climate for innovation and long-term growth has been discussed above. Capital formation and its costs have been pinpointed as the major problems facing American industry in its efforts to improve its competitiveness in a vastly different world economy than that of 15 years

INDUSTRY	R&D EXPENDITURES (Billion $)	HOW FINANCED
1. Aerospace	24.0	80% Government
2. Electrical Machinery & Communications	20.0	60% Industry
3. Machinery	11.9	87.5% Industry
4. Chemicals	9.4	97% Industry
5. Autos, Trucks, Transporation Equipment	9.2	77% Industry
6. Professional & Scientific Instruments	6.8	84.8% Industry
7. Petroleum Products	2.5	Nearly all Industry
8. Rubber Products	1.5	84% Industry
9. Food and Beverages	1.07	Practically all Industry
Total	86.37	

Source: Battelle Memorial Institute

This table shows the 1988 estimates of R&D investment by those industries that spend more than $1 billion a year on R&D. Since total U.S. investment is estimated at $132 billion, of which industrial R&D represents $96 billion (70 percent comes from companies and the rest from government), the industries listed here constitute the bulk of the investors in R&D.

ago. The opportunities available in new science and technology are breathtaking, but the horizons for exploring them are long, and they require cheap and abundant capital investments per worker—of both physical and intangible capital. Intangible capital encompasses R&D, engineering, experimental production, construction costs, market development, and legal precautions. These and many other expenses can frequently be deducted by the firm, but they are capital costs all the same.

But even if this fundamental capital problem is ameliorated, there is much that firms and individuals must do for themselves, particularly in the manufacturing sector, which performs 95 percent of commercial R&D (the table above shows the industries that spend more than $1 billion per year in R&D). This sector constitutes two-thirds of the nation's tradeable goods, nourishes the service sector, provides for defense needs, and boosts the overall productivity of the economy. The force of international competition will drive out the bad managements and firms.

The task of management and technologists must be to create wealth by steady cost reductions and incremental improvements in large-scale production, which will be needed for the innovative activity involved in utilization of the new technologies. This will, as is already happening in Japan, lead to a concentration on higher value-added products with advanced technology, in which the labor costs are a small part, and can justify high wages. This type of strategy fits the American entrepreneurial spirit, which is hospitable to the new. In effect, today's comparative advantages are dynamic and ever-changing. Managements must accept that firms need to become increasingly multinational and move closer to their markets. This will aid growth prospects in the world as a whole. The U.S. cannot be walled in any more. Such isolation is a recipe for progressive impoverization and technological sterility.

The national goal

What I argue for in this article is for greater growth of the economy. We should aim at the 3.5 percent real GDP growth per year, which was the rate during most of the postwar years. In the nineties the work force should only increase by 1 percent. In addition, there is a probable drag of 1 percent of GDP per year required to service the foreign capital we have borrowed (by increasing exports). Thus, even a 3.5 percent growth rate translates into a 1.5 percent per capita growth in real GDP, slightly below our historic nearly 2 percent long-term growth. If we are to achieve even this reasonable goal, great changes in national and international economic policies are inevitable. It is time the American people and their elected representatives faced the hard truths. □

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