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Inflation and Public Policy

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Investment Ratios and Economic Growth Rates

. . . Three major factors help account for the noticeable difference between U.S. and European growth rates.

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Inflation and Public Policy

By John J. Balles, President
Federal Reserve Bank of San Francisco

*Remarks to Oregon Bankers Assn. Convention
Sunriver, Oregon, June 14, 1974*

I'm glad to have the opportunity to visit with so many old friends and new acquaintances here in the beautiful and productive state of Oregon. And as a speaker, I'll try to keep in mind your unofficial state motto, "Come visit us, but don't stay too long." However, quite a few Californians apparently ignore that injunction, because I understand that 18,000 of them cross the border to settle in Oregon every year.

A useful perspective on the nation's problems and promises can be obtained from overseas, and I obtained just such a view recently when I undertook a five-week tour of nine Pacific area countries. The immediate purpose of the trip was to discuss the regulation of foreign banks, both abroad and in the U.S. In addition, I wished to establish on-going contacts with the central banks of the Pacific region, for the purpose of future cooperation on problems of mutual interest, and also for the purpose of making the Federal Reserve Bank of San Francisco a major nerve center in U.S. banking and financial relations with this rapidly growing region.

As I toured around the Pacific area, however, I could not help but be impressed—indeed dismayed—with the problem of rampant inflation in every country that I visited. Of course, we in this country are also suffering from this problem of

world-wide inflation, characterized by double-digit interest rates and double-digit price increases. Yet I found that in most of the Far East countries the rate of inflation over the past year has been even more serious than in the United States. This has led to some highly destabilizing effects. For example, in Japan the major wage contracts negotiated this spring contained provisions for 25-percent annual wage increases, adding a strong cost-push factor to the inflationary trend already experienced there. In Australia, as another example, the urgent need to combat inflation has led to an extremely tight monetary policy, and short-term business borrowing costs were as high as 20-25 percent when I was there last month.

Desperate Problem of Inflation

All of the officials that I contacted overseas expressed sympathy for the efforts we've been making in this country to overcome our many economic problems. At the same time, they were worried about the damage that could be done in their area by continued price rises in the United States, the cornerstone of the Pacific and world economies. But, for our own sake, we should be concerned about the severe and protracted problem of inflation—one of the most difficult economic problems in the nation's history. This inflation threatens to destroy all the hopes we have of regaining the prosperity levels of recent years.

And in the words of Federal Reserve Chairman Arthur Burns, "If long continued, inflation at anything like the present rate would threaten the very foundations of our society."

You're already familiar with some of the unique factors that helped cause our present inflation, so I'll review them only briefly. During 1973, a business-cycle boom occurred simultaneously in this and every other major industrial country, and because of this synchronized upsurge in production, the prices of labor, materials and finished goods were bid up everywhere. In addition, disappointing crop harvests the previous year forced a sharp run-up in food prices through most of 1973, while the price and production policies of the oil-exporting countries brought about a dramatic rise in energy prices last winter and fall. More recently, a price bulge has developed with the removal of wage and price controls.

Worse still, these special factors only magnified an underlying bias toward inflation found in this and every other industrial nation. People want the good things of life and they want them now, generally turning to government when they cannot obtain those things through their own efforts. The public nowadays expects the government to maintain a prosperous economy, to ease the burden of job loss or illness or retirement, and to sustain

the incomes of farmers, home-builders and other segments of the economy. But in the rush to realize these goals—again I'm quoting Chairman Burns—"governmental budgets have gotten out of control, wages and prices have become less responsive to the discipline of market forces, and inflation has emerged as the most dangerous economic ailment of our time."

To show the pernicious effects of inflation, consider the havoc created in the world's financial markets by the increase in price of a single major commodity, petroleum. This development has placed more severe strains on the world's monetary system than at any time since World War II. For the U.S., Europe and Japan, the oil-import bill will be roughly \$50 billion higher than in 1973, contributing to a \$100-billion investable surplus for the oil-exporting countries by the end of the year.

It could be said that a decision by the OPEC countries to export oil at today's high prices is equivalent to a decision to invest huge sums of money abroad; especially in view of their very small domestic markets for imported goods and services. The oil exporters apparently have demonstrated a preference for investing in the Eurocurrency market, which is a highly efficient mechanism for financial intermediation. Nevertheless, that market has cer-

tain obvious defects under present circumstances. Funds placed in the Eurocurrency market tend to be on short-term deposit, while the debts required to ease the payments strains of oil imports will need to be relatively long-term. Moreover, serious financial instability may well result from sudden and massive shifts of funds out of particular money markets and across currency lines.

Outlook for Prices and Production

The GNP price index rose at an 11½-percent annual rate—an unprecedented peacetime increase—during the first quarter of this year, and the rate was even higher after adjustment for the soaring price of imports. The increase, of course, was concentrated in the food and fuels categories. Consumer food prices rose at a 15-percent annual rate—somewhat below last summer's peak increase—and energy prices jumped at a 67-percent rate—several times any earlier increase. Recent improvements in the supply situation for food and fuels suggest that these sectors will be less critical during the rest of the year. Even so, any improvement in these areas may be offset by the drive on the part of basic materials-producing industries to cover sharply rising labor costs and to enlarge long-depressed profit margins.

Basic wage increases have not been as high as might have been expected for such an inflationary era. During the first quarter, wages and fringe benefits increased at a 6.9-percent annual rate in major contract negotiations—not much higher than the 1973 average. But labor's increasing emphasis on escalator provisions for both wages and pensions—and "uncapped" escalators at that—creates the danger of a vicious circle of rising prices and wages. And even with the total wage bill kept under control, any decline in productivity (such as we encountered last fall and winter) could send unit labor costs soaring. Under the impact of bottlenecks and market distortions, unit costs increased at an 11-percent annual rate over that period—twice as fast as in most of 1973—and that type of inflationary pressure is continuing.

Wholesale prices of industrial commodities rose at a 36-percent annual rate in the several months prior to the lifting of controls, and the increases since then in steel, aluminum and other basic industries have been equally large. We can hope that the initial bulge of post-control increases will soon disappear, and that the spiral of price increases will begin to contract rather than expand further. But to do this, we must curb speculative excesses wherever they appear.

According to a forecast prepared by my economics staff, prices are likely to rise by 8½ percent for the year. Bad as that is, it still represents a significant deceleration in the price trend in contrast to the first quarter's 11½-percent rate of increase. As for production, real output may show no increase at all for 1974 as a whole. However, that suggests a noticeable improvement in the second half, following the 6-percent rate of decline in the first quarter and the generally sideways movement of the present period.

The major areas of strength in the outlook are business spending for new plant and equipment, as well as inventories. Government spending should rise considerably—in Washington, and also at the state-houses and city halls. However, the expansion will be held in check by weakness in several consumer-oriented sectors, especially autos and other durable goods and (in particular) new residential construction.

Business spending for new capacity will be the driving force behind the national economy this year and for several years to come. New plant and equipment should increase at least 13 percent this year, despite the continuation of shortages of certain parts and materials. As evidence, new orders for capital goods have jumped 50 percent over the past two years—the sharpest increase of the past several decades

There is a crucial need to build up capacity in petroleum, steel and other basic materials-producing industries, which have been operating close to the theoretical limits of capacity for over a year.

The neglect of these basic industries dates back to the period of excess capacity of the 1960's, but investment continued to lag thereafter because of the inhospitable atmosphere created by a recession, price controls and environmentalist pressures. The need for new capacity then became obvious when the double devaluation of the dollar limited the sales prospects for foreign goods in this country while creating a vast demand for American goods overseas. The stage thus has been set for a massive business-investment boom, although the financing for this boom will remain questionable until business firms raise their profit margins above the low levels of the late 1960's and early 1970's.

The strong prospects for business spending are not likely to be matched anytime soon by the consumption sector. Consumers were in a recession during the final quarter of 1973 and the first quarter of 1974, with a 4-percent rate of decline in real spending, and the recovery from that slump may be moderate and somewhat prolonged. The consumer has seen his rising take-home pay completely eaten

away by inflation over the past year; he has seen his real wealth decline because of rising prices and a sliding stock market over the past half-decade; and on top of that, he has been confronted with a huge overhang of debt resulting from the spending spree of the past several years. He is thus likely to remain in a cautious mood for quite a while, especially when considering purchases of big-ticket items such as autos and household furnishings.

The other weak spot in the outlook is housing, an industry of considerable interest to Oregonians. In dollar terms, spending in this sector could decline 14 percent this year, compared with last year's 7½-percent increase. But in real terms, the slump should be somewhat steeper. Real spending declined at a 33-percent rate in late 1973 and early 1974, and the upturn originally projected for the second half of the year has now been endangered by sharply rising mortgage rates and the withdrawal of savings funds from mortgage-financing institutions. Some help will come from the Administration's plan to subsidize a potential 300,000 new and existing units, through below-market interest rates. Even so, a sustained recovery in housing is not likely until the inflation menace is somehow overcome. As things stand, many builders fear that the soaring prices of land, labor and materials

could relegate the single-family home to the status of a museum piece.

Outlook for Oregon

The outlook for Oregon is mixed, just as is the national outlook, with weakness in those industries which supply consumer-oriented sectors, and strength in those industries which support the nationwide business-investment boom. The lumber industry is likely to suffer a moderate decline in production and employment, reflecting the slump in the housing industry and the partially offsetting boom in non-residential construction. Also, residential permit activity in the state has been running about one-third below year-ago levels, although basic demand appears strong, as evidenced by continued population growth and a decline in Portland's vacancy rates.

In contrast, demand for pulp and paper has remained high, and prices rose to 21 percent above year-ago levels after controls were lifted from the industry this spring. The rising return on invested capital, together with the prospect of continued shortages, is spurring this and other basic industries—such as the machinery industry—to plan for substantial additions to capacity. With respect to energy supplies, Oregon's abundant rainfall (if you'll pardon the reference) and its large supplies of hydro-power place it in

a more favorable position than its neighbor to the south, which is heavily dependent upon external sources of natural gas and fuel oil to meet industry's energy demands.

Agriculture should have a reasonably good year, although nothing approaching the halcyon days of 1973. Gross cash receipts of Oregon's farmers and ranchers should increase about 7 percent—far below last year's record—while net farm income may even decline slightly because of soaring production costs. Gross crop receipts should be up, despite a recent decline in wheat prices, because of a sharp increase in the harvest of that major crop. A gain in livestock receipts is less certain, because of a softening of prices and a one-third decline in the number of cattle placed on feed.

Policy Problems

The outlook for the state and the nation is dominated by the need to expand basic industrial capacity, so as to reduce the severe inflationary pressures which now confront us. The choice of policy weapons thus depends upon how well they support the necessary expansion of supply, and how well they curb excessive demand. By this standard, direct wage and price controls clearly fail, because of the distortions and bottlenecks they have created over the past several years. Controls were a noble experiment, but like that other noble experiment

of a generation ago, they will be remembered only for the terrible hangover they generated.

On the fiscal side, we must keep the Federal budget under control so that it doesn't aggravate our serious inflation problem. Congress should strongly resist pressures for a tax cut, which would stimulate demand at a time when the correct policy prescription calls for a strong expansion in supply. Restraint is doubly necessary because a substantial amount of fiscal stimulus is already included in the fiscal 1975 budget, with a projected deficit of at least \$11½ billion. This follows a \$3½-billion deficit in the fiscal year now ending—a period of unprecedented peace-time inflation. More broadly speaking, it is very discouraging to look at the record of fiscal policy of the last fifteen years in terms of its contribution to economic stabilization. In the entire period 1961-1975, a surplus appears in only one year (1969). All other years show deficits.

Monetary policy has a difficult role to play because of the distortions created by inflationary pressures in the real economy and in the credit markets. The Federal Reserve intends to encourage sufficient growth in supplies of money and credit to finance an orderly economic expansion, but it does not intend to accommodate accelerating inflation. To this end, the growth of the money supply has decelerated in the last

several months, after a bulge late last fall and again in February and in March. Over the past twelve months, the money supply has increased about 6½ percent altogether.

Yet monetary policy has had to contend with a fantastic rise in business demand for short-term credit. Commercial-bank business loans increased at more than a 25-percent annual rate in the first four months of this year, and the pressure was eased only slightly by a slowdown in mortgage and consumer loans. Business-loan demand was stimulated by increased financing for new plant, equipment and inventories, and also in recent months by a shift away from the commercial-paper market and into the banks. Loan increases incurred because of capacity-expansion requirements were to be welcomed. Increases incurred because of the higher costs of doing business in an inflationary atmosphere were understandable, although not welcome—but those loans made because of speculative inventory purchasing and other purposes should have been rejected. At any rate, thanks to rising prices and soaring loan demand—along with the market's expectation of a sharp monetary-policy response—we have witnessed a sharp and surprising upsurge in interest rates. Within three months' time, the prime business-

loan rate rose almost three percentage points to an unparalleled 11½ percent.

The capital markets have also been under heavy pressure, even though many corporate and government treasurers have scaled down or postponed scheduled bond issues. The situation has not been helped by the very large financing needs of the housing agencies, and in particular, by the concern aroused by the Con Ed and Franklin National episodes. Thrift institutions meanwhile have suffered substantial outflows of funds, reflected in the rates of various market instruments—witness the sharp increase in non-competitive tenders at Treasury bill auctions and at the May refunding of longer issues.

Many market participants have feared a further upsurge in interest rates as a consequence of the recent reduction in money-supply growth. But their fears may be largely unfounded. Many borrowers this spring saw the earlier rise in the money supply as presaging both increased inflationary pressures and a tightened policy response, so they borrowed as much as they could, creating excess demand for funds and pushing rates even farther upward. These exceptional factors could just as well change in the other direction, causing short-term rates to fall because of the belief

that inflation was coming under control. In addition, any slowdown in inflation should reduce the massive increase in the replacement cost of inventories, and thereby reduce the need for borrowing to carry larger stocks.

At present, we have a difficult role to play, but so do you. There's a new word to describe your task—"de-marketing", which means cutting back the demand for your product during a period of shortages. You must make sure that your stock in trade is used only for the most essential purposes, concentrating on those sectors that will expand the nation's productive capacity. This approach may make funds both scarce and expensive for many of your good customers, but at this juncture, it seems essential that you rein in the demand for loans.

The greatest need in financial markets today is discipline, and you are the people who must instill that sadly lacking quality into current business activity. Admittedly, part of the problem has been caused by corporations turning to banks for the money they would ordinarily raise through the sale of stocks, bonds and commercial paper. And as I've already said, some of these demands must be met, to help meet the nation's future needs. But those

who come to you with other proposals, no matter how attractive, must be forced to lower their sights or even to withdraw completely from the market.

If you follow the business press at all, you'll realize that I am not alone in making this plea for sanity. One publication recently editorialized, "The nation's commercial banks are heading down a dangerous road. In their eagerness to accommodate old customers and build new business, they are pushing out loans at an unsustainable rate and trying desperately to attract deposits to cover them." Here is another comment, "In the push to expand, banks have taken more and more risks and devise more and more ways to stretch the regulations"—followed by the ominous note, "No bank officer under 45 years old today can even remember 1933." And here is a welcome note of caution from Arthur Snyder, President of the Bank of the Commonwealth of Detroit: "As a matter of public policy, the banker is expected to be different from the ordinary business man. He is affected with the public interest; he is the guardian of the liquid assets of millions of families and businesses. The essence of being a banker is to stand apart from the excitement and to serve business and the community without joining in business activity."

Concluding Remarks

To conclude, there's no blinking the fact that the nation is going through a very difficult period. Economic activity seems to be slowly improving, but at a somewhat fitful pace because of serious supply constraints. The price trend seems to be decelerating, helped along by the prospect of bumper crops as well as new productive capacity in industry, but again, the improvement occurs at a maddeningly slow pace. Productivity continues to stagnate because of the problem of bottlenecks, and profits gains thus remain limited, at least after adjustment for inflation.

Nonetheless, we are moving in the right direction, especially since new capacity is being built that will permit the economy to return to its historical growth trend. Monetary policy has been formulated to assist that movement back to trend, and meanwhile to squeeze out the inflationary excesses developed in recent years. At the same time, in its role as lender of last resort, the Federal Reserve has shown that it will not permit disorderly conditions to develop in the credit markets. Over time, with the cooperation of the banking and business communities, the return to a period of healthy growth should be assured.

Investment Ratios and Economic-Growth Rates

By Hang-Sheng Cheng

It is a well-known fact that the United States generally invests a smaller fraction of its current national output in business plant and equipment than other industrial countries. This fact is often cited as an explanation for, first, a slower rate of capital accumulation and, second, a slower rate of economic growth, than what is experienced by other industrial countries. Both inferences are a **non sequitur**. The former is faulty, because it implicitly assumes internationally equal capital intensity of production and identical relative-price structures, whereas neither could be taken for granted in international comparisons. For instance, when proper adjustments are made to take account of international price differences, the U.S. investment ratios for the 1950's and the early 1960's—the latest period for which complete data are available—turn out to be no lower than those of other industrial countries, contrary to what unadjusted investment ratios would show. As to the relationship between investment and growth rates, a single-variable approach obviously leaves much to be desired.

This paper presents a more general analytical framework, which includes capital accumulation as one variable accounting for growth, but also permits empirical estimation of the contribution to growth made by several other individual variables. Using this approach, the author shows that the difference between U.S. growth rates and those of the European countries in the 1950-62 period can be traced to the relative strength of three sources of growth—technology enhancement, economies of scale, and improved allocation of resources—all of which were perhaps more closely related to stages of economic growth than to rates of capital formation.

* * * * *

Economists and policymakers have long been concerned about the role of capital formation in the economic-growth process. In the United States, in particular, several questions have often been raised about the nation's growth policy: Are we lagging behind other industrial nations in new business investment, thereby accounting for our slower rate of economic growth? If so, should we not adopt effective policy measures for encouraging business investment in plant and equipment?

The point has often been raised in relation to the question of lagging industrial productivity. For example, former Secretary of Commerce Peter G. Peterson said,

“This whole issue of productivity must become the central issue for the country. For, in the final analysis, the only way you are going to avoid serious inflation and the only way you are going to avoid persistent devaluation is to be managing the productivity side of your economy as well as other countries do. And this leads to the matter of investment. At the present time, for example, the Japanese are investing about 20 percent of their gross national product in new plant and equipment. The Germans are investing about 17 percent or 18 percent. We are investing 10 percent. . . . We should never let ourselves believe that we can maintain competitive productivity and can continue to ignore the fact that other countries regularly put this much more into new plant and equipment. For by every study I have ever seen, capital investment makes an enormous contribution to productivity.”¹

This concern over the adequacy of the U.S. investment rate has been frequently expressed during the last fifteen years. In 1958, the

Rockefeller Brothers Fund issued a report calling for a higher rate of investment—hence, a higher rate of growth—as the most practicable way to provide the public services needed for solving America’s socio-economic problems.² The call was picked up in John F. Kennedy’s 1960 election campaign and received widespread attention in the slogan: “Get the U.S. moving again!” Since then, a large number of academic and government studies have been made, various policy measures adopted, and government agencies set up, for the express purpose of encouraging investment and promoting productivity growth in the United States. In the meantime, a countervailing concern has arisen over the costs of rapid economic growth in terms of environmental pollution, resource depletion, and quality of life in general.

The issues arising from that discussion are both broad and complex. Instead of covering the entire gamut of issues, this paper concentrates on one narrow but crucial question: the relationship between investment ratios and economic-growth rates. “Investment ratio” is defined here as the ratio of a nation’s investment in business plant and equipment to its gross national product, and “economic-growth

rate” is defined as the rate of increase of real gross national product.

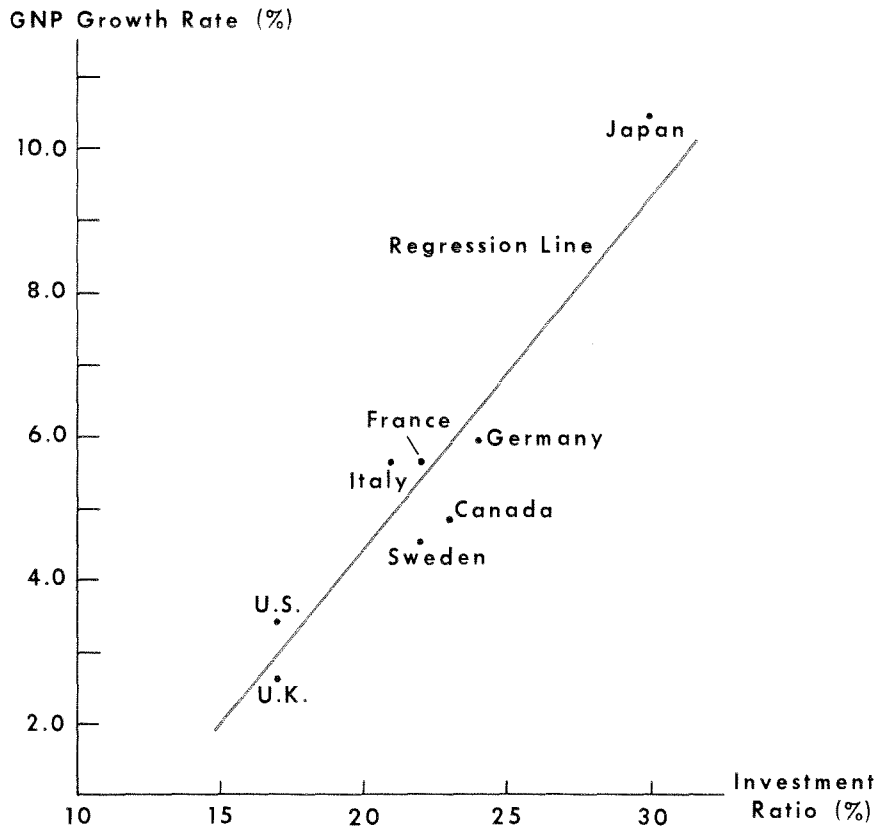
It is often assumed that a direct causal relationship exists between the two, such that a low growth rate can be directly attributed to a low investment ratio. The policy corollary of that assumption is that a higher investment ratio is needed for obtaining a higher rate of economic growth. However, this thesis stems from an over-simplified view of the economic-growth process. In contrast, the main contention of this paper is that investment ratios are liable to provide a distorted indication of the relative capital-growth rates in various nations, because of international differences in relative-price structures and capital intensity of production. Thus, on both economic and purely statistical grounds, investment ratios fail to explain why economic-growth rates differ among industrial nations.

Further, this paper proposes a more general framework of analysis for studying the economic-growth process. A simple model is suggested, in which the investment ratio is included as only one of several factors affecting the economic-growth rate. The model also provides a convenient tool for estimating the contributions to

economic growth made by individual factors of growth. The findings of a massive empirical study by Edward F. Denison³ on the sources of economic growth in the United States and eight European countries are then cited to show how this analytical approach can provide a deeper understanding of the economic-growth process than is provided by the naive investment-ratio approach.

Our analysis shows that the higher European growth rates of the 1950-62 period were completely explainable in terms of higher technology enhancement, large economies of scale, and improved allocation of resources. All three factors were related to the difference in stages of economic growth between the U.S. and European economies, rather than to their relative rates of capital formation.

There is no doubt that capital investment stimulates growth, and that within a reasonable range a country can raise its economic-growth rate by investing a larger proportion of its current output. However, this paper attempts to look beyond these simple propositions, and to develop a more useful way of comprehending the economic-growth process.



The countries with high rates of growth are also the countries with high investment ratios

Part I presents statistical data on investment ratios and economic-growth rates of the United States and other industrial nations for the 1955-70 period. Part II presents a critical appraisal of the investment-ratio thesis of comparative growth rates. Part III suggests a more general framework of analysis and

summarizes Denison's principal findings in order to cast light on the differential U.S. and European growth rates in the 1950-62 period, the period covered by Denison's study. Part IV then explores the policy implications and suggests directions of further research.

Table 1
National Investment Ratios and Growth Rates
of Real Gross National Product, Annual Averages
1955-1970

	Country Ranking			
	Investment Ratio	GNP Growth Rates	Investment Ratio	GNP Growth Rates
Japan	30	10.4	1	1
Germany	24	5.9	2	2
Canada	23	4.8	3	4
France	22	5.6	4	3
Sweden	22	4.5	4	5
Italy	21	5.6	5	3
United States	17	3.4	6	6
United Kingdom	17	2.6	6	7

Sources: Based on data in United Nations, Statistical Office, **Statistical Yearbook, 1971, 1972**, Table 18, pp. 63-75; Organization of Economic Cooperation and Development, **National Accounts of OECD Countries**, various issues.

Investment growth rates

Table 1 presents data on the average annual investment ratios and average annual growth rates of real gross national product for the United States and seven other industrial countries during the period from 1955 to 1970.

During that period, the United States invested a far smaller proportion of its current national output in fixed capital formation than did any of the other industrial countries, with the sole exception of the United Kingdom. The investment ratio for each of those two countries was about 17 percent, in striking contrast to Japan, which

invested about 30 percent of its current output. The other five industrial nations' investment ratios were all clustered within a fairly narrow band between 21 and 24 percent.

Nearly the same pattern was repeated with the growth rates of real gross national product. Again, the United States and the United Kingdom ranked the lowest on the list, with annual growth rates of 3.4 percent and 2.6 percent, respectively. At the other end was Japan's output, increasing at a whopping average rate of 10.4 percent per year. In between, the other countries' growth rates ranged between 4.5 percent and 5.9 percent per year.

The table shows that the countries with high rates of growth were also the countries with high investment ratios. Figure 1 shows this even more dramatically. The points all scatter along a positive-sloped straight line relating real growth rates to investment ratios. The goodness of the fit is no doubt affected by the extreme case of Japan, but a close correlation would result even if Japan were left out of the calculation.

The straight line shown in Figure 1 is based on the following regression equation:

$$g = -6.42 + 0.53 \text{ IR}$$

(3.87) (7.20)

$r^2 = 0.90$, $SE = 0.81$, $DW = 2.09$, where g denotes the real-GNP growth rate, IR the investment ratio, r^2 the squared correlation coefficient, SE the standard error of the regression, DW the Durbin-Watson statistics, and the bracketed numbers below the coefficients the t statistics.

Critical appraisal

It is tempting to conclude from this evidence that high investment ratios bring about high growth rates, and that a country can move up the economic-growth scale by investing a higher proportion of its current output in business plant and equipment. At first

blush, the argument appears beyond dispute. Production requires capital. Investment in plant and equipment increases the nation's capital stock, thereby expanding its productive capacity. Cyclical fluctuations aside, one can rightly argue that the higher the long-term rate of investment, the faster will be the expansion in national output. Hence, high investment ratios provide a reasonable explanation for high growth rates.⁴ Nevertheless, the argument is faulty in this context for two major reasons.

First, capital is only one of the factors, albeit an important one, accounting for economic growth. Other factors, such as labor, technology, education, natural resources and industrial organization also affect the nation's growth rate. Within an individual nation, we could assume constancy or steady growth of those other factors, and thus assert that a higher rate of investment will bring about a higher rate of economic growth. In the international context, however, this is not necessarily so. Even among the so-called advanced nations, conditions differ significantly one from

another, such that it would be injudicious to attribute a higher growth rate to a higher investment rate, or to imply that a nation could possibly raise its growth rate to anywhere near to that of another nation by investing a comparable proportion of its national output.⁵

Secondly, in analyzing the contribution of capital investment to economic growth, the point to focus on is the growth rate of a nation's capital stock, not its investment ratio. Production obviously requires plant and equipment. Growth in output requires expansion in plant and equipment, and a high output-growth rate should call for a high rate of expansion in such capital stock. The investment ratio, on the other hand, measures the intensity of a nation's effort in saving-investment activities. Within the same nation, a high investment ratio may well result in a high capital-growth rate. Between nations, however, the nation with the higher investment ratio will not necessarily have the higher capital-growth rate.

There are two reasons why that is so. First, a nation's capital-growth rate is equal to its investment ratio divided by its capital-output ratio.⁶ Hence, it is possible for a country to have a lower rate of capital growth, even though it

invests a higher proportion of its national output than some other nation, if its production is more capital-intensive than the latter's. Secondly, in computing investment ratios, both investment and national output are expressed in national prices. Where the prices of capital goods relative to the prices of other goods differ internationally, a high investment ratio could be consistent with a relatively low rate of real capital formation when adjustment is made for such price differences.⁷

These are not mere theoretical considerations. Empirical evidence suggests that a simple comparison of investment ratios would indeed tend to give a misleading impression of the relative capital-growth rates in different nations.

In testing the empirical importance of the above considerations, the most difficult problem is that of data availability. In particular, statistical data on national capital stocks are notoriously inadequate, making it difficult to obtain a direct comparison of national capital-growth rates or of national capital intensities. However, the indirect evidence presented later in this paper indicates that production

in the United States was about 20 percent more capital-intensive than in major European nations during the 1950-62 period. On this consideration alone, the investment ratio would overstate the U.S. capital-growth rate relative to that of European nations by about 20 percent.

In addition, the structure of relative prices also appears to have differed substantially from one nation to another. In their massive study of international price comparisons for the 1950's, Milton Gilbert and associates found that the prices of capital goods relative to general-output prices were between 33 percent and 73 percent higher in European countries than in the United States during that period.⁸ Using these price data, Edward Denison found that, when valued in national prices, investment ratios of seven European nations averaged about 16.6 percent in 1962, considerably higher than the U.S. investment ratio of 12.1 percent for the same year; yet, when valued in U.S. prices, that differential disappeared completely.⁹ With investment valued in national prices, the U.S. investment ratio was much lower than those of France, Germany and Italy throughout the 1948-63 period, but with proper adjustment made for international price differences, the cumulative in-

vestment during that period per civilian employed was more than twice as high in the United States than in any of the other three countries.¹⁰

Thus, contrary to the usual impression, the U.S. investment ratio during the 1950's and early 1960's was not any lower than those of major European nations—when adjustments are made to take account of international differences in relative prices. Moreover, real investment per worker was considerably larger in the United States than in major European nations. All this took place over a twelve- to fifteen-year period—i.e., 1950-62 or 1948-63, depending on the data series used—for which an international comparison of investment ratios **unadjusted** for international price differences would show a much lower investment rate here than elsewhere.

Broader framework

It is true that economic growth rates have been considerably higher in other industrial countries than in the United States. If higher investment ratios alone are not a satisfactory explanation, what other explanation or explanations can be offered?

This section presents a more general framework of analysis, including investment ratios as one of the factors accounting for growth, but extending beyond that to include other factors as well. The analytical framework is stated in an explicit and systematic manner, so that all the underlying assumptions are fully revealed. The model is designed to be empirically operational, in the sense of having real-life counterparts capable of being empirically tested.

The model presented here is patterned after one developed by Robert M. Solow.¹¹ Very simply, a nation's output is regarded as dependent on its level of capital input, labor input, and a catch-all factor to be called "technology". The latter includes such general economic factors as education, industrial organization, size of market, factor mobility, etc., as well as production technology in the narrow sense. Technological changes are considered "neutral" with respect to both capital and labor inputs, such that they merely enhance or reduce the volume of output obtainable from given levels of capital and labor inputs. Then, the production function can be written as

$$(1) Y_t = T_t f(K_t, L_t),$$

where:

Y designates national output,

T "technology",

K capital stock

L labor force

f() a function,

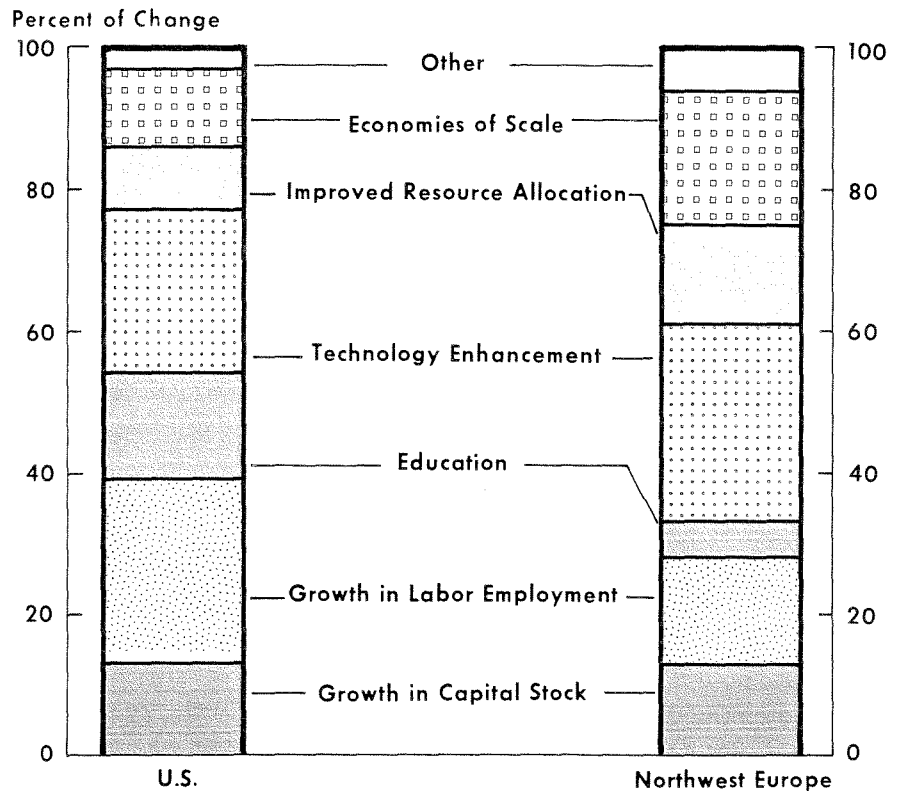
and the subscript **t** time period.

By considering changes over time and by assuming perfect competition in commodity and factor markets so that factors are paid the value of their marginal products,¹² the nation's economic growth rate can be expressed as

$$(2) g = \frac{\Delta Y}{Y} = \frac{\Delta T}{T} + s_K \frac{\Delta K}{K} + s_L \frac{\Delta L}{L}$$

where **g** designates the growth rate, and s_K and s_L respectively the shares of capital and labor in national income, and a "Δ" sign before a variable its change over time.

Equation (2) states simply that the growth rate can be decomposed into three contributing factors: (a) the rate of improvement in "technology", (b) the rate of growth in the capital stock weighted by capital's share of national income, and (c) the rate of growth in the labor force weighted by labor's share of national income.



Differential in growth rates attributed to technology, economies of scale, and improved resource allocation

What conclusions can be drawn from this analysis? First, the growth of capital stock resulting from investment is one of the contributing factors to economic growth. Equation (2) thus restates in a formal manner what has already been stated previously. But in analyzing the contribution of capital investment to economic growth, the point to focus on should be the growth rate of capital stock, not the investment

ratio. Nevertheless, insofar as the investment ratio is related to the capital-growth rate, the investment-ratio thesis can be considered as a special case for explaining economic growth.

Secondly, other factors besides the capital-growth rate also account for differentials in economic-growth rates among nations. Equation (2) states that one nation's growth rate may be

higher than another's because its labor force is expanding faster, because its capital stock is expanding faster, because its relatively faster-growing factor also commands a larger share of the national income, or because other factors lumped together as "technology" make greater contributions to growth. Thus, the equation shows clearly the logical peril of attributing high growth rates solely to high investment ratios.

Equation (2) provides a convenient analytical framework for deriving quantitative estimates of the contributions to economic growth made by various individual factors. Given the growth rates of the capital stock and the labor force and their respective shares of national income, their contributions to economic growth can be readily computed. Other factors are grouped together under "technology" in this equation only for convenience of exposition. Empirically, "technology" may be decomposed into any number of factors—such as education, technology enhancement, economies of scale, improved resource allocation, etc.

At the risk of oversimplification, it may be said that equation (2) lies at the core of the massive study by Edward F. Denison, **Why Growth Rates Differ**, which contains far more refinement than can be represented in our equation. In his study, Denison measures the sources of economic growth in the United States and in each of eight European countries during the period from 1950 to 1962. His findings are summarized in Table 2.

Denison shows that real GNP increased by 3.32 percent annually in the United States during the 1950-62 period, compared with a 4.78-percent average rate of growth in the European countries. To account for the differential in growth rates, he lists 23 different sources of growth, which are grouped here in 7 broader categories for ease of analysis. An analysis based on these data suggests the following conclusions:

1. In both the United States and the European nations, growth in capital stock contributed only about 13 percent of the economic growth in the period discussed. This finding lends support to the earlier argument concerning the inadequacy of the investment ratio as the sole explanatory variable.

2. In absolute magnitudes, capital contributed more to European growth than to U.S. growth—0.64 vs. 0.43 percentage points, respectively. That difference was due partly to the fact that the annual growth rate of capital stock was higher in Europe than in the U.S.—4.55 vs. 3.75 percent, respectively¹³—and partly to the fact that the capital share of national income was higher in Europe than in the United States—18.4 vs. 15.0 percent, respectively.¹⁴ Assuming the validity of our earlier findings that the capital-growth rate is equal to the real-investment ratio divided by the capital-output ratio, and that U.S. and European investment ratios were about equal when adjusted for international price differences, then the evidence on capital-growth rates indicates that U.S. production was about 1.21 times as capital-intensive as European production.

3. Growth in labor employment and technology enhancement together accounted for one-half of the U.S. growth in real GNP during the 1950-62 period. Technology enhancement, economies of scale, labor employment, and improved resource allocation together accounted for three-fourths of European growth during that period.¹⁵

Table 2
Sources of Economic Growth in the
United States and Northwest Europe,* 1950-62
 (percentages)

Sources of Growth	Contributions to growth rates in		Shares in total contributions to growth in	
	U.S.	Northwest Europe	U.S.	Northwest Europe
Average annual rate of growth	3.32	4.78	100	100
Growth in capital stock	0.43	0.64	13	13
Growth in labor employment	0.90	0.71	27	15
Education	0.49	0.23	15	5
Technology enhancement	0.76	1.30	23	27
Improved resource allocation	0.29	0.68	9	14
Economies of scale	0.36	0.93	11	19
Other**	0.09	0.29	3	6

Notes: *Including Belgium, Denmark, France, Germany, the Netherlands, Norway, and the United Kingdom.

**Including hours of work, age-sex distribution of labor employment, capital stock other than business plant and equipment (i.e., dwellings, inventories, international assets), irregularities in demand pressure.

Source: Denison, op. cit., pp. 281, 298, and 300.

4. The differential between U.S. and European growth can be attributed entirely to three factors: technology enhancement, economies of scale, and improved allocation of resources. Had the three contributed the same amount of impetus to economic growth in Europe as in the United States, European growth would have been no higher than U.S. growth during the 1950-62 period. These factors thus require closer examination.

Technology enhancement contributed 1.30 points to European growth but only 0.76 points to U.S. growth, the difference of 0.54 percentage points being attributed by Denison to a "change in the lag in application of knowledge."¹⁶ New technology once applied in one country is quickly disseminated to the rest of the world, but the actual application of that new technology may lag considerably because of institutional and human factors—oligopolistic industrial structure, management attitudes towards innovation, availability of a network of supporting services, etc. The shortening of this time lag provided a major impetus to growth in Europe during the 1950-62 period, largely because Europe acquired advanced U.S. technology instead of being forced to develop that technology with its own resources.

Improved resource allocation contributed 0.39 percentage points of the difference between U.S. and European growth rates. Denison attributes slightly more than one-half of the difference to Europe's greater shift of resources from agriculture to other industries, about one-quarter to shifts out of non-agricultural self-employment, and the rest to removal of international trade barriers.¹⁷ The first two were clearly related to differences in the pace of industrial adjustment stemming from the difference in stages of economic growth between the United States and Europe. The third source was apparently the result of the formation of the European Common Market in 1958.

Lastly, economies of scale contributed 0.57 percentage points to the difference between U.S. and European growth rates in the 1950-62 period. Part of that differential was due to the more rapid growth of national markets in Europe, but most was due to the shift of European consumption to high income-elasticity products.¹⁸ As per capita incomes rose in Europe, the consumption of consumer durables and other types of "luxury" goods expanded rapidly. Because of Europe's relatively low per capita incomes in the early 1950's, pro-

duction of such goods was generally characterized by small-scale and high-cost operations. As national markets for these products expanded, European producers were able to enlarge their scale of operations and to adopt many cost-saving devices and techniques which had long been in use in the continental-sized American market.

To summarize, all three factors were strongly affected by special conditions characteristic of Europe's particular stage of economic growth and economic integration during the 1950-62 period. In contrast, the difference in investment ratios played only a relatively minor part in accounting for the observed difference in European and U.S. growth rates.

The fact that our data do not extend beyond the early 1960's does not diminish the significance of these findings. The important point is that technology enhancement, improved efficiency in resource allocation, and economies of scale accounted for the entire difference between U.S. and European growth rates during this particular period. We cannot determine whether the same factors would explain the continued difference between U.S. and European growth rates without a major updating of the

Denison study. Also needed is a comparative study of Japanese economic growth, which at first glance might seem unique, although it could well turn out to be reducible to the same factors that accounted for the faster European growth rates of the 1950-62 period.

Policy implications

This paper has focused on the logic of certain commonly held propositions regarding investment and growth, and on empirical data accounting for the difference in U.S. and European growth rates. The findings, however, are not devoid of policy implications.

By refuting the meaningfulness of the commonly-used international comparison of investment ratios and growth rates, we should be able to lay to rest the illusion that the United States could boost its economic-growth rate to the levels achieved elsewhere through policy measures designed to raise the U.S. investment ratio. To the extent production is more capital-intensive here than in Europe, the U.S. investment ratio would have to be much higher than the European ratio in order to achieve the same capital-growth rate—and even then, the U.S. growth rate would still fall considerably short because of other factors at play.

A fuller understanding of the factors involved should help to reduce the level of unrealistic expectations by growth enthusiasts.

However, policies for promoting higher levels of saving and investment may still be justified for other reasons. With the manifold socio-economic problems confronting the nation, a re-ordering of national priorities is called for, and a likely outcome of that re-ordering may well be a decision to allocate more funds to overcome basic materials shortages and other problems.

Considerable opposition to an active growth policy has arisen in recent years because of its alleged costs to society.¹⁹ The arguments for and against such a policy extend far beyond the scope of this paper. Suffice it to say that questions on desired growth rates and investment rates involve some of the most fundamental issues of social choice. Ultimately, in a democracy, the public must decide how much it is willing to sacrifice its current standard of living, how much environmental pollution it is willing to tolerate, how rapidly it can afford to deplete limited natural resources, and how much compromise it can accept on tax equity, in order to stimulate investment and promote faster economic growth.

There are obviously no simple answers.

Rational decisions on the nation's economic-growth policy are predicated on a sound understanding of the growth process. Much has been learned on that subject in the past several decades, thanks to a strong upsurge of interest in growth problems that brought forth a large crop of scholarly studies on the topic. In recent years, however, an anti-growth mood has set in. The intellectual excitement generated by the works of Kuznets, Solow, Phelps, Denison, Mansfield and others²⁰ has subsided considerably. But although intellectual interest rises and falls, the problem of social choice persists, and it can be expected to be with us for many years to come. We can only hope that the momentum generated by the studies of the 1960's will be picked up again, and that sustained effort will be made in exploring the mysteries of the economic-growth process. To begin with, an updating and expansion of Denison's classic work should be among the research topics of first priority.

FOOTNOTES:

1. Floyd G. Lawrence, "Let's end decisions without direction: an interview with Peter G. Peterson," *Industry Week*, June 25, 1973, pp. 34-39.

2. Rockefeller Brothers Fund, *The Challenge to America: Its Economic and Social Aspects* (Doubleday, 1958).

3. Edward F. Denison, *Why Growth Rates Differ* (Washington, D. C.: Brookings, 1967).

4. More precisely, it may be shown that, under certain assumptions, the growth rate will be directly proportional to the investment ratio. Let $Y = kK$, where Y is national output, K capital stock, and k the inverse of capital-output ratio. Then $\Delta Y = k\Delta K$. (Note that ΔK is also the rate of investment in real terms.) Now, define $i = \Delta K/Y$ as the investment ratio in real terms, in contrast to IR , which is the investment ratio when both investment and national output are in current prices. Then, $\Delta K = iY$. Substituting, we then obtain the growth rate $g = \Delta Y/Y = ik$.

The expression appears identical to that which results from the Harrod-Domar model, yet is fundamentally different from the latter in that the demand side—a crucial factor in the Harrod-Domar model—is ignored in the present discussion. Bringing in the demand side would make no difference to the result here, but would greatly complicate the subsequent discussion with little gain to the substance of this paper's conclusions. For the Harrod-Domar model, see Evsey D. Domar, *Essays in the Theory of Economic Growth* (New York: Oxford, 1957), pp. 83-128, and Roy F. Harrod, *Towards a Dynamic Economics* (London: Macmillan, 1949), pp. 63-100.

5. Even as astute a scholar as Robert M. Solow cited such data as evidence for the alleged relation between investment and growth, although he was not unaware of the logical pitfalls thereof. See his "Fixed Investment and Economic Growth," in Edmund S. Phelps, ed., *The Goal of Economic Growth* (New York: Norton, 1969), pp. 90-105.

6. Symbolically, let $c = \Delta K/K$ and $i = \Delta K/Y$, where c designates capital-growth rate, i the investment ratio in real terms, K the capital stock, ΔK growth in capital stock, and Y national output. Then, by simple substitution, $c = iY/K$.

7. Symbolically, let $IR = I/Y = (P_i I')/(P_y Y) = pi$, where IR designates the investment ratio when both investment and output are in current prices, I and Y investment and output in national prices respectively, P_i and P_y the prices of capital goods and of general output respectively, I' and Y' real investment and real output respectively, p the relative-price ratio P_i/P_y , and i as previously defined is the real investment-output ratio, I'/Y' . Then $i = IR/p$. Now let subscripts 1 and 2 denote countries 1 and 2. Obviously, $i_1 < i_2$, if $IR_1 > IR_2$ but $IR_1/IR_2 < p_1/p_2$.

8. See Milton Gilbert, et al, *Comparative National Products and Price Levels: A Study of Western Europe and the United States*, (Paris: Organization for European Economic Cooperation, 1958).

9. Denison, *op. cit.*, p. 161. The European nations studied were Belgium, Denmark, France, Germany, the Netherlands, Norway and the United Kingdom.

10. Denison, *op. cit.*, pp. 167-170.

11. Robert M. Solow, "Technical change and the aggregate production function," *Review of Economics and Statistics*, August 1957, pp. 312-320.

12. Differentiate (1) with respect to t and then divide through by Y to obtain

$$(a) \frac{\Delta Y}{Y} = \frac{\Delta T}{T} + T f_K \frac{\Delta K}{K} + T f_L \frac{\Delta L}{L}$$

where f_K and f_L are the partial derivatives of f with respect to K and L respectively. Assume perfect competition, so that factors are paid the value of their marginal products, which means, from (1), capital income will be $Y_K K = T f_K K$ and labor income $Y_L L = T f_L L$, where Y_K and Y_L are partial derivatives of Y with respect to K and L . Now, define s_K and s_L respectively as shares of capital and labor in national income. Then

$$s_K = \frac{Y_K K}{Y} = T f_K \frac{K}{Y} \quad \text{and}$$

$$s_L = \frac{Y_L L}{Y} = T f_L \frac{L}{Y}$$

Substitute into (a) above to obtain

$$\frac{\Delta Y}{Y} = \frac{\Delta T}{T} + s_K \frac{\Delta K}{K} + s_L \frac{\Delta L}{L}$$

which is (2) in the text.

13. Denison, *op. cit.*, p. 137. The data are averages of growth rates of a) gross national product and b) net stocks, of business plant and equipment.

14. Denison, *op. cit.*, p. 42. While capital-growth rates are multiplied by capital shares in national income to obtain capital's contribution to economic growth rates, in accordance with equation (2) above, our data would yield 0.84 percentage-points contribution to European growth and 0.56 percentage-points contribution to U.S. growth—rather than 0.64 and 0.43 figures presented by Denison. Yet despite the difference in proportion, the two sets of estimates are in proportion to each other: $0.84/0.56 = 0.64/0.43 = 1.49$.

15. The contribution of "technological advancement" to economic growth is derived as a residual after the contribution of all the other factors have been accounted for. As such, it is possibly subject to a wide margin of error.

16. Denison, *op. cit.*, pp. 280-81.

17. Denison, *op. cit.*, pp. 298 and 300.

18. *Ibid.*

19. For a persuasive and economically sound analysis, see Edward Mishan, *Technology and Growth, the Price We Pay* (New York: Praeger, 1970).

20. Simon Kuznets, *Economic Growth and Structure* (Norton, 1965); Robert M. Solow, *op. cit.*; Edmund S. Phelps, *Golden Rules of Economic Growth* (Norton, 1969); Edward F. Denison, *op. cit.*; Edvin E. Wickham, *The Economics of Technological Change* (Norton, 1968).