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Summary and Research Agenda

The foregoing chapters have been replete with detail. To help the reader see the forest from the trees, here we summarize the chief points made in the study, particularly the findings of the substantive chapters 3, 4, and 5.

Further, since every research project—good, bad, or indifferent—implies an agenda for future research, the concluding section of this chapter explicitly points out some of the further work the author believes important for increasing our understanding of economic growth. Improvements of the data and methodology underlying the estimates of total investment and capital are suggested, as well as further analyses of their role in the growth process.

Summary

CONCEPTUAL FOUNDATIONS AND METHODOLOGY

This study rests squarely on the concept of capital as output- and income-producing capacity, and of investments as outlays that maintain or enhance productive capacity. On the basis of this definition, it is argued that total investment and the associated stocks of capital should include not only the tangible nonhuman capital outlays of all sectors, but also rearing costs (tangible human investment) and intangible

investments that are embodied in, and improve the quality or productive efficiency of, tangible factors. The intangibles are viewed as including outlays for research and development, education and training, health and safety, and mobility.

It is hypothesized that (1) comprehensive estimates of total real capital stocks should largely (if not completely, as conjectured by Schultz) explain the growth of real product, and (2) the growth of real intangible relative to that of tangible capital stocks should significantly narrow the tangible factor productivity residual.

The estimates of total gross and net investment and the associated capital stocks, by type, are presented within a compatible economic accounting framework, ensuring consistent and presumably more accurate estimates of income, saving, investment, and capital, by sector. The description of estimating methodologies and data sources, detailed in the appendixes and summarized in chapter 2, enable the reader to evaluate the reliability of the estimates for himself. It is our judgment that the quality of the estimates is comparable to that of the official Commerce Department national income accounts, from which much of our material is drawn.

THE RISING TOTAL INVESTMENT AND SAVING RATIO

In contrast to the declining secular trend shown by the conventional series, all of our measures of total capital formation indicate a significant rise in the proportion of income and product saved and invested between 1929 and 1969. By 1969 virtually half of adjusted GNP was devoted to the forward-looking outlays we term total gross investment, up from around 43 per cent in 1929. The ratio of net investment to NNP rose even more, proportionately—from near 21 per cent to almost 30 per cent over the forty-year period. In constant dollars the net increases were smaller, reflecting a faster increase in the investment price index than in the product price index, especially before 1948.

All of the growth in gross investment relative to GNP was due to a sharp increase in the proportion of GNP devoted to intangible investment, particularly after 1948, as the ratio of intangible to tangible investment almost doubled. The tangible nonhuman investment proportion of GNP remained virtually constant, while the rearing cost ratio declined (although more moderately in real terms). Within the former category, new construction and inventory investment declined and equipment and other durable goods expenditures rose relatively.

The relative increase in intangible investments, both gross and net,

was smaller in constant than in current prices due to a faster increase in the price deflators for intangibles than in the implicit price deflator for national product. Among intangibles, by far the largest proportionate increase came in R&D outlays. The share of GNP devoted to education and training, the largest of the intangibles category, rose by 80 per cent, while the health and safety investment ratio increased by half. Mobility cost was the only type of intangible investment to rise proportionately less than GNP.

Looking at movements of total gross investment ratios across subperiods bounded by peak years of the business cycle, we see occasional declines—between 1929 and 1937, for example, and in the latter 1950s—reflecting incomplete economic recoveries. These occasional declines were due entirely to downturns in tangible investment ratios, however, since the gross intangible investment ratio increased across all subperiods. The movements appear less regular when the estimates are taken net of depreciation and in constant prices.

The investment ratios also declined in all cyclical contractions, with a greater amplitude in the net than the gross measures. Here again the declines were entirely due to the tangible nonhuman components. The gross intangible investment ratios rose, reflecting their strong uptrends and a countercyclical tendency of mobility and certain educational outlays.

On a sector basis, virtually all the rise in the several investment ratios vis-à-vis national product was accounted for by government, although on a somewhat irregular pattern by subperiod. The ratio of personal investment to product tilted up (especially on a net basis), while that for business tilted down. Net foreign investment shows an irregular pattern, with no particular trend.

Next we assess the proportions of GNP accounted for by sectoral investment via changes in the sectoral distribution of income and in the proportions of sector disposable incomes devoted to investment. Thus, a major rise in the public sector share of GNP plus a modest rise in the ratio of investment to sector income were responsible for the dramatic rise in the ratio of gross government investment to GNP. Despite a drop in the ratio of gross personal income to adjusted GNP from 79 per cent in 1929 to 67 per cent in 1969, the proportion of DPI invested rose from one-third to almost 40 per cent, maintaining the personal sector ratio of gross investment to GNP. The business sector ratio of gross disposable income (saving, for this sector) remained quite stable in good years at around 10 per cent, although it was a bit lower in 1969 than in 1929. With gross investment at 124 per cent of gross disposable income in both of these years, the business sector ratio of gross investment to GNP

was likewise modestly lower. On a net basis the decline was more pronounced.

The movements of the saving ratios of the various sectors were similar to those of the investment ratios, but at different levels. Thus, persons and governments were net savers (by our definitions), whereas business was a net borrower.

During economic contractions, investment ratios declined consistently in the business sector, while behavior in the personal sector was mixed. But in the government sector ratios of investment to product invariably rose while the saving ratio fell, providing a strong counter-cyclical effect.

With regard to changes in the investment mix by type and sector, the rise in the intangible investment proportion stands out in all sectors. Although the proportion was highest in the public sector and lowest in business, it was in the business sector that the ratio of intangible to total investment showed the greatest relative increase between 1929 and 1969.

TOTAL CAPITAL STOCK MOVEMENTS

By 1969, net investment and price movements had resulted in a current dollar value of total gross national wealth (GNW) of almost \$11 trillion. This was 8.7 times adjusted GNP, compared with a \$1.2 trillion stock in 1929, which was 9.4 times adjusted GNP. This implies a 0.2 per cent annual rate of increase in the product-capital ratio in current prices.

In constant dollars real total GNW increased at an average rate of 2.8 per cent a year, compared with a 3.4 per cent rate of growth in real GNP. Thus, total capital productivity rose at an average annual rate of about 0.5 per cent a year. This result does not support the hypothesis that the growth of real total capital explains the entire growth of real income; there must be further residual factors of significance, as discussed later. The relation of NNW to NNP is much the same as the relationship based on the gross estimates. The downward trend of the real capital coefficient was interrupted only in those subperiods in which output grew less than productive capacity. In business cycle contractions capital coefficients obviously rose, since capital stocks continued to grow during downturns, even during the Great Depression. Incremental capital coefficients, measured between business cycle averages, were generally lower than average coefficients for total and for tangible capital, but not for intangible capital; there they were

slightly higher, giving an upward tilt to the average intangible capital coefficients.

With regard to the distribution of total capital by financing sector, only the public sector showed a marked increase, which occurred before 1948. The business and foreign sector shares fell significantly, while the personal sector proportion was in a modest uptrend.

The growth in the governmental share of capital can be traced to the major increase in the proportion of GNP originating in government, combined with a relatively stable sectoral capital coefficient. The modest expansion in the personal sector was caused by an increase in the sectoral share of adjusted GNP which was not entirely offset by a relative decline in the sector's capital coefficient. In the business and foreign sectors, the decline in the shares of total capital was due both to declining percentages of GNP and declining sectoral capital coefficients.

Consistent with the marked increase in intangible investment relative to the tangible variety, real stocks of intangible capital increased at a 3.8 per cent average annual rate, compared with 2.4 per cent for tangibles. Slicing real capital in terms of embodiment, human capital, which includes the bulk of the intangibles, grew at a 3.1 per cent annual rate, and nonhuman capital, at a 2.5 per cent rate. These rates of capital growth compare with a 3.4 per cent rate of increase in real GNP.

Reflecting the differential growth rates, real intangible stocks grew from less than one-fourth to more than one-third of the total between 1929 and 1969. Within the intangible category, R&D stocks showed the most rapid growth, followed by education and training, health, and mobility, in that order. Within the tangible category, human and nonhuman tangibles showed about the same rate of growth, around 3 per cent per annum. Within the latter group, equipment showed the highest rate, followed by inventories, structures, and land.

The government-financed portion of intangible capital was much higher than that of the other sectors. Business, on the other hand, financed the smallest portion of intangibles but accounted for the highest proportion of tangible capital stocks. The personal sector, sole financier of human tangibles, accounted for the smallest share of the nonhuman tangibles.

The largest employer of capital is, of course, private business. Looking at the total capital used in the private domestic business sector, we note that its productivity rose at an average rate of 1 per cent a year. In relation to tangible capital alone, real private domestic business product rose at a 1.7 per cent annual rate; in relation to real intangible capital, it fell at a 0.4 per cent rate, reflecting the growth of intangible capital relative to tangibles of over 2 per cent a year.

THE CONTRIBUTION OF CAPITAL TO ECONOMIC GROWTH

The 2.4 per cent yearly growth rate in real total capital represents 70 per cent of the 3.4 per cent average annual growth of real product in the private domestic business economy over 1929–1969. Thus, the 1 per cent annual growth rate in “total capital productivity,” reflecting the net impact of various residual forces, accounted for 30 per cent of the economic growth rate. The proportion attributable to residual productivity was somewhat smaller in the period prior to 1948 and larger thereafter. In the national economy as a whole, the proportion of economic growth attributable to expansion of total capital was larger than in the business sector, but the calculations for the business sector are more meaningful.

Assuming the same marginal productivity of tangible and intangible capital in the business sector, the contribution of the former was 1.7 percentage points, compared with 0.7 percentage point for the latter. Although the growth of real intangible stock was significantly faster, its relative magnitude was much smaller, about one-third in 1929. It follows that of the 1.7 per cent annual increase in tangible capital productivity (exactly half of the overall economic growth rate in the business economy), the relative growth of real intangible capital accounted for more than 40 per cent. The proportion was a bit larger in the 1948–1969 subperiod.

The chief residual forces accounting for the remainder of growth are: (1) scale economies; (2) changes in economic efficiency; (3) changes in the inherent quality of natural and human resources; (4) changing labor efficiency with given technologies; and (5) for the business sector, changes in unmeasured governmental inputs relative to real private costs.

We suspect, however, that our estimates tend to overstate the net contribution of the residual, noncapital-related forces. Among the reasons for this qualification is a probable understatement of the growth of the real intangible capital stocks and of their marginal productivity.

Nevertheless, it does appear that the growth of real total capital cannot account for all of the growth of real product in recent decades, and so the hypothesis of Schultz and others is not confirmed by the present estimates. Even in current dollars there was some increase in the factor income-capital ratio.

Due largely to the significant increase in the implicit price deflator for capital stocks relative to that for adjusted national product, the ratio of factor income to total capital increased significantly less than total real capital productivity over 1929–1969 in both the national and business economies. The average gross rate of return was 10.2 per cent in

1929 and 10.8 per cent in 1969 (having peaked in the 1948–1953 subperiod).

The gross rate of return on total human capital was above that on nonhuman capital throughout the period. It stood at 11.7 per cent in both 1929 and 1969, compared with 9.2 and 9.9 per cent for nonhuman capital at the beginning and end of the forty-year span. The net rates of return were very similar to the gross rates.

In the total domestic economy rates of return were somewhat lower than those in the business sector. While this reflected slightly lower labor compensation in the nonbusiness sectors, it was chiefly due to significantly lower returns on capital as a result of the imputations adopted in estimating nonbusiness property income. Over the whole period there was less variation in rates of return between peak cycle years than in the business sector, as well as less of an upward tilt.

The reader is warned that the calculated rates of return, even for the business sector, are affected by methods of estimation, particularly with regard to deductions for maintenance of human capital. Returns before deduction of maintenance are much higher, of course, and show a downward trend. On the other hand, when factor income is related to *utilized* capital stocks the upward trend is more pronounced than that shown by the rates cited above.

When incremental rates of return between cycle averages are calculated, the rates on human capital remain consistently above the rates on nonhuman capital since World War II. It is hard to escape the conclusion that society has been underinvesting in human beings relative to nonhuman capital, at least in recent decades. This is particularly true when weight is given to the psychic satisfactions from much of the human investment over and above the pecuniary returns.

Research Agenda

The chief contribution of this study, in the author's view, is the development of a consistent and comprehensive body of estimates of total gross and net investment and the associated stock estimates in current and constant prices within a systematic economic accounting framework for the national economy and its major sectors. This embraces the movements of the key variables and their interrelationships, with some attempt at interpretation.

But even on the basis of the present body of estimates there is much room for further analysis. In particular, statistical analyses of the

saving and investment functions for the national economy and its major sectors are called for in order to explain the upward trend of the total saving and investment ratios, which contrast strikingly with the conventional saving and investment functions. Beyond the overall functions, the behavior of the various types of tangible and intangible investments should be analyzed. In addition to the income variables, national and sectoral, other variables should be brought into the regression analyses, such as asset holdings, interest rates, and relative output and input price movements.

The other main direction in which further analysis would be fruitful is in statistically fitting production functions and otherwise analyzing the growth process. The close relationship between the growth of real total capital stocks and real product is clear; less clear is the role of the various types of capital, the elasticity of output with respect to each major type, and the relative importance of the several residual, noncapital-related forces. Perhaps new types of production functions and new analytical techniques should be developed. Also, elasticities and rates of return on the various types of capital might be estimated by alternative approaches to the methods developed here for estimating average and incremental rates of return on human and nonhuman capital, separately and in combination.

Granted the usefulness of the total investment and capital estimates, improvements in the underlying data and in the estimating methodology should come with time. The data base is particularly weak with regard to outlays for training and mobility among the intangibles, nonbusiness inventory accumulation, and the stocks of land and other natural resources.

The methodology used to estimate rearing costs and human maintenance contains original elements, as does the methodology employed in estimating the stocks of intangible and tangible human capital. These could undoubtedly be refined through constructive criticism, and alternative methodologies developed. The price deflators also leave something to be desired, particularly those based largely on input prices, as well as the price indexes for land and other natural resources.

Finally, it is to be hoped that an increasing proportion of the total investment and associated stock categories will be included or identified in the regularly published official U.S. national income and product estimates. The separate identification of forward-looking developmental outlays would be helpful, even if these are not classed as investment. As this writer has urged elsewhere, a fundamental restructuring of the economic accounts along the lines suggested here would facilitate economic growth analysis. The structure of the present U.S. national income accounts was based largely on the concepts of Keynes,

who was concerned with diagnosing cyclical fluctuations of income and employment and therefore accorded a central role to business tangible investment. But for purposes of growth analysis the broader concepts and measures of total investment and capital are needed. The upsurge of interest in social accounts and indicators in recent years adds urgency to the case for including estimates of intangible and human investments and capital alongside the tangible nonhuman investment and capital estimates for all sectors. Perhaps this study, by demonstrating the feasibility and relevance of such estimates, will accelerate work on their development and analysis.