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FACTORS INFLUENCING THE DEMAND FOR FUNDS BY BUSINESS ENTERPRISES, AND THE PROBLEM OF PROJECTING BUSINESS CAPITAL REQUIREMENTS

PART 1 — *Analysis of the Problem and Discussion of Procedures*

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I INTRODUCTION

This paper is a discussion of various statistical procedures for projecting future business capital requirements. The forecasting of what business activity or use of funds actually *will* be at some specified date is a quite different undertaking, important in its own right, but not under discussion here. Our attention will be confined to the problem of estimating business capital requirements associated with assumed levels of over-all economic activity, and in particular the problem of estimating what those requirements would be under such conditions of sustained maximum employment (growth plus stability) as might reasonably constitute a guiding standard or objective for economic policies.

We do not believe that any relation of investment to output, can, in our type of economy, be made *automatically* self-sustaining. Our frame of reference assumes the operation of a public policy which, in the interests of general economic stability and growth, will aim also at keeping the relation of investment to output considerably more stable than it has been in the past, or would tend to be in the absence of such policy. The policy-makers therefore need to set up some standard or objective rate by which to judge current investment levels.

It seems obvious that the investment objective could be set so high, or so low, as to nullify the chances of actually maintaining maximum production over the long run. Somewhere between these impractical extremes is a range in which the objective may be set with maximum chances of success. If the policy-makers set an investment objective in that range, their success is by no means assured, but at least they have started out on the right foot. The objective itself may of course be altered in response to changes in such basic conditioning factors as new technological developments, the consumption and savings propensities of the people, and extra-economic (e.g., military) claims on resources.

Projection of "sustainable" levels and patterns of business investment is simply one aspect of a more general analysis that seeks to determine what pattern of distribution of national output and income is most conducive to steady growth. In an economic model of this sort, business investment has to be related to other variables in a fashion consistent with growth and reasonable stability. Such investment must provide adequate expansion of capacity in line with the projected growth of various types of demand. It must be consistent with absorption of the various forms of savings; and the price, cost and income relationships in the model must be such as to yield appropriate incentives – in the form of expanding markets as well as profits – for the projected level of business investment. To each of these relationships, historical data provide useful though at present inadequate guidance.

If any quantitative model of a sustainable maximum production economy is to make sense, the business investment component of it must at least meet the tests implied by the relationships stated above. These relationships must work out to plausible and reasonably stable values so that the model as a whole is neither inherently unrealistic nor unstable.

If a business investment projection is developed for such a model by a "partial" approach, using just one of these relationships, it must subsequently be checked for consistency in regard to the other relationships as well.

II Projection of Investment Requirements: Basic Approaches

Most actual attempts at projecting business investment are of the partial or one-sided character just mentioned. The four basic approaches which have been used by various investigators in the field are briefly described below.

1 *Considering business investment as essentially a means of maintaining and expanding productive capacity, and relating it to the projected growth*

of demand for goods and services. This approach calls for (a) a provisional projection, either of total production directly or of total final demand, which is then translated by inter-industry analysis into projections of production for individual industries; and (b) determination, from either historical statistics or current technical investigations, of the quantitative relation between business investment outlays and growth of capacity.

This approach starts from a projection of the gross national product, as determined by trends in labor force growth, hours of work, and over-all productivity. What remains is to estimate a relationship between output (or growth in output) and gross investment. The crucial problem is how stable or projectable that relationship is. This involves questions of (a) the relation between expansion and replacement investment, and (b) the relative prominence of capital-using as against capital-saving improvements.

This approach is suited to projection of working capital as well as fixed capital investment, i.e., in plant and equipment. Both fixed and working capital may be regarded as essential factors determining the capacity to produce. The principal difference between the analytical treatment of fixed and working capital requirements is that the former are generally estimated on a gross basis and the latter on a net basis. The reason underlying this difference is the slower turnover of fixed capital as compared with working capital, which makes the financing of fixed capital replacement much less automatic.

Use of this approach implies that in reconciling income and product accounts at a full employment level of national income, income components and saving will have to be adjusted to the level of investment as projected, rather than the other way round.

2 *Considering investment as essentially a necessary offset to savings if full use of resources is to be maintained.* This approach calls for (a) a provisional projection of income and savings for both businesses and individuals; (b) provisional assumptions regarding the government contribution to net savings or offsets thereto; and (c) provisional assumptions as to offsets to savings other than business investment. In this approach, the "objective" for business investment appears as a residual offset to saving.

This approach faces up to the basic problem of maintenance of full use of resources in the economy as a whole, but presents obvious difficulties. In the present state of knowledge of individual consumption function, the flow of individual savings is notoriously hard to project. The amount of business investment is dependent not only on profits (see Approach 3, below) but on the disposition to invest, which is what one is trying to project. Moreover, this approach calls for previous estimates of all the offsets to saving other than business investment, and to that

extent passes the buck. It gives no basis for any further breakdown of the projected business investment total by industries or other categories.

3 *Considering business investment as essentially a reflection of current or expected levels of profits.* Proponents of this approach can point to a relatively close correlation between short-run fluctuations in profits and investment, as well as to the generally accepted proposition that investment is determined largely by profits in their twofold capacity as incentives and sources of equity funds. Considerable econometric analysis has been done by Tinbergen, L. Klein and others on defining the "investment function" in terms of a relation to profits and other variables, with primary emphasis on profits.

The chief difficulty with this approach arises when one seeks to apply it to concrete secular projections as distinguished from cyclical forecasts or purely conceptual model-building. It requires a provisional projection of profits, which appear at present to be even more difficult to project secularly on general assumptions than either total output or savings. And it ignores variables, such as changes in the level of output, which may be more fundamental than profits.

4 *Considering investment as, either empirically or logically, a secularly stable fraction of total output, and projecting it therefore as a percentage of gross national product.* Variants include the use of a regression relation to gross national product, and the introduction of time as a second independent variable.

This method is easy, but short on logic. Generally no reason is given for assuming future stability of the investment/output relation, or any steady trend in the relation, and the method often boils down to fairly unsophisticated extrapolation.

One basic difficulty, shared to some extent by other approaches, is that in projecting a "sustainable" investment/output relation for a hypothetical state of continuous maximum employment, there is no comparable past period on which to base a relationship for such projection. The relation applying in boom periods would seem too high, involving as it does some liquidation of backlog demands and some accumulation of surplus capacity and inventories; on the other hand, the average ratio over all phases of the cycle may be too low.

We can now turn to our survey of various specific techniques for projecting business investment requirements. Section III will survey various procedures based merely on the relation of investment to capacity requirements, without reference to the adequacy of funds or incentives for investment. Section IV will discuss procedures by which the profit incentive

factor in determining investment may be evaluated. Section V will discuss procedures for relating projected investment to the utilization of saved funds.

III Some Specific Projection Procedures Based on Relation of Investment to Growth of Capacity

In the discussion of procedures in this section, we shall give primary attention to the projection of rates of gross investment in plant and equipment. The subsection below contains the little we have to say on procedures for projecting working capital requirements.

WORKING CAPITAL OUTLAYS

Brevity on this topic is justified partly by the greater simplicity of procedural problems in the case of working capital outlays. By accepted accounting conventions these outlays are treated on a net basis. In an assumed secular context of stable prices, they represent exclusively capital expansion rather than replacement. They are consequently more directly relatable to projected trends of output growth than are the gross outlays for combined replacement and expansion of fixed capital.[1]

In the present stage of knowledge, at any rate, it seems justifiable to make secular projections of inventory accumulation and other working capital uses of funds simply on the basis of historical ratios to sales, modified by a time trend of such ratios. The time trend allows for assumed continuation of the process of speeding and otherwise improving the handling of materials and products. Further investigation of the trend of business practices may give a better basis for modifying the prospective time trend in the ratio, for both inventories and the other working capital uses. There is also room for some improvement in the procedures for translating over-all projections of national product into projections of corporate sales or total business sales as a basis for applying the working capital investment ratios.

Any projections of the total amount of working capital outlay required in the interval between the present and some future date must of course take account of possible present deficiencies or excesses in working capital, relative to requirements at maximum employment levels of business. If, for example, inventories are currently deficient by this standard, the inven-

[1] What has been said applies, of course, only to secular projections under assumptions of stable growth. The *cyclical* behavior of working capital investment is even more mercurial than that of plant and equipment outlays, and not easy either to schematize in a realistic model or to forecast in concrete situations. Such problems of cyclical behavior lie outside the scope of the present paper.

tory investment needs for attainment of a normal or sustainable relationship by some specified future date should include an allowance for making up this deficiency, over and above normal growth requirements.

As we shall see later, the treatment of current deficiencies or "backlog" requirements in *fixed* capital is not so simple.

FIXED CAPITAL OUTLAYS

We shall now consider some specific techniques used by various specialists for projecting plant and equipment outlays on the basis of the kinds of data now at hand. This survey makes no claim to be comprehensive. It explicitly ignores two types of procedure that may be regarded as lying at opposite extremes in regard to degree of detail.

One involves techniques of maximum simplicity, such as 1) extrapolation of historical investment trends, 2) the use of ratios of investment to gross national product, or 3) the use of regressions of investment on gross national product and time. It does not seem profitable to us to discuss such techniques as statistical operations. Furthermore, these simple, "straightforward" methods have no clear rationale other than the maxim that a simple method is to be preferred unless a complex one can prove its superiority. To be sure, the more complex alternative methods we shall describe here have not yet proved their superiority. We believe, however, that they are designed to give improved insight into the determinants of investment activity, and some of them should merit increasing confidence as better underlying data come to hand. For that reason, it seems to us appropriate to discuss these more sophisticated methods even before they have acquired much utility as practical tools.

We are likewise omitting discussion here of the manifold devices and problems involved in a really detailed synthetic projection of investment needs. With sufficient resources it might be possible to build up comprehensive projections on an industry-by-industry basis, taking into account the specific technical, financial and organizational problems of each industry in turn. An elaborate study of this sort would at the same time direct attention to such general questions as managerial criteria of replacement and expansion policy, and the effects of changes in the product-mix on aggregate relationships.

The problem of fitting a set of one-industry investment and output projections into an internally consistent projection of the structure of the whole economy is a formidable one, to which the work of Professor Leontief and others on inter-industry relationships seems to hold the key. This range of problems lies beyond the present paper, which will confine itself to over-all methods. It might be noted, however, that some of these

methods are applicable to specific industries or sectors of investment, where the necessary data are at hand.

1 *Gross vs. net investment.* The analysis of plant and equipment outlays, to determine functional relationships with output and income aggregates for projection purposes, is complicated by the fact that outlays for structures and equipment are gross. They serve in part to enlarge capital and in part to make up for capital consumption. Some procedures of projection attempt to take these two aspects separately into account. But the data are scarcely adequate to justify very elaborate procedures.

The basic distinction between investment for replacement and investment for expansion can be set up in at least three different ways. We may distinguish between the replacement and expansion of A, the net dollar value of productive facilities; B, the stock of productive facilities in "real" terms, or C, productive capacity. In each case we get a different picture of how large a part of a given gross investment is going into expansion. For example, in the recent postwar years the investment needed to maintain the stock of producers' real plant and equipment B has been more than was needed to offset depreciation charges and thus maintain the net dollar capital value of plant and equipment A. This was due of course to the fact that the prices of new structures and equipment since the war have been higher than the original cost of the structures and equipment being written off. At the same time, it is quite likely, though difficult to prove, that the investment required in the postwar period to maintain capacity C was less than that required for maintenance of the physical volume of structures and equipment B. This is the same thing as saying that the *average per-unit productivity of plant and equipment capital* – measured in physical terms, at capacity – has increased.

2 *Procedure based on surveys of capacity expansion and replacement outlays.* All three of the breakdowns of gross investment suggested above may ultimately be useful in analysis and projection of investment requirements, though only the one based on capacity C can be directly related to output levels. Data showing investment outlays in relation to capacity growth and maintenance are practically nonexistent and of doubtful quality. The principal recent "series" in this field is that provided by the McGraw-Hill surveys of plant and equipment outlays, in which a sample of large manufacturers were asked to break down their actual and anticipated expenditures into those for expansion and those for replacement and modernization. This breakdown has been reported for actual 1948 outlays and for anticipated outlays in 1950 and in 1949-53. The same respondents were asked to report their percentage increases in capacity

for 1939-45, 1946-48, 1950, and 1949-53. Table 1 summarizes the data.

One possible approach to an estimate of plant and equipment investment requirements, under projected over-all output levels, would make use of the McGraw-Hill findings on expansion and replacement outlays as related to capacity.

For two periods – 1950 and 1949-53, both on the basis of reported anticipations – it is possible to derive the ratios shown below:

	1950	1949-53
	(millions of dollars)	
"Expansion" outlays, per percentage point of capacity expansion on base 1939 = 100	$440	$372
"Replacement and modernization" outlays, per percentage point of capacity in place at middle of period, on base 1939 = 100	25	26

These ratios, suitably adjusted for changes in construction and equipment prices, might be used to translate projected growth trends of capacity into gross investment outlays. Results obtained by this procedure do not appear unreasonable, and the logic of the procedure itself is superior to that of most other available methods. But until more extensive data are available, it must be regarded as hardly more than an interesting experiment.

For one thing, we do not know how to weight combined construction costs and equipment prices to get deflators for dollar figures on expansion and replacement-and-modernization outlays. One can only surmise that the weight assigned to equipment prices ought probably to be greater in the replacement-and-modernization deflator than in the expansion deflator. But how much greater?

Nor do we know yet whether such ratios as those shown above tend to be stable or to show secular, cyclical, or other variations. The considerable difference between the 1950 and 1949-53 ratios of expansion outlays to capacity is not encouraging.

Finally, reporting of the purpose of actual or planned investment outlays is itself imprecise, and represents rough guesses by the respondents. In a large proportion of cases a specific outlay yields expansion, replacement and modernization all together, and no one knows just how to allocate the costs.

These uncertainties may well diminish as data are accumulated for more time periods and supplemented by studies in specific industries.

3 *Procedure based on direct relation of gross outlays to capacity expansion.* This represents an effort to sidestep the statistical difficulty of segregating those parts of gross investment that are functionally related to the growth and maintenance, respectively, of the capital stock. It consists simply in relating total gross investment to growth in capacity.

Table 1

SELECTED DATA FOR USE IN PROJECTIONS OF MANUFACTURING FACILITIES OUTLAYS[a]

(dollar figures in millions)

	1948	*1950*	*1949-53*
Total Plant and Equipment Outlays	*$8,160*	*$6,300*	*$28,630*
Capacity expansion	3,430	2,200	7,430
Replacement and modernization	4,730	4,100	21,200
Percent of Total Plant and Equipment Outlays	*100%*	*100%*	*100%*
Capacity expansion	42	35	26
Replacement and modernization	58	65	74
Index of Capacity (1939 = 100)			
At beginning of period	[b]	163.0[c]	156.0
At end of period	156.0	168.0	176.0
Average during period	[b]	165.5	166.0
Percentage points of increase during period	[b]	5.0	20.0

[a] Source: McGraw-Hill Plant and Survey Reports. Data for 1948 and 1949-53 were estimated from the results of the November 1948 survey; data for 1950 were estimated from the November 1949 survey.

[b] Not available.

[c] No data were collected for capacity expansion during 1949, but the index figure for 1950 assumes that capacity expansion during 1949 was 7 percentage points on the 1939 base, or 4.5 percent of the capacity at the end of 1948. A 3 percent expansion was reported as anticipated during 1950.

The procedure implies a close correspondence between the growth of investment outlays related to capacity expansion and those not so related. For this reason, if for no other, it would be inapplicable to year-to-year historical data. It is obvious that the relative emphasis on investment for expansion varies in the course of the investment cycle; but if there is a fairly stable *secular* relationship, it may be of use. The purpose we here have in mind is analysis and projection of sustained or secular growth.

Suppose, for example, the following conditions: (a) The growth trend of capacity has a constant geometric slope; (b) capital outlays related to capacity expansion are (after price deflation) secularly proportional to the amounts of expansion produced; and (c) the remainder of capital outlays is (after price deflation) secularly proportional to capacity.

We have already seen that the limited data so far yielded by the McGraw-Hill investment surveys suggest that condition (c) and possibly condition (b) may be found to apply. Condition (a) may also be close enough to the truth for practical purposes. If all three conditions hold, it would follow that total gross outlays (deflated) are secularly proportional both to capacity and to the absolute rate of capacity growth.

In most practical applications, data on capacity are replaced by data on output in selected years of approximately maximum use of capacity.

The "observations" consist then of output rates in a few widely spaced peak peacetime years, and investment outlays for the intervening periods. It is convenient to investigate the investment/capacity growth relation by integrating both variables: i.e., by plotting a regression between output and cumulative gross investment totals. Such a regression comes out almost linear for the period 1919-49, whether applied to the plant and equipment outlays of all nonfarm producers or to those of manufacturers alone.[2]

In other words, in successive intervals between years of full normal capacity utilization, the volume of gross plant and equipment outlays per unit of capacity increase is nearly constant. This suggests that a forward projection of the expansion of output can readily be translated into terms of the required gross capital outlays.

It is interesting to note that the results of this procedure, applied to the projection of manufacturers' plant and equipment outlays, do not differ much from those of the procedure previously described, which uses the McGraw-Hill survey results.

4 *Procedures based on relation of stock of capital to capacity.* As an alternative to the methods so far described, one may turn to the more copious but less directly relevant data on real and monetary net capital formation and capital consumption. The current dollar estimates rest primarily on business accounting statements collected by the Bureau of Internal Revenue, the Securities and Exchange Commission, and private statistical services, while the deflated estimates have been prepared in large part under the auspices of the National Bureau of Economic Research and more recently the Department of Commerce.

For projection purposes, the relation between gross investment and total capacity can be broken down into: (a) a relation between capacity and the physical size of the stock of capital (i.e., a projectable *average productivity* of capital); or (b) a relation between gross investment and the size of the capital stock (which implies a projectable *average life* of capital goods).

Proper treatment of these two relations presents some difficulty. It appears that the capacity/stock-of-capital ratio, though it may have held approximately constant for several decades in our history, has risen markedly in the last twenty years or so, making prediction risky. More-

[2] For indications of the results of applying this technique to manufacturers' plant and equipment outlays, see *Economic Report of the President*, January 1949, pp. 55-56; and *Business Needs for Venture Capital* (a report by the Department of Economics, McGraw-Hill Publishing Co., for Electric Bond and Share Co., December 1949), pp. 1-6.

over, it is not yet established whether this change is due to an increased prominence of capital-saving improvements, a lengthened service life of capital goods in relation to reported or estimated depreciation periods, or to other causes.[3]

On theoretical grounds there is no particular reason to expect either the average productivity or the average life of capital goods to remain constant; and we do not yet know whether they can be expected to vary along some reasonably steady, and hence projectable, trend.

Despite the complications involved in using bookkeeping figures in projecting capital requirements, the fact remains that they are likely to be by far the most extensive series of data available. It follows that efforts should be continued to exploit them, by uncovering the relationships between these book figures, gross investment, and capacity. In this way it may eventually be possible to make specific allowance for such baffling factors as: (a) depreciation charges relative to obsolescence; (b) the introduction of new and improved types of capital goods; and the (c) effects of changes in the "mix" of capital goods.

The Slichter Method of projecting investment requirements is an interesting variant of the foregoing approach, meriting some discussion.[4]

In the first place, Professor Slichter deals with the relation between capital stock and capacity, not as aggregates, but on a per-worker basis: relating the growth of labor productivity to the increase in the stock of capital per worker. It is not clear to the present authors, however, just what is gained by the per-worker approach. The required investment per worker is subsequently multiplied by the number of workers to get total investment requirements. Would not the same final result be secured by working with aggregates?

[3] In an interesting pioneer analysis of postwar investment needs made in 1946, Frederick C. Dirks refers to "the increased technological effectiveness of new materials and types of equipment in many lines." He does not attempt to allow for this factor but regards it as more or less offset, during the period 1941-47, by "changes in the dollar cost of like amounts of physical capacity." This statement seems to us to make better sense if the words "plant and equipment" are substituted for "capacity," since the effect of the suggested offsetting of biases would be to make the dollar cost of like amounts of physical capacity more nearly constant. Cf. Frederick C. Dirks, "Postwar Capital Formation and Its Financing in Manufacturing and Mining Industries" (Postwar Economic Studies No. 5, *Private Capital Requirements,* Federal Reserve Board, September 1946), p. 11.

[4] Partial descriptions of this procedure and its results appear in two articles by Sumner H. Slichter: "Is America's Industrial Plant Too Small?" *New York Times Magazine,* November 30, 1947, and "Will Recovery Continue?" *Commercial and Financial Chronicle,* October 27, 1949.

Professor Slichter concludes on the basis of historical data that the secular growth of productivity (as measured by expansion of total full-capacity output per employed worker) is more than proportional to the growth of real plant and equipment per employed worker. He suggests that a growth trend rising about 3 percent a year in the former series is associated with a growth trend rising about 2 percent a year in the latter. It would follow that the ratio of the aggregate stock of plant and equipment to aggregate capacity is subject to secular decline.

This procedure is thus designed to incorporate a secularly progressive allowance for capital-saving improvements, or increase in the average productivity of capital. As yet, it is not clear whether such a trend, as observed in the more recent historical estimates, reflects a real technological development or some deficiency in our measures of the size of the capital stock, which in turn might be traceable either to the estimation of capital consumption or to price deflation.

Note on backlog requirements: A conceptual point which plays an important part in the published projections of both Professor Slichter and the McGraw-Hill group is the vexing question of "backlog" requirements.

If a projection of future investment needs applies to a period following one of inadequate investment, should the projection include an extra allowance for making up accumulated deficiencies in plant and equipment? These deficiencies can take either or both of the following forms: *capacity shortage* – when existing facilities are inadequate to meet full-employment demands under the standards of utilization for which those facilities are designed; or *excess age* – when existing facilities are, on the average, older than they would be over the long run on the basis of capital stock and normal replacement projections.

Professor Slichter's extra backlog of investment need, which he has estimated as in excess of $50 billion, is not explicitly broken down as between the two factors shown above. The following quoted description, however, indicates that it leans heavily on the "excess age" factor:

> There can be no doubt that the plant of industry is *too small* for the present labor force and that much of it is *old and obsolete*. . . . America has more machines and other equipment in place than we had in 1929. . . . If one measures capital, however . . . by its unused life, American industry has about one-fifth less capital per worker today [late 1947] than in 1929. An expenditure of about $50 billion would be needed to raise capital per worker to the level of 1929 and a considerably larger outlay to raise capital per worker to the level which would be normal in view of the long-term tendency of capital per worker to increase at the rate of about 2 percent a year.[5]

[5] "Is America's Industrial Plant Too Small?," *New York Times Magazine*, November 30, 1947, p. 8. Italics supplied. Mr. Friend states in his discussion of this paper that

The McGraw-Hill view on prospective capital requirements likewise allows for making up a large accumulated deficiency, as indicated by the following statements:

> *Business has made up less than a third of the backlog of needs for new equipment accumulated during the depressed 1930's and during wartime.* That conclusion is based on calculations by S. Morris Livingston, Chief of the National Economics Division, Office of Business Economics, United States Department of Commerce. In a study which appeared in the June, 1949 Survey of Current Business, Livingston found that business expenditures for new equipment followed a steadily rising trend of 3% per year between 1869 and 1929. Between 1929 and 1945, actual purchases fell $44 billion (in 1929 prices) below the level needed to continue the trend. Since 1945, they have exceeded the trend by $14 billion (1929 prices).
>
> Livingston's study supports the conclusion that business needs to maintain the current rate of capital expenditures. If his figures, which are in 1929 prices, are converted to today's prices, and if construction needs are added to his calculations of equipment needs, *the deficit in capital expenditures at the end of the war was close to $100 billion.* On the same basis, current capital expenditures are about $6 billion a year above the long-term trend of expenditures in good years and bad. Consequently, *to make up the accumulated deficit,* business capital expenditures would have to continue at today's rate ($23 billion in 1949, equal to 9% of total national output) for about 17 years.[6]

Both the Slichter and the McGraw-Hill treatments of "accumulated capital deficencies" call for some critical appraisal. The basic point we wish to make is that the two types of deficiency identified earlier as "capacity shortage" and "excess age" are not of equal status.

Making good a capacity shortage does require a certain extra investment, sooner or later. This extra allowance is properly added to any estimate of investment requirements based on secular growth and normal replacement.

But the type of deficiency reflected in an abnormally high average age of facilities may under some conditions call for no extra investment at all, and in any event cannot be quantified as a requirement on the same footing as the "capacity shortage" type. If the retirement rate of facilities can be held down to normal for a period approximating their life span, then merely normal replacement outlays will by that time have "rejuvenated" the stock, i.e., eliminated the excess average age of facilities. If

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the trend slope of equipment outlays was considerably steeper than the 3 percent annual rate cited by Livingston. Projection of a steeper trend would of course make the "accumulated deficit" come out even larger. Our statement above, regarding the McGraw-Hill conceptual approach, remains valid.

[6] *Business Needs for Venture Capital* (McGraw-Hill Publishing Co., a report by the Department of Economics, for Electric Bond and Share Co., December 1949), pp. 8-10. Italics supplied.

that much temporary stretching of the life of plant and equipment is feasible, then the "excess age" type of deficiency imposes no additional capital requirement. It imposes merely the handicap of having to get along temporarily on over-age facilities while waiting for the rejuvenation process to work out. In practice, of course, a small part of total requirements are physically non-postponable, and require some extra replacement investment. The extent to which *additional* super-normal replacements will be made depends on business incentives and decisions in the particular situation.[7]

The McGraw-Hill staff has also attempted to measure the additional backlog investment need on a somewhat different basis. With reference to the relatively obsolete character of certain types of industrial equipment, we find the following statements:

> . . . manufacturers [in 1950] will be spending $4.1 billion for replacement and modernization. But at least part of this will only offset the wear and tear of the year's operations. Nobody knows what a proper allowance for this factor should be. If we assume that it is equal to the annual depreciation allowance that manufacturers charge up on their books, then we have to subtract $4.5 billion. That leaves only $600 million out of this year's capital expenditures for real modernization.[8]

> In reporting on the condition of their plants and equipment last year, manufacturing companies indicated to McGraw-Hill that it would take almost $20 billion to put their facilities into first class shape. They were able to spend only about $1.5 billion on this kind of modernization in 1949. This year, as plans stand, they will be able to spend only about one-third as much [refers apparently to the $600 million in paragraph quoted above]. At that rate, and even if all research and technical development were halted now, it would take 40 years to completely modernize the nation's manufacturing facilities.[9]

The McGraw-Hill reports refer to a concept of "real modernization" outlays, apparently computed as the difference between total replacement outlays and wear-and-tear. It should be clear from what has been said above that this type of outlay represents, if anything, merely the *acceleration* of the rejuvenation process and cannot legitimately serve as the basis for estimating how long it might take to remove any existing excess-age or deferred-replacement handicap.

[7] A note on policy: The extent to which additional retirements are *desirable* in the interests of the economy as a whole depends at least partly on whether resources are being fully used or on whether the rate of investment is already higher than could be sustained. Thus Professor Slichter argued in late 1947 that it was not then desirable to seek further stimulation of business investment, despite the deficiency of plant and equipment. See his *Times* article cited above, p. 76.

[8] "Industry's 1950 Capital Spending Plans," *Business Week,* January 21, 1950, p. 78.

[9] *Business Plans for New Plants and Equipment, 1950* (McGraw-Hill Publishing Co., Department of Economics, January 1950), p. 4.

Nor can the "real modernization" figure legitimately be used to measure progress toward another objective concept framed by the McGraw-Hill authors – the improvement of facilities up to standards of "first class shape." If this means that all plants in an industry are to be substantially as efficient as the best, it would seem practically unattainable in a truly progressive economy. On the other hand, if it means bringing the average quality of all productive facilities up to *best 1950* standards, this objective would presumably be attained in well under forty years merely by virtue of normal replacement.

5 *Determination of obsolescence as a residual.* We have already noted the troublesome fact that no existing measures of the stock of capital appear to bear a constant relation to capacity. Our difficulties result from not knowing at what rate to allow for capital consumption, and from the fact that "replacement" generally involves some net improvement.

This suggests that it might be fruitful to try to derive directly a rate of "capacity attrition," ignoring altogether the more conventional concept of capital consumption. Capacity attrition is lower than capital consumption to the extent that replacement of capital (in the accounting sense) increases capacity. Suppose we make these assumptions: (a) The *shape* of the capacity attrition curve is constant and known; (b) the length parameter of this curve is constant but unknown; and (c) data are available for real gross investment over a long series of years, and for capacity in several different years spaced over the period covered.

For this method of derivation the first step is to build up a provisional "stock" time series by adding the gross investment each year and making a deduction for capacity attrition on the basis of the assumed attrition function applied over some arbitrarily selected service life. This "stock" series is then tested by comparing its secular behavior with that of available capacity measures, such as output in selected peak or near-peak years. If the "stock" series rises faster, percentage-wise, than capacity, it is then recomputed with a shorter service life; if the series rises more slowly than capacity, it is recomputed with a longer service life. By successive approximations, a service life can be found which (in conjunction with actual gross investment data and the assumed shape of the attrition function) yields a "stock" series most closely approximating the apparent actual secular behavior of capacity. Once this is found, it can be used to translate projected future capacity requirements into gross investment requirements.

The term "stock" has been kept in quotes, since what this synthetic series really measures is capacity, not the stock of capital in monetary or real terms. Similarly, the capacity attrition rates determined by this

method do not correspond to rates of capital consumption in bookkeeping, Treasury, or real terms.

This method has two weaknesses. First, it rests on the unverified assumption of a secularly constant capacity attrition schedule. Secondly, it requires a very long continuous time series of deflated gross investment: an initial historical value for the "stock" series has to be built up by applying the capacity attrition schedule over a previous period as long as that of the assumed maximum service life. If that period is, say, twenty years, then the stock series cannot begin until twenty years after the earliest gross investment datum.[10] Actually, the maximum service of plant and equipment is probably much longer than that. Some structures are still in use after many decades of service. For this reason it is probably desirable to restrict application of the method to equipment alone, and to indulge in some arbitrary "tucking-in" of the tail of the capacity attrition schedule, with the hope that not too much error will be introduced thereby.

The Roos Method, closely related to the procedure just described, is one earlier developed at the Econometric Institute. The only available description of it is here quoted from a paper by Dr. Roos:[11]

> Form the annual differences of domestic producers' durable equipment expenditures minus reported depreciation and obsolescence; sum these differences from 1918 to date to obtain a measure of net capital formation; transform these expenditures to constant dollar figures by dividing by the BLS index of metals and metal products.
>
> The resulting series is without starting point and scale but otherwise measures changes in the physical level of plant assets. If one assumes that technological changes are reflected in the prices of the goods, the index may also be taken as a measure of changes in productive capacity. Then by fixing any two points, it can be transformed to measure the capacity in terms of any comprehensive production index such as the Federal Reserve Board Index of Industrial Production. The Econometric Institute fixed these points by assuming that in the peak periods of activity in 1919 and in the early part of 1923, production was at a rate equal to 95 per cent of capacity. The ratio of production to capacity was then computed for each year.

It will be observed that Dr. Roos accepted "reported depreciation and

[10] It is not possible to build the "stock" series upon any existing benchmark datum of the stock of plant and equipment, since it is not supposed to behave like such a series. The relation between stock of plant and equipment and capacity is assumed to be changing. The outcome of the analysis would consequently depend on the quite arbitrary choice of one of several benchmark dates for tying the synthetic "stock" series to existing stock estimates.

[11] "Papers and Proceedings of the 60th Annual Meeting of the American Economic Association," *American Economic Review,* May 1948, pp. 317, 319.

obsolescence" as his capital consumption rate for equipment, and used no fixed base datum for the "stock" of equipment.

Comparison of the Roos method with that described just before brings out the fact that the shape of the "stock"-of-equipment series depends on the capital consumption rate and on the base "stock" datum chosen. If both were determined in advance, the entire "stock" series would be determined, for the gross outlays series is given. If only the capital consumption rate *or* the base "stock" datum is determined at the outset, the other of these two can be left free and made to depend on fitting the trend of the "stock" series to some independent criterion of capacity, such as peak-year output.

IV Profit Incentives

Section III discussed procedures using growth in output as the basic criterion for projecting a sustainable level of investment. Although profits do not deserve the same status in the types of projections considered here, there is still the important problem of estimating profit levels consistent with particular projections of investment. This is one of the relationships that must be taken into account in asking whether the investment projection is reasonable in the framework of a more comprehensive projection of the national product and national income. Another, the availability of funds, is discussed in the following section. Other tests of consistency, such as the relation of wage rates to investment, would involve us in a general discussion of economic projections – which is beyond the scope of this inquiry.[12]

With respect to profit incentives there are three main questions to be considered. The first is what the actual level of profits might be, given the general assumptions of the full-employment projection. The second is whether the relationship of this level of profits to projected investment is reasonable from the point of view of incentives. The third is whether

[12] Mr. Friend, in his discussion of this paper, suggests that a rise in wage rates relative to equipment costs and interest rates "may tend permanently in the postwar period to raise investment for a given level of [business] income."

We have not been able to test the importance of this factor. It may be worth pointing out, however, that the upward trend of wage rates relative to the costs of carrying equipment investment is by no means a unique postwar phenomenon (in fact, from 1945 through 1948 the change appears to have been temporarily in the opposite direction). It is rather a secular trend, the effects of which have presumably been expressed in the historical trend of investment outlays. Unless the trend is shown to have accelerated, therefore, it would not seem proper to make any additional allowance for it in deriving investment projections from historical series.

profits are reasonably related to the other income shares, considering the relation between income and consumption. Discussion of the last question would take us too far afield.[13]

Since the main purpose of full-employment projections is to attempt to discover the structural relationships that might prevent the realization of sustained growth, it is appropriate to begin with the "expected" level of profits, rather than the level which might be most appropriate from the point of view of incentives.

The following discussion is primarily the result of our thinking on the problem of projecting profit relationships for manufacturing. For other broad categories, such as public utilities or trade, they might be quite different. Even within manufacturing it is doubtful how far one can go with broad generalizations.

A METHOD FOR PROJECTING THE "EXPECTED LEVEL" OF PROFITS

For relatively short-range full-employment projections, say a half-dozen years or so, the most appropriate technique that we have been able to find for projecting expected profit levels is a seemingly unsophisticated one. This method involves projecting profits of an industry as a function of output, taking for the base period a profit level associated with very high utilization of capacity. The value of output is adjusted for assumed changes in unit wage and material costs.[14] With sales determined, this procedure amounts to projecting profits as a secularly constant percentage of sales.

The method rests on the assumption that firms' pricing decisions can be generally described in terms of fixed gross margins, i.e., by adding a fixed percentage margin to unit variable costs. Such pricing is rational if producers are uncertain both as to the shape of their demand schedules and the reactions of competitors to changes in their prices.

Overhead costs being relatively stable, this type of pricing will result in pronounced changes in profits with changes in the degree of capacity utilization, but in relatively constant profit rates at given percentages of

[13] This problem will be discussed by Benjamin Kaplan in a paper being prepared for the forthcoming Income Conference on economic projections.

[14] For an extended discussion of this technique and of the general assumptions involved, see W. W. Leontief, "Wages, Prices and Profits," *Quarterly Journal of Economics,* November 1946. It may be noted here that this technique does not involve the assumption that all the coefficients remain constant; for a given industry, constancy is assumed only in the relationship of total overhead costs to sales, and, as will be indicated presently, in the relation of total "overhead inputs" to profits at a given degree of capacity utilization.

capacity utilization. At near-capacity operations, therefore, this type of pricing policy would result in the trend of aggregate profits rising proportionately to the trend of output, with the value of the latter adjusted for changes in unit wage and material costs.

What basis is there for assuming that stable gross margins are a structural characteristic of the economy? Kalecki has calculated gross margins for the whole of manufacturing for the census years 1919-37. For the relatively prosperous years of the period (extended by us to include 1939) the results are as follows:[15]

Census Year	*Gross Margin as Percentage of Sales*
1919	22.4%
1923	23.2
1925	24.2
1927	25.3
1929	26.7
1937	24.8
1939	25.0

The data show rather moderate fluctuations from one census year to the next, but an appreciable rise in the gross margin during the decade of the twenties, and some decline in the late thirties. In terms of the hypothesis outlined above, the trend may be partly explained by the relatively high degree of capacity utilization in the late twenties. There is also reason to believe that the observed changes in the margins are in some part due to changes in census coverage, and to changes in the industrial composition of output.

After making the appropriate statistical adjustments Richard Ruggles has calculated the gross margins for a number of smaller industrial groups. Unfortunately, he has not yet published his results. Our impression of them, which the reader is entitled to regard skeptically, is that in general the margins for industrial groups are much more stable than margins calculated for the whole of manufacturing. Historically, the changes do not appear to show any systematic tendency. As a corollary to the relative stability of gross margins, Ruggles found that price movements in various industries could be very accurately predicted from changes in the weighted average of their unit wage and material costs. In those industries where there is a high degree of fabrication, price movements were closely associated with changes in unit wage costs. In those industries in which raw materials were important inputs, product prices moved nearly proportionately with the material costs. Moreover, the results were quite inde-

[15] Michal Kalecki, *Essays in the Theory of Economic Fluctuations* (George Allen and Unwin, Ltd., London, 1939), pp. 22-23.

pendent of differences in the market characteristics of the industries concerned.

Since the late prewar years it appears that gross margins have declined rather appreciably. The 1947 census data do not permit gross margin estimations for the whole of manufacturing. The following are calculations based on comparable industry groups covering about 80 percent of value of output in 1939:[16]

Census Year	*Gross Percentage Margin*
1939	30.0%
1947	26.2

Though valid generalizations would certainly require a much more thorough examination of the data than we have undertaken, calculations for the broad industrial groups do not disclose that this decline was a result of changes in industrial weights. Most of the heavy industries showed lower margins in 1947 than in 1939. In textiles and apparel manufacturing, however, they were somewhat higher in 1947.

Several pieces of evidence suggest that gross margins have not changed materially during the postwar years. In the first place, the ratio of total profits, depreciation, salaries and interest payments of manufacturing corporations to their estimated sales (an admittedly crude approximation of the gross margin ratio) fluctuated only between 17 and 18 percent during the years 1946 through 1949. Another bit of evidence is the association of profits with changes in the degree of capacity utilization. Although we have no reliable direct measure of the latter, available evidence indicates that in general manufacturing capacity was more intensively utilized in 1947 and 1948 than in either 1946 or 1949. Profits, as a percentage of sales, rose from 8.8 in 1946 to about 9.8 in 1947 and 1948, and declined to 8.0 in 1949.

Though the data referred to in this discussion, especially for the postwar years, would hardly support any firm conclusions, it appears reasonable to use the working assumption that, during relatively short periods, at least, gross margins will be constant. It should be emphasized, however, that relatively small changes in the gross margin, or changes in the relation of profits to the gross margin, can result in appreciable errors in projecting an expected level of profits – even under the assumption of stable growth.

One disturbing possibility is that gross margins may over the next

[16] The higher margins for the portion of manufacturing covered than for the total in 1939 is chiefly due to the omission of motor vehicles and parts, and steel works and rolling mills, industries in which the margins are substantially lower than the average for all manufacturing.

several years tend to rise to the prewar levels. It is reasonable to assume that the decline came about primarily through wartime price control, and that for one reason or another manufacturers in general hesitated to take full advantage of market possibilities after price controls were lifted.[17] Possibly their restraint was due to their already sizable profits, and to the fear that the boom might be short-lived. On the other hand, price control may have introduced a real structural change in the economy.[18] For purposes of relatively short-range projections, we assume that it has. In any event this is not a question about which we shall have to speculate for too many years.

THE EXPECTED LEVEL OF PROFITS FROM AN INCENTIVES VIEWPOINT

Much more speculative than estimating expected profit rates is judging their consistency with a particular level of investment. The studies that have been made of cyclical profit-investment relationships by Tinbergen, Lawrence Klein and others are not very helpful. Studies on an individual firm basis, such as Modigliani is undertaking, may be more fruitful in disclosing the relation of current and anticipated profits to investment decisions. Until this type of analysis has progressed to the point that will make valid generalizations possible, we shall have to rely on judgments based primarily on historical experience.

We can, however, describe the profit-investment relationship implied by the projection techniques discussed above; and we can attempt to postulate the conditions under which the relationship may or may not be stable. The following discussion is based on the results that would be obtained from application of these techniques to a projection of "expected" profits and a sustainable level of investment in manufacturing.

An investment projection relating investment to changes in capacity, and a profits projection based on the assumption of gross margins, would indicate profits increasing relative to investment. The projected level of investment would be lower in relation to the value of manufacturing output, or total gross national product, than it has been during the past

[17] This thesis has been elaborated by Benjamin Kaplan.

[18] According to Lerner's formula for measuring the degree of monopoly — $\frac{\text{prices minus marginal cost}}{\text{price}}$ which is roughly equivalent to the gross margin measurement — the postwar economy was more competitive than prewar. The degree of monopoly in manufacturing was about 15 percent lower according to his formula. in 1947 than in 1939. But, paradoxically, this could only come about with administered pricing. Had producers priced by the rules of competition, prices and margins would have been higher, and the degree of competition, so measured, lower.

several years.[19] This is essentially because by 1949 capacity had in most industries caught up with demand, and normal future growth in capacity would therefore be slower. Moreover, if investment were assumed to rise steadily over the period of the projection, say five years, it would have to start from a lower base than the postwar peak.

The assumption of constant gross margins would result in profits rising proportionately with full employment output, but there is some question whether the base might not be appreciably lower than postwar profit levels. If this were the case, profits could initially decline both in absolute amount and in relation to investment. Several factors may have resulted in higher profits during the postwar period than during a more "normal" period of sustained prosperity. It has often been said that profits would have to decline with the return of a buyer's market. If "return of a buyer's market" means a general decline in demand, the statement may be true. But in that case we would no longer be dealing with a full-employment projection. And regardless of profits, investment would be expected to decline below a sustainable rate. But "return of a buyer's market" may also be taken to mean simply a return to more active competition. This would mean lower pricing margins. However, as was indicated above, there is no evidence that during the postwar period gross margins were abnormally high; indeed in the bulk of manufacturing they were lower than prewar.

On the other hand, a projection would not postulate price rises and associated inventory profits like those of the postwar period. And if it were assumed that capacity would not be quite as fully utilized as during 1947 and 1948, this would also make for somewhat smaller profit margins. These factors, however, can be reasonably taken into account in a projection of expected profits. In the years 1947-49 corporate profits before taxes averaged about $17.1 billion annually, or about 9.2 percent of sales. Adjusting for inventory revaluation, the estimates are $15.8 billion and 8.5 percent respectively. In including 1949 in the average we have already made some allowance for a lower degree of capacity utilization. But if the appropriate profit-sales ratio is in the neighborhood of 8 to 8½ percent, total projected profits before taxes would expand from a base above the 1949 level.

Expected profits therefore would probably rise both in absolute amount and in relation to projected investment. The following appear to be the two main grounds on which it could be argued that anticipated profits would not furnish adequate incentives for the projected level of investment:

[19] See Mr Koch's paper, which follows.

First, it could be argued that even if profits did rise beyond the 1949 level, the postwar profit level itself was inadequate from an incentives viewpoint. If this hypothesis is correct, the investment levels realized during the postwar period must have been the result of temporary factors, such as the need to make up accumulated wartime shortages, whose effect outweighed those of inadequate profits. The authors know of no method for proving or disproving this thesis.

It would be of some value to compare postwar with prewar investment-profit relationships, in particular those of the late twenties. Unfortunately, data for such a comparison are not available. Very rough estimates indicate that manufacturing profits were somewhat lower relative to investment in the postwar years than they were in 1927-29. But even if refined estimates were available for both periods, we would not know whether profits during the twenties were in excess of the amount required for a sustainable level of investment. We only know that the level reached during the period was not sustained.

Secondly, it also might be argued that the distribution of profits among firms might not be such as to yield adequate investment incentives. For example, earnings might be concentrated to a high degree, and required capacity increases be widespread. If this were the case there might be some question of whether the distribution of projected investment involved an efficient allocation of resources. Therefore the distribution of profits is an important consideration in dealing with the incentives problem. And it heightens the need for intensive industry and individual firm studies.

On the other hand, it can also be argued that a profit-investment relationship such as we have predicated may result in more than adequate incentives for the realization of a sustainable level of investment. This would be the case if such a level of profits called forth a rate of investment large enough to cause widespread excess capacity or a very high rate of obsolescence. A profit-investment function of this character has been postulated in a number of business cycle theories. Until more is known about the factors governing investment decisions, however, we should discount the possibility of over-stimulation of investment.

A more serious problem which such a hypothetical profit level might pose is its relation to the other income shares from the point of view of maintaining a full-employment level of consumption. Without a redistribution of the income shares favoring consumption – either through the price mechanism or fiscal policy – there may be some doubt whether consumption would rise sufficiently to insure over-all stability. If it should not, the problem of maintaining full employment would not be an easy one.

It need not be emphasized that given the present state of our knowledge, all the conclusions implied by these methods of projection are highly conjectural.

V Availability of Funds for Investment

Most full-employment models have dealt with the problem of availability of funds only in terms of aggregate savings-investment relationships. In these models, a "shortage of funds" has meaning only in the very general sense that the expected rate of total savings is smaller than the projected level of investment. The possibility of shortages of particular types of funds, or for particular types of business, is assumed away in the process of netting out and aggregating savings. Aggregation assumes that different types of savings are interchangeable, and that access to savings is determined only by the profitability of investment. Within such a framework, financial limitations cannot be important in explaining an under-employment equilibrium or an inadequate level of investment. Thus, except for the case of a general shortage of funds for investment, the usual econometric models do not allow for the possibility of investment being limited by shortages of various types of funds.

One of the reasons for this oversight is that the Keynesian analysis, on which these projections are generally based, deals with differences in types of capital only in their effect on liquidity preference and the rate of interest. The rate of interest itself is usually considered an unimportant variable in the models, though not in the Keynesian theory. It can be agreed that with some major exceptions interest rates do not play an important role in investment decisions. But the forms in which firms hold their assets and liabilities, and the relative availability of different types of funds, have an important direct effect on investment decisions, apart from any effect they may exert via interest rates.

Such variables cannot be explicitly taken into account, however, in a formulation solely in terms of aggregate savings-investment relationships. Models need to be set up which will recognize, first, major financial differences between various sectors of the economy. So far as is statistically possible, there should be separate accounts for households, farms, partnerships and proprietorships, business corporations, financial institutions, and government. Analysis of the business sector, with which this paper is primarily concerned, requires still further breakdown and will be discussed below.

A second major requirement is that models be set up in terms of various types of income and financial flows rather than simply in terms of savings aggregates. The relative availability of funds from internal and external

sources, their relative accessibility in equity and debt forms, the terms and maturities on which credit is available, etc., all have important bearing on investment decisions. These factors cannot be dealt with in the Keynesian framework alone.

Satisfying these two requirements means setting up a sources and uses of funds analysis for the various economic sectors. For the type of projections with which this paper is concerned, total financial requirements of a sector would be based on the sector's "needed" level of investment in plant and equipment and working capital. Next we should attempt to estimate the general pattern of funds required to finance these "needed" investments on a sustainable basis. Finally, if it were possible to make such projections for all sectors of the economy – an admittedly ambitious goal – the resulting total requirements by types of funds could be compared with the pattern of funds the economy might be expected to generate in the framework of the model's assumptions. The supply side of the problem is taken up in Mr. Jones' paper and is not explicitly dealt with here. One purpose of such projections is to form a judgment on whether private investment is likely to absorb all of the savings that the economy might make available to it on a debt basis, under full-employment conditions. Another is to judge whether the economy will generate a sufficient flow of equity capital to finance the business investment needed for continued growth.

A sources-and-uses-by-sector analysis is conceptually similar to the technique used in the Federal Reserve Board's moneyflows studies. The moneyflows accounts are essentially sector sources and uses accounts. They do not, however, segregate depreciation and other account items in the manner shown in the Commerce statements. It would be useful if the Commerce and Federal Reserve Board accounts were set up in such a manner that they were completely reconcilable.

KOCH'S SOURCES AND USES PROJECTION FOR MANUFACTURING

Mr. Koch's paper, "A Method of Projecting Expenditures and Financial Requirements of Manufacturing Corporations under Full-Employment Conditions," illustrates this type of analysis for a particular sector of the economy – manufacturing corporations. He has, first, projected the total financial requirements of manufacturing corporations on the basis of fixed and working capital outlays needed for the assumed rate of expansion of their output and sales in a full-employment economy. As a second step, he has estimated how much of their total financial requirements these corporations might be able to satisfy from their internal sources of funds. From this he has derived total requirements for funds from external

sources, and the proportions needed in debt and equity forms, to enable these corporations to maintain a "sound" financial position. All the items in his projection are estimated on both a "high" and a "low" basis. In one of his projections Mr. Koch has combined the high estimates for uses of funds with the low for sources to get "maximum" outside financing requirements.

The major purpose of these projections was to see how far one might go in this sort of analysis on the basis of available techniques for projecting sources and uses of funds, available knowledge of the criteria for a desirable pattern of sources of funds, and available financial data.

These projections called for two major "financial" determinations: 1) the distribution of profits after taxes as between dividends and retained earnings, and 2) the distribution of external financing as between equity and debt. The total level of profits was estimated as constituting an "expected" rather than a "required" level.

Mr. Koch's projections assume that manufacturing corporations will pay out in dividends two-thirds of their income after taxes, as compared with about two-fifths of earnings actually so distributed over the past several years. With considerably smaller total financial requirements, and a relatively modest decline in total profits from levels of the past three years, the assumption of a more generous dividend policy is reasonable. However, it is difficult to judge on the basis of historical sources and uses data available for the postwar years alone whether a 66 percent dividend-profit ratio is more reasonable than a 50 percent or a 70 percent ratio. To be sure, profits and dividends estimates extend back into the 1920's; but without supplementary financial data there is little historical basis for a projection of retained earnings. This is particularly disturbing in view of the importance of this source of funds. One cannot claim, however, that the problem would be easy, even were the historical data available.

The second major problem was to divide external financing requirements between debt and equity forms in a manner which would not adversely affect the postulated level of investment. The criterion selected by Mr. Koch was a pattern of financing which would not worsen the average debt-equity ratio of manufacturing corporations over the period of the projection. What this means is that the corporations would need a flow of external equity capital which would so supplement retained earnings as to keep the over-all debt-equity ratio constant. Though the importance of the debt-equity ratio has been emphasized in financial literature, there is some question as to whether investment decisions are made in terms of this ratio. Other possible related criteria could be set up in terms

of a ratio of debt or debt charges to profits, or in terms of some liquidity ratio.

In extending this type of analysis, further breakdowns of sources of funds would be desirable: for example, a division of total debt financing into short- and long-term. This might be done in terms of a liquidity criterion utilizing available historical data.

THE PROBLEM OF AGGREGATION

One of the serious shortcomings of these projections, recognized and emphasized in Mr. Koch's paper, is the bias imparted by aggregation in the direction of understating financial limitations. Aggregation implies that the projection will be representative of the adequacy of funds to all concerns of a given sector. This is not an entirely realistic assumption. Some concerns will be at a distinct disadvantage in their access to various types of capital. There is no reason to assume that, with respect to over-all financial limitations on investment, their deficiencies will be offset by surplus availability of funds to more fortunate firms.

Another method of approach would be to appraise the adequacy of sources of capital solely by comparison with historical standards, rather than in absolute terms as was done in Mr. Koch's projections. Then it might reasonably be assumed that the distribution of firms around the average, with respect to their financial positions, would be the same in the future as it was in the past. There is at present, however, no way of checking the validity of the assumption. Moreover, this type of analysis has other serious shortcomings of its own.

One way to reduce the bias implicit in aggregation would be to work in terms of smaller sectors, based on important financial differences among various types of concerns. The most appropriate classification would be by size of firm and by major industrial group. Available evidence strongly indicates that differences in the availability of funds to individual firms of a particular size group in any industrial sector would be much smaller than differences between smaller and larger concerns, or among firms in different industrial sectors. Aside from improving the general reliability of the projections, there is independent interest in attempting to measure the relative inadequacy of various types of capital to smaller concerns, especially for purposes of economic policy.

In a recent study, the Department of Economics of the McGraw-Hill Publishing Company made some estimates of the needs of small and medium-sized corporations for additional venture capital. It was concluded that in 1947 and 1948 their deficiency amounted to $1.25 billion annually, and that on the assumption of a 20 percent lower profit level in a

future prosperous year, these concerns would need $3.75 billion annually in additional venture capital. The estimates were arrived at by calculating the additional plant and equipment expenditures these companies would have made, if their share of total manufacturing plant and equipment expenditures during 1947 and 1948 had been proportional to their share of total fixed assets. The difference between actual and calculated expenditures was then imputed to a shortage of *venture capital* of the same magnitude.

Some questionable assumptions are involved in these calculations. But one point incidentally mentioned in the McGraw-Hill discussion would seem particularly to merit further exploration. This is the suggestion that new capital requirements of the smaller firms may be comparatively high in proportion to their asset holdings, because these smaller size classes must include more new and rapidly growing firms.

It may be possible to set up this last statement in rough quantitative terms. Such an attempt is obviously important if we are to gauge fairly what part of total investment funds needs to be made available to new and smaller businesses.

If "birth rates" and "death rates" of firms were uniform throughout the whole gamut of sizes, maintenance of a constant degree of size inequality (or "concentration") among firms would call for a distribution of investment corresponding to the distribution of capital assets among the various size classes. Both the number and the average size of firms might vary over time; but the concentration pattern, as shown for example by a Lorenz curve, would remain the same.[20] In order to reduce the degree of concentration of capital assets, a more than proportionate rate of investment in the smaller[21] size classes would be needed.

But even if the degree of concentration of assets is not to be reduced, but left constant, realistic assumptions would still seem to require that smaller firms get a bigger share of the total new investment than would correspond to their share of total capital assets at any given time. There are two reasons for this: 1) Most firms start small,[22] and 2) business mortality is much higher among smaller firms.

[20] We have not attempted to work out a mathematical proof of this statement, but it seems inherently reasonable.

[21] "Smaller" in this discussion should be interpreted in a relative sense, referring, say, to the lower deciles or percentiles of the size array. With changing price levels and an expanding economy, any comparison of size distributions based on the same set of absolute size classes at two different dates can be seriously misleading.

[22] The average initial investment of new manufacturing firms in the period 1946-48 was only $12,000. Corresponding figures for new wholesale and retail firms in 1945-47 are $22,000 and $9,500 respectively. For further details see Lawrence

Both observations are well known, and susceptible of measurement. With appropriate statistical data, it should be possible to work out the quantitative relations between required rates of investment *to establish new firms* of various sizes, of investment *to expand existing firms* of various sizes, and the resulting distribution of capital assets by size classes. An over-all business investment requirement might thus be broken down to show subtotals for small business and/or new business.

Appropriate allowance would have to be made, of course, for growth by mergers and for the transfer of capital assets of liquidated firms.

It must also be recognized that this problem in vital statistics is not likely to have a unique solution, particularly from the public policy standpoint. There remains the question of whether we want the degree of concentration of capital assets to rise, stay constant, or fall. Moreover, any program to aid small business might be expected to have the following three effects, each of which may work in the direction of reduced concentration: (a) raising the business "birth rate"; (b) reducing "infant mortality"; (c) encouraging the faster expansion of small firms.

Statistical analysis alone will not indicate how much emphasis "ought" to be put on each of these three effects.

SUGGESTIONS FOR FURTHER RESEARCH

The previous discussion has centered largely on the problem of setting up a projection of sources of funds that would be consistent with a sustainable level of business investment. A second major problem is to inquire whether the needed sources of funds would likely be available to the sector in question, given the general assumptions of the projection. One method of handling this problem – and this was essentially the method Mr. Koch used – is to compare the needed sources of funds with their availability historically. This approach must be used if the projections cover only a single economic sector. However, in dealing with a large economic sector, judging availability by historical comparison is a somewhat questionable procedure. Account also must be taken of the requirements of other economic sectors, and of the availability of funds to them. In other words, an adequate analysis of the availability of funds to a particular sector involves, as was mentioned earlier in this discussion, extension of the analysis to the entire economy and setting up comprehensive sources and uses accounts. At the present time, the limitations of

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Bridge and Lois E. Holmes, "Capital Requirements of New Manufacturing Firms," *Survey of Current Business,* April 1950, and Lawrence Bridge, "Capital Requirements of New Trade Firms," *Survey of Current Business,* December 1948.

data plus a great number of unsolved theoretical problems preclude such an ambitious undertaking.

In the remainder of this section, we shall indicate some of the additional types of financial data and studies of financial factors governing investment decisions which are needed to refine our concept of a desirable pattern of sources of funds within the corporate sector of the economy. At the present time, the only historical data on corporate sources and uses covering more than the postwar period is the Commerce series for total nonfinancial corporations. As was indicated above, what we most need by way of historical data is a breakdown of this series by major industrial group and by size of firm. Without it, analysis of the problem of availability of funds cannot be carried very far.

In addition, there are several ways in which the details appearing in published sources and uses data might be further extended and supplemented to make them more useful for purposes of analysis. In the first place, it might be possible to provide a more detailed identification of the sources of outside funds. This would be particularly useful in attempting to relate the pattern of demand to the supply of funds flowing through financial institutions or provided directly by other sectors of the noncorporate economy. For recent years, at least, the Business Structure Division of the Department of Commerce has prepared estimates of net new security issues purchased by various types of financial institutions, individuals, and others. A series of this character, going back into the twenties, especially if it could be broken down into stock and bond issues, would be very valuable. It would also be desirable to have loans and mortgages broken down according to type of purchasing institutions.

Another analytically useful means of classifying outside financing is by the terms on which the funds were obtained: interest rates, maturities and type of security offered by borrower on loans, and costs of flotations on security issues. The 1946 Federal Reserve Board bank loan study did break down outstanding loans of member banks in terms of these variables, and by size of borrower as well. Such data should be related to sources and uses statements by size of borrower. Though it would be statistically impossible to construct a comprehensive historical series of this character, sample studies of particular industries probably could be undertaken.

For analytical purposes it would also be extremely helpful if financial flows estimates were available on a gross as well as on a net basis. Short-term analysis, particularly, could go much further if it were possible to distinguish between gross and net changes in various asset and liability items, as we can with only one at the present time – security issues. Gross

flow estimates could not, of course, be derived from accounting data or from monetary statistics. It is to be hoped that in the future some of our imaginative statisticians will devote themselves to the problem of measuring gross financial flows.

In stressing the need for additional historical data, we do not wish to imply that their accumulation would solve all of our difficulties. Our main handicap in dealing with the "financeability" of a sustainable level of investment is our inadequate knowledge of the character of the functional relationships between "financial" factors and investment decisions. We need to know the effect of the forms in which business firms hold their assets and liabilities, in particular the effect of their liquidity, on investment decisions; the influence on investment decisions of the relative costs and availability of debt and equity capital; the meaning of the "cost" of equity capital; and the importance for investment decisions of the relative availability of capital in external and internal forms. A good deal more empirical research will be required before such considerations can be adequately dealt with in economic projections.

VI Summary and Conclusions

To estimate the business financial requirements implied by a projection of sustained economic expansion, one must take into account the manifold interdependence between business investment and other components of the economy's structure. Among the important relationships to be evaluated are:

1 The relation of business investment to increased output and demand

2 The relation of projected investment to business incentives, in terms of both total and distributed earnings

3 Requirements of funds for investment, in relation not merely to total savings but also to the availability of specific forms of savings. Adequacy of funds means that enough savings be available to specific types of business in such specific forms as short-term credit, long-term credit, external equity investment, and retained business profits. The supply of these various forms of saving, and the respective needs therefor, will depend on the distribution of personal and business income and on the development of financial institutions and practices.

It is only too clear that a comprehensive econometric analysis, involving simultaneous incorporation of all the relevant interrelationships in a calculation of business financial requirements, would call for an ex-

tremely complex dynamic model of the economy. Further refinement and testing of economic models will certainly be useful, but we feel that results of practical significance in the foreseeable future can best be sought by less elegant procedures. Much useful present knowledge of the factors determining saving, investment, and financial practices would have to be sacrificed if a solution were sought in the framework of a formal mathematical model.

In Part 1 of this paper we have set forth a number of suggestions for possible further analysis, using basic data which either already exist or could be brought to hand. Part 2, by Albert R. Koch, is presented as an illustration of the possibilities and limitations of quantitative investment projection in a specific field of business on the basis of data and procedures now available.