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Appendix A

COST STUDIES UNDERTAKEN BY THE FEDERAL GOVERNMENT¹

For many years various agencies of the federal government have engaged in the preparation of studies which now constitute a large warehouse of information on costs. Unfortunately only part of the material is available in published form; a tremendous amount of data has not been made public at all. The present summary is designed to show the general characteristics of such cost analysis, rather than to describe published material.

Although the earliest cost survey reported dates back to 1900, a large proportion of the studies were not undertaken until 1929. The approximate timing of the studies is shown by the following summary estimates of their number. The number of items was developed by counting each commodity or service and each year covered as a separate study. Thus, a study which covered hides and shoes in three separate years would be counted as six items.

<i>Years</i>	<i>Cost Studies</i>
1900-09	97
1910-16	644
1917-18	763
1919-28	1,472
1929-39	2,909

Types of Surveys

Cost surveys have been made by such a variety of agencies, for so many purposes, and following so many different methods, that proper use of their results requires an analysis of the

¹ This appendix is the outgrowth of a study undertaken by Mr. Mark Massel for the Bureau of Research and Statistics of the Office of Production Management. The basis of this report is an inventory of the cost studies of the federal agencies. The views expressed herein do not necessarily reflect the opinions of the Office of Production Management.

surveys themselves. For example, a study of weighted averages of total costs would not, in all probability, reflect the proportion of total costs represented by labor because a substantial amount of wages is included in overhead. The results of the same survey might require recasting to be useful in developing a cost formula for a government contract because it included collection expenses, which are not incurred in such contracts, in administrative costs. In like fashion, studies of national weighted average costs are unsatisfactory if costs reflecting regional or quality differences are desired, or if marginal, incremental, or bulk-line costs are needed. The following sections are illustrative of the limitations, methods, and scope of cost studies as revealed by the recent survey.

Purposes of Surveys

Federal agencies have developed cost information to fill several needs: as parts of general economic inquiries into particular industries; as aids to procurement functions; as by-products of the agencies' own operation for administrative and budgetary analysis; and as elements in regulatory functions. Some agencies have conducted surveys for a number of such purposes. For example, the Federal Trade Commission has developed costs to support economic studies, and to reinforce its regulations of monopolistic influences and restraints of trade; the Tariff Commission has conducted studies of costs to supplement economic analysis, and to make cost comparisons for tariff adjustments.

General inquiries have served a variety of functions. Cost studies have been developed to supplement economic analyses of prices, industrial structures and production practices by such agencies as the Agricultural Adjustment Administration, the Alcohol Administration, and the Federal Trade Commission.

Some agencies, such as the Bureau of Foreign and Domestic Commerce, have related surveys to a program of educating business buyers and sellers on the general ranges of costs and on problems of cost finding. In this type of activity, as in the development of unit construction costs which the Tennessee Valley Authority publishes, statistical averages or norms are

set up to serve individual organizations as benchmarks for managerial measurements of efficiency.

The use of costs in government purchasing has been related largely, but not exclusively, to defense procurement. During the last war Federal Trade Commission cost surveys were utilized to help determine whether prices suggested for negotiated contracts were reasonable, and to set the final prices under some cost-plus contracts. Today cost information developed over a period of time serves the Maritime Commission in its formulation of shipbuilding contracts. One agency, the Tennessee Valley Authority, uses information on cement costs to adjust contract prices as a regular peacetime procurement practice.

The Forest Service makes cost studies as part of its selling policy. Determinations of fair selling prices for the standing timber in the National Forests are based largely on analyses of logging and milling costs.

A wealth of information, especially in the field of construction costs, has been developed as a by-product of the regular operations of several agencies. The Public Works Administration, the Rural Electrification Administration, the Bureau of Indian Affairs, and the Bureau of Reclamation analyze certain elements of operations on individual projects through cost data. A few agencies develop similar internal analyses for various services such as motor vehicle, building, central filing, and telephone switchboard operations.

The utilization of cost information in the development of regulatory functions has usually been focused on problems of price regulation for commodities and public utility services. Thus, the Tariff Commission has to compare the cost of production of domestic commodities with those of competitive foreign items as set down in a specific market. The Bituminous Coal Division must determine weighted average costs by districts and marketing areas so that these costs may serve as bases for setting minimum prices for bituminous coal. The Federal Trade Commission, in its "Robinson-Patman" investigations, examines differences among individual enterprises with regard to cost of manufacture, sale and delivery.

In the public utility field, costs have been studied as an aid in checking valuations of fixed property and prices paid for

equipment, and in analyzing the costs of the services themselves. For example, the Interstate Commerce Commission maintains a continuing program for the study of trends in construction costs to support its general valuation studies, while the Federal Power Commission has pursued construction cost studies in the power field. The Federal Communications Commission developed an intensive study of the manufacturing costs of communications equipment as a check on transactions between affiliated communications and equipment companies. In the service field, the Interstate Commerce Commission has investigated costs under various alternative methods of transportation for rate making purposes, and the Maritime Commission has conducted a continuing program of analysis of costs of ship operations under its contracts.

Cost information has been utilized in some fields of regulation where cost-price relationships are used only as evidence of underlying conditions. Thus in several antitrust cases the Department of Justice applied cost and financial data in developing evidence of monopolistic conditions. The unjust enrichment taxes necessitated cost and financial analyses in the Bureau of Internal Revenue. It might be noted, parenthetically, that in most problems of regulation and revenue the conventional focus is on the costs of the individual enterprise; while in some, such as the determinations of tariffs and minimum bituminous coal prices, statistical summations of industries are utilized.

Forms of Data

The forms in which cost data are cast are too varied for a complete listing. In many instances, the agency is able to change the classifications of the final or published data by retabulating the original returns or by recapitulating sub-totals; in others, the present forms cannot be changed. There is no necessary consistency in the forms of the data for the surveys of the individual agencies.

Probably the most frequent method of averaging costs is the development of a weighted average of total costs for an entire industry. In some cases, ranges in costs are available; in many, frequency distributions may be worked out; in a few, estimates of "normal" costs can be made.

Most cost breakdowns follow functional lines: manufactur-

ing, selling and administration. Within these functions, the types of expenses may be broken down into labor, materials and overhead. It is unusual, however, to find such breakdowns under administrative and selling expense. Some surveys produce much finer detail by showing costs of the various labor operations or by dividing overhead into superintendence, power, depreciation, small tools, supplies, etc. These breakdowns are usually given in dollar figures, but some tabulations show them only as percentages of total cost or of sales.

The functional breakdowns of manufacturing, selling and administrative costs have been disregarded in those surveys which have confined classification to types of expenses such as labor, materials and overhead. However, such groupings may differ from one survey to another. Thus, indirect labor may be included either in overhead or in total labor costs. A few surveys are confined to one or two elements of cost, for example, labor costs or taxes.

Transportation is included in surveys of total delivered costs, but is accounted for only partially in those which derive f.o.b. factory costs. Further, studies of delivered costs may be restricted to one producing region, may concentrate on one marketing region, may include transportation costs in national averages, or may reflect them in regional averages.

The problem of estimating costs by stages of manufacture or for separate processes assumes significant proportions on many occasions. Some studies carry cumulative costs through specific stages, paying little or no attention to changes in ownership, and simply adding up the costs of the separate processes; others utilize the prices charged by the raw materials producer rather than his costs. Thus the costs of canned vegetables may be derived by adding to canning costs either the farmers' costs of growing the vegetables or the prices the canners pay for the vegetables.

Relating costs to specific products and sizes is another technique which has been developed in varying degree. Cost figures have been derived for differences in the qualities of certain commodities, such as the various grades of gasoline. Some surveys have covered specific articles with detailed specifications; others have covered average costs for the whole range of qualities of a specific item; a few have been set up to develop averages for large industrial groups such as nonferrous mining.

In most surveys of packaged products, average costs covering all sizes are usually presented. However, in some cases, cost differentials have been developed for different sizes of containers, for example, No. 2 and No. 10 cans of vegetables.

Types of Authorization

Another element influencing the cost data is the type of authorization under which the survey is made. The instrument of authorization may consist of legislation, court decisions, Congressional resolutions asking for inquiries, directives from the President, requests from other agencies, or a combination of these demands. Unfortunately the effect of the authorization is not always clear. Moreover it is not practicable to classify them because of the variety of components: even the authority given the individual agency may undergo changes through time; and some agencies prosecute surveys under several authorizations during a single period.

Many authorizations contain only general reference to costs; some include no mention of cost; others list specific inclusions or exclusions. In a few acts, Congress has stated which types of cost shall be considered and how they shall be valued. For example, the Bituminous Coal Act provides for weighted average costs, including the depletion and depreciation charges used for purposes of determining income taxes. However, most agencies are free to decide how costs shall be estimated and how surveys shall be conducted, subject only to the review of the courts. Thus the Federal Trade Commission, except for its work on Robinson-Patman cases, determines the types of cost to be included and the bases for valuation. The Department of Justice, in utilizing costs in connection with antitrust cases, follows general rules of evidence in presenting such information, with no limitations on its treatment of costs other than the reactions of courts and juries.

General authority to conduct surveys is the basis for certain cost projects of several agencies such as the Federal Trade Commission, the Agricultural Adjustment Administration and the Commodity Exchange Administration. The cost technique employed in such projects depends on the purpose at hand. For example, a study dealing with labor costs might segregate all labor costs from other elements, lumping direct and indirect

labor together; while a Bureau of Foreign and Domestic Commerce survey of distribution costs would focus on the purchasing, storing, selling and delivering functions of the distributor, including labor as an element in each function.

The franchise for undertaking the cost projects of some agencies is implicit in the general authority to carry on non-regulatory functions. Thus cost information has been developed as a phase of administrative control over construction projects by the Public Works Administration, the Tennessee Valley Authority, the Bureau of Reclamation, the Rural Electrification Administration and the Soil Conservation Service.

Another aspect of authorization, with special bearing on the ability to secure information, is the power of an agency to compel disclosure of internal information or its ability to develop voluntary cooperation. Although private companies have supplied cost data freely in the case of most surveys, the authority of an agency to utilize the power of subpoena may on occasion have been very helpful.

Methods of Conducting Surveys

The composition of cost data is strongly affected by the methods followed in the underlying surveys. Control over the process of defining and estimating costs can be greatest when cost data are developed through an agency's own books, as in the cases of the Bureau of Indian Affairs, the Bureau of Reclamation, the Tennessee Valley Authority and the Public Works Administration. Similarly, control may be exercised to a considerable degree through field audits of the books of individual enterprises, as in certain surveys of the Agricultural Marketing Service, the Bureau of Agricultural Economics, the Tariff Commission and the Federal Trade Commission.

There is somewhat less opportunity to control cost methods when a study is based on mail questionnaires, and for this reason attempts have been made to provide safeguards. Mail surveys have been implemented at times with uniform directions for execution of the questionnaire. Some agencies, such as the Federal Trade Commission, have utilized spot audits to check the reliability of investigated items which differed widely from general averages; others have simply tabulated the mail returns.

During the first World War, the Federal Trade Commission occasionally employed private accounting firms to determine company costs through field audits. No other instance of such a procedure has come to light, since there has been no subsequent staff shortage comparable with that period.

Because of legal requirements, such agencies as the Tariff Commission and the Bituminous Coal Division hold formal hearings to permit interested parties to comment on previously released tentative findings of fact or to furnish new cost information. Such hearings may provide new data or additional checks on the material developed by the agency.

Representativeness of Sample

In gauging how reasonable it would be to apply the results of a survey, the representativeness of the sample covered may bear great weight. There are wide variations in sampling practice. In the case of some surveys, notably those of the Bituminous Coal Division, substantially the entire industry is covered. At the other extreme are studies devoted to one company, sometimes during one brief period, sometimes over a series of years. In the prosecution of cases, the Department of Justice and Federal Trade Commission usually devote their analyses to one company. The Tariff Commission, in studying cost trends for its own analyses, may confine its data to one or a few representative companies, although it does not follow this procedure in its formal investigations. The Bureau of Mines has published many engineering cost studies of individual operations for comparative purposes.

Representativeness may be defined in terms of industrial coverage, geographical scope, types of operations, or types of qualities. The Tariff Commission's determination of representative costs is based upon the need to compare costs of competing foreign and domestic products. Thus a domestic product which has not been in competition with a foreign product for reasons of physical characteristics, region of origin or point of sale, would not be included in a representative sample. The problem of sampling is complicated further by the fact that one survey may cover companies which are representative of a particular producing region but not of the entire country; another survey may have covered companies which

are fairly satisfactory samples of the entire country although the companies included in any one region may not be representative of that area.

Definition of Cost

There is wide variety in attitude and practice regarding what ought to be included in cost and how the various elements should be estimated. Some surveys have been affected largely by the individual businessman's opinions as to the proper components of cost. Under such conditions audits become mere checks on accuracy. Other surveys have been based on rules setting forth acceptable elements and methods of valuation. The manual *Uniform Contracts and Cost Accounting Definitions* was developed by an interdepartmental conference of the Federal Trade Commission, the Departments of War, Navy, and Commerce, and the Council of National Defense, for use during the last war. It should be noted, however, that the development of cost regulations has not been as extensive as the regulation of financial reports.

On occasion, rulings providing fairly close control over cost definitions may have been worked out for field studies that remain unpublished. Since many such instructions are formulated verbally or through the unwritten rules of practice of an agency, it is often quite difficult for the outside student to evaluate a survey properly.

The methods of investigation followed must be considered carefully if one intends to compare cost data pertaining to different periods and prepared by different agencies. For example, a number of cost surveys made in the bituminous coal industry have utilized such varying methods of information collection, classification, and valuation that comparative cost analyses of the data are subject to many qualifications. Cost surveys were made by the Federal Trade Commission for 1916-18 (a survey in 1920 was stopped by an injunction); by the United States Coal Commission for 1921-22; by the National Recovery Administration under the Bituminous Coal Code for November 1933 to January 1935 (with a special labor cost study in May 1933); and a continuing survey has been conducted by the National Bituminous Coal Commission and by the Bituminous Coal Division of the Department of the

Interior from 1936 to the present time. It should be noted, parenthetically, that some of this material was not tabulated and that all the tables were not published.

Examination of the pertinent forms, and of the data released through these studies, brings to light significant variation in the ways in which costs were classified and combined. It is not clear, for example, that each agency obtained total costs for mine labor. The same type of labor was classed as "Mine Supervisory" in some surveys and as "Administrative Expense" in others. In some, mine office expense was included in fixed charges and general expense, and in others it was shown separately. Some surveys included selling with total costs while others eliminated such costs; one included as a selling cost discounts allowed to wholesalers, i.e., the difference between the prices to retailers and to wholesalers.

In one survey, operator's statements were accepted at face value; in two others, they were corrected for items which seemed out of line with the general averages; in another, there were revisions based upon the judgment of the agency's staff. Differences in treatment are most apparent in the charges for depreciation and depletion; the Federal Trade Commission corrected such items on the basis of its own analysis; the U. S. Coal Commission accepted the operator's charges if they were based on the Bureau of Internal Revenue's valuations; while the National Recovery Administration, the National Bituminous Coal Commission and the Bituminous Coal Division of the Department of the Interior accepted the depreciation and depletion allowances permitted for income tax purposes, the latter two under Congressional mandate.

Conclusion

The body of cost information in the various agencies has considerable potential usefulness. It can be employed to make direct estimates for price analyses of certain products; it can be made an integral part of economic analyses; it can help to determine which are the danger points in setting up cost or escalator provisions for negotiated contracts; it shows promise of use in labor mediation, as a source of information on what wages an industry can afford to pay and what would be the effects of changes in labor conditions on costs; it offers aid in

formulating, designing, and administering new cost surveys; it provides benchmarks of costs for use in promoting effective management.

The application of this information, however, is neither fool-proof nor simple. To obtain the full benefits of any survey one must make a comparative analysis of its background and determine the needs to be met. Some results may be used directly, some may be useful with modification, others may be valueless. Although much of the useful source material is not generally available at the present time, a considerable body of valuable information can be found in the published material. Utilization of the confidential data is, of course, confined to the federal agencies.

APPENDIX B

COST ACCOUNTING AND PRICE
DETERMINATION IN THE
SOVIET UNION



Appendix B¹

COST ACCOUNTING AND PRICE DETERMINATION IN THE SOVIET UNION²

LENIN'S famous slogan, "accounting and control are the chief things necessary for the smooth and correct functioning of the first phase of the communist society,"³ has wide currency among Soviet economists, and the better part of their thinking is devoted to problems of cost accounting and price policy. Without formulating them in terms of modern theory (or connecting their practices with the theoretical work done elsewhere), they conceive of these questions in a manner determined by the peculiar concept of economics which their literature has made familiar.⁴ Unfortunately, a reliable judgment as to the efficiency of the Russian accounting system is rendered almost impossible by the frequent occurrence of "bottlenecks" which may be attributable as much to disproportions between

¹ This appendix is a segment of a larger study of the problems of economic planning in Soviet Russia by Paul A. Baran. In the large study, Mr. Baran attempts to show that deliberate socialist planning begins in Russia with the first Five Year Plan. The earlier period of War Communism was characterized by a system of emergency war regulations complicated by the political necessities of revolutionary action.

² The author would like to express his great indebtedness to Professor Edward S. Mason for his encouragement and suggestions in connection with this study. Dr. Abram Bergson and Dr. P. M. Sweezy made valuable criticisms which are gratefully acknowledged.

³ *State and Revolution* (Vanguard Press, 1927), p. 204.

⁴ "We do not have here a free play of prices as is usual in capitalist countries. We fix the prices of bread first of all. We fix the price of the industrial products. We are promoting a policy of lowering the costs of production of industrial output, endeavoring at the same time to keep stable the price of agricultural commodities. Is it not clear that such a particular and specific order does not exist on the market of the capitalist countries?" Joseph Stalin, *Voprosy Leninizma* (Problems of Leninism, 11th ed., Moscow, 1939), p. 235. (This and other passages from Russian books and periodicals are translated by the author.)

ambitious governmental aims and real possibilities as to erroneous calculations and false economic decisions. It is obvious, for instance, that the famine in the year 1932-33 had nothing to do with good or bad price fixing, or with correct or artificial accounting. It was caused by a political action of the government, which underestimated the peasants' power of resistance (slaughtering of cattle, etc.) and disregarded the short run economic consequences of its precipitous political action. On the other hand, clear cases of calamities which occurred only because of errors in establishing price relationships are just as customary.⁵ Certain features of Soviet price and cost calculations can, however, be distinguished; they are then seen to represent a peculiar mixture of different methods, resulting in part from the tremendous strain under which the whole system works, in part also from rather dogmatic theoretical techniques.

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Generally speaking, the Russian planning system is based on a set of fundamental decisions, according to which the production and allocation of goods and services are directed without regard to their monetary valuation.⁶ The social product of a year, consisting of a certain quantity of various commodi-

⁵ At the XVIIIth Congress of the Communist Party of the Soviet Union, V. M. Molotov reported: "In the year 1935 the Government had only to follow the suggestion of Comrade Stalin and to establish bonuses for delivery of cotton and tremendous successes were achieved in a very short time." (*The Third Five Year Plan*, Report to the XVIIIth Congress of the Communist Party of the Soviet Union, p. 26). Again, Trade Commissar A. Mikoyan remarked: "We had a muddle in the prices of textiles. The result was that the industry made surplus profits on some lines of output and incurred heavy losses on others. Our business managers were anxious to produce more than the planned quantity of the profitable goods and not to produce at all the commodities whose production caused them a loss. These 'loss lines' are, however, just as important for us as the 'profit lines.' Now all that has been corrected!" *Ibid.*, p. 24.

⁶ "Accounting in money terms carried through the medium of prices does not suffice in a socialist economy. Accounting in terms of quantities and qualities of products of labor (per piece, per weight unit, etc.) and in terms of labor hours is just as necessary. Without this latter type of accounting it is impossible to safeguard the right proportions in the development of the material production of the socialist society. If the accounting in kind in capitalist countries has only a statistical

ties, is distributed by the authority among competing uses. After the desired capital investment has been determined and the expected quantity of consumer goods estimated, the prospective amount of money income to be paid out is computed. By deducting therefrom the envisaged proceeds of direct taxation and governmental borrowing, a figure is obtained which indicates the magnitude of the purchasing power remaining at the disposal of the population. For this purchasing power to be absorbed, the prices of goods and services offered to the consumer have to be fixed in such a way as to render their aggregate money value exactly equal to the amount distributed as income by the different governmental agencies. Since the general standard of living is extremely low, the resources allotted to the output of consumer goods are severely limited, and the list of these goods is accordingly short; thus the "freedom of choice" left to the population is almost illusory. While formally enjoying the right to select and to substitute, the population in fact has the alternatives of acquiring whatever goods are available or foregoing the satisfaction of its most fundamental needs. If these collections of goods were produced in planned quantities and qualities, the consumer—though obtaining less "ophelimity" (but perhaps more "utility") as compared with the state of affairs in which he could choose fully among various ways of spending his income—would still be able to transform his money income into *some* goods and services. Such an "ideal" situation has never been approached in fact. Even in the best periods since 1928-29 (the beginning of the first Five Year Plan) there has never been a time when ordinary consumers could spend their entire income on the limited list of commodities offered by the government stores.⁷ Formal prob-

importance and some interest from the viewpoint of business cycle research, in the socialist society it is of paramount practical significance. . . . The money income of the population being fixed, the prices fixed by the government determine the partition of the social product into a fund of consumption and a fund of accumulation." S. Atlas in *Problemy Ekonomiki*, No. 4, 1939.

⁷ Hence the frequent appearance of large amounts of "floating" purchasing power which in the legal channels meet no regular supply and thus drive the prices on the "underground markets" up to fantastic levels. (See the dispatches of Mr. G. E. R. Gedye in the *New York Times*, September 11-22, 1940.) A simple "quantity equation" explains these inflationary phenomena.

lems are not separable from the material contents of planning. Where guns or machines are more important than butter, there is little butter. Freedom of choice, maintained by the distribution of "general purchasing power" which can be used according to individual tastes, has meant privation at a time when bare necessities have been unobtainable. To limit this "freedom" by offering only a certain number of commodities, but in sufficient quantities and qualities, may provide a more or less complete satisfaction of wants. Inasmuch as the part of the social product devoted to "Sphere A" (as the Russians call the investment goods industries, armament industries, etc.) was extended to the limit, while the quantities assigned to consumption (Sphere B) were confined to existence minima, difficulties would have arisen even if the planning mechanism had worked with the highest precision. Disasters like bad harvests and failures by some economic units to live up to their estimates would create gaps on the supply side that would upset all "proportions" even if these proportions had been calculated as carefully as possible. These gaps—which in a community working not for guns but for butter, or endowed with rich reserves from previous years, could easily be filled with the help of emergency stores accumulated for such purposes⁸—necessarily lead in Russia to shortages and "bottlenecks" which disrupt the planned exchange of income and commodities.

A correct solution of the pricing problem could create a system of relative prices which would direct the resources assigned to the satisfaction of consumer needs into their most effective employment. The quantity of these resources, however, and the extent to which the shortage of all consumer goods is permitted to prevail, depend on the preference scale of the authority, on the country's natural resources, and on the productivity of its labor. As long as the first condition persists as it has, and the last two factors are underdeveloped, the only function left to an adequate price and cost accounting

⁸ This explains in part the comparative ease with which the German planners achieved their goal of rearmament. The Hitler government began work on the basis of large unused capacities, of idle reserves of qualified workers, and was able to take over an established economic system. The cooperation of all the economically dominant strata of the German population, aid from abroad, and the continuity of business management are other factors which also facilitated the huge investment of resources in armament industries.

system is to maximize the results of the economic activity *on the basis* of the fundamental decisions and conditions as given. It is difficult, therefore, to agree with A. P. Lerner⁹ when he insists that the planning authority should confine itself to the enforcement of the basic principle that "price must be made equal to marginal cost." Such a policy would be appropriate only if the planning authority believed that its function should "wither away," and intended to leave the allocation of the nation's resources to the choice of the consumers. Desirable as it may appear, there is no reason to regard such a policy as a *sine qua non*. While it is true that consumer goods, once their aggregate quantity has been established, should be priced according to this principle in order to maximize the satisfaction derived from them, the decision about this aggregate quantity itself (or in other words, about the rate of accumulation which is desired) would have to remain at the discretion of the planning authority. The time preference of the community as a whole may be different from the time preference of its individual members; the government may refuse to rely upon voluntary savings attracted by a high interest rate (as proposed by Enrico Barone); or it may wish to make extra profits on some commodities (with a view to curtailing their consumption) and to incur losses on others (with the intention of sponsoring their consumption). Such decisions are to be expected if planning involves a certain definite economic policy, be it rearmament, industrialization, or some other change in the economic structure of the country. To deprive the planning authority of the right to pursue such a policy, to limit its function merely to the execution of consumers' ballots, would reduce to absurdity the whole idea of a centralized direction of economic affairs. Moreover, this centralized direction may possibly (but not necessarily) represent the more "rational" set of preferences, measured in terms of maximum welfare, as compared with the outcome of consumers' choices which could be (and are) governed by very doubtful "tastes."¹⁰

⁹ *Economic Journal*, 1937, p. 270.

¹⁰ See R. F. Kahn, "Some Notes on Ideal Output," *Economic Journal*, Vol. 45 (March 1935), pp. 1-35. Of course, it is an entirely different problem to determine what represents the optimum method of reaching the aims of state economic policy. It is quite possible that selling at marginal costs combined with strong propaganda campaigns designed to influence existing demand and to create new demand, with administra-

But even though *selling prices*, which represent governmental decision as to distribution of wealth and employment of resources, need not necessarily be identical or even proportionate to costs, the *proper calculation of these costs* is imperative. Only by carrying through this calculation can the planning authority obtain indispensable information as to how much every economic decision means in terms of alternative choices. Thus the Russians appear to be on the right track, in principle, in treating their prices as a sum of different elements. "The final retail price is composed of (1) the costs of production, (2) general oncosts of administration, wholesale distribution, etc., (3) profit of the enterprise, (4) turnover tax (sales tax), (5) retail expenses which again may be split into oncosts of doing business and profits."¹¹ All these items may be classified for our purposes into two main categories: costs within the broad meaning of the term, on the one hand, and contributions toward accumulation of capital, on the other. "The prices fixed by the Government and the extent of their deviation from costs thus depend on concrete considerations of economic policy in every given period,"¹² and the magnitude of the second component of price cannot possibly be treated except in connection with specific problems. The turnover tax, which is not uniform for all goods, is varied according to numerous considerations;¹³ the profit rates for different industries also

tive measures forbidding and permitting certain types of consumption, or with a system of taxation that redistributed the national income, would lead to the most desirable results. This question cannot, however, be dealt with theoretically; its answer depends on concrete conditions in different countries. Whereas the German authorities even under the Weimar Republic taxed wages at the source of income and made the employer responsible for the remittances (because the government was not certain of obtaining payment from the wage earner himself), the British tax morale permitted full wage disbursement without endangering fiscal receipts. In a country like Russia, all indirect devices like taxation, advertising, etc., would certainly prove less efficient from the viewpoint of the government than a direct policy of price fixing.

¹¹ S. Atlas, *op. cit.*, p. 84.

¹² I. G. Gorelik, *Metodika Planirovania Tshornoi Metalurgii* (Methods of Planning in the Metal Industry, Moscow, 1937), p. 94.

¹³ The aggregate amount "syphoned out" by means of direct taxation and borrowing is very small compared with the total revenue derived from the turnover tax. The expedient of indirect taxation rather than of outright price increases or of higher income taxes is relied upon to

are fixed with regard to the desirability of their expansion; finally retail earnings vary with the character of the store and with the type of commodity. An investigation of such price fixing practices—very similar, by the way, to the policy in this field adopted in Germany—would require a broad examination of the development of different branches of the Russian economy and could be successfully undertaken only as part of a general appraisal of the way in which this development is regulated.

We are not, however, primarily interested in this aspect of the problem, for government influence upon the *final* price is obvious, and the fact that this price is set by *fiat* is frankly admitted. Of much greater concern is the far more complicated chain of problems connected with the notion of costs.

3

The devices employed in the calculation of costs—though widely discussed in the literature¹⁴—correspond neither to the behavior envisaged in the “pure theory of socialist economics” nor to the “rational attitude” assumed in “bourgeois” economics. They resemble rather the practical policy of businessmen as recently described.¹⁵ This is particularly strange since the reasons which induce the private entrepreneur to deviate from the rationale elaborated by theory, and to attempt to maximize his profits and safeguard his investment according to institutional data and concrete market conditions, do not apply at all in a planned economy where the state as monopolist is in possession of the powerful tool of price fixing and not only could but should (for the sake of its own calculation) employ the most modern techniques of economic analysis. But as “bourgeois” economics is mercilessly condemned, even its formal achievements are widely ignored.

eliminate excess purchasing power mainly for political and psychological reasons. Moreover, the flexibility of this tax, which varies from commodity to commodity, renders it a powerful tool for adjustment of prices to unexpected changes in conditions.

¹⁴ Unfortunately accessible only to a limited extent in this country, and apparently difficult to discover even in Russia. The most important work in this field is embodied in governmental instructions and circulars which are very seldom published.

¹⁵ See, for example, Hall and Hitch in *Oxford Economic Papers*, No. 2.

On the other hand certain difficulties which worry the economist outside the Soviet Union are easily disposed of in that country. The question of whether to calculate raw materials, for example, according to their original value (first in, first out) or their replacement value (last in, first out) is no problem at all. All raw materials are acquired at a *fixed* price and their valuation remains unchanged over an accounting period.¹⁶ Original price and replacement price are equal (at least during this accounting period, which is long enough for all practical purposes) no matter what the changes in scarcity conditions may be.¹⁷ The same applies to all labor and to all "purchases from other entrepreneurs," which are contracted for on the basis of fixed prices and therefore cause no cost accounting difficulties.

The problems arise exactly as they do in private enterprise. The proper allowance for depreciation and the task of determining joint costs are dealt with according to a rule of thumb, unsatisfactory though it may be.

The ruling formula, applied by practically all enterprises and enforced by the Soviet authorities, may be briefly expressed as follows:

$$\text{Amortization Rate} = \frac{(\text{OV} - \text{AV} + \text{RE}) \cdot 100}{\text{LT} \cdot \text{OV}}$$

where OV = original value, AV = actual value, RE = repair

¹⁶ "Fixed prices of raw materials, semi-finished goods, fuel and power are established for the enterprise at the beginning of an accounting period and remain regularly unchanged during the year." D. S. Levin and M. G. Polyakov, *Kalkulirovanie sebestoimosti produktsii miasnoi promyshlennosti* (Cost Calculation in the Meat Packing Industry, Moscow-Leningrad, 1926), p. 37.

¹⁷ In this connection an argument of Professor von Hayek in *Economica* (May 1940), is important. The adjustment of prices over a period of time is certainly less effective than an instantaneous adjustment. Professor von Hayek believes that only the market provides such an immediate reaction of price to changes in conditions. This would be true, however, only if the market were perfect. The same reasons which make it impossible for the planning authority to change prices "every fortnight" seem to inhibit large corporations from altering their price lists more frequently than is absolutely necessary. Besides, the technical difficulties which would arise in case of such frequent changes, the annoyance to the buyers, who would have to change their calculations unceasingly, seem to make a certain "rigidity" of prices unavoidable even in the market economy.

expenses, LT = lifetime of the equipment. This formula, however, involves the difficulty of ascertaining the actual value of the plant. It was solved in the first years of Russian planning by periodical (mostly annual) expert appraisal which established the actual value as well as the loss in the original value incurred by operation. It was soon discovered that this procedure, correct as it might appear, involved extremely arbitrary valuations, estimates and judgments, which not only yielded unreliable figures, but resulted in considerable red tape, interrupted normal work for the period of revaluation, etc.¹⁸ On the other hand, it was the only possible way of calculating, as the plants had not been built or bought by their current proprietor (the state), but had originated before nationalization. Thus their value could not be established except by a new appraisal which would take account of far-reaching changes in general conditions.

As soon as new plants built by the planning authority went into operation, original cost data were readily available. The appraisal device, repugnant for many reasons, was given up, and the same formula was applied on a somewhat different basis. $OV - AV$ came to be regarded as a fixed magnitude elaborated by the planning authority.¹⁹ According to technological data (life of the equipment, its productive ability on the basis of a certain number of work hours) the central board fixes depreciation quotas which have to be added to the direct or prime costs, regardless of the real lifetime or the actual productivity of the plant in question. This approach, however, makes the quotas altogether arbitrary. The life of the equipment may be shorter or longer than assumed (depending heavily, among other things, on the care with which the workers handle it), its technical productivity smaller or greater,

¹⁸ "There are three approaches to the valuation of fixed equipment: (1) original value, (2) replacement value, (3) original value less wear and tear. As yearly reappraisal of the fixed equipment is very difficult, and involves great expense in money, time and labor, the plants are appraised according to their original value, i.e., the value they had when they began to function." A. Arakelyan in *Problemy Ekonomiki*, 1938, No. 5.

¹⁹ "In calculating the depreciation of the original value, a norm is used which is fixed by the government." See for details, D. S. Levin and M. G. Polyakov, *op. cit.*, pp. 24 *et seq.*

but the regulating authorities pay no attention to these fundamental questions in fixing their rules.²⁰ The enterprises may make additional profits if the equipment lasts longer than its assumed lifetime, or incur unexpected losses if the cumulated quotas fail to provide them with the value of the outworn plant.²¹ It is evident that the remedy of adopting "technological" amortization quotas according to experience in capitalist countries is a questionable one. A machine which lasts ten years in this country may not be able to stand Russian treatment for longer than five years.²² Great as this difficulty may be, the method itself would not be open to as much criticism

²⁰ "The obligatory inclusion of depreciation quotas in the calculation of costs of output leads to an accumulation of an amortization fund independently of the financial result of the activity of the given corporation." V. G. Dolgov, *Analiz Godovogo otcheta i balanso khozziastvennykh organizatsii* (Analysis of Annual Reports and Balance Sheets of Business Enterprises, Moscow, 1937), p. 23.

²¹ "Since the question of correctness of the amortization quotas is of great importance, as these quotas strongly influence the cost figures they have to be revised regularly. It is necessary to examine whether they really correspond to the effective wear and tear and, in cases of large deviations, the reasons for these disproportions have to be clarified." V. G. Dolgov, *op. cit.* Another author puts the question more strongly: "The acting norms of amortization are not revised and are calculated very often in accordance with foreign price lists. They do not correspond to a smaller or larger extent with the real technical wear and tear of the means of production. That is particularly true when they are taken over from accounting materials supplied by capitalist enterprises without being properly qualified and without due regard for the particular reasons for certain depreciation practice applied abroad. Our legislation adopting these high amortization quotas had in view the possibility of capital accumulation necessary not only for reproduction of the equipment in its original form, but sufficient for its reconstruction on a higher technical level. Such a viewpoint demands an increase of amortization quotas which have to finance the construction of new enterprises not only after the old ones are worn out, but much earlier than that, because of the higher rentability of more modern installments . . . That makes our solution of the amortization question rather a matter of definition agreed upon between economic authorities." A. I. Rothstein, *Problemy promyshlennoi statistiki v SSSR* (Leningrad, 1936), pp. 288 *et seq.* This book, which seems to be by far the best in this field in Russian literature, should be consulted on all questions connected with the problem at hand.

²² Agricultural tractors serve in Russia at most 10,000 work hours, and need three general repairs, whereas in this country their term of service is usually estimated to be at least twice as great.

as the principle of exclusive regard for *original* values. To base depreciation calculations on these values (which in addition are corrected for changes in the "price level" and represent deflated figures of very doubtful accuracy) is to give a completely distorted cost picture which includes considerable amounts of outlay that are entirely unrelated to amortization. The Russian economists realize this quite well, but maintain that the procedure is rational by pointing to the necessity of capital accumulation. But even though the necessity exists, it is entirely inadmissible to work in additional profits and earnings under the heading of costs (first element of pricing) after profits, taxes, etc. (second element) have been accounted for separately.

Since the worn-out plant can usually be rebuilt at considerably lower cost than was incurred in the construction of the original one,²³ and since technical progress makes possible the introduction of better and more productive machines and tools, the system of calculating depreciation on the basis of original values obviously deprives the planning authority of correct information about the costs of producing a unit of output, and makes virtually impossible a valid comparison between different techniques of production. Cost figures which are regarded as low (in comparison with other enterprises) may in reality be very high, and include vast amounts of hidden profits; high cost figures may lead to an erroneous impression of real scarcity conditions, as their magnitude may be determined by overvaluation of an old plant. These mistakes might be corrected by the consumer if by shifting his demand from the "too expensive" goods to the "cheaper" ones he could force the authority to impute the resulting market price to the capital goods and thus reevaluate plant and equipment. But as under Russian conditions the better part of the demand is not consumer's demand, but demand originating within the four walls of the planning board, the problem can be solved only by "trial and error," by a very conscious application of the *tâtonnement* method, and by careful imputation of

²³ This statement, however, must be qualified in the case of the Soviet Union. Insofar as imported machines or parts of machines are necessary for the renewal of the plant, and foreign exchange is scarce, the renewal, in terms of Russian evaluations, may be more expensive than the original plant—depending on the given situation of the Russian balance of payments.

the value (however estimated) of the finished product to the value of capital goods. Since the entire capital accumulation is controlled by the central authority and technical innovations are directed according to its decisions, this practice would by no means exclude the possibility of sponsoring investment in industries which incur losses. It would, however, make it feasible to calculate how much this "protection" costs in terms of alternative uses. But it is precisely this application of cost calculation that the methods employed in Russia exclude. It is therefore entirely impossible to conclude whether the amount of waste is minimized, whether the desired aims are reached with the employment of the least investment of resources, or whether mobilization of the available resources could furnish better results. Once again the scarcity prevailing throughout the country (particularly as measured by the yardstick of governmental goals) precludes a proper appraisal of the adopted techniques. Since this scarcity is particularly marked with regard to capital goods, and since labor is cheap, all labor-saving devices have to break through the wall of adverse profitabilities. Even without taking account of interest on capital, which does not exist in Russia except for short term money and governmental loans, the expensiveness of capital goods, the extremely high valuation of machines and tools imported from abroad (they are still necessary for many new installations) tend to make the average total costs of a unit of output in new plants higher than in the old ones. Nevertheless they coexist; the most up-to-date plants working with heavy accounting losses are kept running alongside the old prewar establishments making high profits. The only progressive equilibration of this abnormal state of affairs is, in the opinion of the government, accelerated accumulation of capital, an independence of "expensive" foreign supplies, and an increase in the productivity of labor.

4

As Max Weber once remarked, historical materialism is not a horse-cab from which the passenger may alight whenever he pleases. The strong interdependence of the degree of development of *Produktivkräfte* and the corresponding *Produktionsverhältnisse* cannot be disregarded without heavy penalties.

The endeavor to impose upon a backward, agricultural country a highly organized, precisely functioning and thoroughly calculated economic system must necessarily involve stupendous losses in life and goods. No country can neglect with impunity the law of comparative costs; nor can it enforce a saving of over 50 percent of the national income without inflicting privation and suffering upon its population. This is particularly true if the productivity of labor (as Colin Clark demonstrated strikingly in his illuminating *Conditions of Economic Progress*) is as low as it is in Russia. Even if the time preference of the Russian population were not converted into its negative, but were allowed to underlie all the economic activities of the country, the nation would still live on a low level of income as compared with the industrially advanced countries of the world. All the details of planning technique, taken for what they are worth, are of secondary importance in the light of these basic facts. Many things could be done better, commodities that are needed could be produced and conveyed to the consumer, goods regarded as "necessary," but which pile up on the shelves of the shops, could remain unmanufactured. Yet all these improvements, important as they are, cannot decide the fate of the experiment. One of the most brilliant economists in the Communist Party, the late E. Preobrazhenski, remarked: ". . . in our country where the centralized planned economy of the proletariat has been established and the law of value has been limited or replaced by the planning principle, foresight and knowledge play an exceptional role as compared with the capitalist economy. Errors in foresight committed by our central leadership may have much heavier consequences than errors committed by managers of private enterprises where mistakes in one direction are often cancelled out by mistakes in the opposite direction according to the law of great numbers."²⁴ These words were prophetic. The mistakes and errors of the "central leadership" have been numerous. Its unwillingness to make use of advanced economic science, its indiscriminating adoration of the machine, its power to disregard the consumer as an economic as well as a political "voter"—may be only aspects of the backwardness of the country. But it is wrong to say that, "It is the ability to solve

²⁴ E. Preobrazhenski, *Novaia Ekonomika* (New Economics, Moscow, 1926), pp. 11 *et seq.*

in a lasting manner these various price problems rather than any technological accomplishments that will afford the test of the adequacy and feasibility of the Soviet program of economic expansion.”²⁵ Rather, the extent to which the system will be able to eliminate scarcity and to raise the productivity of labor will finally determine the success or the failure of the entire undertaking.

The economic theory of socialism is just as useless in matters of economic policy under a planned economy as the theory of pure competition is in capitalist countries. Free competition is incompatible with large scale enterprise. Economic liberalism is impossible in a world of monopolies, oligopolies and imperialism. Rational socialist planning cannot coexist with poverty, with armaments, with autarchy, with “primary accumulation of capital.” Formal questions of planning are inseparable from the material content of the planning.

The study of the economic policy of Russia, of the ways and means employed by Soviet planners, is thus not a study of socialist economics. Whether it is the study of failure to construct a socialist society in a single backward country, or the study of an early stage of socialist economics of the future may be left to the decision of history. It is, however, necessary and valuable. It can supply us with information as to how successes can be achieved (even if they could be reached in other countries, under more favorable conditions, more cheaply, with less sacrifices, less waste, less irrationality). It can provide us, moreover, with some indispensable knowledge of how mistakes and disasters can be avoided.

²⁵ A. Gourvitch, in *American Economic Review*, Supplement (1936), p. 282.

APPENDIX C

THE REPLACEMENT OF
DEPRECIABLE ASSETS



Appendix C

THE REPLACEMENT OF DEPRECIABLE ASSETS

FEW branches of industrial practice are subject to greater confusion than that concerned with the replacement of durable assets. It is therefore appropriate, in a report on cost-price relations, to examine the principles of correct practice and survey customary procedures. Some of the difficulties result from *ex parte* preparation of estimates. Frequently both the suggestion and the cost estimates for replacing a machine come from a prospective salesman for the new machine.¹ Although the more reliable tool-makers² value the goodwill of the manufacturer too highly to sell him a machine which they have no reason to believe is economical, the *ex parte* position of the estimator is not conducive to the most objective study of replacement problems.

Not many firms have any adequate method of determining when the possibility of replacement should be explored. If direct or indirect costs of production move out of line, a budget may set the management looking for possible ways of reducing costs, but no budget in itself can show when a

¹ The term machine will be used throughout this appendix to denote any depreciable asset. In addition to machinery itself this usage will thus include such assets as buildings, production layouts, and process patents.

² The term includes construction companies, production engineers, etc. In this connection it is interesting to note the published advice of H. K. Ferguson, head of a large building construction firm, in an article in *Factory Maintenance and Management* (Vol. 95, No. 4, pp. 42-45) entitled "To Build or Not to Build." He repeatedly states that no firm should build if it can reasonably avoid building by simplifying the line, rearranging departments, leasing space, etc. Further, "it is never safe to build when more than half the cost of land and buildings must be borrowed." Finally, "no business should build itself into such a position that, because of heavy expenditures for plant and equipment it is impossible to . . . break even or better during the next depression on 50 percent of production volume."

machine is approaching the point of obsolescence. No automatic procedure will reveal the answer even to the simpler question of when to replace a machine with an identical machine which will have lower operating and maintenance costs. It would appear that usual practice is to maintain a machine until some person, master mechanic, foreman, superintendent or salesman, has a "hunch" that it might be well to replace it. Estimates are then made of the saving that could be effected, and if this amount is sufficient to "pay for the machine" in "a short period" the change is instituted.

The most casual examination of the files of a journal dealing with the problems of production executives (such as *Factory Management and Maintenance*) will convince the reader that this sort of procedure is unsatisfactory. Consider such a simple matter as the alteration of a low power factor. Unlike most wasteful practices, the existence of this "leak" is presented to business executives every month if the electric utility has the usual penalty clause for a low power factor. Yet over a period of about ten years, at least three or four articles or notes appear each year telling of the phenomenal savings some company has achieved by installing capacitors or synchronous motors. The technique for making the saving was well known, and it had been shown applicable to almost any plant using electric motor driven machinery. Nevertheless, a large number of firms postponed making any investigation of the possible savings for years,³ when the usual experience was to find savings "paying for" capacitors in a very short time.

1. *The Age of Depreciable Assets in Use*

It is not possible to obtain an accurate picture of the age distribution of all machines in use, but the available data indicate that a very large proportion of the machinery that was functioning in 1939 was so old that its continued use was unlikely to be economical. Mere age, of course, is no evidence that a machine should be retired. Some types of machine may still be economical after fifty years of service; others may be obsolete after two or three years. Furthermore, the use made of the machine by different plants will influence the time of

³ Replacement could conceivably have been postponed because of lack of funds or credit.

obsolescence markedly. A thirty-year-old freight car may be quite economical for meeting a short peak demand but excessively costly for continuous use. These variations between types of machine and usage are further complicated by the different "life experiences" of apparently identical units. With so many factors to be considered, any over-all examination of age of machines must not be understood to indicate the amount of obsolete machinery but rather to suggest the range of issues involved in the problem of replacement.

The most generalized approach to this problem is the study of the durable goods inventory as a whole. Terborgh has pointed out that the durable goods inventory comprises more than half of the total national wealth in the United States and more than three fourths of the wealth exclusive of land and natural resources. He estimates further that this inventory contains ten to fifteen years' consumption at the current rate. Since 1930 the age distribution of the goods in this inventory has altered markedly. Apparently there were in 1939 a greater number of durable goods than ten years previously, but the amount of service life remaining in these goods was on the average enough less to give the total inventory the same prospective stock of services.⁴ Only a portion of the large stock of durable goods consists of instruments of production (and thus bears on the general problem of cost-price relationships). Of the estimated 360 billion dollars expended for durable goods during the twenty years from 1919 to 1938 only about 37 percent went into producers' plant and equipment.⁵

Turning from the over-all picture, which shows that "the gap between the average quality and condition of durable goods in use and the best that current technology affords is . . . much wider than before the depression"⁶ to the case of specific durable goods, we get a more definite impression of over-age machines.

In 1925 only 44 percent of machine tools in use were more than ten years old; in 1930 this percentage had risen to 48; in 1935 it was 65; and by 1940 the proportion had risen to 70

⁴"Present Position of the Durable Goods Inventory," George Terborgh, *Federal Reserve Bulletin* (October 1940), p. 1041.

⁵Compiled from George Terborgh, "Estimated Expenditures for Durable Goods," *Federal Reserve Bulletin* (September 1939), p. 731.

⁶George Terborgh, "Present Position of the Durable Goods Inventory," *loc. cit.*, p. 1043.

percent.⁷ The situation with respect to railway equipment is even more striking, and here the trend toward increasing amounts of old equipment is of even longer standing. In 1930 20 percent of railroad locomotives were *less* than ten years of age—a “normal condition” only if locomotives have a fifty-year life. By 1940 the proportion had shrunk to 6 percent⁸—a “normal condition” only with a locomotive life of one hundred and sixty-seven years!

The age distribution of freight cars falls within narrower bounds than that of locomotives, as is evident from the following table:

AGE DISTRIBUTION OF CARS ON HAND—
JANUARY 1, 1940^a

Class I Railways

<i>Present Age Group</i>	<i>Total on Hand</i>	<i>Percent of Total Owned</i>	<i>Cumulative Percent of Total</i>
1 - 5	152,787	9.34	9.34
6 - 10	76,863	4.70	14.04
11 - 15	327,422	20.01	34.05
16 - 20	377,164	23.05	57.10
21 - 25	301,638	18.43	75.53
Over 25	400,317	24.47	
Total Owned	<u>1,636,191</u>		
Jan. 1, 1940	1,636,191	100.00	

^a American Railway Car Institute Bulletin, *Statistics of Car Building and Car Repairing* (1939).

This study by the American Railway Car Institute reveals that less than one seventh of the railway freight cars are less than ten years of age while three sevenths are between ten and twenty years old. Stated in another way, this means that half a million fewer railway freight cars were purchased during the 1930's than during the 1920's. It is shown also that the replacement rate in the 1920's was roughly equal to that of previous years. The virtual absence of replacement in the early 1930's was a result of the loss in railway traffic, and the replacements

⁷ "How Industry, Labor and Government Can Help America," *Factory Management and Maintenance*, Vol. 98, No. 8 (August 1940), p. A31.

⁸ Terborgh, *loc. cit.*, p. 1042.

of 1934-39 were only half of normal. With increasing traffic the railroads must face the problem of determining whether it is cheaper to buy new cars or to run the old cars in the face of increasing repair costs. Since almost a quarter of the cars are over twenty-five years of age, the replacement problem is of major concern to the railroads; it seems probable that cars of this age are seldom economical for anything but peak loads or special services.⁹

When the effects of a secular decline in use are combined with the effects of cyclical depression the replacement of durable goods may be very seriously curtailed. This was the case with freight cars and is also the case with steam engines. Two thirds of the steam engines in use in 1940 were over twenty years old.¹⁰ The maximum "life" for steam engines commonly accepted in the calculation of depreciation is twenty-five years.¹¹ Where technological advance is not only rapid but also of considerable magnitude, the situation is less striking in terms of age of machines than in terms of the proportion of machinery which could be replaced economically. Under such circumstances it is even more important that systematic and periodic studies of the possibility of replacement be made if profits are to be maximized.

2. Steps in the Replacement Problem

There are three phases of the replacement problem: (1) to determine whether any given machine should be replaced by

⁹ Any study of the age distribution of assets must take into account the fact that the lives of individual assets of the same kind vary just as the lives of human beings. Robley Winfrey in a monograph entitled "Statistical Analyses of Industrial Property Retirements" (*Bulletin 125*, Iowa Engineering Experiment Station) presents retirement and survivor curves for 176 different sets of data. An example of the extreme spread of life is seen in three groups of small distribution transformers used by midwestern power companies (curves 145, 147, 149). One group of 216 had an average life of 5.8 years with the maximum life of any individual 13.5 years. A second group of 116 transformers with an average life of 11.0 years had a maximum of 23.5 years. An asset which would appear to be highly standardized but which had a wide life range is a sample of 939 cast-iron electric car wheels used by the Milwaukee Electric Railway and Light Company (curve 31). The average life was 30,500 car miles and the maximum 82,500 car miles.

¹⁰ *Factory Management and Maintenance* (August 1940), p. A32.

¹¹ See W. A. Paton, *Accountants' Handbook* (Ronald Press, 1932).

some one of a number of other given machines (or the service the machine renders purchased as such), (2) to determine the possible alternatives to the continued use of any given asset, and (3) to determine when such studies of depreciable assets are needed. It can readily be seen that these questions must be answered in reverse order. Sometimes the need for studying the replacement of an asset is thrust upon the management by the breakdown of the machine, but such occurrences cannot be made the basis of a system of replacement. This problem of knowing when to study replacement possibilities can be solved arbitrarily by a rule that every asset shall be studied, say, once a year. Robert M. Gaylord, president of the Ingersoll Milling Machine Company, recommends a periodic check on equipment for replacement possibilities. Few firms have any systematic policy with respect to periodic checking for the possibility of replacement.¹² His company, producing machine tools, had been selling its machines on the basis of economy studies for years, but not until 1927 did the management consciously shift from a replacement policy of "Will it run?" to "Can it be done cheaper or better?" At this time the company adopted a policy of checking on every machine at the end of ten years. The difficulty with any arbitrary period for examination is that in some cases it will be much too frequent and in others not nearly often enough. Since there is considerable expense involved in making estimates, some balance must be struck between the cost of making more frequent examinations and the savings that can be achieved in this way. While some firms may habitually replace assets too soon, it is doubtful if any firm spends too much money in exploring the possibilities of replacing present assets.¹³

The problem of determining the possible alternatives is almost as difficult and as badly handled in practice as the whole subject of knowing when to study replacement possibilities. It is the responsibility of the engineering staff to know all the methods whereby the stream of services rendered by the asset can be obtained. The search for these possibilities requires at

¹² Robert M. Gaylord, "When to Buy New Equipment," *Factory and Industrial Management* (July 1932), pp. 272-74.

¹³ This exploration of possibilities of replacement with presently known assets must not be confused with research and development work to discover new techniques.

times a high order of imagination, bordering on the realm of discovery. For instance, Grant¹⁴ cites a town which in purchasing an old gravity feed-water supply employed an engineer who failed to imagine the possibility of pumping water from wells. Three or four years later the state Board of Health suggested this possibility.

When the management has decided to make a study of replacement possibilities and the engineering staff has determined the alternatives, the central problem of estimating whether or not it will pay to purchase new assets can be approached. The economist's answer to the problem is outlined in Chapter VII. The approach of the next section of this appendix will be that of the businessman or engineer.¹⁵

3. *When Is It Profitable to Replace a Machine?*

A sufficiently accurate answer to this question, when the replacements being considered are deemed to have about equal life, can be obtained by way of the three following questions:¹⁶ (1) What annual savings can be expected from using the machine at the expected level of output? (2) What will be the annual charge necessary to insure recovery of investment within the minimum expected life of the machine due to cessation of demand, obsolescence or wear and tear? (3) Does the profit, if any, remaining after subtraction of the charge for recovery of investment from the expected annual savings represent the most profitable way open, or likely to be open, for use of the capital involved? To answer these questions may not be as simple as would appear at first glance.¹⁷

¹⁴ Eugene L. Grant, *Principles of Engineering Economy*, revised edition (Ronald Press, 1938), pp. 235-36.

¹⁵ *Ibid.*, Chs. XIV and XV, outlines a system basically similar to that described in Chapter VIII of this report.

¹⁶ This simplified procedure follows that proposed by Gaylord, *op. cit.*, pp. 272-73.

¹⁷ These criteria are for competitive conditions and require some modification when applied to monopoly. In the case of unregulated monopoly, whether complete or partial, the question is not really any different except insofar as a fear of regulation or competition prevents profits from appearing too high. In the case of regulated monopoly, one of the costs to be considered is the change in rate base. J. M. Clark in his *Studies in the Economics of Overhead Costs* (University of Chicago Press, 1923), points out that this reduction of rate base deters public utilities from replacing obsolete equipment.

To determine the annual savings it is necessary to estimate only those costs which will be altered by the use of the new machine. For instance, there is no reason to assume that indirect labor cost will be decreased by the installation of a new machine which uses less direct labor simply because there is in operation a cost system which allocates indirect labor cost on the basis of direct labor cost. Similarly, no reduction of floor space charge should be made unless the freed space can be utilized to average advantage. When the problem is approached in this manner, it is obvious that there is no reason to be concerned about the book value of the replaced asset; the costs associated with this asset have been incurred and no action taken now will alter them. While it is true that under competition a firm cannot continue in business if it repeatedly fails to make sufficient provision for retiring its assets, it is doomed to failure even more rapidly if, having made unwise decisions about the purchase and depreciation of assets, it refuses to replace assets whose operation entails out-of-pocket costs higher than the total costs of new assets that render the same services. Since the problem is to determine the costs that will be altered, sunk costs cannot, by very definition, be considered. It is important, further, to bear in mind the limitation entailed by the fact that savings must be realized not at capacity output but at the expected level. Finally, no charge is to be made in computing the savings on account of depreciation or interest on the new investment, but any decline in salvage value of the old asset should be reckoned as a cost of continuing the use of that asset.

To estimate the service life of the investment requires even more careful judgment than to estimate savings. It is unfortunate that this entire question is ignored by the usual methods of replacement study. A common practice is to lay down a rule that an investment must "pay for itself" in a certain period of time, say two years. A study of replacement policies showed that the average period during which an asset had to pay for itself was about three years.¹⁸ Apparently the meaning usually attached to the dictum that "a machine must pay for itself in two years" is that the savings during each of the first two years must be 50 percent of the cost of the machine. If a profit rate of 20 percent is expected, this means that the life of the ma-

¹⁸ See Chapter VII above.

chine is arbitrarily set at $3\frac{1}{2}$ years. If the "pay out" time is raised to three years, a profit rate of 20 percent yields a life of $7\frac{1}{2}$ years, which is certainly not excessive for a conservative estimate in view of the rate of obsolescence today. Probably when "pay out" periods of five years or over are used the profit rate is first subtracted from the savings; we are then speaking of a concept very close to that of our "estimated life."

Since replacement studies are infrequently made on the basis of careful estimates of probable life, it is difficult to tell whether the third criterion (do the savings represent the most profitable use of the capital involved?) is given adequate consideration. Most concerns which are large and progressive enough to be considering a number of alternative types of investment in order to cut cost are probably able to borrow to carry out any changes that show good prospects of profit. In this case the criterion should be: will it yield a certain rate of return? This seems to be the idea of E. M. Richards, chief industrial engineer of Republic Steel, who says that in a choice between alternatives the criterion should be the rate of saving on the added investment of the more costly process.¹⁹

The type of examination outlined above, which has been put forward as a practical one by some progressive businessmen, has much to commend it. The freedom from highly technical considerations of present worth and interest rates should appeal to business executives. Its presentation of a rate of profit after provision has been made for capital recovery should emphasize the possibilities in any given investment.

¹⁹ "To Buy or Not to Buy Equipment," E. M. Richards, *Factory Management and Maintenance*, Vol. 91 (December 1933), p. 499. His six points outline a method very similar to the one suggested above, except for his somewhat modified criterion of choice. He sets a three-year pay-out as proper for normal times and one year for depression in order to conserve cash.

APPENDIX D
SPECIFICATION OF BOOK
PAPER PRODUCTS



Appendix D

SPECIFICATION OF BOOK PAPER PRODUCTS

THE following classification of book paper products was prepared by Albert Sawyer of the New York law firm of Wise, Corlett and Canfield, in connection with a study of the relation of realized and quoted prices. The book paper industry is one among about fifteen branches of the paper industry, and as such represents a considerable degree of specialization. How much farther specification of paper products can be carried is indicated in this classification. Since there are 40 product classes, 12 grades, 33 finishes, 9 sizes and trims, 8 colors, 8 quantity classes, and 19 types of packing, a meticulous specification of product would distinguish between 170 and 180 million possible products in the book paper industry.

Product Classes

- Adding machine and cash register paper
- Bank stock
- Book—M.F., E.F., super, etc.
- Carbonizing
- Coated 2 sides
- Coated 1 side
- Coated bond
- Coated cover
- Coated embossing cover
- Coated box cover
- Coated shelf paper
- Coating raw stock
- Decalcomania
- Endleaf
- Drawing
- Envelope

French folio
Gumming
Hanging—wall paper
Lining
Litho and label
Machine coated
Music
Offset
Playing card
Postal card
Poster
Rag book
Soap wrapper and cardboard
Tablet
Text
Greeting card
Rotogravure
Postage stamp
Folder stock
Ditto
Tariff
Wrapper spec.
Uncoated box cover
Blanking paper

Papers in the above grades containing more than 25 percent ground wood and less than 35 percent bleached sulphite are in the “ground wood paper” division. Papers above these limits are in the “book paper” division.

Product Grades

A or 1
B or 2
C or 3
D or 4
E or 5
Extra strong
Extra quality
Publication

Government
All other special
Seconds
Job lots

Product Finish

Antique laid
Antique
Bulking
Eggshell wove
M.F. or E.F.
High bulk
Super
Glossy enamel
Dull
Felt
Embossed
Plater
Laid
Watermarked wove or laid
Duplex
Hard sized
Titanium filled
Vellum
Eggshell laid
Duplex enamel
Brush finish enamel
Tub or surface sized
Special or fancy (unclass.)
Ant. or Egg. W/M wove or laid
Lacquer
Varnish
W/M super
Super 1 side
Ant. laid W/M
Ant. bulking
Hard sized antique
High bulk eggshell
Hard sized high bulk

APPENDIX D

Size and Trim

Regular	untrimmed
	trimmed 1 or 2
	trimmed 3 or 4
	deckle
Irregular	untrimmed
	trimmed 1 or 2
	trimmed 3 or 4
	deckle
	round cornered

Product Color

White, natural
 (also azure in envelopes)
 India, ivory cream
 Light color
 Deep color
 Duplex
 Special

Product Quantity Class

Less than ream
 Ream
 125 lbs. (carton)
 500 lbs. (4 cartons or 1 case)
 2,000 lbs. (4 cases)
 5,000 lbs.
 10,000 lbs.
 36,000 lbs.—carload

Product Packing

Rolls 500 lbs. or heavier
 250 lbs.—500 lbs.
 Less than 250 lbs.
 Less than 6" in width and 9" in diameter
 Banded

- Bundles** flat with or without cardboard protection
skeleton frames
soft fold or lapped
sealed
- Cartons** ream marked
ream sealed
- Cases** ream marked
ream sealed
cut and sealed
- Skids** ream marked
ream sealed
- Crates**
- Cellophane wrapped rolls**

**DIRECTOR'S COMMENT
BY C. REINOLD NOYES**

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BY C. REINOLD NOYES

THIS report is subject to two limitations, one set by the mandate of the Committee and the other by the method of presentation adopted by the Committee. It seems to me that both of these limitations may lead to confusion, or help to continue confusion, in the minds of those who use the report—as many doubtless will—as a manual or guide to empirical studies of costs. A word of caution, here, may help to avoid such confusion and therefore help to make this admirable and constructive study even more useful.

1. The mandate of the Committee (see Preface) requires a behavioristic approach—that is, a study of the influence of costs on price decisions. This is, of course, a great improvement over the speculative or introspective method of imputing economic motivation. The result is, however, that the Committee is obliged to take as its data costs as these are conceived and recorded in current business practice. But the elements included in accountants' costs fit neither those of the economic theory of costs nor those of the theory of productivity. In fact they fit no better than the last two fit each other.

a. The theory of costs deals only with real costs—that is, factors made available—though these are convertible into terms of payment for factors and therefore into money costs.

b. The theory of productivity deals only with factors actually used, though again these are convertible into terms of payment and therefore into money costs.

c. Accounting deals only with contractual and imposed costs in terms of money.

The details of the differences in these three approaches were given in *Technical Paper 2* (National Bureau of Economic Research, 1941) and *American Economic Review*, 31 (1941), p. 473, and it is not necessary to repeat them here. Suffice it to say that the category of costs for each of these purposes excludes or includes certain elements which another

includes or excludes. Except as these differences are reconciled or allowed for, neither form of present theory can be applied without qualification to current accounting data, nor can conclusions from empirical studies of such accounting data be used without qualification to modify either form of theory. Until that is done the scientific utility of empirical studies in this field will be very limited.

d. In another respect there is a difficulty in the use of present theory in such studies. As I have shown in the paper cited above, the theoretical device called marginal cost theory is inconsistent with both the theory of costs (factors made available) and the theory of productivity (factors used) insofar as the marginal costs to be considered are limited to what the accountants call direct or "out-of-pocket" costs as against overhead (i.e. to variable as opposed to fixed costs). So-called variable costs exclude the returns on several factors which are made available and even those on some factors actually used. Nor is the device applicable in practice—except in a limited number of particular situations where more or less of the elements of cost are disregarded (see my paper cited above)—unless it is confined to use with reference to additions to a current output which is already covering all contractual and imposed costs. Thus any assumption that marginal costs, as usually defined, are or should be generally determining of price policies can only interfere with the attainment of successful results from empirical cost studies.

2. The other limitation is the consequence of the Committee's choice of approach, which treats the subject from the angle of the several causes of change in costs as these have been analyzed in past theory. These causes are:

Short run

- a. Changes in rate of output.
- b. Changes in prices of input factors.
- c. Changes in technique.

Long run

- d. Changes in size of plants and firms.

When the actual accounting data are dealt with I am of the opinion that it will not be found possible to distinguish the operation of these four causes of change of cost. This will be

largely due to the fact that some of these rubrics are not pure; they consist of mixtures which have not been adequately analyzed. It will also be partly due to the fact that some of these rubrics have been contaminated with a purely mystical supposition—the law of the proportioning of factors and its inference and basis, the declining marginal efficiency of each factor as its proportion is increased.

In the short run:

a. Changes in rate of output, with given and uniform technique and given prices of input factors, cannot change costs in terms of factors actually used. To the extent that costs are figured instead in terms of factors made available, the effect of changes in rate of output will depend wholly on the decision whether to allocate such costs one way or the other. This decision is necessarily an arbitrary or conventional one. If the decision is to allocate such costs only to the product upon which the factors are actually used, increased output will show an increase in such costs per unit. If the decision is to allocate such costs regardless of use, increased output will show a decrease in such costs per unit (see my paper cited above). Other changes in costs as a result of changes in rate of output are only apparently, not actually, due to this cause. That is, they are either due to the use of more or of less efficient machinery, etc., already installed (i.e., changes of technique) or to more or less efficient labor, etc., at the same price (i.e., changes in prices of input factors).

b. Changes in prices of input factors are only causative with relation to prices insofar as they do not result in changes of technique (for instance, only when labor cost changes to the same degree as wages). All other effects may be said to be *induced* by price changes of input factors, but what is actually induced is a change in technique. In such cases the induced change in technique is itself equally a causative factor on price decisions. Sometimes it works in the opposite direction from that of the change in price of input factors (i.e., compensatory). Sometimes it works in the same direction (i.e., substitutive). Thus rises in labor costs may induce better machinery (technique). But declines in machinery costs may also induce better machinery (technique).

c. Changes in technique properly include any changes in real input-output relations. It is impossible to define technique in

any narrower way if the various types of input are, as is necessary, classified by their kind and quantity of effect, not by their prices, and if output is measured in terms of an unchanged product. The committee recognizes this broad definition in the first paragraph of Section 1, Chapter VII. Then, in the following paragraph, an attempt is made arbitrarily to exclude those changes in technique which are induced by changes in price of input factors and those differences in technique which are due to changes in rate or differences in scale of production. There the constraining effect of theory appears. These effects are not separable from, and in fact are measured by, the change or difference in technique only.

It is also to be noted that the presupposition of short run analysis, that the plant remains unchanged, excludes all changes of technique other than changes from one to another technique *already installed* (i.e., changes in parts of plant used or in kinds of men hired or materials bought). Installations of new techniques are treated, in theory, as long run phenomena. The fact that both long and short run changes in cost are largely due to this one cause, changes in technique, does not, however, vitiate the value of separate studies of the two runs. For the potential variability of technique, and therefore the effect on price decisions, is obviously different in the two cases.

In the long run:

d. Changes or differences in size of plants and firms seem to me *not* to be, of themselves, causative of differences in cost. Under the necessarily broad definition of technique, as given above, and under the only possible definition of kinds and quantities of input, there can be no influences on prices, or differences in costs, proceeding from differences in the size of plants and firms other than differences in technique and in prices of input factors. The difference in cost due to scale of *individual* operations is either due to a difference in technique—the use of a machine or a method (e.g., straight-line production) which can be used economically only on a certain minimum scale—or to more continuous use which is the same thing as a change in the rate of output (see 2a above). The difference in cost due to scale of *aggregate* operations is either due to differences in technique (organization) or to differences in price of input factors (specialization, etc.).

e. There is in the minds of economists, generally speaking,

a prepossession, which crops up in this report, to the effect that there is some other influence on costs besides the above. This seems to be the idea that the marginal productivity of any factor declines automatically as its proportion in the mixture is increased. That, in my opinion, is purely imaginary. There can be no change in proportioning of factors without a change in technique. But changes in technique are specific, definite and definable. Apparent changes in proportioning require exploration until the actual change (in technique) is found. There is room for no notion of continuous and automatic fluxions in respect of the proportioning of factors, for the changes consist solely of discontinuous and deliberate steps.

The foregoing analysis leads to the supposition that, in the course of their investigations, empiricists in this field are likely to find that all influences on costs reduce to two, changes in technique (including techniques with minimum economical scale) and changes in the prices of input factors. To these two influences there may need to be added, for a behavioristic study in our present institutional environment, one other influence. In its theoretical aspect it is the effect of the decision as to the actual method of allocation of the costs of factors made available that are incurred while these factors are not in use. In its practical effect on price making this is but part of a larger question—the question as to the extent to which management must consider its contractual and imposed obligations for payment to factors not used or to nonfactors (not properly costs) and the extent to which it can ignore (and fail in) payment to factors used (properly costs). (Spatial relations to markets [transportation costs, etc.] are, of course, another influence on costs by themselves. But this influence is unrelated to those considered and is a separate field of study.)

So far as the influence of the two other apparent causes of changes or differences in cost is concerned, it would seem that the correct statement would be something like the following:

1. Changes in rate of operation *permit* differences in cost provided they enable or prevent the use of already installed techniques requiring a minimum scale of economical operation, or providing they enable or prevent economies in the price of factors. In the absence of these two elastic elements no

differences in costs for factors actually used result from changes in the rate of operation.

2. Differences in the size of plant or firm *permit* differences in cost provided they enable or prevent the use of actually available techniques requiring a minimum scale of economical operation, or providing they enable or prevent economies in the price of factors. In the absence of these two elastic elements no differences in costs for factors actually used result from differences in size of plant or firm.

If my tentative predictions turn out to be correct, attributing causation to other and secondary influences will merely have caused confusion and hunting of nonexistent causes will have resulted only in a waste of time. However, the proof of the predictions may require such a waste of time, though not so much if the investigators recognize in advance the possibility of the nonexistence of one of these theoretical causes, the possibly secondary character of two others and the certainly arbitrary, variable and institutional, character of allocation.

In my judgment, and for these reasons, only as the two limitations described are taken account of and adjusted for will it be possible to approach the Committee's very desirable goal of a "coordination of empirical studies and theoretical analysis."