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America's Capacity to Produce

In a notable volume on *America's Capacity to Produce,* Dr. E. G. Nourse and his associates take their problem to be "America's capacity to produce during the period from 1900 to 1930 with the capital goods and labor force which she then possessed and with the technology and the general pattern of operative and commercial organization then prevailing" (p. 415). The measurements of capacity are made, it is said, on the basis of "technological considerations" alone (p. 21). Considerations of ability to pay and of costs are ruled out, and "excess capacity" is interpreted as technically unnecessary idleness. The general plan is to make estimates of "practical," not "theoretical," capacity. This end is attained by striking estimates for each industry on the basis of (a) prevailing techniques in the industry, (b) prevailing customs as to number of shifts, length of working day, and so on; and by scaling down the estimates thus reached to allow for (c) whatever seasonal variations in output exist in fact, (d) "unavoidable" interruptions resulting from breakdowns of machinery, fires, strikes and so on, (e) the capacity of idle plants. For the sample of industries covered in the study, the final estimates are expressed as ratios of actual output to "practical capacity" output. The trends in these ratios of utilization are examined, and on the whole no tendency towards a secular rise is found. Further, a weighted average of the ratios of utilization is struck for the period 1925-1929 and the single year 1929. The average ratio is 80 per cent for 1929, which means that output might have been larger by 25 per cent. To allow for "failures of coordination," the estimate of potential increase in output is reduced to 19 per cent. This estimate is checked against data on labor power in 1929, and it is found that with some redistribution the labor force would have proved adequate for full utilization of the industrial plant.

The study results, then, in two outstanding conclusions: (1) there has been no cumulative piling up of "excess capacity" over the last three decades; (2) our production even in boom times falls considerably short of possibilities. These statistical findings are significant as such and also have a critical bearing on the thesis of the broader inquiry. In examining how firmly these find-

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ings have been established, nothing is more important than the adequacy of the concept of "capacity to produce" which underlies the statistical work.

I. The Concept of Capacity to Produce

No concept of "capacity to produce" can be satisfactory unless five elementary propositions are clearly recognized. The first is that the central notion of "capacity to produce" is one of a maximum—that is, the maximum attainable production. The second proposition is that "capacity to produce" is an economic and not a technological problem, the thing to be maximized being human satisfactions. Since productive resources can be assigned to ends of varying urgency, the real problem is what allocation of resources will maximize production in the sense of a sum of satisfactions, not in some technological sense—say, in terms of weight or bulk. The third proposition is that an indefinite number of answers may be given to the question of what is the maximum attainable production. The answer will depend upon what assumptions are made concerning economic practices—that is to say, the rules of the economic game. A relatively minor change in economic organization might be assumed, for example, that protective tariffs are eliminated or that the run of technical practices is brought closer to the best. Or else a revolutionary change might be assumed, for example, that our farms, forests, mines, factories, railroads, highways, and so on, are made to turn out all that the available laborers working the optimum hours per week are capable of producing when directed by the most skilful engineers aiming only at maximum production of goods. The fourth proposition is that, while an investigator of a nation's "capacity to produce" may choose whatever assumptions he pleases, this raises rather than settles the matter of their 'significance.' The final proposition is that an estimate of potential increase in output, whether high or low, has little meaning unless it is accompanied by a theoretical analysis which indicates how the increase may be realized.

The Brookings inquiry faces squarely the problem of a maximum. However, it gets off to a bad start because the second proposition is not observed with sufficient care. The authors do not really rely, as they state, merely on technological considerations, but their technological bias causes difficulty all the same. Before turning to this difficulty, a few observations may be set down to indicate that in the plan of measurement described above considerations of price are, in fact, inextricably mixed with considera-

tions of technology. (a) To make estimates of capacity on the basis of "prevailing techniques" is to assume the whole network of prevailing price relationships. As prices change the least cost combination of productive agents also changes and technical practices follow suit. (b) If an enterpriser is on the margin of doubt as to whether or not it is worth his while to introduce a night shift, a rise or fall in the price of labor will probably resolve the doubt. (c) Production of ice cream is highly seasonal, but it might not be if an ice cream soda sold for $2 in the summer and 2 cents in the winter. (d) Let enough money be expended on a repair force, and the loss of time due to breakdowns will be less than any assignable quantity. (e) If selling prices rise sufficiently, all or nearly all idle plants will resume operations.

Clearly, the 'price' factor enters into the Brookings estimates of capacity. But the difficulty is that its role is blurred by the technological factor. The technological bias results in treating ratios of plant utilization as so many observations on the inability of our economic system to obtain the fullest production of which it is capable. In effect the Brookings investigators multiply actual output by the reciprocal of a weighted average of ratios of utilization for a sample of industries and consider this quantity an estimate of our "capacity to produce." But this quantity has an indefinite relation to maximum attainable production, since maximum utilization of the "practical capacity" of our industrial plant is not the same as our maximum ability to produce. What is required by our second proposition is that output be maximized in an economic sense, not that existing plant be worked to the full on whatever products it is now making. Ratios of utilization are, and must always be, ambiguous 'observations' on a nation's efficiency in production. Even in a business economy a low ratio for beehive coke ovens may indicate that too much coke is produced by a notoriously wasteful process rather than too little. If we had simultaneously a sharp increase in birth rates and decline in death rates, the emergence of excess capacity in old casket factories and in newly erected baby carriage factories might mean that the goal of maximum national production is being approached more closely than if the unchanged plant of casket and carriage makers operated at full capacity. Putting the cyclical problem aside, in a dynamic society low ratios of utilization, no less than high ratios, may mean that productive resources are currently being used efficiently.

To estimate the maximum attainable production, productive resources must be considered as mobile. What degree of mobility

is proper will depend on the system of economic practices postulated. If we assume a reorganization of economic life along collectivist lines, a considerably greater degree of mobility of industrial plant and labor may be envisaged than if we assume that protective tariffs are eliminated. For our present purpose, we need merely note that the Brookings investigators assume considerable technical and geographic mobility of the labor force; that the assumptions governing their estimates of plant capacity—such as acceptance of prevailing techniques, customs of operation, and seasonality—do not preclude some mobility of industrial plant; and that mobility of labor is more important to estimates of capacity than mobility of plant. There is nothing about the underlying assumptions of the Brookings inquiry, other than the technological bias, that seems to require an identification of maximum use of plant with maximum ability to produce. It is, of course, more difficult to estimate the output that would obtain under a rearranged industrial pattern than to estimate the output that would be realized with full use of the existing plant; though there is an offsetting gain in escaping the need to consider the capacity of each industry as a fixed quantity when we know, in fact, that the output of any given industry is usually indefinitely expansible, even in the short run, under adequate stimuli.

It may, of course, be argued that an estimate of "capacity to produce" made on the assumption of full use of the existing plant gives *one* answer to the question of what is the maximum attainable production. However, it is obvious that full use of every part of the industrial plant will lead not only to returns that are in many cases disproportionate to cost, but also to an unusable accumulation of considerable quantities of all sorts of intermediate products. This is recognized by the authors of *America's Capacity to Produce* at the end of the volume, where they attempt a correction for "failures of co-ordination."[1] Apart from the arbitrariness of the correction, the important point to note is that it serves to reduce the estimate of "capacity to produce," while the preliminary figure of capacity might actually need to be raised to make it approximate an estimate of capacity carried through on the assumption of optimum allocation of productive factors within a postulated framework of economic practices.

Let us now consider the 'significance' of the explicit assumptions concerning economic practices made in the Brookings survey. Following the Brookings investigators, we may say that our

[1] See below, p. 307.

"capacity to produce" is equal to actual output plus the additional output that could be got through use of the idle plant. The former quantity can be ascertained more or less definitely. The latter quantity, as already stated, is estimated by assuming prevailing techniques, customs of operation, and seasonality, by making further allowance for more or less unavoidable interruptions, and by excluding the potential output of plants that are shut down. These assumptions seem excessively restrictive. They appear to doom in advance estimates of capacity, for all but declining industries, to the neighborhood of actual output; they therefore rule out what is most needed for a significant appraisal of America's capacity to produce. An instructive though somewhat extreme example is the treatment of the Southern branch of the cotton textile industry. The problem here is how to take account of the custom of multiple shift operation followed by some of the mills. The authors decide to take as their estimate the capacity "as it would be if spindles were always operated on as full a schedule as they have occasionally attained, and if the spindles idle even in these times of maximum activity were also operated on at least a single-shift basis" (pp. 199-200). This formula yields a ratio of utilization of 89.8 per cent for 1925-1929. Actually, the "times of maximum activity" are seasonal peaks and the spindles idle "in these times" are relatively few. Thus the seasonal factor accounts for the greater portion of the gap between 89.8 and 100. The circularity of the estimate of capacity is not obvious from the ratio put down for this industry, mainly because this happens to be an instance where the rule requiring adjustment for seasonality is not applied.

Another serious shortcoming of the assumptions that underlie the Brookings estimates is their lack of theoretical unity. These assumptions, as we have already shown, presuppose the price system as it now functions. On the other hand, the additional output that could be attained by putting the 'idle' capacity to work is, of necessity, estimated on the assumption that the present price system is suspended or materially modified. Once either assumption is made, it would seem that such price-conditioned factors as a large portion of seasonal variations, customs of operation, and so on should be reexamined in the same stroke. What is equally if not more important, the assumptions of the Brookings estimates are not fitted into an analytic framework of a functioning economic system, and therefore fail to indicate *how* the calculated slack of productive capacity could be taken up. In the absence of a plan for realizing what is set down as a potential increase of out-

put of 19 per cent in 1929, this figure has little meaning even if all other doubts are set aside. The final volume of the Brookings series supplies a corrective to *America's Capacity to Produce* by presenting a program for economic reconstruction; but as will presently be indicated this plan is incapable of closing the gap between actual output and "practical capacity" output.

II. The Estimates of Plant Capacity

The doubts aroused by the Brookings concept of productive capacity extend also to the multitude of decisions made in applying the concept statistically. At times these decisions violate the basic assumptions of the inquiry; at times they seem slipshod. All too frequently they are unexplained and even unstated.

We may illustrate by examining the manner in which the rule of scaling down estimates of theoretical capacity to take account of seasonality has been employed. (1) The adjustment factor applied to theoretical capacities is the crude ratio of the average monthly output to peak output. This method may result in serious error when the secular trend is steep. (2) Except for a few industries (high explosives and electric power production, and to a minor extent the meat packing, dairy, and automobile industries) no account is taken of intraindustrial differences. This makes the seasonal allowances too low whenever the seasonal patterns of different regions, of leading producers, or of leading products fail to synchronize perfectly. (3) Inadequate attention is given to the fact that seasonal variations are rarely constant for more than a few years.[2] For the bituminous coal and the meat-packing industries the seasonal factors are based on periods covering a quarter of a century. (4) Changes in seasonality are recognized in a few instances, but not in a manner consistent with the governing assumptions of the estimating procedure. The intensified seasonality of automobile production in recent years is classed as unnecessary and the seasonal correction is therefore worked out on the basis of 1923-1926. For a similar reason the seasonal allowance for anthracite coal is based on the period 1905-1914. The notion of "necessary seasonality" enters also into the analysis of the iron industry. All this is accomplished in the face of repeated stress that existing seasonality will be treated as a fact. (5) Little information is given on the seasonal allowances. The period on which the seasonal factor is based and its size can be made out for

[2] See Simon Kuznets, *Seasonal Variations in Industry and Trade* (National Bureau, 1933), Chap. XI.

only five of the twenty-nine manufacturing industries covered in the survey (meat packing, dairy, automobiles, black powder, and high explosives). In another four or five cases it is clear that a seasonal allowance has been made, but its magnitude is undiscoverable. In the remaining manufactures there are varying degrees of uncertainty whether any seasonal allowance has been made.

A similar list of criticisms might be drawn up with respect to each of the major rules of the Brookings procedure; but it would serve no good purpose. We may, however, take Table 1 as a rough measure of the workmanship that has gone into the study. This table relates to manufactures, which have "special importance for the hypothesis" of the study and for which, along with mining, "the most definite and satisfactory measurements" are claimed (pp. 162, 415). It will be noticed that in almost half of the cases the ratios of utilization set forth in the conclusions have no exact counterpart in the basic narrative or tables. The discrepancies may mean mainly that an incomplete account is given of the methods used; but they at least suggest the lighthearted manner in which many of the estimates are presented. Of course, disagreement does not necessarily mean that the method of estimating is poor. Neither does agreement prove that it is good; for example, the capacity of the machine tool industry is treated as constant during 1925-1930, without citing any evidence or authority in support of the estimate, and the ratio of utilization of 110 for 1929 raises further doubts.[3] Judging from the first column of the table, capacity data apparently are lacking for many industries for 1925-1929. Again, the fact that an estimate is somehow produced for each industry for this period is more conclusive with respect to the workmanship in general than the quality of any estimate in particular.

The entries in the first column of the table throw light also on what the Brookings investigators consider one of their outstanding results. Of the twenty-nine industries in the list only eight have data covering three decades and four of these fall in the iron and steel group. Clearly, this is a slender sample on which to base any definite conclusions concerning secular changes in the ratio of utilization of the manufacturing plant since 1900.[4] The sample

[3] A ratio in excess of 100 for a month or two may be easily explained, but not an average ratio of 110 for a year—particularly since the ratio is above 100 for ten consecutive months. See p. 586.

[4] This is recognized on page 297, but the note of caution is removed in the final conclusions on page 421. In later volumes, the absence of a secular trend in the degree of utilization of plant capacity in general is treated as an established fact.

TABLE 1

Data Bearing on Brookings Estimates of Capacity of American Manufactures[a]

Industry[b]	*Year when continuous data on capacity utilized begin*	*Percentage of "practical capacity" utilized in manufacturing industries during* 1925-1929: *According to basic chapters or appendix*	1925-1929: *According to chapter on "Conclusions on Manufacturing"*	1929: *According to basic chapters or appendix*	1929: *According to chapter on "Conclusions on Manufacturing"*
Meat packing	..	86	86	..	89
Dairy products	..	90–95	95	..	98
Fruit and vegetable canning	..	83–87[c]	80	83–87[c]	87
Beet sugar	1900	70	70	..	67
Flour milling	1900	44–46[d]	50	46–49[d]	53
Cotton manufactures	1900	80	80	83[e]	82
Wool manufactures	1921	..	70	..	69
Silk and rayon manufactures	1925	..	85	..	88
Full-fashioned hosiery	..	..	97	..	92
Men's clothing	..	..	78	..	76
Boot and shoe	..	80	80	..	80
Automobile	1910	83	83	85	85
Automobile tire	1921	85	85	76	76
Paper[f]	1899	92	92	92	92
Printing and publishing	..	90	90	..	92
Pig iron	1900	85	85	93	93
Steel	1900	93	93	..	100
Rolled (steel) products	1898	..	73	..	81
Tin plate	1899	68	68	74	74
Wire	1919	74	74	..	74
Locomotive	..	30	40	..	45
Textile machinery	..	55	55	..	58
Machine tool	1925	71	71	110	110
Lumber	..	..	72	72	72
Window glass	..	62	62	52	52
Plate glass	..	85	85	93	93
Black powder	1917	53	53	51	51
High explosives	1917	80	80	81	81
Chlorine and allied products	..	..	75	90	90

a The dots in the second and fourth columns mean that no figure is specified. In the few cases where no figure was given but one could be derived from data presented, an entry has been made. The dots in the first column mean absence of continuous data. The term "continuous data" is interpreted liberally. For example, there is an entry for rolled steel products, though there are only six unevenly spaced figures in a period of thirty-two years.

b The industrial designations are as given in the chapter on "Conclusions on Manufacturing." The only important conflict between these headings and the basic narrative is in men's clothing. The text discussion covers both men's and women's clothing.

c Derived from the statement that "the canning industry as a whole was equipped at the close of the 1920's to handle some 15 or 20 per cent of additional output" (p. 185).

d Derived from statements that rated capacity utilized was 41.4 per cent in 1925-1929 and 44.1 per cent in 1929, and that rated capacities should be reduced by "some 5 to 10 per cent . . . to keep the estimates in line with our criterion of practical operating conditions" (pp. 187, 193, 572).

e Derived by reducing the computed ratio of utilization of spindle capacity by 2.3 per cent, this being the reduction factor applied to the ratio for 1925-1929 (pp. 200, 204, 575).

f Judging from page 239, it seems that the figures should be 94 instead of 92.

for industrial divisions other than manufactures is better in some cases but worse in others, so that the table is fairly representative of the industrial field as a whole. It thus appears that the conclusion that there has been no secular change in "excess capacity," one of the most important in the book, is inadequately grounded in actual statistics. We shall find that this conclusion plays a major role in the later analysis.

The examples we have presented show that the statistical work of *America's Capacity to Produce* falls short of expectations, and that the conclusions both for all industry and for individual industries must be used with the greatest caution even by those who are ready to accept the conceptual framework of the study. However, it is only fair to bear in mind that the measurement of capacity is an undeveloped statistical field. Bold estimating at critical points is often necessary and this naturally breeds carelessness on matters of detail. Also, divided authorship, while probably unavoidable in a large undertaking carried through in short time, does not promote consistency. It is a pleasure to add that the statistical work of Dr. F. G. Tryon on mineral industries and electric power production is on the whole an excellent piece of craftsmanship.

III. The Estimates of Labor Capacity

The estimates of labor capacity are restricted to 1929 and play a subsidiary role in the Brookings calculations. But some account of them is essential, since they constitute a vital check on the estimate of the additional output that could be gotten in that year by putting idle plant capacity to work.

The conclusion is that with some redistribution of the labor force the available labor power would have proved just sufficient to man fully the available plant in 1929. This conclusion is based on the following statistical argument. By increasing the labor force of mines 6 per cent and of manufactures 12 per cent,[5] the output of each could be increased by about 20 per cent. Mines would need to draw upon other industries for 20,000 laborers and manufactures would require 1,000,000 additional laborers. They would come mainly from agriculture and trade. Agriculture could relinquish 500,000 workers and at the same time increase output

[5] We get this figure by (a) increasing the estimated number of laborers attached to manufactures by 1 million, the figure suggested; (b) multiplying (a) by 0.965, as the authors do, to allow for illness and job changing; (c) expressing (b) as a percentage of the average number of workers employed in 1929. See pp. 512-518.

by 10 per cent. The merchandising trades could release 200,000 workers and still accommodate the increased output of industry. Other industrial divisions, after stepping up operations and reemploying labor attached to them, would have a surplus of 305,000 workers, which is only 15,000 short of the remaining requirement of 320,000.

This balance is as fragile as it is neat. The estimates are not built up by individual trades or types of skill, but are made in broad strokes for major industrial divisions. Little or no evidence is cited in support of the estimated number of laborers that the various industries could release. The arithmetic assumes both technical and geographic mobility for over a million men, but no indication is given either in *America's Capacity to Produce*[6] or in later volumes of how this mobility would be effected. Nor is provision made in the labor accounts of the construction industry for the new demand for housing that would accompany a redistribution of the population. In estimating the labor requirements of mining and construction, allowance is made for seasonal variations, but not so in the case of manufactures. No explanation is given of the different rates of increase of labor which it is said would be required to effect an equal increase in the output of mines and manufactures. Further, with due recognition of the relative fixity of the salaried force, the output per worker would be more likely to diminish than to increase as output approached "practical capacity" in these industries, because of the use of poorer grades of equipment and labor, increased militancy and mobility of labor, and relaxed supervision. It seems that agriculture and merchandising are invidiously singled out with respect to ineffectiveness of labor—inadequate application in the former, both that and unfruitful application in the latter. Finally, the change in industrial practices called for in agriculture and merchandising seems to contradict the basic assumption of prevailing techniques. These several factors suffice to indicate that the data on labor power provide no real confirmation of the estimate of the extra output to be gotten by eliminating plant idleness.

IV. The Potential Increase of Output in 1929

Putting aside the statistical defects of the estimates of plant and labor capacity, we must still face the fundamental question of how the potential increase of output of 19 per cent in 1929 could have

[6] At one point (p. 395) it is stated that this problem "must be dealt with in the fourth volume"; but it is not considered in the fourth volume.

been harnessed. There is nothing definite on this point in *America's Capacity to Produce*. We are offered just two clues to the business of reform. The first is in the Foreword, where the promise is more or less clearly given that "only evolutionary modifications and readjustments" (p. 2) will be considered. The second comes in the final chapter and is somewhat bolder. Here the authors rightly note that it is not "realistic" to assume a rise of ratios of utilization in all industries to 100 per cent, since this would lead to "piling up huge stocks of certain types of goods" (p. 417). They claim that this factor calls for a reduction of the preliminary estimate of the potential increase of output, as does the obsoleteness of much unused equipment and also the inevitability of inter-industrial dislocations. But the correction required is slight—from 25 to 19 per cent. For, while the "present unutilized capacities are not coordinated in such a way as to make possible anything like full utilization of the existing slack, the most serious limiting factors could promptly be removed" through "the direction of new productive effort towards coordinating the various industries and leveling up those which threatened to become limiting factors" (pp. 417-418).[7]

The notion of centralized control so vigorously suggested by these observations is abandoned in later volumes. The promise of the Foreword, on the other hand, is fulfilled in the final volume. The principal idea there advanced is that "the broad highway along which continued economic progress must be sought is the avenue of price reductions."[8] By passing on to consumers the benefits of technical progress, the buying power of the masses will be stimulated, profits will be maintained if not enhanced, and the motive force to fuller utilization of our productive resources and to accelerated growth of these resources will be supplied. The appropriateness of this proposal to our basic economic difficulty, as the Brookings Institution has diagnosed it, is a question best deferred to a later point. Our present problem is simply whether the proposal supports the estimate of potential increase of output in 1929; that is to say, whether intensified competition could have closed the gap in the late twenties between actual output and "practical capacity" output.

Perhaps the simplest way to approach this question is to set

[7] As already stated, these interesting dicta are at variance with the basic assumptions of the estimate which they purport to correct; also, the correction is entirely arbitrary. See above, p. 300.

[8] H. G. Moulton, *Income and Economic Progress*, p. 126.

down some of the ways in which our economy with intensified competition would *not* have differed from the actual system we had (and have). Two considerations are here of chief importance. In the first place, an appreciable portion of the slack in productive capacity in 1929, as measured in the Brookings study, is properly attributable to the cyclical factor. While a cyclical peak was reached in 1929, business was not uniform through the year. The average level of the Federal Reserve Board's seasonally adjusted index of industrial production in 1929 is only 95 per cent of the level reached in June. Since a boom culminates at different times in different industries, it is conservative to say that cyclical forces alone kept output for the year at least 5 per cent below capacity. Presumably, business cycles would exist under the new scheme no less than under the old.

In the second place, slow adjustment in the supply of productive capacity to the demand for its use would continue, quite apart from the cyclical factor, to make for idleness of industrial plant. Oil refineries would still find at times that cracking equipment is insufficient to permit continuous operation of stills, natural gasoline plants that their supply of natural gas has disappeared, and beet sugar mills that crops are short. New coal mines would still be opened in the face of "excess capacity," electric power plants built in anticipation of growth, cotton mills built in new areas because of the recalcitrance of labor, and flour mills because of changes in freight and custom tariffs. The beehive coke industry would continue on its career of decadence with large excess capacity, and factories everywhere would still find that some obsolete equipment does not repay use.[9] Partial idleness of industrial plant is inevitable in a dynamic economy and is to some extent a condition of industrial growth.

In the short run an increase in the purchasing capacity of the masses would probably increase the rate of use of plant capacity. But there is little reason to believe that a program of price reductions, whatever its effect on the relative income of the masses, would of itself lead over a period of years to a substantially closer adjustment of plant capacity to the purchases by households and industry than what we had during the twenties.

[9] The factor of "frictions" is summarily dismissed in *Income and Economic Progress* (p. 35), but at the cost of misrepresenting the nature of the calculations in *America's Capacity to Produce*. It may also be noted that practically all the illustrations given above are based upon the latter book and that any number of additional instances are there given. These data merited some attention in the final volume.