THE ACCOUNTS AND THE COMPUTER

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(1) The primary contribution from the computer's application to the national accounts may well be to erode the line between micro and macro analysis. Key macro totals in the accounts sum individual company reports. The computer permits us to develop distributions of these reports. Such distributions, regularly presented, would permit discovery of the first forerunners of change, would help distinguish, e.g., widespread strength in an export drive or a profits surge, from participation by a few major concerns that dominate the aggregate.

(2) The strikingly different parameters in cross section and time series studies (e.g., price elasticity of housing) will in some measure reflect incomparability between the micro data that enter into each. The computer makes possible the use of the wide array of micro data that really underly the accounts to develop consistent analyses of time series (of both aggregates and distributions) and cross section analyses.

(3) The inconsistencies now imbedded in the accounts but gilded over by the abilities of the estimators are well-known. Discussions of wage price policy rest on data for wages that have no necessary compatibility with data on profits, etc. But since 1,500 corporations account for at least half of U.S. net income, sales, and investment, the computer can test the consistency of reports made by different units in these firms to different agencies—a process totally out of the question before the computer.

(4) The potential that the computer offers for prompt revisions in the accounts; for revisions by systematic rule; for tests of sensitivity of the entire set of accounts to particular tailor-made adjustments, is clear.

(5) Company purchase orders and accounts are increasingly recorded on cards or tapes. From these we may derive input-output detail and process detail that are light years better than those now feasible from intermittent survey aggregates.

We begin from a simple premise—most economic analysts will actually take little interest in national accounts data. Newspaper columnists express such interest, and politicians—perhaps because they can always count on finding an unprecedentedly large figure to quote, say for GNP this year. But the economists who work with the accounts are not truly interested in the data: their concern is with the economy behind the figures.

The advent of the computer—a term we shall use as shorthand for electronic data processing in general—makes it possible to reconsider how the accounts may be better adapted to serve this underlying concern.[1] Five areas of change may be suggested, of which the first may prove the most important.

1. The potentialities of electronic data processing were emphasized perceptively, if briefly, in a report by a committee headed by Raymond Goldsmith, for the National Bureau of Economic Research, *National Economic Accounts of the United States* (1957) Ch. XV.

1.

In recent years economists have developed a clearer and clearer line between two portions of their discipline—macro analysis (using the national accounts to analyse aggregative activity) and micro analysis (in which other tools are used to study the firm and the household). This distinction is sensible, useful —and specious. We know that no sharp analytic distinction can be made: the "economy as a whole" exists only as the summation of activities by the micro units. The national accounts can therefore tell us nothing about economic activity not drawn from the data that report the actions of micro units—households, businesses, co-operatives, governmental units.

We cannot presume that an interest in macro activity differs from one in micro analysis because only the former concerns itself with the interrelations and interactions among the micro units. Key advances in the study of consumer behavior in recent years, for example, have been made by recognizing that the saving and spending patterns of particular families are roundly affected by the behavior and standards of other families. (That advertisers and philosophers had long since been afforded such insights is surely beside the point.) And with the flowering of theories of imperfect competition, and bargaining, traditional emphasis on such interrelations has, if anything, intensified. Planning financial portfolio shifts, scheduling new real investment, making decisions on shift working, new hires and overtime work, pricing policy—these all require the firm to assess appropriate behavior by anticipating the behavior (or probability distribution of behavior) of its competitors.

All of this amounts to saying that both micro- and macro-analysis really demand data for the micro units.[2] For both concern themselves with the decisions and evident actions by these units, as with the interactions that affect these decisions and flow from these actions. The coming of the computer makes it possible to work with the micro data in a variety of ways.[3] The enormous ingenuity of national accounts analysts in the past suggests that they can readily rise to this new challenge, and thereby make sets of accounts that will be even more useful than the present ones.

To see what advances might be possible let us consider two major uses of the accounts: forecasting short-term business changes and analyzing the structure of the economy.

A. In every developed country, as in every nation with central planning, the accounts are liberally used to analyze the current and prospective state of the economy. Take, for example, the annual report of the U. S. Council of Economic Advisers. That report would become meager and inadequate if one were to cut from it all references to data in the national accounts, all judgments that rest directly on such data.

2. How they are to be summarized will depend on the particular question under study, and not automatically on the simple distinction between understanding the course of the economy or the experience of individual economic units.

3. Cf. Guy Orcutt, "Microanalytic Models of the United States Economy", *American Economic Review* (May 1962); Richard and Nancy Ruggles, Price-Cost Behavior of Manufacturing Establishments (March 1965 draft paper).

But typically these accounts provide a battery of heavily summarized and averaged data, aggregated in a particular way. If we use them, we must view the activities of the micro units through this particular veil of aggregation. The resultant insights can be quite minimal. The U. S. national income accounts, for example, provide an unusually rich and consistent array of data. But if we wish to analyze the change of investment in producers' durable equipment, say, from the last quarter of 1964 to the first quarter of 1965, they provide only two direct figures—one for current dollar change, and one in constant dollars.

Surely this is minimum information on so complex a phenomenon. Here are thousands of firms, responding in their several ways to their capacity, costs, and anticipations, operating in tens of thousands of markets, with widely differing results—and all we relay of this activity in the accounts is a mere total for their aggregate investment. The rate of change in investment must surely have varied among the thousands of firms involved: they could not all have changed at the average rate. Some decreased their investment. Some increased it. Some increased at a greater rate than others. And the variation among them must have been related to variations in the conditions confronting them as well as their preferred modes of adjustment.

In micro analysis we attend to these differences, seek to understand them. Why should such analysis be worlds apart from what the accounts tell us? Surely not because macro analysis spurns such data and insights, nor because the competent agencies are indifferent to such potential—but largely because it has been considered impossible to cope with so vast an array of detail. In consequence the analyst of current economic conditions (as the government agencies, politicians and businessmen whom he seeks to inform) have been denied information of great potential value.

The computer, however, permits us to cease bowing down before the huge image of the weighted sum. We need no longer devote all our attention to point estimates, thereby ignoring the full distributions. The computer can conveniently provide us with a vast variety of distributional information, offering to us a deeper understanding of current change. Thus, for example, search programs can instruct the computer:

(a) To locate for our attention the first forerunners of change—within an industry, within asset size groups, within the economy as a whole.

(b) To compute what proportion of firms increase their investment (their employment, sales, etc.) by what percentages.

(c) To provide distributions of firms (or establishments of reporting units by deciles, ranking by amount (e.g., dollar volume of sales) or amount of change (e.g., profits).

As one suggestion of how such data might be presented, Table 1 outlines some tabulations for U. S. investment in 1960. Aggregate expenditure on producers' durable equipment reveals no clearly discernible trend from the first to third quarter. Had the underlying data by firm been consulted, however, perhaps a more regular and persistent pattern might have been discerned.

For construction activity a distribution of contractors by change in the value of construction activity could be similarly informative. (Since the U. S.

derives its activity totals from reports on construction starts for individual localities the table stub suggests a distribution by localities.)

One final example. If one sought to go behind changes in the foreign balance, to learn why the export drive was successful this quarter (or not) it would surely be relevant to learn whether the result reflected (1) successfully trading by a few large firms, or (2) widespread strength, continuing from previous quarters. The distributional detail could inform us, whereas the simple aggregates give us only a dusty answer on this point.

TABLE 1

	1960			
	I	II	III	IV
A. Gross private domestic investment				
Producers durable equipment	$22.5	$23.2	$22.8	$22.1
Number of firms				
Total	100.0	100.0	100.0	100.0
Increasing PDE				
over 10%	10.2	8.4	7.1	6.0
5–9.99%	8.0	8.5	6.9	6.5
0–4.99%				
Decreasing PDE				
.1–4.99%				
5–9.99%				
over 10%				
B. Residential construction (nonfarm)	$18.7	$18.3	$18.1	$17.8
Number of areas				
Total				
Increasing construction				
over 10%				
5–9.99%				
0–4.99%				
Decreasing construction				
C. Net exports	$ .3	$ 1.1	$ 2.0	$ 3.4
Exports	$23.9	$25.0	$25.2	$25.6
Imports	$23.6	$23.9	$23.2	$22.2
Number of firms				
Total	100.0	100.0	100.0	100.0
Increasing exports	15.3	20.2	19.0	21.3
over 5%				
2–4.99%				
Decreasing exports				

B. A second major use of the accounts is to cast light on the basic structure of the economy. They are obviously valued for developing demand functions—demand for plant and equipment, consumer goods and services (total and by category), savings functions for individuals, assets by type, etc. The accounts are also required for establishing the determinants of productivity change, shifts in production functions, models of wage and price movements.

In recent years work in these fields has tended to focus either on the use of

cross section or of time series data. Some distinguished attempts have, of course, been made, to combine functions derived from one approach with the other,[4] but not always with encouraging results. It is a safe surmise that some non-trivial portion of these results arises from other than conceptual differences. Cross-section relationships do, of course, tend to measure long-term structural differentials to a greater extent than do the monthly and annual series in the accounts. Different patterns of aggregation report different realities. But more than once a look at the coefficients derived from these alternative approaches makes one wonder how much the reported differences in parameters only reflect differences in source. This is not the context in which to enter into a discussion of how widely apart the data can be. It may be sufficient to note that (to my knowledge) the U. S. national income accounts make only the most peripheral use of that immense set of consumer expenditure and savings studies that have been conducted for so many years at such considerable expense,[5] not because the hard-pressed estimators willingly pass up any body of data, but because there is no sure way of knowing whether data from that source are properly additive to those from other sources. (There is—I would add—some basis for believing that they are seriously non-comparable.)

As another indication one might note the sharp inconsistency between elasticities estimated from different sources. The extensive work by Stone, Wold and Jureen, Tobin, Fox and others is well-known, and has provided us with contrasts for food. A fairly recent study of the price elasticity of the demand for housing in the U. S. confronted figures of 1.0 (and greater) from national accounts time series data with one of .08 (based on budget data).[6] This incredible range may testify merely to a difference in theory underlying the alternative models. But it may not. Are any of us in a position to say that differences in measurement do not contribute decisively? Aggregation may distort the measures we seek—or it may improve them, depending on the statistical properties of the phenomena involved. If given merely the time series summaries embodied the usual accounts presentation the analyst has no choice as to aggregation procedures. He must resort to complex statistical procedures—none of them really decisive—to surmise what aggregation has done to the micro data. A recent shrewd study by Kuh, on determinants of business investment, suggests the enormous advantage of having micro data which the analyst is free to aggregate—so that he can work with the data at both levels.[7] Kuh worked with a sample of 60 firms, a large group for an individual investigator who must develop his own data. But the national accounts for many nations in fact rest on reports for hundreds or thousands of firms. Given the existence of the computer it now becomes possible for the national income accountant to provide the analyst with both time series in the accounts and the underlying micro reports

4. Besides the classic work by Stone one could refer to early work by Marschak, more recent studies by Klein, Kuh, Mundlak.

5. Chiefly for a few items in the service area.

6. Richard Muth, "The Demand for Non-Farm Housing" in Arnold Harberger, Ed., *The Demand for Durable Goods* (1960), pp. 31–72.

7. Edwin Kuh, *Capital Stock Growth: A Micro-Econometric Approach* (1963) Chs. 6, 7.

that were aggregated to give those series. The possibilities for deeper analysis should increase enormously.

Until now it was inconceivable that one could provide national accounts with reasonable expedition and also incorporate the results of reports for individual consuming units as such. But in many nations the computer is already summarizing data usable for such purposes with far greater speed than required for incorporation in the accounts. In the United States, for example, monthly data on the employment status and family characteristics for a representative sample of families are summarized by the middle of the next month. It would be a simple extension to secure data on housing status regularly from the same families—so that the time series in the national accounts would be created as successive summaries of cross-section data.[8] In that event these data could be analyzed cleanly, without data incomparabilities masquerading as conceptual differences between short-run and long-run functions. (Additional advantages might accrue. Thus the analyst may well be interested in the consumer demand for housing rather than construction. At present our time series must ignore variation in construction inventory. Direct consumer reporting would facilitate treating residential construction in the accounts as we treat expenditures for other investment items—net of inventory change.)

2. Data Consistency: Balancing the Accounts

We have grown so accustomed to the face of the accounts over the years that we have come to overlook one of its harsh imperfections. I am referring to that inconsistency between the various sources of underlying data with which those who put together the national income accounts must now grapple. The basic reports on sales are not necessarily consistent with those on employment. Nor those on profits with those on investment, those on inventory investment with those in plant and equipment investment—and neither with reports for investment in intangibles. I need not labor the point that major economic policy choices today assume—must assume—a consistency in the underlying data. Where is the profound discussion of wage-price guideposts, incomes policy, or productivity trends that does not implicitly relate to the real world via a morass of relationships based on data from different sources—wages to price, employment to production, etc. Hence our policy choices rest upon (a) inaudible prayers that the law of large numbers is mighty and will prevail—even where small numbers are involved—plus (b) hunches that in any case the national income statistician will adjust his data so they look as though the law prevailed.

Until recently, there was no exit. Either one accepted these inconsistencies and spent much time gilding them over, or one thought wistfully of a single broad survey or interrelated set of consistent surveys. Since it is easier to reconcile

8. A proposal to secure a good deal more information on consumer expenditures from the same survey is outlined in the writer's "Measurement for Economic Models", *Journal of the American Statistical Association* (June 1954). However, which of the items to be so collected would have higher validity than institutional and enterprise sources for preparing the accounts would depend, naturally, on the solidity of these alternative sources in particular countries.

statistics than persons, the national income accountant inevitably settled for the former solution. Today, however, a tertium quid is conceivable. It derives from two considerations.

(1) The typical electronic computer has a deep memory and vast ability to compare numbers and proportions.

(2) In most industrialized countries as in most socialized ones, the central economic decisions are concentrated in a tiny percentage of all economic units. To take a single instance, the United States today has something like 8 million private businesses, governmental units, not-profit organizations. Of the 7½ million private businesses, far less than one-hundredth of one percent (1,275 corporations) account for—

⅔ of all business receipts (i.e., sales plus other income),
½ of net income
and presumably well above a third of all assets[9]

A single Federal Agency plus, say, 50 other governmental units encompass the bulk of public expenditure. Some 1500 units, therefore, would account for an enormous chunk of most flow and stock items that appear in the national economic accounts.[10]

Given the computer one can now reasonably think of testing both the consistency and adequacy of the current reports from these 1500 units. The adequacy of their reports will dominate or decide the movement of many series. But although our major firms inevitably report in nearly all surveys, there is no reason to assume a consistency among their reports. One agency will ask a firm to report its profits inclusive of those on foreign investment. Meanwhile the firm reports on new investment, to another agency, excluding foreign investments. Reporting on employment to one agency the firm will exclude subsidiary activities—e.g., real estate ownership or central offices—but when reporting on sales to another it will be asked to include them. To the extent that reports are prepared by different units in large organizations (or different persons in small ones) they may be additionally inconsistent—relating to differing periods, varying scope—and none the wiser.

The more closely the reports are understood and compared, and the higher their quality, the more the quality and contribution of the accounts can be advanced. The computer could assist in a variety of ways.

1. It can prepare a combined report for every individual company by collating the returns now made to separate government agencies—an employment report to one, a profits report to another, sales to a third, balance sheet data to a fourth, etc.[11]

2. It can readily print out two copies of each such collated report; automatically mail one to the company for its review, and leave the other for inspection by the national income analyst.

9. U. S. Internal Revenue Service, *U. S. Business Tax Returns, 1959–60*, pp. 18 and 46; and *Corporation Income Tax Returns, 1959–60*, p. 67.

10. Even where existing procedures rely on different reporting systems—e.g., exports, prices—the activity is nonetheless so concentrated.

11. In the U. S. these firms would all have unique identification numbers as a result of the social security and income tax programs.

3. It can test the reasonableness of the data for each company—printing out ratios that test for internal inconsistency (e.g., is the payroll per employee reasonable? Is the profits-sales ratio extreme?); or consistency with the all-industry average in the same period; or relationship to the firm's data for prior periods.

4. It can be programmed to print out only the exceptions. Thus it would print out only returns for companies where at least one figure fell outside what the income analyst had defined as acceptable control limits, the print-out marking precisely which figures were in question.

What follows?

(1) A large part of the analyst's job in balancing the accounts consists in tacitly adjusting for such inconsistencies, often at the price of a day of reckoning when benchmark data become available.

(2) The machine permits him to remedy inconsistencies at the micro level, and by systematic machine adjustment programs, if he so chooses.

One may surmise that if the computer began to tell him that many substantial adjustments were required each month the usual accounts unit would discover it intolerable to do explicitly what is now done implicitly. One would then expect some additional step—such as direct reporting to the central economic statistics agency by those 1500 units, or greater integration of statistical surveys, or some tertium quid.[12] The use of the computer, however, would add significantly to our information—surely a contribution to advancing the accounts even if no immediate steps were taken to correct the underlying difficulties.

3. Linking National Accounts and Economic Indicators

Economists and administrators of the most varied persuasion rely on "economic indicator" series, as well as the national accounts, for analyzing current economic conditions. The frequency with which indicators are consulted by responsible analysts suggests that they are of true value. But today these series exist quite apart from the accounts—alone and in a world the national income specialists surely never made. Is there any strong reason why they should continue to exist so splendidly isolated from the accounts? Surely the gap between these systems is inconvenient to the users—and possibly detrimental, because of hidden contradictions between the data presented in each. The computer could assist in bringing them more closely together.

Let us consider one of these indicators—the series on business failures. This series derives from reports for individual firms. But the national accounts data on business profits also take their origin in reports for individual firms. Why not expand the accounts, provide for a distribution of firms by rates of profit on sales? Table 2 suggests a simple format: firms with high rates appear at one end

12. The discussion has been put in terms that apply to any nation that derives accounts from varied survey sources. For the U. S., however, one specific possibility arises that would permit far greater consistency of annual data, via the personal and corporate tax returns. This is discussed in the writer's "Statistics, EDP, and the Tax Administrator" in the *National Tax Journal* (September 1961).

of the distribution, actual failures appear at the other. Instead of the usual pair of simple (and noncomparable) aggregates—a total for profits, a count of failures—an array of comparable data could show the continuum in between. (Incidentally such an array would also provide a far richer set of measures than another indicator series—rate of profits on sales for all firms.) Prior to the computer any such presentation would have been terribly difficult to achieve with any promptness. But it could now be readily and regularly prepared in more than one country.[13]

TABLE 2

	1960			
	I	II	III	IV
Corporate profits before tax	$48.5	$45.4	$42.1	$41.1
Firms by rate of profit per $ sales				
Total Number	100.0	100.0	100.0	100.0
Over 15%	10.2	5.1	4.3	6.0
12–14.9%				
"				
"				
"				
"				
"				
Loss				
Failures				
Change in nonfarm business inventories	$ 8.0	$ 3.9	$ 2.6	$ 1.9
Firms by quarterly change in inventories				
Total Number	100.0	100.0	100.0	100.0
Rise: over 10%	7.0	2.0	1.8	1.9
5–99.9%				
"				
"				
"				
"				
"				
Decline: 0–4.9%				

Or consider another indicator—the change in busines inventories. Instead of relying on the exiguous information available in that simple total we could look to the accounts to provide a distribution of the percentage changes in inventories by firm.[14]

We need not conclude that all economic indicators could necessarily be fitted into a reasonable framework for the accounts. But assuming that both the accounts and the indicators are utilized for similar purposes, we should utilize the computer to integrate them for the benefit of economists who regularly use both.

13. In the U.S. today such a presentation could be made quarterly only for manufacturing corporations. But a far wider universe could be represented annually.

14. The series would be totally useless until some time has elapsed, but then become of real substance. The problem, of course, is the same as the limited usefulness of a figure for GNP for a single year.

4. Data Revision and Adjustment

Probably too little technological unemployment has occurred in national accounts work. Many more analysts should be displaced—so that they can turn their talents from the essential but duller work now required of them to the more challenging work of improving the structure of the accounts and themselves doing more analyses of their findings. Let us consider two classes of revision and adjustment that now occupy much time of expert specialists in national accounts organizations.

A. At intervals benchmark data become available. The accounts must then be adjusted to these new levels. Sometimes the work of revision is so enormous that it is nearly impossible to carry through these labors. Key revisions are put off until a later day, to be made when other benchmark adjustments are completed. (Meanwhile, needless to say, users of the data are working with less satisfactory materials than could exist.) But let us ignore such delays. The work of revision is often appalling in its magnitude: in an interlocking set of accounts virtually every figure ought to be re-examined. If the accounts encompass flow-of-funds and input-output relationships as well, the task increases exponentially.

The computer provides a light in the forest here, for electronic equipment has a positive penchant for adjusting several hundred thousand numbers in the accounts up or down by varying amounts—for doing so without arithmetic error, for providing summations and checks at every stage in the process. For the computer to do so the analyst must write a program for such revision. There lies the rub, of course. In doing so he must make manifest those rules of thumb, implicit constraints, acceptable ratios that he now uses for adjusting the accounts. If one of his constraints reads: "revised series A may not increase by more than 3% in any year," then that constraint must be written down. If another reads "revised series B may not increase at a greater rate than revised series C in any given year," that must be written down. If a third is that the ratio of series A to C in any given year may not exceed x%, then that too must be written down.

The analyst will surely be appalled at the task of writing down this minimization problem, with its battery of constraints. But doing so has several advantages. First of all his procedures become available for review by his co-workers—if they are not already so—and perhaps thereby improved. What every user really believes himself to be using are the economic accounts of the nation—not Dr. JB's accounts, computed by undescribed procedures, and changing when Dr. JB leaves the accounts unit. Secondly, the process of writing down makes explicit many adjustment procedures that are now implicitly hidden in other adjustments—and thereby opens them both to his evaluation and that of his co-workers. Thirdly, the computer's aptness for simulation models makes it possible to carry through the consequences of each adjustment procedure (or group of them) to see just how the final set of accounts will look as a result. At present we know only the net result of applying hundreds of adjustment factors *en bloc*. Fourth, the computer will carry through the adjustments without clerical error, and readily compare totals and subtotals, to establish whether the balancing of accounts comes to within any specified sum.

The major consequence, however, is that the analyst can devote the larger portion of his time to a far more demanding task than carrying through the mechanics of revision. For given the computer runs that report the results of following through on his usual rule of thumb he must then decide how satisfactory the results are. If they are weak in some respect the computer can take a new program, in which he modifies one or two ratios, then run through the entire set of adjustments and show him what the revised rules now produce.

B. A quite different class of adjustment is that from one national pattern of accounts into another—say the SNA. One troublesome aspect of the adjustment, though hardly the greatest, is simply the creation of equivalence insofar as a rearrangement of data already estimated is requisite. However, once a conversion program has been written, it is possible to provide the SNA form of the national accounts once a day if need be.

5. Detail For Input-Output, Flow of Funds

There may exist some fortunate isle whose numerous felicities include just the array of data its national income accountants need for preparing input-output tables. If so it is doubtful whether many of the members of this conference have visited there. The computer, however, gives promise, without assurance, of substituting for it.

Let us take as one example the detail on government purchases. In many nations today purchases by or for the central government account for a significant share of total production. But in how many does the national accounts unit have adequate detail on these purchases? For the United States we have had some kind of control information that provides us with such detail for 1929, 1947, and 1958.[15]

But the impact and variability of government purchases from year to year is wide. Fairly full detail on its purchases by product or industry is requisite—for current economic analysis as well as for a reliable input-output matrix. One solution, however, is ready to hand.[16]

Every acquisition of goods by government usually involves a procurement order specifying the item, and the source—plus a measure of units or values. In the U. S. many of these orders are already coded (and an adequate sample of future orders could be coded) according to a standard government catalog of items. After the purchase is delivered the check in payment indicates the time when the item is destined to be reported as a government purchase. Suppose that the check also carried the item code over from the original purchase order?[17] We should then have detailed information on products purchased by the government, their valuation and the time of purchase. Such data would permit more useful

15. A distribution of manufacturers' sales by type of purchaser was included in the Censuses of these dates. Even such information is hardly equivalent to a full distribution of central government purchases of goods, much less of all goods and services.

16. Ready—without any implication that the administrative difficulties may not be significant.

17. I owe this suggestion to Samuel Elson, formerly of the U.S. Treasury.

current accounts, would provide sufficient detail for input-output.[18] (If the purchase orders were recorded on one tape and the payment checks on another, machine comparison of the tapes could associate the item code from one with the purchase value from the other.)

A second example can be even more speculative. The extension of input-output tables to encompass measures by process has been discussed for some time. Throughout industry today machine programs are already operating machine tools, controlling process operations in a range of production from coal mining and electric power generation to baking. (General Electric, having spent $46,000 on numerical control equipment in 1955, was spending $3.5 million in 1963, was "beginning to question why any machine tool we buy is not numerically controlled."[19] The tapes that control and record the output of these tools and production units provide precisely the kind of detail that would be incorporated into an extension of the usual input-output tables to encompass production by process.[20]

The anonymity of the machine tape would permit similar cumulations for ownership of cash balances, stocks and bonds without disclosure of confidential information.[21]

The speculations described above range from ones that are nearly embodied in some systems of accounts to others not likely to be adopted within this century. But one may hope that the potential offered by the computer is increasingly exploited. For that potential includes an opportunity for reorienting significant portions of economics almost as much as was done by the florescence of national income accounting in the 1930's and 1940's. And not less interesting is the opportunity it offers to simplify and ease some of the most onerous tasks now done by those who bear the heat of the day in the actual preparation of national economic accounts.

1) La contribution principale de l'application du calculateur éléctronique aux comptes nationaux pourra bien être l'érosion de la ligne entre le micro- et le macro-analyse. Les macromontants dans les comptes récapitulent les rapports de chaque société commerciale. Le calculateur permet le développement de la répartition de ces rapports. De telles répartitions, si on les présentait avec regularité, permettraient une indication des premiers avant-coureurs du changement, aideraient distinguer, par exemple, les forces générales dans une campagne d'exportation, ou dans une augmentation de bénéfices, de la participation de quelques sociétés majeures qui dominent l'ensemble.

18. This need not be done for all checks. Sampling would suffice for the statistical needs—with a certainty stratum for orders above a given sum, or for given products.

19. H. B. Miller, GE Vice-President, Manufacturing Services, "Programmed Cost Improvement", Institute of Industrial Engineers, September 1963.

20. We are not referring here to any symmetrical extension for all products and processes, but rather to a beginning for those of major analytic interest.

21. The laborious task would be one of persuading financial agencies to classify holders of accounts. However, there would be no necessity for such classification to appear on their checks in order to tabulate flows and balances. A to-whom from-whom classification would be quite another matter, of course.

2) Les paramètres, différents de manière frappante, dans des études par profil transversal ou par des examens en série (par exemple l'elasticité dans les prix du logement) réfléteront la proportion de dissimilitude entre les micro-données qui participent à chacun. Le calculateur rend possible l'emploi de la quantité considérable de micro-données qui sont la vraie base des comptes pour développer des analyses logiques d'études par examen sérial (d'assemblages aussi bien que de répartitions) et par profils transversaux.

3) Les inconséquences enrobées maintenant dans les comptes mais passées dessus par les estimateurs sont notoires. Les discussions sur la politique des salaires de basent sur des données de salaire qui n'ont aucun rapport nécessaire avec celles des bénéfices, etc. Cependant puisque quelque 1500 corporations sont responsables pour au moins la moitié du revenu net, des ventes et des mises de fonds, le calculateur peut mettre à l'épreuve la logique des rapports que présentent les succursales diverses de ces sociétés aux agences différentes—un procédé qui était absolument impossible avant le calculateur.

4) Le potentiel du calculateur pour faire des révisions promptes des rapports; pour des révisions par méthode systématique; pour des épreuves de la sensibilité d'un ensemble de comptes aux alignements individuels et sur-mesure, est evident.

5) On enrégistre les commandes d'achats et les comptes d'une société de plus en plus sur des cartes ou des rubans magnétiques. Par ce moyen on peut dériver les détails des consommations des différents autres produits nécessaires à la production d'un certain produit par rapport à ceux du rendement, les détails du procéde, qui sont de loin meilleurs que ceux qui sont faisables maintenant par l'étude intermittent des assemblages.