MICROBUSINESS ACCOUNTING AND MACROECONOMIC ACCOUNTING: THE LIMITS TO CONSISTENCY*

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The paper is concerned with analyzing the consistency problem that arises when the macroenterprise sector of a nation's accounting system is put on a microdata foundation. This foundation is composed of sets of microbusiness accounts, after some appropriate rearrangements and reclassifications. We pose the question: can the macroenterprise sector accounts be regarded as a consolidation of (observed) microbusiness accounts? The answer is positive from a purely conceptual viewpoint, but negative from a statistical viewpoint which preserves the decision-making records of microbusiness units. The latter phenomenon is referred to as the limits to (statistical) consistency while attempting to maintain the viability of a national accounting system.

The analysis proceeds by exploiting the structural properties of market transactions matrices for a nation's economy. The results are sufficiently general to encompass the case where the transaction matrices are initially characterized by both sectoral discrepancies and transaction flow category discrepancies. In this general context it is shown that the statistical inconsistency potentially resulting from the replacement of the macroenterprise sector by an aggregation of microbusiness units has certain properties with economic meaning. This leads to a discussion that explains the ultimate rationale of statistical inconsistency: the fact that different microeconomic decision units may have different views and knowledge of common market transactions. The paper concludes with some implications for future research that appear to follow from the historical development of the subject matter.

I. INTRODUCTION

The purpose of this paper is to present and analyze some of the statistical problems that arise when macroeconomic accounts are put on a microdata foundation. Macroaccounts, here, cover the full range of a nation's annual accounting system including capital finance accounts and balance sheets. The paper, though, will be particularly concerned with the economic accounts of the enterprise sector. When we try to put the macroenterprise sector on a microdata foundation, it is natural to turn to microbusiness accounts. These accounts, therefore, include both business income statements (current accounts) and balance sheets (capital accounts). The microaccounts represent a particular configuration of business microdata—the configuration that displays the performance of decision-making units.

The idea of putting macroeconomic accounts on a microdata foundation is not new. The history and economic motivation behind this idea are outlined in the next section. Recent innovations, however, with respect to both macroaccounts and microdata now lead one to believe that the basic idea is at least partly capable of practical implementation. Indeed we will see that micro-macro models have

already appeared in the economic literature, although not yet in the framework of a complete and integrated accounting system. In this paper we try to show that conceptually it is possible to put macroenterprise accounts on a microbusiness accounting foundation. Conceptually, the macroaccounts would be consistent with the related sets of microdata accounts. All this, however, is a conceptual ideal. For statistical purposes, it is most unlikely that such a consistent foundation can be built that would at the same time preserve the decision-making records of microbusiness units. There are key sources of statistical inconsistency that should be distinguished and, perhaps, measured.

In order to reach the heart of the inconsistency problem, the paper exploits the structural properties of market transaction matrices. The matrices aid in distinguishing what are and what are not essential features of the inconsistency problem. These transaction matrices are reminiscent of those that evidently appear in the European System of Integrated Economic Accounts. We note that market transaction matrices of macroaccounting have something in common with cash-flow accounts popular in business accounting circles. We also discuss the relationship of the particular statistical problem (dealt with in this paper) to some of the outstanding issues for improving the United Nations System of National Accounts. Some of the issues turn out to be special cases of our basic statistical problem.

The paper follows with proposals for empirical work. The Conclusion contains the analytical implications of learning to live with micro-macro accounts in which there are limits to statistical consistency. A principal message is that one can live with and even benefit from inconsistency provided that the analytical properties of such an accounting system are understood and appreciated.

II. BACKGROUND

This section provides the historical perspective and economic rationale needed to appreciate the main problem of the paper. The treatment here is strictly of the overview type so no attempt is made to be comprehensive. Readers interested in further details are advised to consult the references given in this section. (Some readers may even prefer to skip the section—without serious loss of continuity.) In any event, some general knowledge of the national economic accounting literature is assumed. The best single reference, for background purposes, is a paper delivered by Richard Ruggles at Statistics Canada in November 1984.

II.1. Decision Units

The natural place to begin is with the seminal work of Stone (1947). His system, inter alia, provided a set of accounts for a sector called "productive enterprises." Some consideration was given to the problems of making the enterprise sector accounts compatible with the accounting records of a national economy's individual firms. But Stone's main emphasis was on ensuring consistency in the treatment of transactions representing national aggregates or between macrosectors such as enterprises and households. It remained for a

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colleague of Stone, namely F. Sewell Bray (1949), to relate the economist's system of national accounts to business accounting practices and procedures. In particular, Bray was concerned with adjusting and reconciling business accounting records so that, at least conceptually, the Stone enterprise sector accounts might be considered an aggregation[1] of individual business accounts. Many of the differences between the economist and the professional accountant turn out to be differences of terminology rather than substance. Both parties ultimately think in terms of accrual accounting. If business accounts are made to be reasonably complete then these accounts, after some rearrangement and adjustment for revaluation, can be aggregated to approximate the macroaccounts of the enterprise sector. Bray pointed out that it is too much to expect business accounting practices to become perfectly uniform, but the consequences of this were not pursued. Neither was Bray concerned with the economic policy advantages of putting macroaccounts on a microdata foundation. This is not surprising since both the data and computer technology were unavailable 35 years ago to seriously apply the conceptual work of F. S. Bray. The situation, though, began to change in the 1960's.

A new view of economic modeling based completely on microdata originated with Guy Orcutt (a concise reference is Orcutt (1964)). His work led to the development of microanalytic simulation models. The basic components of the model are decision-making units—individual households, firms, banks, governments; there is no aggregation over decision units other than market relationships. This permits the model to reflect the distinct behavioural patterns and performance of the individual units that are typically lost in aggregation. There are two potential advantages: (1) macroeconomic policy is best evaluated by the impacts on individual decision units, and (2) the greater variety of microdata sets generated by decision units is valuable for econometric estimation purposes (Orcutt (1968)). Most of this early work, however, was not based on "real" data nor were micromodels related to a nation's system of macroaccounts. Some steps in these directions were taken in the 1970's by Bergmann (1974) and Bennett and Bergmann (1978).

Two specific cases where microbusiness accounting data are used in modeling should now be mentioned. First there is the Swedish MOSES, a micro-to-macro simulation model of the Swedish economy. The most recent references are Eliasson (1984) and Albrecht and Lindberg (1982). The model deploys "firms-level" data taken from company accounting reports and other public sources including both income statements and balance sheets.[2] Although only the largest Swedish manufacturing firms are explicitly covered, there is some analysis of the "residual" sector. The model is linked to the Swedish national accounts with emphasis on long-term simulation results. It should be noted that Swedish national accounts do not evidently contain balance sheets so that the micro-to-macro integration is incomplete. The model, though, does provide some revealing insights of statistical inconsistencies when microdata are utilized together with traditional macrodata. Second, there is the Cambridge MDM, a large econometric

[1]For the moment we prefer the term "aggregation" which encompasses both "combination" and "consolidation."

[2]There is also a microdata set drawn from a special survey at the "division-level."

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model of the U.K. economy. A recent addition to this model is the disaggregation of the company sector[3] which presently consists of the top 100 industrial firms plus the "residual" company. Thus there is now a national econometric model embodying individual company data based on published accounting reports (see Goudie and Meeks (1984)). The authors of the new model display the benefits of working with "decision-unit" level disaggregation and, indeed, confirm the conjectures of Orcutt (1968) with respect to both economic policy evaluation and efficiency of econometric estimation. No consideration has yet been given to the issue of statistical inconsistency that may arise when microaccounting data are embedded in a system of national accounts.

II.2. *Quadruple Entries*

The gradual evolution of directly incorporating individual business accounts in economic modeling was stimulated by two events: (1) the availability of large microdata bases both from public and private sources, and (2) advances in computer technology required to manipulate the data. In the meatime there has been another strand of events more in line with the concerns of national accounting. The original Stone–Bray conceptions encompassed both current (income) accounts and capital finance accounts and balance sheets. In practice, though, it was the current accounts that were mainly compiled by national statistical agencies, namely the national income and product accounts. This led to distinct interpretations concerning the nature of macroeconomic accounting as compared to microbusiness accounting. The latter is based on double-entry bookkeeping principles where the double entry covers the full range of interlocking current and capital accounts with respect to the single business unit. On the other hand even when economic accounts are limited to current income accounting, it was pointed out that double entry is still applicable, but the nature of the double-entry principle is different: the double entry now mainly refers to articulation across the various economic sectors. A clear statement of this matter appeared in Nassimbene (1953) and was further expounded in Stuvel (1965, pp. 12–13).[4] Some national accountants, most notably Copeland (1952, pp. 30, 82) and (1955), have nevertheless insisted that when national accounts encompass both current and capital finance items, then the true nature is one of quadruple-entry bookkeeping. In essence there are dual double entries reflecting both the internal balance (interlocking) phenomenon of traditional business accounts and the external balance (articulation) phenomenon of national economic accounts.[5]

Copeland's ideas are conceptually correct. But even if ecconomic accounts embody a full set of capital accounts (in addition to current accounts) there would still be a critical difference between business accounting and economic accounting. The fact is that economic accounts are not compiled from individual observed accounting entries, summarized or otherwise. The double-entry discipline, and certainly the quadruple-entry discipline, are not imposed on the original

[3]The macrosector composed of quoted incorporated companies and enterprises.
[4]See also Ijiri (1979) for a similar viewpoint.
[5]The notions of "internal balance" and "external balance" are further discussed in the next section.

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observed or recorded transactions because there is no one accounting authority to do such an "impossible" job. This, perhaps, is what made the late Simon Kuznets (1948) so uncomfortable with the accounting approach to the measurement of national income and expenditures. Presently constructed national accounts are the highly-skilled solution of an enormously complicated "jigsaw puzzle" more than anything else; see Jaszi (1970, pp. 194-96).

All this sets the stage for the important contributions of Ruggles and Ruggles (1975) and (1982a,b). Our interpretation of their work within the context of this paper is as follows. A complete accounting of a national economy must embody both current income accounts and capital finance accounts with the addition of balance sheets. The latter implies an estimation of revaluation accounts. At the same time, a national accounting framework should embrace microdata as well as macrodata. The macroenterprise sector would be a consolidation of composite microdata sets reflecting the individual units of the sector (Ruggles and Ruggles (1982b, pp. 51-52)). In effect the two major recommendations would solidify the quadruple-entry interpretation of national accounts because the analogy between economic accounting and business accounting is strengthened. Ruggles and Ruggles construct an Integrated Economic Accounts for the U.S. that is both conceptually complete and potentially capable of putting macrosectors on a microdata foundation. The empirical work, however, is presently limited to rearrangement and reclassification of the traditional "jigsaw puzzle" pieces that already form the U.S. national accounts and related systems. No significant attempt has yet been made to go outside the traditional data sources. It is implicitly assumed that outside sources (e.g. microdata) would be adjusted to the received macrodata (after appropriate rearrangement and reclassification). Ruggles and Ruggles do note that revaluation can lead to inconsistencies in national balance sheets since there is no guarantee that external balance is maintained when individual debtors and creditors have different views on revaluation of financial instruments. One other key contribution is the segregation of market transactions from nonmarket (imputed) transactions.

Some of the important themes outlined in the preceding paragraph are developed further in the next section—within the special context of this paper. Additional and final background is provided by innovations in the field of business accounting that have also tended to close the gap between business accounting and economic accounting. The two fields are becoming closer together not only conceptually but also in practice. Briefly, innovations in inflation-adjusted accounting (summarized in Hibbert (1983)) tend to make business accounts more consistent with the valuation and revaluation principles underlying economic accounts. In particular there is recent evidence that business management accounting is especially sensitive to economic valuation principles (Revsine (1984)).[6] The European commercial practice of value-added accounting is almost entirely analogous to the familiar production and appropriation accounts for the macroenterprise sector (Morley (1979)). Value-added accounts are easy to adjust for inflation and changes in replacement costs; holding gains and losses are relegated to the revaluation entries in closing balance sheets.

[6]See also Casey and Sandretto (1981).

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III. STRUCTURE OF INCONSISTENCY

This the key technical section of the paper. The development is oriented to building upon the historical background and economic motivation already outlined. We are also, fortunately, able to build upon some technical appartus (namely, market transaction matrices) that has already been introduced by other economic accountants, although with a different purpose in mind. This permits us to provide references for aspects that are now available in the literature and to concentrate the exposition on issues involving new interpretation and application. The section also makes use of common algebra that the nonmathematical reader could safely avoid. Later sections of the paper relate the technical developments found here to some of the well-known controversial issues discussed in the economic accounting literature. Finally, an excellent general reference to bear in mind throughout this section is the article "An Introduction to National Economic Accounting" very recently prepared by Young and Tice (1985).

III.1. *Essentials*

The issue at hand concerns the statistical inconsistency that arises when the macroenterprise sector of a complete national accounting system is put on a microdata foundation. We may assume that both the "enterprise sector" and the "complete accounting system" coincide with that apparent in the Ruggles and Ruggles (1982a) Integrated Economic Accounts. By "microdata foundation" we will mean a set of available (or modified) microbusiness accounts, covering both income statements and balance sheets, so that conceptually (at least) one might consider the macroenterprise sector accounts to be a consolidation of the corresponding sets of microbusiness accounts. This implies that the considered microbusiness accounts cover the full classification requirements of the macroenterprise sector (later, this assumption will be relaxed). It still remains to define what is meant by "statistical inconsistency." In fact it may appear that the possibility of any sort of "inconsistency" has already been ruled out by assumption! This is not quite true as will soon be apparent. At this point it is also important to add that the individual microbusiness accounts are meant to represent the decision-making record and performance of their coincident units.[7] (This is in the spirit of microanalytic modeling explained in section II.1.) For the present we might think of microbusiness accounts as representing the complete financial statements of individual companies (seen in Young and Tice (1985, pp. 60-61)). It also seems best to initially concentrate attention on nonfinancial corporations. This implies that we are dealing with the microfoundations of the macrononfinancial corporate enterprise sector (called macroenterprise sector, for short).

We now distinguish two major types of inconsistency that may appear in a complete system of national accounts. The first is with respect to the "internal balance" of accounts. The various accounts for each sector must balance and, indeed, the accounts interlock through internal entries and contraentries (e.g. operating income, savings.) We rule out for now the traditional problems of "statistical discrepancy" insofar as internal balance is concerned. All accounts in this subsection and the next will satisfy the conditions of internal balance.

[7]The question of statistical units to represent decision-making units is discussed in the next section.

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The second major source of inconsistency is with respect to "external balance." This essentially refers to intersectoral articulation, whether of the to-whom-from-whom variety or after summation across (sets of) sectoral accounts. Articulation also depends on the degree of disaggregation of flow categories, both for financial and nonfinancial transactions. One example of a statistical inconsistency affecting external balance is the problem of "float."[8] This type of inconsistency presumes a market transaction and is, in principle, the kind of statistical inconsistency with which we are primarily concerned. Further clarification of this matter will be apparent in the course of the analysis. It should be noted, however, that external balance is also affected by nonmarket "transactions," e.g. in the construction of revaluation matrices. These entries are not our main concern, but will be mentioned again later. The important point for now is that consistency problems relating to external balance primarily arise through market transactions. The focus on market transactions, strictly defined, permits us to distinguish what are and what are not essential features of statistical inconsistency that follow when the macroenterprise sector is put on a microaccounting foundation.

Thus we do not need to proceed by actually displaying a complete set of macroeconomic accounts for a nation. It is only necessary to initially consider the market transaction statements that underlie the set of national accounts. There is no need to display the various sectoral production accounts, appropriation accounts, and capital finance accounts[9] since these accounts are mere rearrangements and allocations of the underlying sectoral market transaction statement entries after the addition of a series of internal (to each sector) imputations and balancing entries required to define the various sectoral accounts. Note that market transaction statements preserve transaction flow entries "gross" providing an additional check on the presence of external imbalances.

Tables 1 and 2 exhibit a pair of transaction statement matrices for a national open economy. The format is very similar to the one appearing in an important article by Gorman (1964).[10] The two matrices, in schematic form, have the same dimensions with transaction flow categories appearing in the rows and macroeconomic sectors appearing in the columns. One sector is the familiar enterprise sector. The transaction flow categories are exhaustive covering all financial and nonfinancial transactions, both current and capital, going through the market during a certain time period (presumably the calendar year). The first matrix is called the Credit matrix because the transaction flow categories are described in such a way that all entries ultimately *tend* to increase the cash balance of the corresponding sector indicated in the column. The second matrix is called the Debit matrix since the matched flow categories are now described so that entries ultimately *tend* to decrease cash holdings. The market balancing entry appears in the Debit matrix and is equal to the (net) change in cash holdings during the relevant accounting period. There is one exception to the latter statement. While increases or decreases in cash balances are debit entries for all

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[8]See Garvey (1962) for a complete discussion; "float" is a timing inconsistency mainly occurring with respect to bank-related financial claims and liabilities.

[9]The capital finance account is a modified and extended saving-investment account.

[10]The matrices are also closely related to a matrix format recommended by Tobin (1982) and evidently utilized by the European System of Integrated Economic Accounts.

TABLE 1

MARKET TRANSACTION MATRIX (CREDIT SIDE)

Transaction Category \ Sector	House-holds	Non-corporate Business	Enterprises (Corporate Business)	Financial Intermediaries	Government (Consolidated)	Rest of World
Sales of consumer goods & services						
Sales of producer goods & services						
Sales of fixed capital goods						
Sales of new houses						
Sales of used fixed capital goods						
Sales of used houses						
Sales of land						
Wages & salaries received						
Rent received						
Interest received						
Dividends received						
Social security transfers received						
Other transfers received						
Indirect taxes received						
Direct taxes received						
. . . .						
Accounts receivable						
Accounts payable				c_{ij}		
Wages receivable						
Wages payable						
Taxes receivable						
Taxes payable						
Consumer credit						
Residential mortgages						
Commercial mortgages						
Government securities						
Bank loans						
Nonbank loans						
Corporate bonds						
Corporate stock						
Other fixed claims						
. . . .						
Life insurance reserves						
Pension fund reserves						
Trust fund reserves						
. . . .						
Equity in noncorporate business						
. . . .						
Deposit creation						

Notes: Financial instruments on the credit side imply borrowing, redemption or sales. All entries for "deposit creation" are zero except for (consolidated) financial intermediaries. The typical entry in the matrix is designated c_{ij} where i signifies the transaction category $i = 1, \ldots, n$ and j signifies the macro sector $j = 1, \ldots, m$. A financial category representing "equity in noncorporate business" may not imply a market transaction.

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TABLE 2

MARKET TRANSACTION MATRIX (DEBIT SIDE)

Transaction Category \ Sector	House-holds	Non-corporate Business	Enterprises (Corporate Business)	Financial Intermediaries	Government (Consolidated)	Rest of World
Purchase of consumer goods & services						
Purchase of producer goods & services						
Purchase of fixed capital goods						
Purchase of new houses						
Purchase of used fixed capital goods						
Purchase of used houses						
Purchase of land						
Wages & salaries paid						
Rent paid						
Interest paid						
Dividends paid						
Social security transfers paid						
Other transfers paid						
Indirect taxes paid						
Direct taxes paid						
. . . .						
Accounts payable						
Accounts receivable						
Wages payable	. . . .			d_{ij}		
Wages receivable						
Taxes payable						
Taxes receivable						
Consumer credit						
Residential mortgages						
Commercial mortgages						
Government securities						
Bank loans						
Nonbank loans						
Corporate bonds						
Corporate stock						
Other fixed claims						
. . . .						
Life insurance reserves						
Pension fund reserves						
Trust fund reserves						
. . . .						
Equity in noncorporate business						
. . . .						
Change in cash balances						

Notes: Financial instruments on the debit side imply lending, repayment or purchases. All entries for "change in cash balances" are net. This category can be easily generalized. The typical entry in the matrix is designated d_{ij} where i signifies the transaction category $i = 1, \ldots, n$ and j signifies the macro sector $j = 1, \ldots, m$. A financial category representing "equity in noncorporate business" may not imply a market transaction.

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nonfinancial sectors, the matching category for the consolidated financial intermediaries sector is called "deposit creation" and appears in the credit column for this particular sector.

The structural properties of market transaction matrices are easily summarized. Each macroeconomic sector is in internal balance. So the summation of all credit entries equals the summation of all debit entries including the change in cash balances. This holds for the foreign sector as well as all domestic sectors. The national market economy is also in external balance. So for each transaction flow category, the summation of all credit entries (with summation across sectors) equals the summation of all category-matched entries on the debit side. Note that the summation of all changes in cash balances equals deposit creation. The situation with respect to accounts receivable and accounts payable is also noteworthy. Accounts receivable as a credit entry implies redemption; so the matched category on the debit side must be accounts payable, implying repayment. The presence of financial flow categories such as accounts receivable and payable shows that transaction statement accounting is not in conflict with the accrual accounting basis of economic accounts. For example, sales of goods and services are a credit entry because cash flow is ultimately positive, but the realization of cash flow may be delayed by a corresponding entry to accounts receivable on the debit side.[11]

Before continuing the reader should be aware that some widely-used economic notions are entirely absent from the market transaction matrices. There are, of course, no imputed items such as net rental income from owner-occupied dwellings and imputed receipts from and charges for services performed by financial intermediaries. But also absent are "changes in inventory," "own-account investment in plant and equipment" and all forms of "depreciation." These are internal accounting entries and, therefore, not essential to our main analysis. Most important, the notions of "net income" and "saving" are missing— these are not market transactions. All these economic notions do play a key role when multi-economic accounts are distinguished for each sector. Market transaction statements result when the traditional economic accounts for each sector are subject to vertical consolidation.[12] It should also be noted that the particular sectoral disaggregation and transaction flow category disaggregation shown in Tables 1 and 2 are not unique, but merely illustrative. They are, however, meant to be exhaustive with respect to a national economy. Finally, since both internal balance and external balance are initially assumed, we rule out the conventional problems of statistical discrepancy, errors and omissions, and float (although these problems will be returned to later).

III.2. *Properties*

Consider now the following mental experiment. Tables 1 and 2 embody the market transactions that underlie a nation's system of accounts. (This is before "netting" and before the addition of nonmarket imputations.) The tables are

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[11]It should now be apparent that the "cash balance" approach in market transaction accounting is closely related (but not identical) to cash-flow accounting popular in business circles (see Ijiri (1978)).

[12]Further discussion of these properties can be found in Gorman (1964).

perfectly balanced so that all the "jigsaw puzzle" pieces of original raw data and observations have been processed and, indeed, selected to effect the balancing conditions.[13] In particular, the macroenterprise sector fits perfectly into the overall scheme. The sector itself is naturally subject to internal balance. But the enterprise sector also articulates with all other sectors of the national economy for each and every transaction flow category. This has the following implication. For any specific transaction category, whether current or capital, the summation of all credit entries over nonenterprise sectors equals the summation of all debit entries over nonenterprise sectors *plus* the difference between the debit and credit entries for the enterprise sector with respect to that transaction category. Using the notation of Tables 1 and 2 and representing the enterprise sector by the symbol "k," we then have:

$$\sum_{j \neq k} c_{ij} = \sum_{j \neq k} d_{ij} + (d_{ik} - c_{ik}) \qquad i = 1, \ldots, n.$$

When $d_{ik} \neq c_{ik}$, then $(d_{ik} - c_{ik}) = e_{ik} \neq 0$. In any case:

$$e_{ik} = \sum_{j \neq k} (c_{ij} - d_{ij}) \qquad i = 1, \ldots, n.$$

As one very simple example, consider the transaction flow category "wages received (credit) and wages paid (debit)." Then any difference between total wages received and total wages paid, the total taken over all nonenterprise sectors, must equal wages paid by the enterprise sector (assuming that the enterprise sector does not receive wages). If a transaction category is further specified to read "dividends received by households and dividends paid to households," then dividends received by households must equal dividends paid by the enterprise sector to households (assuming that nonenterprise sectors do not pay dividends).

The kind of articulation described in the preceding paragraph is well known and, in fact, to be expected from a nation's accounting system. Now, to continue with our mental experiment, suppose the macroenterprise sector is replaced by a set of microbusiness units. The market transactions of each business unit are characterized by a column of credit and a column of debit entries which are subject to the usual accounting rule of internal balance. One may imagine that the market transaction statements for business units are extracted from their respective business accounting reports somewhat along the lines of procedures used in Young and Tice (1985, pp. 60-63).[14] The microbusiness units are meant to cover the complete enterprise sector and the units engage in market transactions with each other as well as with other macrosectors. When two or more business units are owned by the same interests, their transactions with each other are included in the market transaction statements, provided that the units have appropriately complete accounting records.[15] The microbusiness units, then, conceptually represent a disaggregation and deconsolidation of the macroenterprise sector.

The process of disaggregation and deconsolidation *per se* does not disturb the external balance requirements of a nation's accounting system. In order to simplify the argument, suppose the macroenterprise sector becomes two

[13]See again Jaszi (1970, pp. 194-96).

[14]The main difference is that we abstract from "netting" and all internal accounting entries.

[15]This aspect is discussed again in the next section.

individual business units. Then it is easy to show that:

$$\sum_{j \neq k} (c_{ij} - d_{ij}) = e_{ik}^1 + e_{ik}^2 = e_{ik} \qquad i = 1, \ldots, n$$

where $e_{ik}^1 = (d_{ik}^1 - c_{ik}^1)$

$e_{ik}^2 = (d_{ik}^2 - c_{ik}^2)$

and the superscripts "1" and "2" represent the two distinguished business units of the enterprise sector. A problem, however, does arise when the conceptual process of disaggregation and deconsolidation does not coincide with the corresponding statistical process. It must be remembered that the transaction statement of the enterprise sector is based on adjusted and selected data (often from administrative sources)—in fact the adjustments and selections are ideally made simultaneously for all sectors and all transaction categories in order to guarantee the internal and external balance requirements of a national accounting system.[16] In this paper we regard microbusiness units as representing decision units; their transaction accounting statements reflect decision-making performance and records. It is of the utmost importance to preserve their respective accounting records in order to claim that the macroenterprise sector has been put on a microdata foundation that has decision-making unit qualities. Therefore the microbusiness accounting data is not open to the kind of adjustments and selections that normally characterize the enterprise sector as a whole. This does not, however, imply that the required microbusiness accounts are unique and subject to no choice. As will be discussed in the next section, there is some choice as to which set of business accounts best represents decision-making qualities. But the choice is not dependent on adjustments and selections to guarantee external balance in a system of national accounts.

Thus, if the macroenterprise sector is replaced by "two" distinct business units, using the best available microbusiness accounting data, we should now expect to find that:

$$\sum_{j \neq k} (c_{ij} - d_{ij}) \neq e_{ik}^1 + e_{ik}^2 \qquad \text{for at least some } i = 1, \ldots, n.$$

This means that there is external imbalance for at least some transaction flow categories. In fact, this is precisely the kind of statistical inconsistency with which we are primarily concerned. The statistical inconsistency, though, has a certain structure with economic meaning. Suppose, without loss of generality, that:

$$\sum_{j \neq k} (c_{ij} - d_{ij}) > e_{ik}^1 + e_{ik}^2 \qquad \text{for one } i.$$

But all sectors, including the two microbusiness units, are assumed to experience internal balance. This means that:

$$\sum_{i} (c_{ij} - d_{ij}) = 0 \qquad \text{for all } j \neq k$$

$$\sum_{i} (e_{ik}^1 + e_{ik}^2) = 0.$$

[16]Recall that we initially rule out statistical discrepancies and float and other problems relating to synchronization and unallocated items. Even the household sector is assumed to fit perfectly into the overall scheme.

The two sets of assumptions can be simultaneously written as:

$$\sum_i \left\{ \sum_{j \neq k} (c_{ij} - d_{ij}) + (e_{ik}^1 + e_{ik}^2) \right\} = 0.$$

This equality, however, is only compatible with the initial supposition if:

$$\sum_{j \neq k} (c_{pj} - d_{pj}) < e_{pk}^1 + e_{pk}^2$$

for at least one other transaction category, designated the "p" category. So a positive external imbalance must be offset by at least one negative external imbalance and the summation of all imbalances (across transaction categories) equals zero. To carry this idea further, it is possible to assume that a statistical disaggregation and deconsolidation of the macroenterprise sector into distinct microbusiness units (decision-making units) may not affect changes in cash balances as recorded in transaction statements. Since changes in cash balances are the final (nth) transaction category on the debit side of the transaction matrix (Table 2), this means that:

$$e_{nk}^1 + e_{nk}^2 = e_{nk}$$

and so:

$$\sum_{j \neq k} (c_{nj} - d_{nj}) = e_{nk}^1 + e_{nk}^2.$$

Thus any external imbalance in a transaction category that tends to relatively overestimate the increase in cash holdings of microbusiness units must be offset by an external imbalance in another transaction category that tends to underestimate the increase in cash holdings of the same microbusiness units. It might also be added that the treatment of changes in cash balances in our transaction matrix tables together with the "matching" category of deposit creation for consolidated financial intermediaries (on the credit side) could be made more complete by accounting for currency in circulation and various types of bank deposits. Our essential conclusions, *mutatis mutandis*, would not be affected.

It should be noted that the kind of statistical inconsistency we have dealt with does not necessarily result from a lack of uniformity in business accounts. Even if the "two" microbusiness units operate perfectly uniform accounting procedures,[17] the same sort of external imbalances may arise. The uniform accounting methods do, however, rule out possible inconsistencies with respect to transactions between the "two" business units. Consider for example the transaction category "sales and purchases of used plant and equipment." If all such sales and purchases originate with domestic business units, then total sales will equal total purchases and there is not external imbalance with respect to this category. On the other hand, strictly uniform accounting procedures are most likely to occur when the business units are owned by common interests, i.e. for purposes of consolidated financial reporting. In this case, though, the transaction valuations are subject to the possibility of transfer pricing manipulation.[18]

[17]See again the discussion of F. S. Bray in section II.1 and later discussion.
[18]The latest word on this subject is Gabor (1984).

There are two final points that might be clarified before closing this subsection. When:

$$e_{ik}^1 + e_{ik}^2 \neq e_{ik}$$

it is possible to adjust the transaction statements of the microbusiness units to conform with the transaction statement of the enterprise sector. This can be done by either adjusting the original "gross" entries on the credit and debit sides of the statement or by adjusting the "net" entries (represented by the symbol "e"). The proportional adjustments would be the same for the "two" microbusiness units but would typically differ for each transaction category that required such adjustment. This procedure is known as adjusting microdata to known macro "control totals." If this is done we would end up with:

$$e_{ik}^1 + e_{ik}^2 = e_{ik} \qquad i = 1, \ldots, n$$

and the problem of statistical inconsistency is resolved. Such adjustments are ruled out of our analysis because of our desire to maintain the integrity of microbusiness accounting data. If these data are to represent the accounting record of decision units, then their special configuration must be preserved. This point is discussed again later. Note that when $e_{ik} = 0$ (or when $c_{ik} = 0$ or when $d_{ik} = 0$) then the corresponding microaccounting entries must all be adjusted to zero. This may involve a serious loss of information at the microdeconsolidated level. The second point is a reminder that the analytical framework only covers market transactions, strictly defined. The great majority of nonmarket and imputed "transactions" are internal accounting entries and, therefore, do not articulate and cannot be a source of external imbalance. There are some minor exceptions to this assertion. For example, the well-known imputation for "services performed by financial intermediaries without charge" does have an articulation dimension (as well as an internal accounting dimension). The articulation aspect, however, is purely artificial—resulting from entries imposed by the national economic accountant—and, therefore, cannot be a source of external imbalance that arises from the accounting records of the business firm or any other sectoral unit that deploys accounting procedures to track performance and aid decision making.

III.3. *Measurement*

The analytical framework used so far in this section is unrealistic. The sectoral transaction matrices were initially assumed to be free from both sectoral discrepancies (internal imbalance) and transaction discrepancies (external imbalance). One might think of this ideal situation as resulting from the usual adjustment and selection procedures deployed by national accountants followed by a rigorous application of the methods first introduced by Stone et al. (1942). These methods would yield fully balanced transaction matrices, reflecting the relative subjective reliabilities of the various data bases in a systematic manner.[19] However these methods have rarely been applied and it is, therefore, more realistic to assume that transactions matrices are subject to a wide variety of discrepancies resulting from errors and omissions, float, unallocated items and problems of

[19]Recent examples are Barker et al. (1984) and Stone (1984).

synchronization. It turns out, nevertheless, that the kind of statistical inconsistency with which we are primarily concerned can still be identified in this more general framework. The main reason is that discrepancies themselves have certain properties that can be exploited to our advantage.

We handle the issue by the device of bordering the Debit matrix (Table 2) by a row of sectoral discrepancies (s_j) and a column of transaction discrepancies (t_i). One might also border the Credit matrix (Table 1) with a corresponding row and column composed of all zero entries. Then in the general case where there do exist nonzero discrepancies of any sort, we may write:

$$\sum_i^n c_{ij} = \sum_i^n d_{ij} + s_j \qquad j = 1, \ldots, m$$

$$\sum_j^m c_{ij} = \sum_j^m d_{ij} + t_i \qquad i = 1, \ldots, n.$$

It is clear that the two major classifications of discrepancies are related; in fact their summations are equal:

$$\sum_j^m s_j = \sum_i^n t_i.$$

Individual discrepancies can be positive or negative so that the simple summations are affected by cancellations. A measure of the overall magnitude of sectoral discrepancies would be:[20]

$$\sum_j^m |s_j|$$

and the overall magnitude of transaction discrepancies would be:

$$\sum_i^n |t_i|.$$

In general we would have:

$$\sum_j^m |s_j| \neq \sum_i^n |t_i|.$$

Note that each of these measures is affected by disaggregation and indeed, the measures are not normalized. It might also be added that the existence of sectoral discrepancies shows that sectoral changes in cash balances (the nth transaction category) are not to be regarded as a "residual"; they are market transaction entries subject to errors and omissions.

Now suppose that the macroenterprise sector is replaced by a finite number of microbusiness units along the lines of previous discussion. It is natural to assume that microbusiness accounts and, therefore, microbusiness transaction statements are complete and internally balanced. If the macroenterprise sector experienced a nonzero sectoral discrepancy, $|s_k| > 0$, then the replacement of this macrosector by a set of microunits will unambiguously lower the economy-wide

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[20]The absolute value of any real number x is represented by $|x|$.

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magnitude of sectoral discrepancies.[21] What, on the other hand, would be the impact on the economy-wide magnitude of transaction discrepancies? To this question there is no unambiguous answer. Instead, economic and accounting evidence imply that the magnitude of transaction discrepancies would most likely increase significantly. There are three main reasons for this assertion.

First the transaction statement of the macroenterprise sector is probably already adjusted and selected to partly conform with articulation elements of other sectoral transaction statements. The normal compilation procedures of the national accountant, in effect, partly simulate the Stone (1942, 1984) methods in order to diminish discrepancies of both kinds. Thus, when the macroenterprise sector is replaced by a finite set of microbusiness units, we should expect the magnitude of transaction discrepancies to increase because microbusiness accounts are not and, indeed, cannot be pre-adjusted. Second, the macroenterprise sector is conceptually a consolidation of microbusiness units. In the process of disaggregation and deconsolidation, additional accounting articulation entries are opened up (even assuming no change in the disaggregation of transaction categories). The additional entries will most likely tend to increase the magnitude of transaction discrepancies because any such articulation problems were ruled out by sectoral consolidation. This factor, of course, is most prevalent when microbusiness accounts of different units are not on a perfectly uniform basis. The third reason involves disaggregation of transaction categories. When a macrosector is deconsolidated, then it is natural to also show more specific transaction categories. It is easy to see that our measure of transaction discrepancies becomes larger, *ceteris paribus*, when more transaction categories are exposed.

All this leads to some interesting conclusions. Consider the limiting case where all domestic macrosectors are put on a microunit accounting foundation. (The following development implicitly assumes a closed economy; alternatively, it might be assumed that the foreign sectoral discrepancy is identically zero.) Since microaccounts are all internally balanced, we would find that:

$$\sum_q \sum_j |s_j^q| = 0$$

where s_j^q represents the discrepancy of the qth microunit in the jth macrosector. Now, microaccounts are not subject to pre-adjustment or preselection methods based on reliability procedures, formal or otherwise. In this case, then, we should expect:

$$\sum_i |t_i|$$

to become larger. But the original equality between the two classifications of discrepancies continues to hold:

$$\sum_q \sum_j s_j^q = 0 = \sum_i t_i.$$

So sectoral discrepancies entirely disappear while transaction discrepancies

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[21]This holds true *a fortiori* if the household sector transaction statement is partly estimated by some "residual" allocation process.

become larger in absolute value.[22] The transaction discrepancies, however, obtain a special characteristic of symmetry whereby all positive discrepancies are balanced in algebraic terms by negative discrepancies. These are the first limits to consistency with which we are concerned. The essential conclusions are invariant to any reasonable normalization factors that might be developed to correctly measure the absolute magnitude of sectoral and transaction discrepancies.

IV. EXTENSIONS OF INCONSISTENCY

Having established the essentials and properties of the inconsistency problem, it is now possible to further develop the basic idea. The development in this section is extensive rather than intensive. A number of topics are introduced, no one of which is discussed in any detail. A detailed discussion would involve a paper much longer than the present one. However sufficient indication is provided to show the direction in which our basic ideas are heading. Questions of empirical application are put off until the next section. References are given to relevant material that can already be found in the literature. In this section we also take the first steps towards considering the problem of statistical inconsistency in a broader context than has been done thus far.

IV.1. *Rationale*

So far we have assumed that microbusiness accounts are "untouchable"—or so it may appear. To clarify the situation it should be recalled that we are only concerned with the business accounting data that would enter market transaction statements and, thus, represent the macroenterprise sector in a nation's set of market transaction matrices. In effect the original microaccounting data (in the form of income statements, sources-and-uses-of-funds statements, balance-sheet statements) are rearranged and reclassified[23] to fit the requirements of a national market transaction matrix. The original microaccounting data may call for some modification to correspond with the conceptual meaning of the various (and exhaustive) transaction categories specified by the matrix. But that is all! No attempt should be made to deliberately adjust microbusiness accounts in order, e.g. to "force" articulation. The general idea, then, is to preserve the integrity and special configuration of the accounts so that they may be conceived as a reliable indicator of decision-making performance and record. This idea may seem naive, but two important points should be kept in mind. First, we are only dealing with market transaction data; all the controversial issues—(i.e. where economics and accounting are in "conflict") such as inventory change and valuation adjustment, depreciation, imputed entries, measurement of saving and investment—are irrelevant at this point because these issues do not directly involve market transactions. Second, we are aware that business units keep different sets of "books." The most relevant accounting records are those prepared for manage-

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[22]The question of how much "larger" transaction discrepancies might become is strictly an empirical matter; see section V.

[23]Somewhat along the lines of, but not identical to, Young and Tice (1985). See also Bray (1949). The question of whether the accounting data are sufficiently complete is discussed in section V.

ment-decision purposes and it is this set of "books" with which we are concerned.[24] It might also be added that our basic idea is not dependent upon the availability of a set of microbusiness accounts covering the whole of the macroenterprise sector. Examples were already given, in section II.1, of "micro-modeling" only part of the macroenterprise sector and this aspect will be pursued in the next section. When the macroenterprise sector is not completely covered, then some analytic consideration must be given to the "residual."

The principal message, then, can be summarized as follows. The macroenterprise sector (or any of its major subsectors) is an economic construct useful for presenting an overall picture of a nation's economy in conjunction with the other sectoral constructs. In this case it is natural to emphasize the economic interdependence of the major sectors by requiring or, indeed, "forcing" articulation even though the original raw data may not indicate (perfect) articulation. Procedures emphasizing economic and statistical interdependence are usually supported by arguments concerning relative reliability of different data sources. When a macroenterprise sector is put on a microbusiness accounting foundation, then there is a distinct change in priority. Microbusiness accounts are explicitly meant to represent decision units (the macroenterprise sector is not a decision-making body, consolidated or otherwise). So the priority now is on preserving the integrity of decision-making accounting records. We do this because the whole point of putting a macroconstruct on a microdecision-unit foundation is to ultimately permit a more sensitive evaluation of the microimpacts of economic policy (even if the evaluation is strictly with respect to macroeconomic policy).[25]

True, we are still living in a world of economic interdependence, whether macro or micro. There is still articulation, whether macro or micro. But the articulation now is not statistically "forced," but must conform with and follow the prior integrity of decision-making accounts. We find there is a sort of "trade-off" between (perfect) articulation and the integrity of accounting records. This trade-off is not new, but is already evident in both the economic accounts and the economic literature under such headings as float and synchronization.[26] But when macroconstructs are put on a microfoundation, the trade-off becomes more apparent. Indeed there is reason to believe that the conflict between the economic policy requirements of external balance and of integrity of accounting records is now becoming more pervasive. This is also occurring at a time when the traditional problems of float and synchronization (and even errors and omissions) are becoming less pervasive. The following paragraphs sketch out our rationale for these beliefs. The discussion is largely restricted to market transactions, both financial and nonfinancial, within the macroenterprise sector. But the sector is considered to include all enterprises, financial as well as nonfinancial.

There are two main reasons why statistical accounting records (after appropriate modification) reveal significantly less-than-perfect articulation and, therefore, yield external imbalance at the national level. The two reasons are

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[24]See further discussion in the next section. A good introduction to management accounting is Sizer (1980). Management accounting records are not likely to embody "fraud," but these records could be difficult to obtain.

[25]See again section II.1. This theme will return in the Conclusion section V.

[26]One might also include unallocated items and misclassification error here.

actually related. First, accounting units do not employ uniform market accounting procedures. This problem is closely connected, but not limited, to the subtle reconcilation issues of accrual accounting and has already been analyzed in Bray (1949). The problem will not be further discussed here. Second, different accounting units involved in a transaction may have inconsistent views of the same market transaction. These views reflect their particular circumstances. The result is that while each accounting unit experiences internal balance through double-entry bookkeeping, the requirements of consistent quadruple-entry bookkeeping (see section II.2) are not satisfied. We now give a few examples.

Under long-term contracting, a business unit is expected to record sales of new equipment and structures according to the value of work executed during an accounting period (together with a *pro rata* share of gross margins). There is no reason to expect the ultimate purchaser to have an identical view. This results in misarticulation with respect to accounts receivable and payable as well as sales and purchases of investment goods. Floatation costs of new equity and transfer costs involved in the purchase and sale of financial claims are clearly the result of a sale of a commodity service by a financial company. The purchaser of the service, however, may regard the transaction as part of a purely financial transaction. There are somewhat similar problems, of a growing nature, with respect to the treatment of leasing. One cannot be certain that both the lessor and the lessee have identical views of the distinction between operating leases and financial leases.[27] This means there would be accounting discrepancies for transaction categories such as interest (paid and received), rent, commercial loans, and complementary commodity services. Another aspect of growing importance is the employment of part-time and temporary labour some of which is supplied by full-time employment service agencies. It is becoming more difficult to define who are and who are not the employees of a business unit. (Insurance and real estate companies have been faced with this problem for a long time with respect to commissions payable to brokers.) In this case we are liable to find accounting discrepancies for transaction categories such as salaries and wages (paid and received), social security transfers and, again, commodity services (sales and purchases). The reader could easily add other examples. Indeed, whenever business units become more specialized and, therefore, become more involved in market transactions,[28] the possibilities of discrepant articulation rise. For example, business units that switch from own-account construction to market construction add to the probability of discrepancies occurring within the transaction category "sale and purchase of new construction" without necessarily diminishing the probability of discrepancies occurring elsewhere. Similarly business units that continually switch back and forth along the scale of the manifold "make or buy" decision (current expenditures) are most likely augmenting the problem of discrepant articulation. The "lease or borrow to buy" decision (capital expenditures) mentioned above has an analogous, though more complex, impact. Finally, recent discussions concerning the treatment of pensions and insurance in both business and household accounts also imply the possibility of misarticulation at the microlevel for related transaction categories.

[27]This is well discussed in United Nations (1982).
[28]The following assertion also depends on the choice of statistical unit; see next subsection.

It is our belief that many of the phenomena outlined in the preceding paragraph are becoming more important.[29] Nonfinancial business units are increasingly engaged in financial transactions; intermediate (producer) services receive more explicit weight with greater "contracting-out"; while individual accounting units become more specialized with respect to their prime activity. So one should expect the statistical inconsistency problem of external imbalance to prevail when the macroenterprise sector is put on a microaccounting foundation. At the same time, however, the conventional sources of market transaction discrepancies, such as float and synchronization, are evidently diminishing. The reason for this, of course, is the influence of computerization. As banking and business accounting records become more computerized (electronic accounting) the importance of informational time lags falls. Computerization also decreases the "errors and omissions" of purely national accounting. But all this does not prevent different accounting units from having inconsistent views of a common market transaction although, in the eventual limit, one might expect even this factor to diminish in importance. The basic problem, however, does not depend on current trends or computerization, but rather on our desire to maintain the integrity of business accounting statistical records even though conceptual economic interdependence may be compromised. This desire ultimately reflects the potential considerations of economic policy evaluation.

IV.2. *Issues*

Three remaining issues must be discussed. The issues are: (1) nonmarket and imputed entries, (2) revaluation statements and balance sheets, and (3) the perennial question of statistical unit. These issues are often controversial as witnessed in the various international documents surrounding the United Nations System of National Accounts. In this paper we can only offer very brief discussion—entirely oriented to our main theme concerning statistical inconsistency—when macroaccounts are put on a microaccounting foundation. It will be seen, although without complete discussion, that the three issues do not add substantially to the main problem of the paper.

The first point is that market transaction matrices are not equivalent to a set of sectoral economic accounts. The sectoral production accounts, appropriation accounts and capital finance accounts result from an allocation of the entries in the corresponding sectoral transaction statements after the addition of a number of nonmarket and imputed entries and after appropriate netting. The additional entries together with the interlocking balancing entries of the sectoral accounts (operating income and net saving) give the accounts their respective analytical flavours. For our purposes, the important point is that the allocation and new entry procedures do not disrupt internal balance nor do the procedures involve a significant element of cross-sectoral articulation.[30] Therefore the kind of statistical inconsistency with which we have been concerned is not disturbed. The procedures, though, do raise questions about "comparability" of microbusiness

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[29]See again Eliasson (1984) and also Postner (1982) and Tobin (1984).

[30]There are some exceptions to this assertion; see section III.2. Complications could also arise with respect to the articulation of accounting for bad debts.

accounting data. Two well-known examples, in this context, concern the imputa-
tion for inventory change (affecting production accounts and capital finance
accounts) and the imputation for depreciation of physical assets (also affecting
the same two accounts but in an opposite manner).[31] If microbusiness accounts
are available on a replacement cost basis, or at least where replacement cost is
appropriate, then the new imputed entries do not raise additional questions. It
should be noted that replacement cost accounting is generally compatible with
our desire to select management-decision accounting sets of microdata (see again
Revsine (1984)). If, on the other hand, the microaccounts are not available on
the replacement cost basis, then these accounts must be pre-adjusted, presumably
by the national economic accountant. Although the economic literature does
contain many cases of such adjustment by private investigators (a sophisticated
example is Lindenberg and Ross (1981)), the methods employed are typically
crude—the methods are not sufficiently sensitive to the particular economic
circumstances of the microbusiness units. For example, one should not deploy
an inventory change valuation adjustment when measuring operating income of
business units specializing in arbitrage and speculative commodity trading. There
are also examples in the accounting literature where replacement cost depreciation
is specifically inappropriate. Indeed, "comparability" is not always enhanced by
moving from an historical cost to a replacement cost accounting basis (see Revsine
(1985)).[32] So new questions do arise, but the answers are not always clear. The
questions, though, do not affect the main arguments of this paper.

The second issue concerns revaluation statements. These statements are
normally needed to connect up with opening and closing sectoral balance sheets.
It is possible to show a revaluation matrix, somewhat similar to our transaction
matrix, except that categories are limited to physical assets and financial instru-
ments and that the credit and debit accounting rules are reversed. There would
also be a balancing credit entry called "change in net worth from revaluation."
The two (debit and credit) revaluation matrices can then be analyzed along the
lines of "internal balance" for each sector and "external balance" for each
financial instrument category. We could even inquire what would happen if the
macroenterprise sector is replace by a finite number of microbusiness revaluation
accounts. This line of inquiry will not be pursued in this paper. Revaluation
statements do not imply transactions, certainly not market transactions (although
revaluations *per se* are often supposed to reflect changes in market prices.) The
problems that arise in this area are not directly related to our problem of statistical
inconsistency through misarticulation when macroaccounts are put on a micro-
foundation. More important, perhaps, is the fact that discrepant articulation
(external imbalance) of market transactions has different national economic
consequences than discrepant articulation of revaluation accounts. There is no
doubt that when sectoral revaluation statements and balance sheets are further
developed, then both sets of consequences should be investigated. For present
purposes, though, revaluation accounting is not an essential aspect of our main
concerns.

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[31]These examples also affect the revaluation statement discussed shortly.

[32]The most recent rationale of accounting measurement can be found in Staubus (1985).

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The third and last issue revolves around the choice of statistical unit[33] for microbusiness accounts. It was initially assumed (section III.1) that the statistical unit might be equivalent to the individual company—with a complete set of accounting records. There was also some discussion (section III.2) about market transactions between companies owned and operated by the same interests. The time has now arrived for clarification. The first point is that microbusiness units are supposed to represent decision-making units, at least with respect to their own accounting entries. It is also necessary to point out that companies (corporations) could mean either very large corporations with diverse and decentralized operations, or the term might represent a mere "dummy" corporation with no economic function whatsoever.

For this reason, and others,[34] it seems best to begin with the group of closely affiliated companies (which may be one company to begin with) and then consider an operational deconsolidation of the group into "divisions" plus a "residual" (non-operating) division. Each division is primarily responsible for current production and nonfinancial decisions within its sphere of operations. Some divisions might coincide with an individual company and so bear some responsibility for financial decisions as well. The residual division (headquarters or possibly a holding company) is mainly responsible for financial decisions for the group as a whole and probably shares responsibility with operating divisions for decisions affecting physical capital. The whole scheme can be represented by two market transaction matrices very similar (not identical) to Tables 1 and 2. The group of affiliated companies is deconsolidated into a number of divisions shown in the columns. The transaction categories, real and financial, current and capital, appear in the rows. Some of the transaction categories would need to be slightly modified in this context. For example when operating divisions transfer "losses" to head-quarters, then "dividends," paid and received, are negative.[35] Each division's transaction accounts are in internal balance in the usual way. The transaction categories, of course, are not in external balance except for those categories that are limited to intra-group transactions (assuming that all divisions of the group practice perfectly uniform accounting.) A horizontal consolidation across divisions of all transaction categories, consolidation being with respect to intra-group transactions, yields the consolidated transaction statement for the group taken as a whole.

If the market transaction matrices for an affiliated group are constructed it will be seen that many entries are set at zero. This would be most apparent when all market entries are allocated to the respective divisions' production, appropriation and capital finance accounts after the addition of the usual imputed and interlocking entries. The production accounts of operating divisions would be dense; their appropriation and capital finance accounts would typically be sparse (but not empty). On the other hand, the production account of the residual

[33]The following discussion is too brief to distinguish between the statistical unit and the reporting unit. We use the two terms synonymously for present purposes.

[34]A more detailed exposition can be found in Postner (1984).

[35]Another example: we would need a special intragroup financial instrument to represent headquarters' ownership of operating divisions' net asset positions, at least for those divisions that are not incorporated and only posses "truncated" balance sheets.

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division would be sparse (empty in an extreme case) while the appropriation and capital finance accounts are typically dense. The important point is that all these accounts are well-defined and relevant to the decision making of the respective divisions. For this reason, the "division" appears to be the suitable choice of statistical unit for microbusiness accounts.[36] This particular unit is closely related to the concerns of management accounting, emphasized earlier. Ideally we would like to construct division-deconsolidated transaction matrices for each and every group of closely-affiliated companies in the macroenterprise sector and imbed the set of matrices in the market transaction matrices for the national economy as a whole. We realize, of course, that divisional unit accounting data are not presently available in any substantive form to put the macroenterprise sector on this type of microaccounting foundation. So some compromises are necessary (see next section). But it is also necessary to understand the direction in which we should be working.

V. CONCLUSION

Thirty years ago Raymond Goldsmith (1955) enumerated the ten principles of national economic accounting. One of the principles concerns "consistency" and two or three other principles are also closely related to the concerns of this paper. We have no general quarrel with the ten principles. Rather, we would argue that some of the principles should be amended in view of new developments in the fields of data availability and economic policy analysis. It is no longer sufficient for national economic accounting to be limited to aesthetically appealing notions.

We know that accounting relationships, whether macro or micro, do not directly reveal economic behavioural relationships except in economic equilibrium. On the other hand, accounting relationships should not deliberately conceal behavioural relationships! Nevertheless, the latter relationships do tend to become concealed when accounting data, whether macro or micro, are adjusted and reconciled to enforce "consistency". Now when dealing with macroaccounting relations, one may very well take the view that behavioural relations are "concealed" in any event by the process of aggregation and consolidation. So it is natural, then, to emphasize macroeconomic interdependence and consistency. But when dealing with microaccounting relations, particularly when based on a statistical unit reflecting decision making, one has an opportunity to expose aspects of economic behaviour that are useful information to the economic policy maker. When this is done, it may very well turn out that theoretical notions of economic interdependence (say, consistent articulation) are weakened; in fact, violated. But is this really a weakness? On the contrary, it is strength because there is considerable evidence that two or more parties involved in a common market transaction may have inconsistent views and knowledge of the same transaction. The views and knowledge of the individual transactors are reflected in their respective accounting records and inevitably affect their respective economic behaviour. So inconsistency embodies an important aspect of the real economic world. If such strands of inconsistency are preserved in our national

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[36]The divisional unit is also useful in other contexts; see Postner (1985).

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accounting procedures, then it is more likely that accounting relations will furnish information that could be used to eventually "explain" economic behaviour and thus also be of value for purposes of economic policy.

Brave words! But where do we go from here? In this conclusion we could do no more than briefly outline some ideas for future research. In effect we call for a simultaneous attack on two fronts.

The first front is an empirical one. Our proposals in this area are not really new, but merely confirm current trends. The discussion is mainly limited to data sources now available in computerized form. (A more ideal set of proposals would follow the discussion of issue number three in section IV.2.) It seems clear that the best opportunity to put a macroeconomic sector on a microdata foundation rests within the macroenterprise sector. In particular, one could begin with the nonfinancial corporate subsector; the macroaccounts for such a subsector appear as part of the Ruggleses' (1982b) Integrated Economic Accounts. The problem then is to remove all nonmarket and attributed transactions from the sector (this is already done, in part, in the Ruggleses' scheme), gross up where feasible, and finally perform a vertical consolidation of the three sectoral accounts (production, appropriation, and capital finance) so yielding the market transaction statement of the nonfinancial corporate subsector. We would now collect microbusiness accounting data, possibly the computerized versions of the Securities and Exchange Commission (SEC) annual reports which are evidently on a company basis. The collection should be restricted to those companies that fall within the nonfinancial subsector. (It is assumed here that SEC reports cover both income statements and derived sources-and-uses-of-funds statements.) Each pair of company statements would need to be purged of purely internal transaction elements and foreign operations, grossed up where necessary, and then transformed into the company's market transaction statement. There would probably be considerable differences between the coverage and disaggregation level of the (mutually exclusive and exhaustive) transaction categories that appear in the sectoral and the various company transaction statements. The best that could be done here is to choose the most appropriate common denominator of transaction categories, possibly after some modifications to the entries in the company statements. The revised classification of transaction categories must again be mutually exclusive and exhaustive with respect to their universe.

At this point we would be interested in comparing the sectoral transaction statement with an aggregation of the company transaction statements. This can be done either at the gross (credit and debit) levels or at the net level. There are two key issues surrounding such a comparison. The first concerns the extent to which the macrosectoral accounts are consolidated with respect to intra-sectoral account transactions. The second issue concerns coverage. The SEC reports are limited to the large registered companies; the sectoral accounts presumably cover all companies of a nonfinancial character. Therefore we must consider and analyze a "residual" transaction statement for all remaining small and unregistered companies.[37]

[37]Possibly using a stratified sampling of these companies backed up by a principle component analysis of their accounting characteristics in order to circumvent the problem of finding "representative" small companies.

Perhaps enough has been said to give some indication of the statistical problems involved in putting a macrosector on a microaccounting foundation. Indeed some of these problems, including the "residual" problem, have already been faced by private investigators (see references in section II.1). A recent effort by H.M. Treasury (1984) in England to compare rates of return figures derived from national accounts and company accounts is reminiscent of the problems mentioned above. With the availability of more complete computerized versions of company accounting records, it would appear that a more systematically programmed attack on the statistical problems is called for. In any event, future research in this area requires the close cooperation of national statistical agencies who have access to other (confidential) sources of company accounting data including management accounting records.[38] Techniques are also now available to circumvent some of the confidentiality limitations of these additional sources. Finally, there is the issue of obtaining a closer dialogue with business accounting standards boards so that company accounting reports become more standardized, but without compromising their integrity to reveal (management) decision-making accounting records.

The second front for future research is a more analytical one. It involves some new directions for the role of the national economic accountant. Indeed at first glance it may appear that national accounting is undermined by the emphasis on microdata sets and the ensuing pervasiveness of statistical inconsistency. After all, the traditional role of the national economic accountant has been precisely to put together and reconcile diverse sources of information in a consistent accounting framework so yielding an overall view of the national economy with special emphasis on sectoral economic interpendence. The national accountant is also particularly concerned with measuring the celebrated national aggregates supported by the famous Keynesian macroeconomic identities. It is not difficult to see that an accounting system, whether macro or micro, in which statistical inconsistency is pervasive does nothing less than remove the very foundations of national accounting aggregates and macroeconomic identities. The calculation of national aggregates no longer yields unique totals and the traditional economic identities are unidentified! Are we then to conclude that this whole paper is an exercise in economic futility? Although this is one possible conclusion, it is also possible to begin moving in new directions.

First it may be "quite a while" until macroeconomic accounts are put on a microaccounting foundation along the lines indicated in this paper. Therefore empirical evidence regarding the nature and extent of statistical inconsistency will also not be available for "quite a while." But in the meantime we do know something about the structural properties of accounting systems embodying inconsistency (see, e.g. sections III.2 and III.3). We claim that these structural properties have economic meaning and reflect an important aspect of the economic world if viewed from the perspective of the universe of microeconomic decision makers. We would, then, advise the national accountant to preserve, as much as possible, the initial sets of data that go into the construction of the published

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[38]See again Sizer (1980) for the relationship between financial accounting reports and management accounting records.

accounts, i.e. *before* the adjustment and reconciliation procedures designed to harmonize accounting constructs and so eliminate statistical inconsistencies. The pre-adjustment sets of accounts might give us some clues about the nature and extent of inconsistencies and their implications for the calculation of national accounting aggregates and the specification of macroeconomic identities. Pre-adjustment accounts could form the basis of simulation experiments and lead to techniques for keeping track of inconsistencies. It should also be noted that the national accountant often uses subjective "measures" of reliability (formal or informal) to diminish statistical inconsistencies. This procedure probably conflicts with the perspective of the microaccounting unit decision maker who bases decisions on the most reliable information available to the unit, although the accounting information may or may not be communicated to a national statistical agency.[39]

Finally, suppose there is a national accounting system entirely built on a microaccounting foundation. Furthermore, suppose the system is characterized by pervasive discrepant articulation—which we called statistical inconsistency. How can such a system's magnitudes be summarized by useful national aggregates? As already mentioned, national aggregates such as gross domestic product and major components may no longer be calculated so as to yield unique totals. The application of group-theoretic operations in an accounting system subject to internal balances and external imbalances evidently fails to yield identical aggregates within the permutation group. Instead we end up with a family of totals and a distribution of totals among the family. This result is confounded by the disaggregation level of the transaction categories which underlie the accounting system. The finer the disaggregation, the greater the family and the less concentrated is the distribution of calculated totals for the typical national accounting aggregate.[40] Could we live with a national accounting system whose summary measures are uncertain and, perhaps, unstable? This question cannot yet be answered until we learn more, possibly by simulation experiments, about the exact nature and extent of statistical inconsistency. This writer, for one, is willing to sacrifice "uniqueness" and "identities" for a framework which promises benefits for economic policy analysis. But the benefits will only be realized if the accounting system's properties are better understood.

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[39]In this paper we emphasize the microaccounting data used by the decision maker; these are the data that should be incorporated in systems of national accounts useful for economic policy analysis.

[40]These technical statements are only based on very preliminary investigation and therefore are subject to considerable refinement.

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