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Segment Statements and Informativeness Measures: Managing Capital vs. Managing Resources

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SYNOPSIS: This article examines the informativeness of disaggregated data in financial statements by comparing the informativeness of conventional disaggregation with that of the industry and geographical disaggregations in segment disclosure. The usefulness of disaggregated data depends on both internal factors that relate to the accounting processes and external factors, that relate to uses to which users apply accounting data. This article focuses on a quantitative dimension of the former, proposing the use of the "disaggregation measure" as a measure of the informativeness of disaggregated data. The article focuses on a qualitative dimension of the latter, examining the need to distinguish the information requirements of those who manage capital from those who manage resources. Capital is homogeneous while resources are not. Hence, the conventional disaggregation, which is much more resource-oriented than the two newer disaggregations, loses its significance quickly as data are aggregated across diverse industries or countries. The industry and geographical disaggregations, on the other hand, are capital-oriented and are rapidly gaining in significance as business diversifies and becomes global. Finally, the article explores an accounting policy issue dealing with the possibility of developing a "segment statement" as a fourth primary financial statement, one that would cut across the balance sheet, the income statement, and the cash flow statement.

Statement of Financial Accounting Standards No. 14, "Financial Reporting for Segments of a Business Enterprise" issued in December 1976, established the requirement that corporations following U.S. generally accepted accounting principles publish segment reports. They must present revenue, operating profit, and identifiable assets by industry and by geographical segments (FASB 1976). International Accounting Standard No. 14, "Reporting Financial Information by Segment" issued in August 1981, also established a similar requirement for those following the international accounting standards (IASC 1981).[1]

Demand for more segment information has continued to increase since then. The FASB responded to the demand by putting on its agenda a project on segment reporting titled "Reporting Disaggregated Information by Business Enterprises." The Board initiated a

[1] See Bavishi and Wyman (1980) for a comparison of the FASB requirements with those of the IASC (1981) as well as with those of the United Nations Center on Transnational Corporations (UNCTC 1977) and of the Organization for Economic Cooperation and Development (OECD 1979). See also Gray and Radebaugh (1984) for a U.S.-U.K. comparison of the practice on segment reporting.

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research project conducted by Paul Pacter and published its research report in February 1993 (Pacter 1993). This project is one of the most thorough studies on the subject of segment reporting currently available. The IASC also continued its efforts on segment reporting and published a draft statement of principles on the subject in September 1994 (IASC 1994).[2]

In May 1993, in a step toward international coordination of accounting standard setting bodies, the FASB and the Accounting Standards Board of the Canadian Institute of Chartered Accountants jointly issued an "Invitation to Comment" (FASB/ASB 1993) on the reporting of disaggregated information. The FASB is expected to issue an Exposure Draft in early 1995 that will propose requiring disclosure of more segment data. The Board will issue a final statement perhaps in late 1995 (Berton 1994). It seems clear that there will be intensive standard setting activities in 1995, both at the FASB and at the IASC.[3]

This article examines the informativeness of disaggregated data in financial statements by comparing the conventional disaggregation with the industry and geographical disaggregations in the segment disclosure. The usefulness of disaggregated data depends on both internal factors that relate to the accounting processes and external factors that relate to uses to which users apply accounting data.

This article focuses on a quantitative dimension of the internal factors, proposing the use of the "disaggregation measure" as a measure of the informativeness of disaggregated data. This is presented in the next section, "The Informativeness of Disaggregated Data" and the section that follows, "An Illustration of the Disggregation Measure," using AT&T's asset and income data for 1991–94.[4]

The article focuses on a qualitative dimension of the external factors, examining the need to distinguish the information requirements of those who manage capital from those who manage resources. This is presented in the section entitled, "Managing Capital versus Managing Resources." Capital is homogeneous while resources are not. Hence, the conventional disaggregation, which is much more resource-oriented than the two newer disaggregations, loses its significance quickly as data are aggregated across diverse industries or countries. The industry and geographical disaggregations, on the other hand, are capital-oriented and are rapidly gaining in significance as business diversifies and becomes global.

Finally, the article explores an accounting policy issue dealing with the possibility of developing a "segment statement" as the fourth primary financial statement, one that would cut across the balance sheet, the income statement, and the cash flow statement. This is done in the final section, "A Segment Statement as a Primary Financial Statement."

All technical matters relating to the disaggregation measures and its complement, the aggregation measure, are summarized in the appendix, "The Generalized Aggregation Measure." Here, after a brief review of the literature dealing with measurements of disaggregated data, the disaggregation measure and the aggregation measure are compared with the entropy-based decomposition measure, noting that the former is based on the arithmetic mean while the latter is based on the geometric mean. They are both special cases of the generalized aggregation measure. The former is used in the main part of the article because it can deal with a disaggregation into positive and negative numbers, as in the in-

[2] See also Pacter (1994) for his work completed for the IASC which includes an extensive survey of disclosure practice on segment data.

[3] Another report that emphasizes the importance of disaggregated data was published in November 1993 (AICPA 1993). This "Jenkins Report" highlights disaggregated information as one of the nine most important areas requiring attention based on their extensive study of users of financial statements. It states, "Both investors and creditors place a high value on segment reporting and believe that current disaggregated disclosures generally do not provide adequate information to help them predict an entity's future earnings and cash flows (p. 4)."

[4] While our focus will be mostly on the asset disaggregation, the principles that we derive on the asset disaggregation can be generalized to the liability disaggregation as well as disaggregation of income and other financial statement items. Also since our focus is on the quantitative properties of the disaggregated asset amounts, we use the term "disaggregation" rather than "classification."

come decomposition into revenues and expenses, while the latter cannot.

THE INFORMATIVENESS OF DISAGGREGATED DATA

Let us first consider specific examples to explore what we mean by "informativeness of disaggregated data." We shall assume throughout the article that the aggregate data, such as total asset amount, is already available. We are interested in what information disaggregated data can provide incrementally over the aggregated data. Specifically, for example, what is the informativeness of disclosing the book value of current assets, say, \$30 (millions omitted), and non-current assets, \$70, separately assuming that we already know the book value of total assets, \$100?

When details are available, the user presumably uses them to determine more accurately such factors as the current replacement cost or liquidation value of assets or cash flows in the future. Since current and non-current assets display different characteristics, the user may apply different coefficients in estimating replacement cost, RC, from the book value. For example:

$$RC = (1.1 \times \$30) + (2.5 \times \$70) = \$208. \quad (1)$$

Here, the user may use a relatively low price coefficient of 1.1, for example, for current assets. This is because most current assets are purchased within the past year. Their book value therefore reflects current market price reasonably closely. On the other hand, the user may use a relatively high price coefficient of 2.5, for example, for non-current assets. They were generally purchased many years ago at significantly lower prices.

Without the breakdown of assets into current and non-current, the user must rely only on the total asset figure, \$100.[5] In this case, the user may use estimates of the proportions of current and non-current assets, say .2 and .8, respectively, and determine RC as:

$$RC = (1.1 \times .2 \times \$100) + (2.5 \times .8 \times \$100) = 2.22 \times \$100 = \$222. \quad (2)$$

This RC differs from \$208 in (1) which is the "correct" figure that the user would have derived if the disaggregated data were available.

The above illustration may also be extended to estimating the liquidation value, LV, of assets. In a fire sale under bankruptcy, current assets may derive more cash per dollar of book value than non-current assets do. The coefficients the user applies might be .8 for current assets and .5 for non-current assets. Thus, if proportions of current and non-current assets are available, the user determines liquidation value as:

$$LV = (.8 \times .3 \times \$100) + (.5 \times .7 \times \$100) = .59 \times \$100 = \$59. \quad (3)$$

If they are not known, the user must replace the actual proportions with estimates of .2 and .8, obtaining:

$$LV = (.8 \times .2 \times \$100) + (.5 \times .8 \times \$100) = .56 \times \$100 = \$56. \quad (4)$$

Here, we may note that if the price coefficient for current assets and that for non-current assets are equal, say, both equal to .65, obviously there is no need for disaggregated data at all. For any proportion, p_1 for current assets and p_2 for non-current assets, which must necessarily add to one[6], we have:

$$LV = (.65 \times p_1 \times \$100) + (.65 \times p_2 \times \$100) = .65 \times \$100 = \$65, \quad (5)$$

Then, the disaggregated data have no "informativeness" for this particular use since the user can determine the liquidation value correctly without the disaggregated data.

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[5] The historical cost figure for total assets alone is of considerable value in estimating current replacement cost of total assets. Its usefulness can be well imagined if one tries to estimate replacement cost of total assets without having the benefit of the historical cost figures from the balance sheet.

[6] By definition, all proportions sum to 1. Strange as it may seem, however, the analysis presented below can be applied intact even when some proportions are negative; this is useful in applying the analysis to disaggregation of net income of, say, \$1 into sales of \$3 and cost of sales of \$2, in which case $p_1 = 3$ and $p_2 = -2$. (See the income decomposition in the bottom half of table 1.) Actually, from the mathematical standpoint, disaggregated data need not sum to 1 for the formulas, such as (7) presented below, to apply. This is a valuable point since the analysis can be used even in cases where the aggregate amount is 0 and no proportions can be computed. However, we shall continue to use the term "proportions" because of its ease in understanding and in reminding us that the aggregate amount is assumed to be known to the user.

Therefore, the accuracy of the user's determination using estimates depends upon two factors: (i) the variability between the actual proportions, denoted by p, where p = (.3, .7), and the estimated proportions, denoted by q, where q = (.2, .8), as well as (ii) the variability among the price coefficients, denoted by v, where v = (1.1, 2.5), for the replacement cost case, for example. If (i) p = q, the user can correctly determine the replacement cost regardless of the variability among price coefficients; or if (ii) all price coefficients in v are the same as in v = (.65, .65), then the user can also correctly determine the replacement cost no matter what p turns out to be.

We cannot say much about the variability among price coefficients because there are so many users and uses to which a given set of disaggregated data may be applied. However, we can say something about the variability between p and q if it is reasonable to assume that, in the absence of p, the user uses as a surrogate q some widely available data, such as the proportions found in the company's last year's financial statements or the proportions found in the average of the industry to which the company belongs. If so, we can perform a more concrete analysis as discussed in the next section using the disaggregation measure.

AN ILLUSTRATION OF THE DISAGGREGATION MEASURE

Let us now examine how to compute the disaggregation measure, denoted by δ, using AT&T's asset and income data taken from its financial statements. Focusing on the asset data for now, the data show the following breakdown of total assets along the three dimensions mentioned earlier, namely, the conventional "liquidity" disaggregation and the newer "industry" and "geographical" disaggregations in the segment disclosure. The company uses two industry segments, "information movement and management" ("information management" for short) and "financial services and leasing" ("financial services" for short). The company also divides total assets into "U.S." and "Foreign." The upper part of table 1 shows the three disaggregations of AT&T's total assets at the four year-ends of 1991, 1992, 1993, and 1994. The table also shows the disaggregation measure, δ, computed for each of the three disaggregations for 1992 over 1991 (92/91), 1993 over 1992 (93/92), and 1994 over 1993 (94/93).

Using the asset data for AT&T in table 1, let us take the disaggregation measures for "II. Industry Disaggregation" for 1992 over 1991, shown in the 1992 column as .0084, to illustrate the method of computation. Using 1992 data for p and 1991 data for q, and the subscript 1 to mean "Information Management" and 2 to mean "Financial Services," we have in the table (stated in percentage):

$$p_1 = .7551,\ p_2 = .2449,$$
$$q_1 = .8162,\ q_2 = .1838. \qquad (6)$$

Since the disaggregation measure δ is one minus the "aggregation measure," denoted by ρ^2, the latter is computed first as follows:

$$\begin{aligned}\rho^2 &= (p_1q_1 + p_2q_2)^2 / [(p_1^2 + p_2^2)(q_1^2 + q_2^2)] \\ &= [(.7551 \times .8162) + (.2449 \times .1838)]^2 \\ &\quad / [(.7551^2 + .2449^2) \times (.8162^2 + .1838^2)] \\ &= .4374 / [.6302 \times .7000] = .9916. \qquad (7)\end{aligned}$$

Then, the disaggregation measure δ is:

$$\delta = 1 - \rho^2 = 1 - .9916 = .0084. \qquad (8)$$

The quantity, ρ^2, which is always between 0 and 1, can provide the same interpretation as for R^2 in statistics based on the fraction of variance (more details shortly) that can be eliminated by using the aggregated data along with the estimated proportions. ρ^2 shows how much can be accomplished without the disaggregated data. Its complement, $\delta = 1 - \rho^2$, is defined as the disaggregation measure since it indicates the fraction of variance that can still be eliminated by the use of the disaggregated data.

Continuing with the example, suppose a user needs to determine the replacement cost of the total assets as of 12/31/1992, whose known book value is $57,188. The user-supplied price coefficients are 1.1 for current assets and 2.5 for non-current assets as in (1). The user wishes to use the 12/31/1992 data, p = (.7551, .2449), but it is not available. Therefore, as its surrogate, the 12/31/1991 data, q = (.8162, .1838), is used, obtaining replacement cost as:

TABLE 1
Disaggregation of AT&T's Total Assets and Operating Income ($ millions)

Disaggregation Types	1991		1992		1993		1994	
TOTAL ASSETS (12/31/9x)								
I. Liquidity								
Current Assets	$24,613	46.13%	$26,514	46.36%	$29,738	48.94%	$37,611	47.45%
Noncurrent Assets	28,742	53.87%	30,674	53.64%	31,028	51.06%	41,651	52.55%
Total Assets	$53,355	100.00%	$57,188	100.00%	$60,766	100.00%	$79,262	100.00%
Disaggregation Measure δ			(92/91)	.0000+	(93/92)	.0026	(94/93)	.0009
II. Industry								
Information Management	$43,546	81.62%	$43,185	75.51%	$43,733	71.97%	$57,800	72.92%
Financial Services	9,809	18.38%	14,003	24.49%	17,033	28.03%	21,462	27.08%
Total Assets	$53,355	100.00%	$57,188	100.00%	$60,766	100.00%	$79,262	100.00%
Disaggregation Measure δ			(92/91)	.0084	(93/92)	.0033	(94/93)	.0003
III. Geographical								
U.S.	$48,424	90.76%	$51,815	90.60%	$53,865	88.64%	69,901	88.19%
Foreign	4,931	9.24%	5,373	9.40%	6,901	11.36%	9,361	11.81%
Total Assets	$53,355	100.00%	$57,188	100.00%	$60,766	100.00%	$79,262	100.00%
Disaggregation Measure δ			(92/91)	.0000+	(93/92)	.0006	(94/93)	.0000+
OPERATING INCOME								
I. Revenue/Expense								
Revenues	$63,089	7144.85%	$64,904	1089.36%	$67,156	1082.46%	$75,094	998.86%
Expenses	–62,206	–7044.85%	–58,946	–989.36%	–60,952	–982.46%	–67,576	–898.86%
Operating Income	$883	100.00%	$5,958	100.00%	$6,204	100.00%	$7,518	100.00%
Disaggregation Measure δ			(92/91)	.0017	(93/92)	.0000+	(94/93)	.0000+
II. Industry								
Information Management	$917	103.85%	$5,765	96.76%	$5,865	94.54%	$7,124	94.76%
Financial Services	–34	–3.85%	193	3.24%	339	5.46%	394	5.24%
Operating Income	$883	100.00%	$5,958	100.00%	$6,204	100.00%	$7,518	100.00%
Disaggregation Measure δ			(92/91)	.0050	(93/92)	.0006	(94/93)	.0000+
III. Geographical								
U.S.	$487	55.15%	$6,006	100.81%	$6,451	103.98%	$7,668	102.00%
Foreign	396	44.85%	–48	–0.81%	–247	–3.98%	–150	–2.00%
Operating Income	$883	100.00%	$5,958	100.00%	$6,204	100.00%	$7,518	100.00%
Disaggregation Measure δ			(92/91)	.4059*	(93/92)	.0009	(94/93)	.0004

[1] Sources: AT&T's annual reports. AT&T's 1994 financial statements contained a major restatement of prior year data due to the merger with McCaw which was accounted for as a pooling of interests. The data in the table do *not* reflect the restatement for earlier years since users had no access to restated data in prior years.

[2] Corporate assets and corporate/nonoperating income were lumped together with the larger of the two disaggregated categories (Information Management and U.S.) to simplify the illustration as their amounts were small. Likewise, nonoperating and other income were netted against expenses.

[3] See appendix for a comparison of the above disaggregation measures with those derived from "entropy measures" wherever they exist. (The latter does not exist when the total number is disaggregated into positive and negative numbers as in the Revenue-Expense Disaggregation and the Geographical Disaggregation in the Operating Income Section.) The two sets of measures are very close to each other whenever the latter measure exists as shown in appendix.

* The highest disaggregation measure, the most informative data, in the table.

$$RC = (1.1 \times .8162 \times \$57{,}188) + (2.5 \times .1838 \times \$57{,}188) = 1.3573 \times \$57{,}188 = \$77{,}621 \quad (9)$$

instead of the correct figure of:

$$RC = (1.1 \times .7551 \times \$57{,}188) + (2.5 \times .2449 \times \$57{,}188) = 1.4429 \times \$57{,}188 = \$82{,}517. \quad (10)$$

Of course, this is only one user and one use. Various uses call for different values of user-supplied coefficients. Under certain conditions, however, (namely, when v_1 and v_2 are independent and normalized random variables), ρ^2 indicates the fraction of the variance in $y = p_1v_1 + p_2v_2$ that can be eliminated as a result of estimating y from $w = q_1v_1 + q_2v_2$. In this example, the high value of ρ^2, .9916, indicates that given the availability of the 1991 fractions of the total assets, the knowledge of the 1992 fractions contributes only marginally, 1–.9916 = .0084. Even so, this 1992/91 industry data has the best measure of informativeness among all three disaggregated asset data in all of 1992/91, 1993/92 and 1994/93.

Now, let us turn to the bottom half of table 1 where income data are disaggregated. Here, the conventional disaggregation is represented by the Revenue-Expense disaggregation. Operating income is shown as the difference between revenues and expenses. The disaggregation measure, however, is very close to zero in each of the three pairs of years ranging only between .0000+ and .0017. The industry decomposition yields similarly low disaggregation measures.

The geographical disaggregation in 1992/91 brings the greatest surprise for us with the disaggregation measure of .4059 or 41 percent. This means that there is substantial room for improving the estimate by having the disaggregated data. This occurred because the foreign operation that generated 44.85% of the world-wide corporate profit in 1991 turned to a loss in 1992, thereby drastically changing the sources of operating income. Users who received only the aggregate income of $5,958 (a phenomenal 575 percent increase over the depressed 1991 income of $883 due to business restructuring charges) might attribute $2,672 (= $5,958 × .4485) to the foreign operations when in fact they were a loser in 1992. The geographically disaggregated data in 1992 were therefore very informative and allowed the users to avoid potential misunderstandings. However, foreign operations continued to lose money in 1993 and in 1994, and the disaggregation measure became close to zero as there were no more surprises in these years relative to their previous years' data.

Whatever the uses may be, the informativeness of disaggregated data becomes greater if the actual proportion p varies widely compared with the estimated proportion q. When we disclose disaggregated data for the first time, it is quite possible to have a wide disparity between p and q for many users and for many uses. As we continue the disclosure periodically, however, the user can use the proportions from the previous period as an estimate of the current period's proportions, with or without modifications. The incremental value of disclosing the current period's actual proportions will be less than that in cases where earlier periods' proportions are not available. In particular, if current proportions are exactly the same as previous proportions (which is almost the case for current and non-current assets in 1992 in table 1), the disaggregation measure is zero, which means that the disclosure of p was not informative.

In practice, the disclosure of these disaggregated amounts may still be of value, since, at a minimum, it affirms the prediction that they will remain unchanged. As a situation is repeated, however, we begin to expect the same outcome and eventually such information becomes of no value, just as the statements "An apple fell to the ground" or "The Sun rose from the East this morning." We are so used to the events that the information about them becomes virtually of no value.

Likewise, in comparison across firms, if the proportions of the two asset categories are almost unchanged from firm to firm, users lose interest in this particular disaggregation. This will be the case if the disaggregation measure is zero when p and q are taken from the proportions observed in the financial statements of two different firms. When the proportions differ over time or across firms, then the in-

formation is of interest to the users. The disaggregation measure reflects this fact by measuring the degree of disparity between one set of proportions and another.

While we present the above analysis only for illustration, such an analysis can provide an important input to standard setters on the relative significance of different disaggregations. Although we limit our examples to the revaluation of assets using current replacement cost or liquidation value, important reasons for disaggregation also include making a return and risk assessment of total assets. Instead of the price coefficients used in the examples, the user in such cases would be letting (v_1, v_2) reflect return and risk factors associated with each component of assets. As mentioned before, the more user-supplied coefficients vary, the more useful the disaggregated data becomes. While the traditional liquidity disaggregation may still be important in this regard, return and risk variance may very well be even greater along the industry and geographical disaggregations.[7]

MANAGING CAPITAL VERSUS MANAGING RESOURCES

We now shift our attention to the external dimension in assessing the relative merit of different disaggregations. Before discussing this issue, however, it is useful to consider the two types of managers, "capital managers" and "resource managers," and the difference in their information needs.

"Capital" and "resources" are the two financial sides of the same entity. The equality of the two is best shown in the balance sheet equation, Assets = Liabilities + Shareholders' Equity. Since current liabilities (excluding the current portion of long-term debt) are, for the most part, generated in the process of managing resources, they are often netted against assets. Following this practice, we state the equality of capital and resources as:

$$\text{Resources} = \text{Capital}. \qquad (11)$$

We define resources to include all assets, net of current liabilities (other than the current portion of long-term debt), and capital to include long-term liabilities (along with the current portion of long-term debt) and shareholders' equity.

This equation highlights the difference in orientation between capital managers and resource managers, even when they happen to manage the same entity. For example, a capital manager sees a refinery as, say, a $100 million capital investment, while a resource manager sees it as a plant capable of processing, say, 30,000 barrels of crude oil daily.

Capital is abstract, aggregated, and homogeneous, while resources are concrete, disaggregated, and heterogeneous. The double-entry bookkeeping system that has been the backbone of accounting for more than five centuries, has, since its inception, recorded resources and capital in tandem.[8] This makes the accounting records capable of handling the information needs of both capital managers and resource managers simultaneously from a single system. It is noteworthy that this resource-capital integration in one system developed long before the separation of managers' duties between capital management and resource management.

The primary responsibility of capital managers is to raise capital and allocate it among projects to earn a maximum total return. The task of resource managers is to operate a project efficiently to maximize the project's return. Examples of capital managers are board members and top executives in a decentralized corporation and examples of resource managers are general managers of a division or a subsidiary of the corporation. All outside investors and managers of investment portfolios are capital managers.

[7] See appendix for a brief review of the literature on disaggregation, a comparison of the disaggregation measure presented here with the "decomposition measure" used in Theil (1967) and Lev (1968, 1969, 1974), noting that both are special cases of the "generalized aggregation measure."

[8] Note, however, that the foundation of double-entry bookkeeping goes much deeper than the balance sheet equation. The balance sheet and its equation existed long before the introduction of income accounts, which are considered to be the critical element of double-entry bookkeeping. See Ijiri (1993) which describes the salient feature of double-entry bookkeeping in the most abstract form as recording of "explanandum" (things to be explained) and "explanans" (things that explain) in tandem.

Capital managers and resource managers both need information, but the types of information they need may be quite different. Capital managers need information that enables them to determine amounts, returns, and risk of invested capital and to estimate their future changes. Resource managers need information that enables them to plan and execute daily use of their resources. Since capital is abstract, aggregated, and homogeneous, capital managers tend to need highly aggregated information. Since resources are concrete, disaggregated, and heterogeneous, resource managers normally need much less aggregated information.[9] Therefore, financial statements may be suitable vehicles for satisfying the information needs of capital managers but not of resource managers. Suitable vehicles for the latter would be "databases" rather than statements.

Complication arises, however, in this separation of information needs between capital and resource managers. This is because capital managers of a corporation are often authorized to hire or fire resource managers. Capital managers have the responsibility of supervising and evaluating resource managers' activities. In other words, they function as "super-"resource managers, blurring the information needs of the two types of managers. Even for external capital investors, they might need sufficiently detailed information to enable them to assess "management risk."[10] Supporters of this view would argue that, while industry and country risks are important, management risk is also an important component of the overall investment risk. Hence, financial statements must contribute in supplying information useful for the assessment of this management risk. While we do not deny the importance of such information, our emphasis is on the increasing importance of industry and country risks and the need to supply information on capital disaggregated along these risk dimensions.

A SEGMENT STATEMENT AS A PRIMARY FINANCIAL STATEMENT

It is conceivable that, if the current force for the rapid diversification and globalization of business continues, industry and geographical disaggregations might become so important that they eventually form a new primary financial statement, a "segment statement." We may consider four reasons explaining the need for such a statement.

1) *Decreasing Value of Liquidity Disaggregation:* First, we traditionally disaggregated the assets of a corporation on the balance sheet based on the physical and economic properties of assets and arranged them in the order of liquidity. This liquidity disaggregation is basically resource-oriented. As such, this disaggregation tends to lose its significance quickly as we aggregate assets beyond the level that resource managers deal with. This is especially true when they are aggregated across diverse industries or countries.[11]

This disaggregation has served the information needs well when an enterprise operated primarily in a single industry and in a single country. In such a situation, liquidity disaggregation may have had the maximum value because no other disaggregation would have captured a greater variability in risk.

[9] For example, suppose that an aggregate amount such as total assets is already available. Then, capital managers may manage reasonably well in assessing the amount, return, and risk of their invested capital in a subsidiary without the knowledge of disaggregated amounts of assets such as the total amount of accounts receivable that the subsidiary has. Resource managers cannot manage their short-term cash budget, however, without the knowledge of the total amount of accounts receivable. More importantly, they cannot manage collection of overdue accounts without getting individual account balances. For this resource management purpose, even the total amount of accounts receivable is over-aggregated.

[10] This argument was called to the author's attention by a referee of this article.

[11] The total amount of inventory of a plant or the inventory turnover rate computed from it may be indispensable information for the plant manager. The same data for the subsidiary as a whole may still be useful for the general manager of the subsidiary operating in a single industry in that the data might trigger, for example, a company-wide inventory reduction effort. But it is questionable what action it could possibly trigger if the total amount of inventory is derived and the turnover rate is computed by adding inventories and costs of sales of subsidiaries in several diverse industries including industrial, transportation, utilities, and service industries. Financial ratios can of course be computed no matter how data are aggregated but the resulting ratios would be of very limited meaning.

This is no longer true, which leads to the second reason justifying the segment statement as a primary financial statement.

2) *Increasing Value of Industry and Geographical Disaggregations:* The top management's focus has shifted to the choice of industries and countries in which investments should be made. These decisions deal with factors containing the greatest variability in return and in risk. Considering the differential impact of technological innovations on diverse industries and the effect of exchange rate fluctuations on the success or failure of foreign investments,[12] these investment decisions on industry and on country are the first-order decisions of today's global business. Compared with these decisions, decisions on how to allocate the capital among different types of assets such as inventories and plant assets, (however important they may be), is secondary. If so, the recording and reporting structure in accounting needs to be modified to adapt to this new hierarchy of decisions.

3) *Cutting Across Three Existing Financial Statements:* A third reason is that the segment statement cuts across all three existing financial statements, (balance sheet, income statement, and cash flow statement), thereby adding a totally different axis to a system of financial reporting. Segments in industry and geographical disaggregations are much more self-contained entities than asset accounts such as inventories and plant assets. This is obvious if we consider how we might allocate corporate income among receivables, inventories, and plant assets. They all interact so closely that income attributed to receivables, to inventories, or to plant assets seem very difficult to contemplate. While there are certainly interactions among segments to some extent, their degree is much less than those of different types of assets.

This means that the segment statement, based on disaggregated data in industry and geographical segments, can relate the two factors necessary to determine "return on investment," namely, (a) the amount of investment in the segment with (b) income earned in the segment. This links both balance sheet data and income statement data. The same linkage with the cash flow statement is also feasible relating investment in the segment with (c) cash recovery in the segment.[13] While the precise form of segment statement would have to evolve from the existing disclosure format of segment reports, the statement should emphasize this feature of cutting across the three primary statements. This is why the segment statement as a primary financial statement would add a new axis to financial reporting.[14]

4) *Information on Capital Being of Primary Importance:* A fourth reason is that financial statements serve external investors. They are capital managers. Their primary interest is in capital and only secondarily in resources. Information that is of utmost importance for capital managers is information on where capital is invested (amount of capital), return it is earning (return on investment), and the speed of recovery of investment (cash recovery, namely return on and return of investment, as the term is often used in business).

Some external investors might serve as "super-"resource managers. They may also need to assess "management risk" in investing in the company. Such information needs, however, are secondary. If, for example, the user needs to predict tomorrow's temperature, it is obvious that an information supplier must first supply data on the temperature up to now. Other information on humidity or barometer readings, etc., may be helpful to the user in predicting tomorrow's temperature but only as secondary data.

Viewed in this way, we begin to understand why the segment statement can be justified

[12] Use of a composite currency is advocated in Ijiri (1995) in place of the usual use of home currency as the reporting currency of financial statements. It presents an argument on why the use of home currency can distort presentation of financial position and operating performance of global corporations by exaggerating the financial impact of currency fluctuations.

[13] See Ijiri (1978) for the structure of "cash flow accounting" and a related performance measure called "cash recovery rate."

[14] Note that accounting theories that place least emphasis on the physical forms of assets are Schmalenbach's (1919) dynamic accounting and Vatter's (1947) fund theory of accounting. As a result, these theories can accommodate different disaggregations of assets on the balance sheet more easily than other theories.

as a primary financial statement. We may even go further and consider the segment statement as a statement capable of serving as a "summary" financial statement. It would provide a bird's-eye view of a world-wide, economy-wide distribution of the company's investments, their returns, and their recoveries, whose details may then be elaborated in the other three financial statements.

In closing, one final point is worth special attention in regard to the integration-differentiation tension in global business (Bartlett and Ghoshal, 1989). The tension stems from homogeneity of capital and heterogeneity of resources and operations. The former is the force that drives standardization and uniformity in accounting, while the latter is the one that demands accounting systems be tailored to local culture and business practice.

Geographical disaggregation based on country has an advantage in this regard since it will allow more flexibility in the method of asset classification and disaggregation within a country. This is because under this disaggregation, all assets in a country are grouped and presented in one line on the segment statement. Local managers can adopt a disaggregation of assets that best meets the local needs. While legal requirements make it difficult to delete or replace any of the disaggregations that are currently in place, for internal use of accounting data we can use an innovative approach in designing a new type of financial statement that best serves the needs of various levels of management.

We are now heading toward the century of globalization. Even the norm for standards in accounting would have to be reevaluated. It should *not* be just uniformity and standardization but should indeed be "harmonization." Perhaps a dual set of principles and standards should guide the practice, differentiating information on capital, for which we need to develop and implement global standards, and information on resources, for which we need local standards that can vary from country to country or from industry to industry. Just as the Internet links diverse types of computers globally but otherwise leaves local operations of the computers intact, financial reporting of a global corporation should meet the integration needs (stemming from the homogeneity of capital) without severely sacrificing the differentiation needs (arising out of the heterogeneity of resources and operations across countries and across industries). The analysis of disaggregated financial information presented in this article aims at developing a basis for this important accounting decision on the choice of disaggregation in the global management and investment environment.

APPENDIX
The Generalized Aggregation Measure

The earliest economic and accounting literature dealing with the measurement of disaggregation are Theil (1967) in economics and Lev (1968, 1969, 1974) in accounting. (See also Elliott and Jacobson 1994 for a more recent discussion on informativeness of information). Theil and Lev use the "decomposition measure," derived from the entropy measure (Shannon 1948), as a way of characterizing the informativeness of disaggregation.

We used another measure, the square of the "aggregation coefficient, ρ" (Ijiri 1968, 1971), here because of its tie with R^2 in statistics and its being computable even for negative proportions and book values, an important feature in applying the measure to income statement accounts as mentioned earlier. The measure is computed based on proportions that sum to one, but this is not necessary. Replacing proportions with dollar amounts of the disaggregated data leaves the aggregation measure intact, which is also an important feature since the measure is computable even when the disaggregated data sum to exactly zero since, in this case, proportions are not defined.

The aggregation coefficient takes the same formula as the correlation coefficient in statistics but is applied to the coefficients in the linear aggregation function rather than to random variables. The decomposition measure and the aggregation coefficient are closely related to each other as elaborated below. When both measures are suitably transformed, the two aggregation measures, ρ^2 derived from the aggregation coefficient (by squaring it) and $\rho_0{}^2$ derived from the decomposition measure (by multiplying two complementary decomposition measures), are distinguished only by the method of taking means, the former using the arithmetic mean and the latter, the geometric mean.

Both are different forms of the same generalized aggregation measure in which coefficient k is set to 1 in the former and to 0 in the latter. If $\rho_0{}^2$ is used as the aggregation measures in table 1, the measures will change only slightly. See below for such figures. In addition, since arithmetic means exist for figures with mixed signs but geometric means do not (unless complex number solutions can be used meaningfully for the problem on hand), ρ^2 can be used even when a number is disaggregated into positive and negative numbers but not $\rho_0{}^2$ (see "NA" or "not available" in the list of aggregation measures below.)

To see the relationship between ρ^2 and $\rho_0{}^2$, we first examine the notion of the generalized mean and then elaborate on the generalized aggregation measure. An arithmetic mean of numbers $s_1 \ldots s_n$ is defined as $(s_1 + \ldots + s_n)/n$. A geometric mean is defined as $(s_1 \times \ldots \times s_n)^{1/n}$. More generally, these means are defined by allowing a weight to be placed on each number, resulting in $(r_1s_1 + \ldots + r_ns_n)/(r_1 + \ldots + r_n)$ for the arithmetic mean and $(s_1^{r_1} \times \ldots \times s_n^{r_n})^{1/(r_1 + \ldots + r_n)}$ for the geometric mean. Using a real number k, the generalized mean $M_k(s, r)$, defined in (A1) below (Bechenback and Bellman 1965), extends them to a more general form, of which the arithmetic and geometric means are special cases with k = 1 and k = 0, respectively:

$$M_k(s, r) = (\Sigma\, r_i s_i^{\,k} / \Sigma\, r_i)^{1/k}, \tag{A1}$$

with summations going from i = 1 to n. Here, for k = 0 it is defined as:

$$M_0(s, r) = \lim_{k \to +0} M_k(s, r) = \exp[(\Sigma\, r_i \ln s_i) / \Sigma\, r_i] = \Pi\, s_i^{(r_i/\Sigma r_i)}. \tag{A2}$$

For $M_0(s, r)$, s_i must be all non-negative due to the logarithm used in the formula. The base of the logarithm need not be e as in (A2), but can be any positive number n, replacing exp by n and ln by $\log_n$ in (A2). It can be easily verified that this measure indeed gives the arithmetic mean when k = 1 and the geometric mean when k = 0. It also gives the harmonic mean when k = –1, which is $[(r_1s_1^{-1} + \ldots r_ns_n^{-1})/(r_1 + \ldots, + r_n)]^{-1}$. In general, $M_i(s, r) < M_j(s, r)$ for any s and r and any i < j (in particular, the geometric mean is less than the arithmetic mean), except when all s_i's are equal, in which case the two means are equal.

Using the generalized mean $M_k(s, r)$, the generalized aggregation measure $\alpha_k(s, r)$ is defined as follows (Ijiri 1971, 1975, and Colantoni and Ijiri 1973):

$$\alpha_k(s, r) = \alpha_k(r, s) = [M_k(s, r)M_k(r, s)] / [M_k(r, r)M_k(s, s)]. \tag{A3}$$

For k = 1, we have:

$$\rho^2 = \alpha_1(s, r) = (\Sigma\, r_i s_i)^2/[(\Sigma\, r_i^2)(\Sigma\, s_i^2)] \tag{A4}$$

For k = 0, we use, because of the non-negativity, p and q in place of r and s, where $p_i \geq 0$, $\Sigma\, p_i = 1$ and $q_i \geq 0$, $\Sigma\, q_i = 1$, and we have:

$$\rho_0^2 = \alpha_0(q, p) = \exp[(\Sigma\, p_i \ln q_i)+(\Sigma\, q_i \ln p_i)-(\Sigma\, p_i \ln p_i)(\Sigma\, q_i \ln q_i)= \exp(-Iqp - Ipq), \quad \text{(A5)}$$

where Iqp and Ipq are decomposition measures:

$$Iqp = (-\Sigma\, p_i \ln q_i) - (-\Sigma\, p_i \ln p_i) = \Sigma\, p_i \ln(p_i/q_i), \quad \text{(A6)}$$

$$Ipq = (-\Sigma\, q_i \ln p_i) - (-\Sigma\, q_i \ln q_i) = \Sigma\, q_i \ln(q_i/p_i). \quad \text{(A7)}$$

Here, $-\Sigma\, p_i \ln p_i$ and $-\Sigma\, q_i \ln q_i$ are called the "entropy" of p and q, respectively.

Finally, the generalized disaggregation measure, denoted by $\delta_k(s, r)$, is simply:

$$\delta_k(s, r) = 1 - \alpha_k(s, r); \text{ with } \delta = 1 - \rho^2 \text{ and } \delta_0 = 1 - \rho_0^2 \text{ for } k = 1 \text{ and } 0, \text{ respectively.} \quad \text{(A8)}$$

In contrast to $\rho^2 = 0.9916$ given in (7) and $\delta = 1 - \rho^2 = 0.0084$ in table 1, we obtain:

$$\rho_0^2 = \exp(-I_{qp} - I_{pq}) = \exp(-.01153 - .01076) = .9780, \text{ and } \delta_0 = 1 - \rho_0^2 = .0220, \quad \text{(A9)}$$

where I_{qp} and I_{pq} are decomposition measures given by:

$$I_{qp} = p_1 \ln(p_1/q_1) + p_2 \ln(p_2/q_2) = -.05875 + .07029 = .01153, \quad \text{(A10)}$$

$$I_{pq} = q_1 \ln(q_1/p_1) + q_2 \ln(q_2/p_2) = .06351 - .05275 = .01076, \quad \text{(A11)}$$

using $p_1 = .7551$, $p_2 = .2449$, $q_1 = .8162$, $q_2 = .1838$ in (6).

Note that the decomposition measure itself is difficult to interpret in an intuitively understandable way such as the one explained for ρ^2 in the paragraph just after equation (10). However, it is interesting to note that when the two complementary decomposition measures are combined in (A9), the result becomes something that can be meaningfully compared with ρ^2, the only difference between the two being the method of taking means.

The following values of the entropy-based disaggregation measure δ_0 may be compared with those of δ given in table 1 for Total Assets (the upper part) and Operating Income (the lower part).

Asset Disaggregation	92/91	93/92	94/93	**Income Disaggregation**	92/91	93/92	94/93
Liquidity	.0000+	.0027	.0009	Revenue-Expense	NA	NA	NA
Industry	.0220	.0065	.0005	Industry	NA	.0121	.0001
Geographical	.0000+	.0041	.0002	Geographical	NA	NA	NA

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