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A. E. Rodriguez, Data Reduction Techniques in the Allocation of Operational Expenses under I.R.C. Section 861: A Structured Approach, 27 Int'l Tax J. 84 (2001)

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Tue Nov 27 20:08:17 2018

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Data Reduction Techniques in the Allocation of Operational Expenses under I.R.C. Section 861: A Structured Approach

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INTRODUCTION

U.S. taxpayers claiming a foreign tax credit must apportion their business expenses between foreign and domestic source gross income for purposes of determining a taxpayer's foreign tax credit limitation and ultimately its U.S. income tax.¹ To properly determine the correct benefit, taxpayers must typically develop an acceptable method for apportioning expenses to foreign and domestic

1. The tax attribute—net taxable income—is identical for a US person or a foreign corporation. Net taxable income requires the sourcing of items of both gross income and deduction. Thus, a US person's foreign tax credit limitation is based on the ratio of net taxable income from foreign sources to net taxable income from all sources whereas a foreign corporation is taxed on the net amount of income effectively connected with the conduct of its US branch. See Internal Revenue Code Sections 904(a) and 882(a), respectively. In this article, our argument is developed alluding to a hypothetical US person. However, the method proposed here is equally applicable when the taxpayer is a foreign corporation.

source income. The method selected must be consistent with Treasury Department regulations issued under Section 861 of the Internal Revenue Code (“Section 861”).²

Section 861 provides rules for the allocation and apportionment of specific deductions (e.g. interest expense, research and experimental expenses, etc.) as well as other business expenses (e.g. overhead, general and administrative, and supervisory expenses). However, although a few examples of factors that should be considered when determining the method for apportioning deductions are provided, the regulations remain generally vague. Instruction is largely confined to allowing the taxpayer to “attribute supportive deductions on some reasonable basis directly to activities or property which generate, have generated, or could be reasonably expected to generate gross income.”³ This deliberate vagueness may reflect a recognition on the part of the tax authority that an array of possible procedures are applicable to the allocation problem, and that requiring that taxpayers use any one particular method may not adequately capture relevant firm or business idiosyncrasies.

In response to the sparseness of relevant guidance or because they don’t believe that selecting a more complex method will result in substantive benefits, taxpayers often resort to well-worn rules of thumb for apportioning deductions, such as the ratio of foreign to domestic gross income as the relevant basis. But in some instances, a more careful matching between expenses and the gross income they generate may improve foreign tax credit limitations in favor of the taxpayer. Accordingly, some taxpayers resort to more complicated but equally well-established cost allocation methods, such as activity-based costing (“ABC”), to appropriately apportion operational costs to foreign and domestic source income.

Activity-based costing is a straightforward approach to operational cost allocations, consistent with the requirements of Section 861 regulations. When this approach is applied to home-office or headquarters’ expenses, for example, one first identifies cost pools and the key activities within each pool that accumulate costs. Cost pools accumulate costs as a result of tasks considered a “headquarters” function. One then measures the costs of the key activities of the various relevant groups, or groupings, assembled at the taxpayer’s headquarters and apportions those costs to the classes of income that the activities support based on an identified allocation basis.

2. IRC §§ 861(b), 862(b). Unless otherwise indicated, all section references are to the Internal Revenue Code, as amended, and regulations promulgated thereunder, or to corresponding provisions of prior codification.

3. Temp Reg § 1.861-8T(b)(3).

There are disadvantages, however. Conducting an ABC-based apportionment study is costly. Because a taxpayer must generally devote substantial time and resources when implementing an ABC-based headquarters cost allocation study, an ABC study's demands on a tax director's already scarce resources may render it an impractical in-house exercise. In addition, because head office costs, although they are generally fixed, differ in nature from manufacturing costs, it is difficult to avoid imputing substantial subjectivity in some of the allocations. This subjectivity increases the study's sensitivity to competing assumptions or selection of key activities, allocations and allocation basis, rapidly reducing its value. A big chunk of the total expense and time spent in an ABC study is incurred when the taxpayer has to identify and characterize the functions of the various business groups and key activities. Clearly, costs could be reduced if the taxpayer could shorten the time and resources used to complete the project without sacrificing its quality.

In this paper, we discuss the relative advantages of using a data reduction technique in reducing time and resources requirements and in eliminating some subjectivity from ABC-based studies. Specifically, we examine the applicability and cost effectiveness of using a data reduction method called cluster analysis in this context.

Data reduction techniques are accepted and well-established multivariate statistical procedures used routinely in the social and biological sciences. In fact, classification is a fundamental step in science. Yet, the literature on cluster analysis is found throughout a variety of disciplines, ranging from electrical engineering to biology to library science to psychiatry.⁴ But to our knowledge, this is the first time the applicability of cluster analysis has been considered within cost allocation studies.

We find a number of substantive benefits when using the proposed data reduction techniques and analytical method. First, as expected, it is possible to significantly reduce the time and cost of completing the task of allocating operational expenses. Second, the Structured Approach provides a more robust and less subjective approach to the analysis. Specifically, it is the naturally occurring variance in the cost data that identify the functional groupings rather than the subjective decisions of an analyst. Third, procedures used to complete a cluster analysis-based cost study are more easily documented; therefore, results are more easily reproducible by third parties. To the extent that tax authorities ultimately review the resulting allocations, well-established basis and methodology are more likely to withstand scrutiny. Fourth, with little re-configuring the method can be utilized several times across different projects.

4. Noted in MS Aldenderfer and RK Blashfield, *Cluster Analysis* (1984), at 78.

We present sufficient background discussion as well as the analysis supporting these conclusions in this paper. The presentation is divided into 9 sections and 2 appendices and organized as follows. In section II, we provide a succinct overview of controlling legislation, regulations and case law on the allocation and apportionment of operational expenses. To understand the advantages provided by the proposed multivariate method, we first present a short discussion of activity based costing. This discussion is found in section III. Section IV contains a discussion on data reduction techniques followed by their applicability to the headquarters costs problem in Section V. In both instances, the discussion is presented in a manner that assumes that the reader is not necessarily familiar with either Activity-Based Costing or statistical methods beyond those found in an introductory statistics course in a college business administration or economics program. The economic foundation underscoring the methodology is found in Section VI. Section VII contains the case study use to explain and test the method. Our results and discussion of the case study appear in Section VIII. The last section, Section IX, contains concluding comments.

BACKGROUND AND CURRENT LAW⁵

U.S. corporations are taxed on their worldwide income. This exposes them to the likelihood of double taxation. On the one hand, they face taxation in the foreign jurisdiction where the income is earned. On the other, they face additional taxation in the U.S. when the income is included in the corporation's taxable income. Congress addressed this problem by enacting Internal Revenue Code Sections 901 and 902. These sections permit a credit for the foreign taxes paid on this foreign-source income. The amount of the foreign tax credit, however, is limited to the U.S. income taxes paid on the foreign source taxable income included in the corporation's taxable income.

Foreign-source taxable income is determined in a two-step calculation. The taxpayer must first identify the foreign source gross income included in the corporation's taxable income. Direct and indirect expenses incurred in earning this income then reduce this amount. Accordingly, it is important to accurately determine not only the gross

5. The discussion here is not intended to be more than cursory review. For a more thorough exposition see CI Kingson & CA Blum, *International Taxation* (1998) or R Doernberg, *International Taxation* (1997).

foreign-source income, but also the proper allocation and apportionment of expenses to the foreign source taxable income.

The income-sourcing and expense allocation rules, specified under Code sections 861 and 862, allow the taxpayer to determine the amounts of taxable income generated from U.S. or foreign activities and the amounts of expense related to that income. In computing taxable income from sources within or without the United States, expenses are allocated to domestic and foreign-source income on the basis of their factual relationship to the production of particular classes of gross income. A deduction is related, and therefore allocable, to a class of gross income if it is incurred as a result of, or incidental to, the activity or property from which the gross income is derived. Under Code Sections 861(b) and 862(b), an item of expense that relates to the production of all gross income is apportioned on a pro rata basis between domestic and foreign-source income. The taxpayer makes these determinations through a process of allocation and apportionment. Apportionment of a deduction between U.S. and foreign-source gross income is accomplished by using the apportionment base that reflects to a reasonably close extent, the factual relationship between the deduction and the gross income.

Treasury Department regulations issued under Section 861 (§ 1.861-8) of the Internal Revenue Code (“Section 861 regulations”) provide guidance to taxpayers for allocating and apportioning expenses, losses and other deductions (collectively referred to as “deductions”) for purposes of determining taxable income. The regulations prescribe a two-step process of first allocating deductions to classes of gross income and then apportioning those deductions between the “statutory” and “residual” groupings of gross income. Classes of gross income may include; for example, gross income derived from business activities, interest, royalties or dividends. The statutory groupings of gross income refer to the foreign source gross income that must first be determined to arrive at foreign source taxable income for purposes of the foreign tax credit limitation. The residual grouping of gross income is the remaining U.S. source gross income.

The Section 861 regulations acknowledge that deductions that are supportive in nature, such as stewardship, general and administrative (G&A) and other supportive expenses may be related to all classes of gross income. As such, the regulations permit the taxpayer “to attribute supportive deductions on some reasonable basis directly to activities or property they generate, have generated, or could reasonably be expected

to generate gross income.”⁶ This process should be accomplished by first allocating the supportive expenses to all gross income. Then, expenses are apportioned between statutory and residual groupings of income. Allocations and apportionment of expenses are generally based on factual relationships between expenses and items of gross income that necessarily require some degree of subjective judgment. The regulations recognize this and provide that taxpayers’ methods of apportionment will be treated as sufficiently precise if they reflect, to a reasonably close extent, the factual relationship between the deduction and the groupings of income.

The regulations provide no specified apportionment method but they do mention some factors to be considered. They include the following:

- Comparison of profit contribution
- Comparison of expenses incurred, assets used, salaries paid, space utilized, and time spent, which are attributable to the activities or properties giving rise to the class of gross income; and,
- Comparison of the amount of gross income

The taxpayer, however, may also consider other factors.

In our case study we are assuming that the company examined is a U.S. corporation. Accordingly, for purposes of applying the overall limitation, the statutory grouping is gross income from sources outside the United States and the residual grouping is gross income from sources within the United States.

USING ABC IN HEADQUARTERS ANALYSIS

Activity-based costing (“ABC”), today used frequently in cost allocations, is not inconsistent with the requirements of the Section 861 regulations. ABC is a popular cost-accounting method that is traditionally used to systematically allocate overhead costs. The theory of ABC recognizes that overhead costs are positively related to non-volume drivers. Before ABC existed, all overhead was allocated to products based on volume drivers such as labor hours, machine hours, or number of units produced.⁷

6. Temp Reg § 1.861-8T(b)(3). Relevant case law includes *Young & Rubicam, Inc v The United States*, 410 F2nd 1233, *Columbian Rope Co v Comm’r*, 42 TC 800.

7. See, R Cooper and R Kaplan, “Measure Cost Right: Making the Right Decisions,” *Harvard Business Review* (Sept-Oct 1998) and “Profit Priorities from Activity-Based Costing,” *Harvard Business Review* (May-June 1991).

ABC measures the costs of the activities of the various functional groupings assembled; it then seeks the most appropriate way of apportioning those activity costs to different products, customers, etc.⁸ In an operations cost allocation exercise for purposes of the Foreign Tax Credit limitation, one apportions activity costs to different classes of related income.

ABC measures the flow of expenses from resources to activities to cost objects. Resources are essentially a firm's people, plant, and equipment. In a headquarters analysis, for example, the resources are its G&A expenses. *Activities* are the main functions performed by the firm and which consume the firm's resources. The *resource driver* is the measure for determining activity costs from resources. For example, the amount of time spent on different activities might be a resource driver for determining the cost of each activity. In fact, time is probably an ideal cost driver since it correctly matches expenses with income generated by the activity, all else equal. However, because few firms apart from consulting or law-firms meaningfully record time incurred in completing tasks, time is typically not available to the analyst.⁹ A *cost object* is an item to which costs flow. In a manufacturing environment, a cost object might be a particular product. In a headquarter's analysis, the cost objects are the two classes of income: effectively connected income ("ECI") and non-effectively connected income ("NECI") or domestic and foreign-source income, depending on the taxpayer.¹⁰ The *activity driver* is the measure for determining the costs of cost objects based on their support by different activities.

Generally speaking, the ABC framework is well suited for allocating and apportioning operational expenses. While certain expenses, such as interest, can be clearly attributed to types of income based on measures like asset size, others like G&A expenses require a different approach. G&A expenses often include a large amount of fixed costs and support different types of income. ABC offers an understanding of those expenses by relating them to the activities that they support.¹¹ For exam-

8. See, generally, CT Horngren and G Foster, *Cost Accounting: A Managerial Emphasis*, 7th Edition (1991).

9. Although a number of firms have instituted time reporting infrastructure and requirements, in our experience only those of firms whose revenues are directly tied to time expended on a task are realistically accurate.

10. If a nonresident conducts a US trade or business, the income effectively connected with the conduct of the trade or business is taxed in the same manner as business income of a US resident. Doernberg, *supra*, note 6, at 28.

11. Activities constitute the main functions of a group, such as making payments or managing supplier accounts. An additional level of detail may be added to the activity framework by examining "tasks" within each "activity."

ple, a common ABC method is the use of timesheets to measure the amount of time spent by employees on different activities. Provided good time measurements exist, personnel expenses can be apportioned to the different activities based on these estimates. Other types of expenses might best be apportioned using other measures. Computer expenses, for example, might be apportioned based on the numbers of computer transactions associated with different activities.

Unfortunately, the known disadvantages of ABC apply in a headquarters study as well. For example, total manufacturing costs typically include labor, material and overhead costs. Labor and material costs can generally be accurately traced to a product. Overhead costs, on the other hand, are usually allocated to products using some allocation basis. But allocated overhead costs create externalities for every product falling under the umbrella of the allocation basis. To the extent that the allocation basis is not truly correlated with the overhead cost then products are costed incorrectly. In addition because overhead is allocated out of common cost pools, a single product that is allocated too much overhead causes other products to be allocated too little overhead. Hence, headquarters costs, just as much as total manufacturing costs, may be biased by externalities caused by allocated overheads.

Leaving aside potential inaccuracies due to externalities caused by allocated overheads as explained above, it is not clear what advantages ABC provides over any other allocation method in completing Section 861 studies.¹² Section 861, for purposes of foreign tax credit allocation studies, are a non-traditional application of ABC; practically none of the recognized advantages of using ABC are applicable. ABC is typically implemented in a firm, to enhance product and customer-related decision-making by company managers. Put simply, management, for the most part, chooses to implement an ABC system because of the importance given to managing overhead costs. In this context ABC provides at least two important benefits. First, a firm's operation is scrutinized in greater detail and its performance and efficiency analyzed and benchmarked against best practices. 861 studies, largely prepared for tax purposes, are rarely presented to management. Benchmarking would be practically impossible due to confidentiality and the firm-specific nature of the exercise. Second, in its traditional production-side application, ABC generally yields a set of overhead cost numbers that, relative to traditional volume-based methods of costing, better represent the con-

12. The popularity of use of ABC in 861 studies may be due to the familiarity with the concept by most accountants (at least the younger ones) who fail to recognize that the applicability of the theory is for the most part relegated entirely to managerial applications rather than tax considerations. More senior accountants may be unfamiliar with ABC and unable to critically evaluate its applicability.

sumption of shared resources by the firm's products, customers and services offerings. The value of this comparative information is that it may enable a firm's decisions makers to change the mix of products produced and customers served to allow it to focus on making profitable products and serving profitable customers. Section 861 regulations state no preference for volume-based drivers over any others, so the distinction is irrelevant. Second, there is no careful optimization calculus at the conclusion of 861 studies based on the ABC analysis, only a realignment of income based on more advantageous matching of expenses to income. Yet ABC does not necessarily bring any unique insight to the process of matching of expenses to income.

ABC DIFFICULTIES AND THE ADVANTAGES OF USING DATA REDUCTION TECHNIQUES

Operationally, when using an ABC-based method, the taxpayer must organize the numerous headquarters cost pools into groups before identifying the relevant activities within each group. The groups are identified based on the functions they conduct for the firm and generally remain close to the administrative model found in company organization charts. Within each of the groups the taxpayer identifies the various activities conducted by the group, selecting the most salient or important one. Subsequently, the taxpayer then characterizes, or describes, each of the groups in terms of one or two activities. The total costs incurred by each of the functional groups are then apportioned to the classes of income that the activities support, based on a reasonable cost driver.

However, the formation of the elementary groups may turn into a costly fishing expedition. In some instances, the groupings may simply consist of the functional groups typically found at headquarters and easily discernible from organization charts: such as the Controllers, Finance, Internal Audit, Planning, among others. If this is the case and it can be easily confirmed that the pool of cost centers are associated directly, and in their entirety, to any one functional group, then the problem of forming groups is simply adding the relevant cost pools; hardly a critical matter. Under this scenario the method proposed here may not necessarily result in any reduced cost to the taxpayer. Still, even when this simple route is available, the data reduction method, in our opinion continues to be less subjective and the results more easily duplicated than the ABC method.

In fact, one finds more often than not, that there is little prior information about the structure of costs, the relevant functional groupings, the

nature of the activities they support, and the overall quality of the general ledger data. On occasion, relationships between cost pools and functional or operating departments are weak and imprecise and the nature of the various cost pools is unclear. This may arise when a firm's administrators organize functional groups that accumulate cost across various cost centers. Organization charts, which typically provide a "mapping" between the elementary cost pools and the functional groups cease to provide useful guidance. These organization charts may reflect administrative relationships rather than cost relationships.

For example, a taxpayer in the publishing business may have an editorial group constituted by professionals from the marketing department, statistical analysts, financial managers, among others, each charging time and operational expenses to different cost centers. In turn, the cost center that collects the financial manager's costs also supports financial managers in other groups, say, for example, marketing. To broach this problem, an ABC analyst must necessarily accept various simplifying and invariably simplistic assumptions. And even then, many cost mappings are studied with the hope of identifying some kind of order among them, which will deepen understanding of the subject matter. Consequently, the resulting efforts are not only exceedingly subjective and time consuming but necessarily of a hit or miss nature.

A SUCCINCT OVERVIEW OF DATA REDUCTION TECHNIQUES

The multivariate analytic technique proposed here is known as cluster analysis, but is also known by the names of inverse factor analysis, segmentation analysis and taxonomy analysis. It is a data mining technique for accomplishing the task of partitioning a set of objects into relatively homogeneous subsets based on the inter-object similarities. Each cluster is homogenous with respect to the clustering variables. Each cluster is different from other clusters with respect to the same clustering variables. Put into a cost allocation context, cluster analysis will enable us to assemble a large number of cost centers into relatively similar functional groups based on the similarities among the activities conducted in the cost centers.

To understand cluster analysis, it helps to start with factor analysis. Factor analysis can be understood conceptually by considering nine variables, $\times 1, \times 2, \dots, \times 9$ clustered into three separate groupings. Variables $\times 1, \times 4, \times 5,$ and $\times 8$ are clustered together, meaning that they are highly correlated with one another and represent a common underlying variable, or factor. Similarly, variables $\times 3$ and $\times 7$ define a separate factor. And the

variables $\times 2$, $\times 6$, and $\times 9$ contribute to form a third factor. So instead of having to understand nine separate variables, the method simplifies to only three factors which contain virtually all the information inherent in the original nine variables.

In cluster analysis we typically begin by measuring each of a set of n objects on each of k variables or attributes. The elementary cost pools that collect all operational expenses constitute the n objects. The k variables, or activities that describe the economic activity conducted by each of the cost pools, are established by closely examining each cost center and collecting all available information; cost center economic activity may also be gathered by polling staff via questionnaires.

Next, a measure of the similarity between each pair of objects must be obtained.¹³ A set of rules, or algorithm, must be employed to cluster the objects into subgroups based on the inter-object similarities. The ultimate goal is to arrive at clusters of objects or cost pools that display small within-cluster variation, but large between-cluster variation. The cost pool clusters are the functional groups we set out to identify.

RECOGNIZING THE FIRM'S INTERNAL AND EXTERNAL ENVIRONMENT

No firm is an island. Firms exist in response to society's need for a particular good or service. To survive, firms must be continuously aware of the key variables in their environment. Environmental forces constantly interact with each other and condition, limit, regulate and ultimately shape the rules of the game that govern a firm's operation. Economic, social, politico-legal and technological forces embodied in governments, local communities, suppliers, competitors, customers, special interest groups, management, workers and other stakeholders, represent internal and external forces that affect the decisions and actions of a corporation.¹⁴

Firms organize themselves internally to navigate these constraints in the most efficient manner.¹⁵ Vigorous competition obliges firms to

13. Various distance metrics can be used as measures of similarity. The most intuitive one is perhaps the Euclidean Distance, the distance along a straight line in space.

14. The list is not meant to be exhaustive; rather, it is meant to be illustrative.

15. This assertion has been repeatedly challenged in economics. The literature suggests that firms do not generally minimize costs or maximize value, but rather, are typically burdened with sheer inefficiency or rent dissipation. The seminal paper in this area is H Liebenstein, "Allocative Efficiency versus X-efficiency" *American Economic Review* Vol 56 (June 1967). For its latest incarnation see Severin Borenstein and Joseph Farrell, "Do Investors Forecast Fat Firms? Evidence from the Gold

respond with innovation and marketing campaigns. Social, economic and environmental regulation similarly imposes both limits and demands. Recognizing the need to attract the best talent, for example, a firm may embrace a program for the rapid promotion of women. The firm may establish a unit to navigate workplace diversity issues. It may seek to hire tax consultants to minimize its tax burden in response to changes in the tax code. Or the firm may choose to discontinue, limit or more closely manage production of a product considered a health hazard by the government.

Responding and managing these external forces typically requires a corresponding adjustment to the firm's internal administrative structure. New administrative departments or groups may have to be created or new functions grafted onto existing departments. In some instances, internal change can be substantive, depending on the nature of the outside force and the alternative chosen by the firm's administrators to manage both the pressure and the effects of the pressure. A firm competing in a rapidly changing technological environment may be obliged to substantially increase their R&D budget. R&D could be conducted internally or sub-contracted. A firm threatened by a competitor's surge in market share may have to augment their marketing campaign or it may choose to withdraw from that market. The marketing campaign is conducted internally or outsourced. A firm's desire to expand into new product markets or into new geographic markets may require the reorganization of entire departments or may result in an acquisition.

To a cost analyst, understanding a firm's market, its products, its competitors, its regulatory burdens, its administrative organization and other particulars of the firm's internal and external environment provides the context for understanding the composition of its cost structure. Based on this detailed overview, a good cost analyst will probably be able to deduce the various functional groups that constitute a firm.

The code requires us to apportion and allocate in a meaningful manner. The context offered here interprets this to mean a close matching between cost and the income generated based on economic functions and activities. Awareness of the internal and external environment also serves another more technical purpose. The clustering algorithm requires a prior estimate of the expected number of functional groups. This prior estimate can be derived from an understanding of the internal and external forces facing a firm and how the firm chooses to respond to them.

Mining Industry," NBER Working Paper No 7075 (Aug 1999). However, these observations are not directly relevant to our argument.

Understanding the nature of the firm's response to its internal and external environment also facilitates the recognition of instances where the firm's administrative response to external or internal stimuli requires examination under Section 482 of the code.¹⁶ Worldwide expenses of a multinational corporation are typically those incurred by the support services groups, domestic operations, and overseas operations. The IRS takes the view that all expenses that proximately and directly benefit a subsidiary or a group of subsidiaries are properly chargeable against the operating income of the subsidiaries. Under these circumstances, these expenses may not be deducted by the parent as stewardship expenses if the benefit that the parent secures as a result of providing the service to the subsidiary is indirect or remote in comparison to the benefit to the subsidiary.

Gauging whether a benefit is indirect or remote is difficult. The Service has tried to provide guidance to taxpayers on the tax treatment of various expenses incurred by a domestic corporation on behalf of related foreign corporations.¹⁷ Section 482 and the guidance provided by the corresponding regulations, among other things, governs the pricing of services provided for the benefit of a related party.¹⁸ Thus, using the conceptual structure recommended here, a cost analyst may more easily recognize that a group set up to respond to particular circumstances discussed above, such as an R&D group, and advertising group or some similar service-oriented group may be interpreted by a tax examiner as benefiting other divisions or subsidiaries.¹⁹

Indeed, if a member of a group of controlled entities ("the renderer") renders services (e.g., marketing, managerial, administrative, technical, etc.) for the benefit of, or on behalf of, another member of the group ("the recipient"), the recipient must compensate the renderer with an amount equal to an arm's-length charge.²⁰

16. Treasury Regulation § 1.482-2(b).

17. TAM 8806002, Sept 24, 1987.

18. Under § 482, the standard to be applied in establishing such prices is the "arm's-length" standard. This simply means that the prices or profits realized in the provision of services between related parties must be consistent with prices or profits that would have resulted from the same or similar transactions between unrelated parties.

19. Regulations § 1.482-2(b)(2) specifically lays out a "benefits test" as the guiding principle for inter-company service transfers. According to this principle, any allocations of income made by the IRS must be consistent with the relative benefits intended from the services, based upon the facts known at the time the services were rendered, and without regard for whether the intended benefits were actually realized. No allocation should be made if the probable benefits were so remote that unrelated parties would not have charged for such services.

20. However, if these services do not constitute an integral part of the business of either the recipient or the renderer, then the arm's-length charge is considered to be equal to the costs (including all costs directly or indirectly related to services performed) incurred by the renderer, unless a more ap-

A CASE STUDY

ACME is a specialty-chemicals manufacturing firm that has its headquarters and operations groups within the same legal entity based in the United States.²¹ ACME has manufacturing, selling and R&D operations and subsidiaries worldwide. ACME wants to develop a method for apportioning its operational expenses to foreign and domestic source income for tax year 1999 and then determine the amount of expenses used to reduce foreign and U.S. source income based on the adopted methodology. And due to her limited resources available, ACME's CFO doesn't want to spend a lot of time completing the study.

At the outset, an analyst in ACME's tax department collected available general-ledger accounting data for each of the cost centers that encompass all headquarters and operational expenses sitting in the same legal entity. The cost center or cost pool level is the lowest-level summation of costs within ACME's internal management reporting system. To retain the greatest level of detail possible, financial information was maintained and analyzed at the cost center level. This availability of detail in the model minimizes the impact of ongoing, and any future administrative reorganizations and other business related changes that may occur later. Changes would oblige the analyst to revise the study each year. The availability of elementary data should also facilitate tax planning.

This cost data is routinely collected and used by ACME for managerial and other administrative reasons. However, apart from an identification number and a short label, there was very little descriptive or contextual information about the functional tasks that charged expenses to each of the cost centers.

The analyst had also obtained all organization charts available. In principle, organization charts can provide a map that would allow the analyst to reconstitute how each of the cost pools support the various departments. However, the organizational charts had been updated only yearly; to make matters worse, the organization charts reflected reporting relationships that did not necessarily reflect a one-to-one relationship between cost pools and departments.

propriate charge is established. In circumstances where these services are an integral part of the business activity of either the recipient or the renderer, the arm's-length charge is the "amount which was or would have been charged for the same or similar services in independent transactions with or between unrelated parties under similar circumstances considering all relevant facts." See also, *supra*, footnote 18.

21. ACME is entirely hypothetical, but the "factual" setting described here are no different from those characterizing any multinational. The description is based on a composite of our experience conducting these studies.

There were more problems. In January 1998, ACME commenced the first phase of a three phase administrative and operational re-engineering plan. The proposed changes were to be implemented over a period of three years. The numerous changes, which include the restructuring and reorganization of departments, personnel reductions, the realignment of reporting relationships, and the elimination and consolidation of product lines had resulted in substantial administrative and operational changes from one year to the next; sometimes changes have occurred from one quarter to the next.

The multiple changes further eroded any clear systematic relationship between the elementary cost centers and ACME's operational departments as described and outlined in the company's organization charts. Thus, without the "mapping" provided by the organization charts, it was nearly impossible to establish the connection between the cost centers and the operational and home office departments. In addition, even if it had been possible to reassemble the relationship between cost centers and departments for the current tax year any benefits of developing the resulting cost architecture would have been modest because ACME continues its administrative restructuring.

Not surprisingly, the tax analyst was unable to piece together all the cost pools that corresponded to particular departments. To gather information about each cost center, the analyst faced spending considerable amount of time tracking the individuals responsible for each of the cost center. It was time to rethink the approach to the problem.

Based on his experience in other manufacturing firms, and on his strong training in economics, the analyst envisioned an alternative approach. The analysis knew that efficient firms in competitive markets ultimately adopt similar technology and cost structure; otherwise, they rapidly lose market share and exit the market. Thus, the analyst concluded that ACME's operational and administrative structure resembled those of its close competitors.

Knowledge of the products and nature of markets in which ACME competes supplemented his prior beliefs. In addition to the cost structure imposed by competitive discipline, the administrative and organizational structure of firms is also likely to reflect the regulatory environment in which a firm operates and competes. For example, because ACME manufactured specialty chemicals the analyst realized that ACME faced special regulatory compliance burdens and therefore specialized departments charged with handling compliance, reporting, safety and possibly security related to ACME's chemical product portfolio. Similarly, the temporary informational complexity created by the ongoing restructuring told the analyst that various departments were formed to manage the

transition and re-engineering that would not otherwise exist. All this information enabled the analyst to create value-chain based functional groupings and a detailed list of economic activities conducted within each of the groupings.

To substantiate the nature and activities within each of the cost pools, the tax department developed and circulated questionnaires to staff and managers designed to characterize the various cost centers. Where available, the tax department analyst also reviewed relevant documents, market forecasts, market assessments, job descriptions, internal regulations, handbooks, relevant contracts and industry publications. The questions were developed based on the knowledge of the company's operations, its competitive, regulatory and administrative environment.

In terms of the statistical procedure, the questions were designed to elicit answers that would impute variance to the elementary cost pools. This variance would then drive the differentiation and clustering of the different groups. In other words, once the individual cost pools groups were fully characterized the tax analyst used cluster analysis to identify the functional groupings returned by the data.

The data presented here is stylized and not actual firm data. Because it is presented to illustrate the technique proposed in this paper, the data reflects neither the entire scope nor the magnitude that one would typically find in a manufacturing firm.

PROCEDURE, ANALYSIS AND RESULTS OBTAINED

The objective of the case study is to explain how to implement the use of the data reduction techniques and to test the power of the cluster analysis in identifying the relevant functional groupings on which the allocations are based. Accordingly, we use stylized, simulated data rather than actual data. By populating the input matrix with simulated data (for which we know the answer), it is easier to test the robustness and accuracy of the data reduction method. Presumably, in a real world setting the activity data would be collected via a questionnaire given to those individuals familiar with the nature of each cost center expenses. A shortened version of the general questionnaire used is found in Appendix A. The list of activities that the individuals completing the study would be asked to rank based on a likelihood scale is found in Appendix B.

Rather than organized to elicit written responses, the surveys reflect a likelihood scale, where 0 would be no likelihood of the activity being present in the cost center and 25 suggesting that the activity would be very likely. In other words, a manager or person familiar with the com-

pany's cost structure would be asked to rank the likelihood that particular activities are likely to charge cost to a particular cost center. For example, the person familiar with the expenses would record in the survey sheet that the likelihood that there is "data inputting" going on in cost pool identified as 2345 is more likely to be a 23.

The elementary cost pools used in the analysis were generated using Excel's random number generator. Data representing operational expenses accumulating in 100 cost centers were created in this manner. Similarly, after putting together a list of attributes typically found in a specialty chemicals manufacturing firm, data was generated randomly via a uniform distribution generator where the seed was adjusted to reflect the prior functional groupings hypothesized.

The 100 elementary cost groups and the 52 economic activities were arrayed into a 52 by 100 matrix. This matrix provided the input into the cluster analysis procedure.

Table 1 displays the simulated data sheet used for the cluster analysis for three cost centers. The complete data matrix, which encompasses 100 cost centers is not presented here. The activities, described in column 2, are grouped according to the functional groupings described in Column 1. However, Column 1 is removed from the spreadsheet before the cluster analysis and the rows scrambled.

TABLE 1. Cluster Analysis Input MatrixACME CORPORATION
COST AND ACTIVITY DATA

Expenses in thousands of dollars

This data reflects result of a survey assessing respondents' understanding of the likelihood that each cost center (column) will reflect the activity identified on each row

For all variables, the scale is:
 Lowest Likelihood = 1
 Highest Likelihood = 25

COST CENTER (IDENTIFIED BY GENERAL LEDGER CODE NUMBER)

FUNCTIONAL GROUPING		<i>Expenses</i>	<i>Activity</i>	<i>Cost Center</i>
		249	1400	533
		1	2	3
Executive	corporate strategy and policy	20	11	13
	board administration	17	11	8
	shareholder advocacy	19	3	17
	corporate evaluation and control	17	4	6
	management of internal and external corporate environments	20	9	14
	formulation and implementation of corporate objectives	18	16	5
Finance	financial reporting (internal and external)	8	5	7
	capital budgeting	8	6	6
Audit	international internal audits	7	15	2
	consolidation of financial data	6	19	3
	controller functions	6	23	8
	interactions with independent auditors	5	21	5
Treasury	loan management	6	7	9
	asset management	8	2	7
	payroll	6	2	8
	pension administration	7	8	11
	cash management	8	2	9
	bank relationships	6	6	11
Tax	tax reporting	9	6	10
	tax administration	6	4	11

(continued)

TABLE 1. Cluster Analysis Input Matrix (*continued*)ACME CORPORATION
COST AND ACTIVITY DATA

Expenses in thousands of dollars

This data reflects result of a survey assessing respondents' understanding of the likelihood that each cost center (column) will reflect the activity identified on each row

For all variables, the scale is:
Lowest Likelihood = 1
Highest Likelihood = 25

COST CENTER (IDENTIFIED BY GENERAL LEDGER CODE NUMBER)

FUNCTIONAL GROUPING		<i>Expenses</i>	<i>Activity</i>	<i>Cost Center</i>
Public Affairs	production and dissemination of promotional materials	6	6	7
	web site management	9	7	8
	annual report preparation	8	4	6
	corporate and internal communications management	5	2	8
	trade show participation management	5	6	9
	industry group participation	5	8	7
Legal Affairs	contract review (legal matters)	5	4	7
	intellectual property management (legal)	9	3	9
	patent process management (legal)	8	2	8
	litigation management	5	3	11
Regulatory Services	corporate functions (legal)	9	9	8
	environmental regulation compliance	7	6	8
	safety regulation compliance	7	7	8
Office Services	product quality control systems	8	9	7
	floor space management	7	5	11
Human Resources	grounds management	6	7	7
	infrastructure charges	6	8	10
	regulatory compliance and administration	6	7	8
Information Services	employee benefits administration	5	9	11
	expatriate administration	6	9	11
	personnel administration	9	11	7
	training	9	6	8
Information Services	datacenter administration	5	6	10
	network administration	9	7	9
	office tech support	7	11	7

(continued)

TABLE 1. Cluster Analysis Input Matrix (continued)ACME CORPORATION
COST AND ACTIVITY DATA

Expenses in thousands of dollars

This data reflects result of a survey assessing respondents' understanding of the likelihood that each cost center (column) will reflect the activity identified on each row

For all variables, the scale is:
 Lowest Likelihood = 1
 Highest Likelihood = 25

COST CENTER (IDENTIFIED BY GENERAL LEDGER CODE NUMBER)

FUNCTIONAL GROUPING		<i>Expenses</i>	<i>Activity</i>	<i>Cost Center</i>
Logistics	order and billing	8	8	9
	transportation and delivery	5	11	11
Purchasing	supplier contract management	9	11	7
Engineering	research and development support	6	6	6
	engineering support	8	6	23
	engineering project review	8	11	22

Results There are several important results. Cost centers are organized into the various functional groupings. The economic activities that characterize each of the functional groupings are also identified. Results returned are presented in Table 2. The activities have been organized into clusters based on the selected algorithm. Clusters labeled 1-13 can be found in Column 1. Economic activities within each cluster are found in column 2.

TABLE 2. Cluster Analysis Output

Cluster Analysis for Activity Based Analysis

		3	7	9
		<i>Cluster</i>		<i>Cost</i>
		<i>Membership</i>	<i>Activity</i>	<i>Center</i>
		1	2	3
Cluster 3	corporate strategy and policy	20	12	0
	board administration	21	12	4
	shareholder advocacy	21	15	4
	corporate evaluation and control	23	13	11
	management of internal and external corporate environments	21	15	5
	formulation and implementation of corporate objectives	15	13	7
Cluster 6	financial reporting (internal and external)	9	9	7
	capital budgeting	7	7	5
Cluster 7	domestic internal audits	7	24	2
	international internal audits	7	18	6
	consolidation of financial data	9	23	6
	controller functions	9	22	7
	interactions with independent auditors	7	15	5
Cluster 4	loan management	7	2	11
	asset management	8	3	8
	payroll	9	5	6
	pension administration	6	8	11
	cash management	9	8	7
	bank relationships	8	6	10
Cluster 5	tax reporting	7	8	7
	tax administration	5	8	8
Cluster 8	production and dissemination of promotional materials	7	6	6
	web site management	9	3	10
	annual report preparation	8	2	6
	corporate and internal communications management	9	8	7
	trade show participation management	7	2	7
	industry group participation	6	5	10
Cluster 2	contract review (legal matters)	6	8	9
	intellectual property management (legal)	7	5	9
	patent process management (legal)	7	6	10
	litigation management	7	7	11
	corporate functions (legal)	5	9	10

(continued)

TABLE 2. Cluster Analysis Output (*continued*)

Cluster Analysis for Activity Based Analysis

		3	7	9
		<i>Cluster</i>		<i>Cost</i>
		<i>Membership</i>	<i>Activity</i>	<i>Center</i>
Cluster 1	Environmental regulation compliance	6	9	10
	safety regulation compliance	5	11	10
	product quality control systems	7	10	7
Cluster 12	floor space management	5	5	6
	grounds management	7	5	11
	infrastructure charges	7	5	7
Cluster 10	regulatory compliance and administration	5	5	10
	employee benefits administration	8	11	9
	expatriate administration	6	5	11
	personnel administration	6	8	9
	training	7	7	9
Cluster 11	datacenter administration	9	11	7
	network administration	5	8	7
	office tech support	7	9	10
	Order and Billing	7	7	9
	Transportation and Delivery	6	7	8
	supplier contract management	7	11	10
	research and development support	8	11	9
Cluster 9	engineering support	9	8	22
	engineering project review	9	8	23

Column 3 and column 4 shows that cost center labeled 1, cost center labeled 2 and cost center 3 belong into cluster 3, cluster 7 and cluster 9, respectively. Although not shown here, the rest of the cost centers are mapped into the 13 clusters identified.

The subsequent step for the analyst is to label the clusters based on the economic activities tagged to each cluster. Thus, the economic activities within Cluster 2, litigation management, contract review, intellectual property management, corporate functions, and patent management, probably match closely to the activities of a company's legal department. Thus, the analyst could label this group Legal. The sum total of the costs of each of the cost centers identified constitutes the allocable amount.

CONCLUSION

Although the regulations provide a few examples of factors that should be considered when determining the method for apportioning deductions, they permit the taxpayer to "attribute supportive deductions on some reasonable basis directly to activities or property which generate, have generated, or could be reasonably expected to generate gross

income.” The method proposed here goes a long way towards increasing the robustness of allocation studies and making them more rigorous.

Using cluster approach to analyzing expenses proves to be substantially more tractable than reconstituting the cost pools into the respective departments for a number of reasons. First, it is unlikely that aligning cost pools with existing departments would facilitate a closer matching of cost to its source income because it is most likely that the functions of each of the departments routinely cuts across various associated functions and disciplines.

In the normal course of business, for example, a publisher relies on marketing experts, statisticians, editors, and other functional inputs. Both the publisher’s and the publishing costs accumulate in various cost pools associated with the various contributing disciplines. Thus, identifying departmental costs and department-specific cost drivers to allocate the costs incurred by the publisher to the source of income would fail to capture all relevant costs incurred.

Second, organization charts, albeit imperfectly, typically provide a mapping between costs and departments. However, at some firms, organization charts may reflect reporting lines. This peculiarity severs the possible direct correlation that one could establish between departmental functions and their costs. Without this connection, it is difficult to derive directly applicable cost drivers from an examination of the functions of the departments.

Third, assuming that one could disassemble all departments into their constituent costs, any rapidly changing administrative structure due to administrative restructuring would negate the benefits of a detailed analysis. Put differently, an expense allocation study for a given fiscal year may serve as the basis for the same exercise for future years or for planning purposes only by coincidence. Thus, a cluster analysis-based Structured Approach to allocating expenses derived from an understanding of the business’ core competencies offers a reasonable and systematic approach to the allocation of expenses without compromising the quality of the analysis.

APPENDIX A: QUESTIONNAIRE

Instructions for Questionnaire

This questionnaire contains a series of questions designed to identify all the ways that each cost center department supports foreign income generation. It should be used in conjunction with the list of economic activities (included here in Appendix B).

When questionnaires have been completed we will quantify the information. Ultimately, we will create a multivariate statistical model to determine the portion of costs incurred in the home office that are attributable to support of foreign subsidiaries. This statistic can be utilized to reduce the company's taxable income. We use the terms home office and headquarters interchangeably.

Please answer the questions for tax year 19XX. Thank you for taking the time to complete this questionnaire.

Questions

1. Identify the coding number of the elementary cost pool that you are examining.
2. For each cost center, please find the economic activities that charged cost to that pool.
3. Based on a scale of 1 to 25, where 1 is not likely and 25 is most likely, please rank whether an activity charged cost to each individual pool.

APPENDIX B: LIST OF ACTIVITIES

Activities

safety regulation compliance
 international internal audits
 production and dissemination of promotional materials
 corporate and internal communications management
 engineering project review
 product quality control systems
 payroll
 bank relationships
 transportation and delivery

(continued)

APPENDIX B: LIST OF ACTIVITIES *(continued)*

Activities

board administration
employee benefits administration
formulation and implementation of corporate objectives
interactions with independent auditors
expatriate administration
industry group participation
tax reporting
contract review (legal matters)
intellectual property management (legal)
order and billing
supplier contract management
trade show participation management
research and development support
personnel administration
environmental regulation compliance
network administration
litigation management
domestic internal audits
grounds management
annual report preparation
controller functions
floor space management
loan management
tax administration
asset management
office tech support
training
patent process management (legal)
corporate strategy and policy
infrastructure charges
financial reporting (internal and external)
engineering support
corporate functions (legal)
corporate evaluation and control
pension administration
datacenter administration
capital budgeting

(continued)

APPENDIX B: LIST OF ACTIVITIES *(continued)*

Activities

cash management

management of internal and external corporate environments

regulatory compliance and administration

web site management

consolidation of financial data

shareholder advocacy