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A LITERATURE SURVEY OF PRIVATE SECTOR METHODS OF DETERMINING PERSONAL FINANCIAL RESPONSIBILITY

by

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Credit grantors and employers have two clearly established methods--judgmental and empirically derived-- of determining personal financial responsibility that can be used as a basis for accepting or rejecting credit or job applicants. This thesis is a literature survey and analysis of those methods. The foundations of the two methods are examined and models of the empirically derived method are discussed. The paper builds upon the cost considerations and governmental constraints of the value-maximizing organization. Operational costs associated with personal financial responsibility determination methods include administrative expense, forgone revenue, and asset depletion due to decision making errors. Governmental constraints include informatio gathering restrictions for equal opportunity and privacy purposes. Applicability of the private sector methods to the public sector is also discussed.

The judgmental and empirical methods are each effective. Their utilization is based upon their respective abilities to minimize cost while achieving the organization's objectives.

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A Literature Survey of Private Sector Methods of Determining Personal Financial Responsibility

by

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ABSTRACT

Credit grantors and employers have two clearly established methods--judgmental and empirically derived--of determining personal financial responsibility that can be used as a basis for accepting or rejecting credit or job applicants. This thesis is a literature survey and analysis of those methods. The foundations of the two methods are examined and models of the empirically derived method are discussed.

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The judgmental and empirical methods are each effective. Their utilization is based upon their respective abilities to minimize cost while achieving the organization's objectives.

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I. BACKGROUND

A. INTRODUCTION

This paper describes methods used to predict the likelihood that individual debtors or employees of private sector organizations will misappropriate proprietary assets entrusted to them. There may be several methods of predicting the trustworthiness of individuals with respect to such misappropriations. Specifically, this paper, which considers personal creditworthiness equivalent to personal financial responsibility, is only concerned with those methods that are used to determine personal financial responsibility as an indicator of such trustworthiness. Credit applicants and applicants for positions of high trust in the private sector are the object of such prediction processes because they are capable of causing, intentionally or unintentionally, significant loss to the private sector organization.

This paper surveys the literature for private sector personal financial responsibility determination methods, describes those methods to the reader, and presents a general model of the value of such methods.

This chapter describes the (1) general environment within which the private sector organization is concerned with entrusting its assets to debtors and employees, (2) economic costs of determining personal financial responsibility, (3) characteristics of personal behavior associated with methods of determining personal financial responsibility, and (4) public sector environment for purposes of comparison to the private sector.

Chapter II presents specific operational problems which private sector organizations address through their personal financial responsibility determination methods. Their data

gathering process and specific personal financial responsibility methods from the open literature are also described.

B. PROBLEM

This section explains how determining personal financial responsibility has an economic impact on the private sector organization. It then discusses how disturbances to organization assets are affected by the personal financial responsibility of the debtors and employees entrusted with them.

1. Determining Personal Financial Responsibility: A Cost

The private sector grants billions of dollars in personal credit to generate revenues and profit [Ref. **1**:p. 28], [Ref. **2**], [Ref. **3**:p. 327], [Ref. **4**:p. 1], [Ref. **5**]. It employs individuals in positions requiring high degrees of trust to fulfill its missions. Private sector organizations, therefore, expose their assets to risks of loss through delinquent loans, bad debts, and criminal activities, including espionage. To protect those assets, these organizations attempt to determine whether or not credit and job applicants should be entrusted with the assets. One means to accomplish this is by determining the individuals' personal financial responsibility.

Because of the resources expended in the process, there are economic costs entailed in determining personal financial responsibility. These costs are discussed in further detail. The methods and costs of personal financial responsibility determination vary and are controllable [Ref. **6**:pp. 113-115]. However, individual behavior and the costs of governmental requirements are significant external factors affecting the determination process over which the private sector organization has little, if any, control.

The goal of private sector organizations is to maximize their net worth [Ref. **7**:p. 11]. Net worth is maximized by maximizing and retaining profit. Profit is

maximized by generating revenues as long as the costs incurred to generate them are not greater than the revenues. At a given level of revenue, costs must be minimized to maximize profit.

The organization incurs costs when lending money to credit applicants and hiring job applicants, and saves costs by limiting these activities. At a given level of revenue, there is a tradeoff between the costs saved and costs incurred from these two activities. As will be shown, part of the costs incurred from debtors and employees is due to their personal financial responsibility. To minimize total costs, the organization should accept the level of financial responsibility in its debtors and employees that can be expected to maximize differential between costs saved and costs incurred. Regarding credit granting, Sullivan states, "In theory, a value-maximizing lender would lower credit standards for new accounts accepted as long as incremental revenues exceed added costs of making the loans." [Ref. 8:p. 2] That is, the organization should determine its optimal level of personal financial responsibility requirements.

A private sector organization formulates policy that implicitly or explicitly defines requisite levels of financial responsibility for its credit and high trust position applicants. The organization then uses some method to determine that responsibility. If the organization decides not to consider the personal financial responsibility of a credit or job applicant, then it in effect has defined the requisite level of responsibility as that of the minimum of the applicant population.

2. Violation of Trust

a. **Introduction**

If all potential debtors and employees were trustworthy with respect to the assets entrusted to them by private sector organizations, then there would be no need to expend any effort or resources to determine this type of

trustworthiness. However, since this is not the case, the organization knows that there will be a certain amount of misappropriation of its assets with which it must deal. This section describes such realities. It discusses the two misappropriation modes--intentional and unintentional--so that the reader understands that there are identifiable problems that are addressed through personal financial determination.

A failure in financial responsibility may be unintentional, such as a loan delinquency. For example, a debtor that desires to meet a loan repayment schedule according to contract may experience an unexpected decrease in income and become unable to meet the repayment schedule.

b. **Fraud**

A failure in financial responsibility may be fraudulent in nature. For purposes here, fraud encompasses any illegal activity that involves the transfer of organizational assets to a person or persons by deceptive means. These activities include blackmail, bribery, embezzlement, espionage, extortion, forgery, and theft. Commonly known as white-collar crime, fraud significantly affects private sector profits: "White-collar crooks bleed American businesses of an estimated $40 billion a year, according to the U.S. Chamber of Commerce." [Ref. **9**] "Fraud is a...major focus of the business community." [Ref. **10**]

Because of the significant economic cost of fraud, the private sector attempts to control it. Prevention and deterrence may be attempted through applicant screening, physical security, and internal controls. However, "There is probably no better deterrent to fraud than effective and functional internal controls." [Ref. **10**]. For example, at National Bancshares Corporation of Texas, "employee theft has dropped in recent years; it credits strong internal and audit controls." [Ref. **11**] In writing on the importance of conducting audits of the adequacy of personnel information,

Mckee and Bayes state, "Accounting theory indicates that employment of...trustworthy personnel is one of the principal elements of an effective internal control system." [Ref. **12**]

(1) Credit Fraud. What can appear to be noncriminal violations of personal trust may in fact be the result of criminal activity because intent to defraud a creditor is not always apparent. If an applicant's objective is to defraud the organization without getting caught in the process, then the individual's means of achieving that objective would be to successfully meet the requisite criteria for applicant approval. To do this, the applicant must become familiar with the organization's method of processing applicant information used to determine the presence of the requisite criteria for an evaluation of financial responsibility. The organization's concern with credit fraud, then, is that the person committing credit fraud interferes with or manipulates the organization's personal financial responsibility determination method. Credit fraud can permit an irresponsible credit applicant to be labelled "creditworthy," when, in fact, the individual should be rejected.

Applicants with fraudulent intentions are not easily deterred. Cheng writes, "[Credit] fraud is difficult to prosecute. Although the borrower...is part of the conspiracy, he is not [usually] the principal criminal." [Ref. **13**] As an example, an employee may often be the third party who accepts payoffs to tamper with consumer credit ratings. Without the "inside" cooperation of the employee, the outsider must resort to other fraudulent means.

(2) Bankruptcy Fraud. Another example of a violation of trust is bankruptcy fraud--a form of credit fraud. Bankruptcy fraud occurs when the borrower buys goods on credit, liquidates them, then either skips out or declares bankruptcy. According to Cheng, "Most scams are the work of

individual con men or *debt-ridden* [italics mine] businessmen." [Ref. **13**]

(3) Bank Fraud. Employee misappropriations can be more obviously criminal in nature than those of the debtor because credit fraud can appear to be unintentional. Straightforward stealing is epitomized by internal bank fraud. Although it is bank robbery that is more often publicized by the press, bank fraud by employees is more than twice as costly [Ref. **14**]. Haas states, "All [the corrupt bank employee] needs is a way to transfer, substitute, or conceal funds;...he has become a most prolific thief." [Ref. **15**]

(4) Espionage. A violation of trust that can involve the misappropriation of both private and public sector assets is the compromise of national security by the private sector employee [Ref. **16**]. The high trust employee is in a position to engage in espionage. Because the costs of national security have more impact in society than the economic costs of any single private sector organization, espionage may be considered a graver violation of trust than embezzlement, theft, or other types of fraudulent activities. In view of the recent espionage cases, Turner's observations made in 1983 are germane:

> Of particular importance is the growing involvement of private industries in sensitive research and production contracts awarded by the Department of Defense for both military and civilian applications. Another factor is the intensified efforts of hostile and even some friendly nations to gather technical information through industrial espionage. In addition, internal crime deterrence and discovery continue to figure significantly on the list of managerial priorities. [Ref. **16**]

Turner continues:

> Frequently, the questions surrounding these criminal incidents focus on the effectiveness and reliability of *personnel selection measures*. But no technique can predict future success or criminal action in a precise manner. Undesirable human characteristics may develop months or even years after a person accepts employment. *[Personal] financial* difficulty...go[es] beyond the scope of pre-employment inquiries. (italics mine) [Ref. **16**:p. 45]

To summarize, credit and job applicants request private sector organizations to entrust them with

assets. The organizations need to approve applicants to generate revenues, but know that the likelihood of misappropriating assets comes with such approval. Such misappropriations may be intentional or unintentional. Intentional mis- appropriations are fraudulent in nature and can involve public sector assets when they are controlled by government contractors. Private sector organizations use methods to determine personal financial responsibility as an indicator of whether or not their assets should be entrusted to credit and job applicants.

C. PURPOSE

The primary purpose of this paper is to document and analyze methods used to determine personal financial responsibility in the private sector and to present a general model for the value of such methods. A single resource which surveys the various private sector personal financial responsibility determination methods currently in use is not known to exist. This thesis provides such a resource.

To achieve the purpose of the thesis, data were collected from the following areas: (1) private sector personal financial responsibility determination methods, (2) public sector personal financial responsibility concerns, (3) personal financial behavior, and (4) personal financial responsibility determination costs.

The determination methods section in Chapter II presents personal financial responsibility methods discussed in the open literature. While the focus of the paper is on the private sector, the public sector overview section demonstrates the similarity of the public sector's personal financial responsibility problems to those of the private sector. Perhaps the application to the public sector of methods used by for-profit organizations can lead to cost savings and/or reduced asset loss. The personal financial behavior and responsibility sections should help the reader better understand the rationales of the private sector

determination methods surveyed. These sections present the constraints within which the determination methods must be formulated. Archival data were gathered for this study from the open literature.

D. PERSONAL FINANCIAL RESPONSIBILITY POLICY COSTS

This section presents the cost constraints of personal financial responsibility determination methods. These constraints are the risks of asset loss and process expense. Private sector concerns with asset depletion are presented first. Specifically, the concerns are with losses associated with deficiencies in the organization's level of personal financial responsibility. Then, the expense incurred to control that level is discussed. Finally, the optimal combination of these two factors is discussed as a total cost minimization objective.

1. Asset Loss

Business risk is the degree to which an organization's assets are subjected to loss or compromise [Ref. 7:p. 408]. Assets include cash, securities, equipment, and proprietary or classified information. Many factors affect business risk, including the level of personal financial responsibility.

Organizations that extend consumer credit to generate revenues or that require high trust positions in the conduct of operations depend upon personal financial responsibility. This dependence increases an organization's business risk and, hence, expected loss. Debtors are expected to repay their debts on schedule. And, one can "relate [employee] position sensitivity to control over corporate assets." [Ref. 17] For instance, a pharmacist stealing drugs from his employer and selling them is a particular case in which the sensitive (high trust) position employee induced asset loss [Ref. 18].

Loss, in this context then, is the economic cost of asset depletion due to the trusting of consumers or employees

with the security of organizational assets. A case in which microfiche cards valued from $30 million to over $150 million were stolen is an example of assets in the form of proprietary information being depleted due to an employee trust violation [Ref. **18**].

In formulating policy that defines personal financial responsibility, the organization is, in effect, establishing a personal financial responsibility threshold *quality* that makes incurred business risk a calculated risk. If that quality is lowered, assets are exposed to greater risks of loss. Specifically, "Two components of the added costs of lowering credit standards are...higher delinquencies and larger bad debt losses." [Ref. **8**:p. 2] As this threshold is raised, fewer people can meet the criteria. It follows then, that there is a direct relationship between business risk and expected loss. Maximizing the threshold quality minimizes business risk and expected asset loss.

An organization establishes operational requirements for credit granting and employment to maximize its net worth. In the short run, consumer demand and labor supply are fixed. Under such circumstances, as the requirements for the *quantity* of people entrusted with assets is increased, the personal financial responsibility threshold must be decreased in order to allow a greater quantity of people to achieve the requisite criteria for meeting that threshold. Hence, the tradeoff exists between the personal financial responsibility threshold and expected loss. The private sector organization can only place its trust in more people if the quality standards for the threshold fall. But, expected loss will increase with the added business risk [Ref. **6**:p. 113].

The "Expected Loss" curve in **Figure 1** shows the relationship of expected asset loss due to the personal financial responsibility threshold. A low-level personal financial responsibility threshold (T_L) allows a high degree of expected loss (L_H) due to increased business risk. As the

requisite degree of personal financial responsibility in a given credit granting or employment situation is increased (T_H), business risk and, hence, expected loss is decreased (L_L). [Ref. 19]

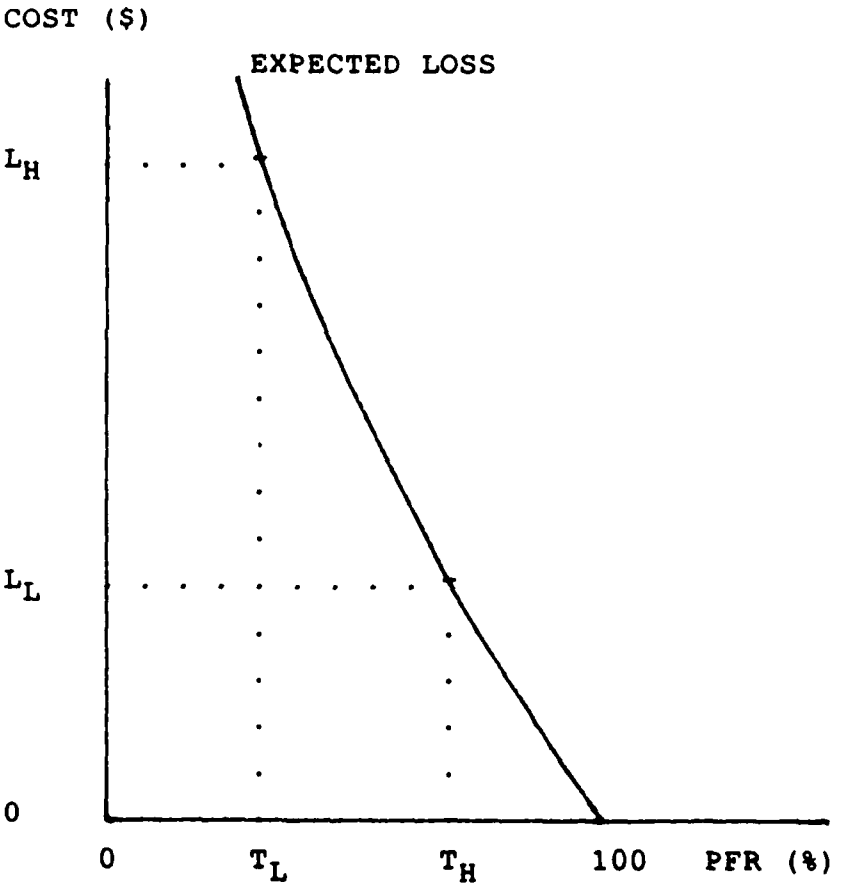

Figure 1.

Expected Asset Loss as a Function of Personal Financial Responsibility

2. Expense

a. **Personal Financial Responsibility/Expense Relationship**

As the criteria for the quality of a personal financial responsibility threshold are increased, so does the expense of executing the personal financial responsibility policy. [Ref. **6**:pp. 113, 115], [Ref. **20**:p. 422], [Ref. **21**]. This expense consists of administrative expense and forgone revenue. Administrative expense entails the personnel and material resources expended in the determination effort. Forgone revenue is income that could have otherwise been earned from loan repayments or employee production. For purposes of the analysis, it is assumed that an employee's production directly or indirectly contributes to organization revenues. Fewer consumer credit and high trust employment applicant approvals than operationally required will result in forgone potential revenues and profit [Ref. **6**:p. 116].

The "Expense" curve in **Figure 2** shows how administrative expense and lost revenue is a function of the personal financial responsibility threshold. As the threshold increases through T_L and T_H, expense increases through E_L to E_H. [Ref. **19**]

b. **Government Regulation**

Organizations are legally bound to the constraints imposed by government regulation. This section discusses the various added expenses the private sector organization faces because of government regulation. It also reviews the general types of regulation.

(1) Types of Expense. One of the expenses incurred in determining personal financial responsibility is the costs of government regulation. Government regulation affects both the credit granting and hiring practices of organizations. Also, it impacts administrative expense and lost revenues. Examples of administrative expense elements that are affected include direct labor, materials, and

services used for the determination methods. For example, the salary of a person making a credit check and the credit report fee are administrative expenses.

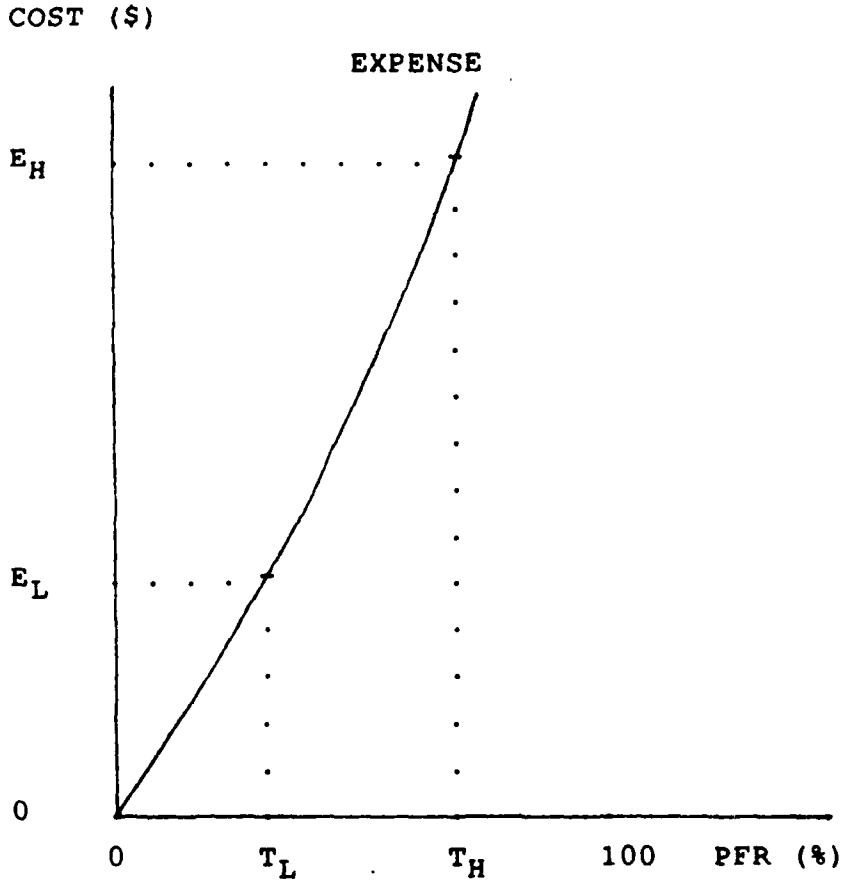

Figure 2.

Expense as a Function of Personal Financial Responsibility

Government regulation affects lost revenue expense by decreasing the incremental income that could have been earned, but was not, because regulation slowed down the determination process for approving loans or employment.

Both compliance and noncompliance with government regulation result in expenses. Compliance expense is defined as the incremental cost incurred when a regulation increases the administrative requirements of the method process. For example, the cost of ordering new employment application forms to comply with equal opportunity legislation would be an administrative compliance expense. Or, if a loan processor were reassigned to check applications to ensure compliance, then the income from the loans that could have been processed if the person had not been reassigned is a lost revenue expense. Noncompliance expense is defined as the cost of litigation, penalties, and future lost revenue.

Peterson argues that consumer credit regulation costs are very substantial and may add 1 percent or even more to consumer credit operations cost [Ref. **22**]. He divides these costs of compliance into direct and indirect costs. He also states that the governmental restriction of certain types of information significantly reduces the abilities of creditors to evaluate the future credit risks of consumers [Ref. **23**].

Direct costs of compliance are those involving incremental personnel or supply expenses. They are incurred to maintain a given personal financial responsibility threshold. For instance, hiring an additional person to ensure credit application forms are consistent with government regulations would be a direct expense.

Indirect costs involve decreases in the individual productivity of credit evaluation personnel or increases in bad or delinquent debts. These costs are incurred from the slippage allowed in the personal financial

responsibility threshold. For instance, rather than expend more personnel effort to ensure credit application forms are consistent with government regulations, the private sector organization might simply require less applicant information for credit approval. That would in effect lower the personal financial responsibility threshold quality and increase asset loss risk. Thus, incurring an indirect cost can result in an asset loss by allowing a lower criteria for personal financial responsibility. Or, regulation might cause fewer applications to be processed, resulting in lost revenue.

(2) Legislation. Government regulation of credit granting and employment is embodied in federal and municipal legislation. Current legislation is significantly concerned with consumer rights--specifically, creditor collection limitations, equal opportunity, and privacy. This section discusses those areas.

One study indicated that while consumer complaints were contributory to regulatory legislation, they were frequently based upon false perceptions of the credit information system.

> Consumers were confused between the functions of investigative reporting and credit reporting since nearly 30 percent believed that credit bureaus do maintain opinion information. [Ref. **24**:p. 15]

It also indicated that "Only 37 percent of [the] respondents correctly identified a credit bureau as a record-keeping agency." [Ref. **24**:p. 3] The study concludes that regulation influenced by consumers' lack of knowledge increases the cost of the credit decision process.

(a) **Wisconsin Consumer Act.** This legislation (WCA) was enacted in 1973 as pro-consumer legislation. It limited "the classes of goods and amount of income that could be taken as security [for consumer loans]." [Ref. **25**:p. 4] Peterson conducted a survey of finance companies following WCA's enactment to determine, in effect, their resulting personal financial responsibility policy changes.

> Most [finance] companies operating in Wisconsin tightened credit availability after enactment of the Wisconsin Consumer Act. Most cited the WCA (either directly or indirectly) or increased losses (or inadequate returns) as the reason[s] for their actions. [Ref. **25**:p. 1]

Such losses are an example of personal financial responsibility policy indirect costs of government regulation: more effort was required by finance companies to process credit applications in accordance with the WCA. As a result, the application approval rate decreased. Also, bad loans and delinquent debts increased due to new restrictions on collateral and collection efforts for approved loans. [Ref. **25**]

(b) **Equal Opportunity**. Recent changes to Regulation B [Ref. **26**], which implements the federal Equal Credit Opportunity Act (ECOA), are a source of administrative expense incurred by organizations that must determine personal financial responsibility. The changes place further restrictions on the type of information that can be requested on credit applications. The direct costs of maintaining the personal financial responsibility threshold with these changes can be greater than the indirect costs of not maintaining the threshold [Ref. **22**]. As a result, private sector organizations might allow the threshold for approval of applicants to decline in order to comply with regulations and maintain revenues, causing an increase in indirect costs.

Regulation B can also increase direct costs. For instance, there is the requirement for written notification to the credit applicant by the organization in the event of its "adverse action" on the application.

Regulation B affects the credit evaluation process by preventing credit grantors from using factors that they believe are relevant and make the process more efficient and profitable [Ref. **22**]. And, for employers, "The Equal Employment Opportunity Commission...holds that inquiries about charge accounts, credit and bankruptcy are evidence of discrimination."* [Ref. **15**:p. 46] These

requirements may be thought of as equal opportunity costs that affect the cost of determining personal financial responsibility.

(c) **Privacy**. Another cost of government regulation is that of consumer privacy. The collection of almost any private information by employers, including personal financial information, is severely limited if it is "non relevant." [Ref. **27**:p. 21] In this sense, "relevant" means a valid business reason--a reason which is directly associated with generating profit. The concept of relevance and nonrelevance is discussed in greater detail in the next section of this chapter. Using such information in a negative way can expose the organization to various liabilities. For instance, not hiring someone due to their credit rating "has been found to be illegal unless the employer can show 'business necessity'." [Ref. **28**:p. 91]

Government restrictions designed to protect consumer privacy may result in a reduction of applicant information quality and quantity supplied to the organization. A mistake based upon such insufficiencies of information can be costly:

> Hiring the wrong person...means the business will again have to face the costs of recruiting, screening, and evaluating. The expense of retraining...may equal or exceed the annual salary. [Ref. **29**:p. 84]

Hiring the wrong person because of privacy legislation restrictions can have additional costs. The organization is exposed to asset loss from illegal activity and litigation if it employs personnel with questionable backgrounds [Ref. **11**:p. 56].

Duffy discusses the need for employers to recognize legislative constraints when establishing employment decisions. [Ref. **30**:p. 309] Such restrictions cause further inefficiencies in the system, increasing

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*Figure 1 of Reference 15 is a guide to sample employment interview questions that distinguishes discriminatory and nondiscriminatory inquiries.

indirect cost. For instance, an employer may consider adebt-ridden job applicant not viable for employment due to emotional distress caused by such financial difficulties. However, the employer may have to hire the individual, instead of a more suitable applicant, because of a government restriction against using such information for employment decisions. Accordingly, there are lost profit costs from not hiring an applicant who would prove to be more productive [Ref. **31**:p. 11].

Employers must be aware of restrictions imposed on them to control data gathering from outside agencies [Ref. **32**:p. 69]. Also, there can be severe penalties to third parties if, without solicitation, they illegally provide personal financial information to an employer [Ref. **33**].

Regarding the collection of information directly by an organization, the Right to Financial Privacy Act (which does imply the connection between personal financial responsibility and trustworthiness) prevents financial institutions from divulging personal financial records at will just because the information might accommodate the determination method [Ref. **34**]. The Act provides for the release of protected and unprotected information to federal law enforcement agencies under specific conditions.

(d) **Noncompliance**. As previously mentioned, there are also specific legally imposed expenses that can result from noncompliance with government regulations as well as loss of revenue from reduced credibility:

> The law is very strict on *employers and credit reporting agencies that willfully fail to comply.* In the event of willful *noncompliance*, an individual may recover any actual damages sustained plus the amount of punitive damages a court awards together with attorney's fees and court costs. (italics mine) [Ref. **35**:p. 279]

For instance, Equifax Services, a national credit reporting firm, had constraints placed on it by the Federal Trade

Commission (FTC) for noncompliance with the Fair Credit Reporting Act (FCRA). In addition to legal fees, Equifax had to increase its operational direct and indirect costs to comply with the FCRA. The FTC required Equifax to provide lesser quantities of more accurate information to its clients. [Ref. **36**]

3. Total Cost Optimization

The personal financial responsibility threshold chosen by an organization forces a tradeoff between its expected loss of assets and its administrative expense and lost revenue. **Figure 3** represents these combined costs with a "Total Cost" curve. [Ref. **19**]

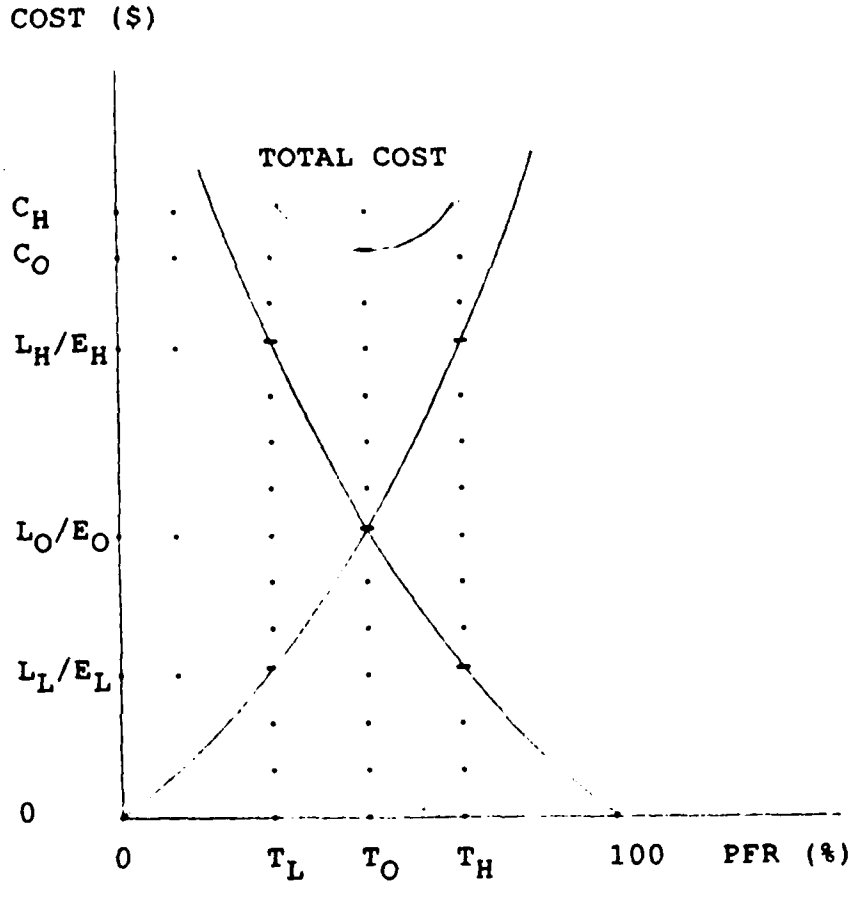


Figure 3.

Total Cost as a Function of Personal Financial Responsibility

In fulfilling the objective of maximizing the value, or in the case of a government agency the utility of the organization, management should seek to choose a personal financial responsibility threshold (T_O) that will minimize the total cost (C_O) rather than maximize personal financial responsibility. Increasing required personal financial responsibility (T_H) beyond the optimal point (T_O) will incur marginal expense ($E_H - E_O$) greater than the marginal loss avoided ($L_O - L_L$), increasing net total economic cost by $C_H - C_O$. Economic profit or net utility is thus reduced [Ref. 6:p. 119]. Lowering the threshold (T_L) below T_O will incur marginal loss ($L_H - L_O$) greater than the expense saved ($E_O - E_L$).

Regarding the incremental administrative cost of determining personal financial responsibility, Boggess states that it should only be incurred when the incremental expected loss avoided will exceed the incremental cost incurred [Ref. 6:p. 115]. For instance, a loss incurred due to a security compromise should be tolerated if the cost of having used a higher personal financial responsibility threshold to prevent the loss would have been greater than the loss is worth.

E. PERSONAL FINANCIAL BEHAVIOR

This section explains why certain behavior is used to determine personal financial responsibility. It first explains that population behavioral data are important to the determination process because of its predictive characteristics. It then describes what data are important.

1. Personal Financial Behavior Data

a. Indicator of Personal Financial Responsibility

A variety of human behavioral activity enters into the personal financial responsibility determination process. Determination methods must be designed to apply to general population behavior to avoid discriminatory accusations. Antisocial (i.e., criminal) behavior is extreme and not indicative (hopefully) of the general

population. Personal financial behavior, though, is a routine part of everyday life that can be used as a predictor of personal financial responsibility when utilized as an input to a determination method applied to the general population. This section discusses consumer liquidity and credit use as sample indicators of personal financial responsibility.

Credit information helps describe personal financial behavior:

> It tells you two things about a person: how promptly he pays his bills and his general level of personal expenditure. The first tells something about his responsibility; the second, when correlated with his stated level of income, may or may not indicate possible conflicting interests. [Ref. **37**:pp. 92,136]

Often credit history is checked to determine financial responsibility. [Ref. **38**:p. 58] Comparing one's historical general level of personal expenditure to one's objectives may indicate the need for further investigation of the applicant. For example, if one's lifestyle has recently demanded an expenditure level of $100,000 a year, then the objective of applying for a $50,000-a-year job could be called into question, possibly indicating potential criminal activity [Ref. **13**:p. 72]. That is, income level and expenditure level are elements of personal financial behavior data that should be examined and compared to each other for indications of personal financial responsibility or conflict.

Cash shortage is the reason consumers decide to become credit applicants in the first place [Ref. **39**:p. 1.]. Credit is used by households to finance consumable expenditures beyond the capabilities of their cash assets. Normal liquidity can be defined as having enough cash on hand to cover contingencies in the absence of regular income for what the household considers a reasonable period of time (e.g., six months). Excess liquidity covers any unplanned loss of regular income beyond such a period [Ref. **39**:p. 2]. Logically, households with excess liquidity would use the

excess for consumable expenditure prior to using credit. This is based upon the premise that the cost of consumer credit is greater than the income derived from liquid investments or savings.

Households short on liquidity must either use consumer credit to make up the shortage or decrease spending. The cost of borrowing increases total nondiscretionary household expense which further aggravates the liquidity shortage. Further consumable expenditure becomes even less affordable as liquidity decreases. An irony of personal financial behavior occurs in the credit granting arena: Relative to income, those that can least afford consumer credit need it the most.

Sexton attempted to discover criteria that can identify relatively good credit risks among low-income families [Ref. **40**:p. 236]. He statistically evaluated 14 personal behavior variables used by large credit granting retailers to determine which variables have potential as indicators of personal financial responsibility. His sample consisted of those already approved for credit; therefore, much of the variables' indicator potential was filtered out. Few significant differences were found in the usefulness of the variables between high and low income families. Having had a credit investigation or having a checking account were two predictor variables for both high and low income families as good credit risks. But, these variables were more significant as predictors of good credit risk for the low income families than they were for the high income families. The study also showed that the presence of income beyond that from the head of household's primary occupation was *not* an important variable for predicting the personal financial behavior of either group [Ref. **40**:p. 239]. This parallels Sullivan and Drecnik's study which found "the probability of household debt use...was *not* [italics mine] significantly

associated with the level of household income." [Ref. **41**:p. 31]

Bowers and Crosby examined the financial behavior of low income consumers to identify variables that explain their behavior. As part of their study, the consumers were trained in and screened for credit card use prior to receiving the cards. Bowers and Crosby suggest that the variables of banking affiliation (for example, Sexton's checking account variable) and knowledge of one's credit card account served as measures of traits which are associated with one's ability to become more financially stable. [Ref. **42**:p. 98]

b. **Sources and Uses**

This section discusses general population financial behavior information that can be externally obtained. This information can be used by the organization as a comparison standard for its determination method. The section then describes categories of behavioral data of interest to organizations.

Prior to developing a method of determining personal financial responsibility, the private sector organization must either develop internally, or obtain from an outside source, the requisite personal financial behavior data. There exists a sizable database of consumer financial behavior [Ref. **43**]. The primary sources are surveys, statistics, and special studies developed by both the public and private sectors. The Federal Reserve Board and the U.S. Department of Commerce are the major contributors of general population consumer financial behavior information.

A private sector organization can use statistical data descriptive of personal financial behavior to formulate policy that defines requisite degrees of financial responsibility for its credit and high trust position applicants. And, it can use this data to continuously monitor that trustworthiness.

Moran, *et al.* [Ref. **5**] state, "of potential utility in discriminating good from bad risks...is...personal data supplied by the applicant for a loan." They conclude that there are specific personal financial behavior factors that differentiate good from bad credit risks, the most significant of which is "buying a home of relatively high value." The authors also found, however, that there "is the lack of differential prediction associated with the variables sex, marital status, old or new customer, and collateral in the form of goods vs. cosigner's guarantee." However, because their study, like Sexton's, was limited only to data from already approved applicants, they admit "the paper's findings [were] tentative and suggestive rather than definitive." [Ref. **44**:p. 59]

Updegrave [Ref. **45**] lists some of the significant personal variables of concern to consumer lenders:

- Number of creditors
- Credit payment history
- Suits, judgments, and bankruptcies
- Length of time at job and residence
- Income
- Occupation
- Age
- Checking or savings account
- Homeowner vs. renter

2. Risk Variables

a. **Relevance**

Personal financial behavior can be categorized by personal trait variables. Some variables (e.g. having a credit card) are obviously financial in nature. Others (e.g. age) are not. In developing a method of determining personal financial responsibility, the organization should be concerned with incorporating those variables in its model that are clearly relevant. Relevant variables are those the organization requires to *effectively* execute its

determination method. Organizations can learn from either experience or statistical studies which variables are relevant.

Moran, [Ref. **5**], Sexton [Ref. **40**], Sullivan and Drecnik [Ref. **41**], and Bowers and Crosby [Ref. **42**] are examples of statistical studies that provide organizations with knowledge of which personal trait variables are relevant. For instance, Moran's study concluded that age, income, automobile age, and home ownership were relevant variables. Sullivan and Drecnik suggest that a consumer's *after-tax* cost of credit is an indicator of the probability of credit use.

By definition, irrelevant variables will add nothing positive to the determination process. They can inadvertently take on unwarranted significance which may lead to either of two types of errors: Type I--rejecting financially responsible applicants or Type II--accepting unqualified applicants as financially responsible. These errors can make the model less efficient by adding clutter, "noise," and administrative expense to the model. More importantly, though, is that the occurrence of these errors can have deleterious effects on the determination method. Because the errors have costs associated with them, they affect the organization's wealth by forgoing revenue because of a Type I error or by increasing asset loss due to a Type II error. It is clearly beneficial, then, to identify variables of personal financial behavior as either relevant or irrelevant.

One way to determine the relevancy of a personal trait variable is to evaluate it independently of other variables by assessing the risk associated with the variable compared to the population at large. For example, if a survey showed that 30 percent of the people who have felony convictions were debt-delinquent, one's first reaction might be, "People who are convicted felons are not financially

responsible," and that a felony conviction is a relevant variable. However, if it was also known that the same behavior was indicated by about 30 percent of the population at large, then the variable should be considered irrelevant.

Variable relevancy is dynamic and should be continuously reevaluated. Peterson points out that, "occupational and employment credit risk varies over time as the business cycle
and aggregate credit conditions change." [Ref. **23**:p. ii]

b. **Complexity**

Complex personal trait variables consist of two or more simple traits. Understanding the correct usage of complex financial behavior variables in a responsibility determination model is critically important. For example, being a convicted felon *and* coming from a broken home is a complex variable. Though each simple trait may be irrelevant, combined, they may become a relevant complex variable.

Peterson demonstrated that simple trait risks are not necessarily additive [Ref. **23**:p. 14]. He combined the relevant positive occupational category of managers and foremen with the relevant negative employment category of manufacturing. This combination resulted in a complex variable that indicated a higher level of personal financial responsibility than the occupational trait did alone. Similar results were achieved with other occupation-employment category combinations such as professionals-manufacturing and professionals-banking, finance, and real estate. Peterson argues that occupational and employment information are relevant indicators of income stability.

c. **Debt Delinquency**

Debt delinquency is a personal trait variable that is of obvious concern to the creditor. In exchange for credit, borrowers agree by contract to specific repayment terms. Adherence to repayment terms can be one indicator of trustworthiness, though not an assurance of it. Embezzlers

may have no problem paying their bills. Repayment delinquency, however, definitely violates the creditor's trust placed in the debtor. A generally responsible person may have very tenable reasons for such delinquency. However, by definition, the individual has indicated a *decreased level of personal financial responsibility* simply because of the delinquency.

Sullivan's study discusses the borrower's "economic incentive to default on credit contracts when perceived costs of default are lower than costs of staying current on the loan." [Ref. 8:p. 4] That is, the debtor weighs the personal economic cost of future difficulties in obtaining credit, with legal matters, and with loan collection efforts against the cost of properly repaying the loan. The debtor then prefers to choose the least costly alternative.

As Sullivan mentions in the study, deterioration of future credit availability is one cost of default. A cost not within the scope of the study is that of the deterioration of personal trustworthiness resulting from the decreased level of financial responsibility demonstrated by the debtor's default. Additionally, if the delinquent consumer feels pressure by the creditor to become current, the individual's employer may become the victim of internal fraud because of delinquency induced temptations.

Generally, the average consumer debt delinquency rate is a function of the business cycle [Ref. 8]. The rate is especially sensitive to the unemployment and inflation rates. Consumer liquidity is also affected by such macroeconomic conditions and in turn affects consumer debt delinquency. In the aggregate, the consumer liquidity-to-consumer credit outstanding ratio was fairly steady from 1963 to 1974 [Ref. 39:p. 4]. "Double-digit" inflation in the late seventies caused the ratio to rise until the 1982 recession hit the national economy. In a 1983 survey by the Federal

Reserve Board [Ref. **39**:p. 17], liquidity was shown to be directly proportional to average household income, which is affected by the inflation and unemployment rates. The national average for the debt-to-income ratio increased 76% from .105 in 1950 to .185 in 1975, indicating that in to the mid-seventies, while income and debt were increasing, so was liquidity and the ability to repay debts on schedule [Ref. **46**].

The relevance, then, of a debtor's delinquency should be measured with current macroeconomic conditions in mind. In Sullivan's analysis of composite delinquency rates, she found that debt burden, as a ratio of consumer debt to disposable income, was significantly and positively associated with consumer debt delinquency rates [Ref. **8**:pp. 12,25,26]. As one would probably suspect, a consumer's debt burden is a relevant personal trait variable for predicting debt delinquency.

Raske's study suggests that specific socio-familial personal trait variables are relevant indicators of potential debt delinquency. He states,

> ...debt delinquency is related to structural factors within the family, that *potential* [italics mine] delinquency can be detected with adequate statistical reliability by knowing what those factors are. [Ref. **46**:p. 39]

That is, internal family dynamics such as marital stress or educational level can have a marked influence on personal financial behavior. Debt delinquency may be a symptom of internal stresses beyond the expected financial indicators:

> Financially dysfunctional families strongly tend to lack planfullness *[sic]*, possibly because they strongly tend to lack goals. Leadership in these families is "soft" or non-existent. Role flexibility is low and roles tend to be stereotyped. Money management is the concern of one spouse ("My wife takes care of the bills.") Family organization tends to be simple rather than complex.

Raske continues:

> Consumer credit is a popular stress-relief device with some addictive qualities, not at all unlike whiskey, especially where problems of self-esteem are present. [Ref. **46**:p. 40]

This emphasizes the criticality of evaluating the relevancy of trait variables that are indicative of personal financial

behavior yet not necessarily financial in nature. Some of these that Raske mentions are [Ref. **46**:p. 46]:

- Debt is usually incurred by one spouse only
- Such debts are paid by the other spouse
- Denial of need for credit
- Nonspecific family goals
- Above average number of children
- Children close in age
- Married young
- Parents' education below local average
- Job prestige below local average

d. **Bankruptcy**

Creditors and employers should be concerned about which relevant personal behavior variables can be used as indicators for potential bankruptcy filings. When debtors desire or require protection from the demands of their creditors, they have the option of filing for bankruptcy. Obviously, creditors realize total or partial loss of assets entrusted to debtors that do file. Also, if employees are insolvent, but desire to avoid filing for bankruptcy, the employees may be subjecting themselves to greater temptations of committing fraud. Employers realize increased risk of asset loss under these circumstances.

The Credit Research Center at Purdue University conducted a survey to determine, among other things, bankruptcy petitioner demographics. Describing the modal petitioner, the study summarized:

> ...the petitioners were primarily heads of households of young families. ...most likely to have a high school degree, be employed in an unskilled labor position, and report family income of $5,000 to $10,000 per year [(1981)]. Households had at least one person [presently] employed full time and expected family income to increase. In contrast to the national sample [of households with consumer debt outstanding]...the petitioners were younger, and were less likely to be married. Most were in the prime family formation years. [They] were much less likely to own their own homes. [Ref. **47**:pp. 17,18]

More importantly, primary causes leading to petition for bankruptcy were typified:

> The path to bankruptcy...was paved by an inordinately heavy use of consumer credit relative to family income. Petitioners had credit from a multitude of sources but were frequent users of unsecured credit from medical sources, dealers, retailers, friends, and others. Those who had consumer instalment debt which totaled more than 100 percent of family income were heavy users of those sources of debt. ...most frequently indicated...[as] the most important cause of bankruptcy was a medical problem, a marital problem, loss of job, or excess use of credit. Forty percent...filed...to avoid paying a particular creditor. [Ref. **47**:p. 61]

Another study by the Credit Research Center found that consumer debt burden and short-term economic outlook are relevant personal trait variables indicative of personal bankruptcy [Ref. **48**:p 15]. From these studies it appears that the private sector organization must not only be concerned with an individual's level of debt, but the reasons for the debts (e.g. medical expenses) and the number of debts as potential personal trait variables.

F. PUBLIC SECTOR OVERVIEW: PERSONAL FINANCIAL RESPONSIBILITY and COST

This section describes the similarities and differences the public sector experiences with personal trustworthiness as compared to the private sector. The violation of trust, its cost implications, and sample proposals to reduce cost are described.

1. Violation of Trust

The same asset loss that the private sector incurs from people who violate its trust plagues the public sector as well. Public sector loss additionally includes the implicit cost of compromise of national security information. This applies even when the information is controlled by government contractors in the private sector because such losses affect national security. Such loss typically involves classified information provided to or developed in the private sector under government contract. Other loss includes technology transfer. The only loss to the private sector organization is the actual dollar cost of assets, penalties, and lost future revenues. However, the implicit

cost to the nation is that of the damage to national security.

The Defense Investigative Service (DIS) is the DOD agency that is primarily concerned with the determination of personal trustworthiness of military and civilian personnel in DOD and the defense establishment [Ref. **49**]. Credit checks are conducted by DIS as part of personal background investigations.

Rosa states,

> virtually every espionage case in the past decade has involved financial motivation. Whether driven by need or greed, these spies sold the secrets entrusted to them for hard, cold cash. [Ref. **50**]

Allen and Polmar corroborate this by arguing that financial gain was the most common motivating factor in the many recent espionage cases [Ref. **51**:p. 282]. Some costly espionage cases of current notoriety include Miller, Pelton, Walker/Whitworth, and Pollard [Ref. **50**]. Walker is believed to have received more than $1 million over a period of a decade. [Ref. **21**:p. 7]

Another current case, though not believed to involve espionage, does involve murder and robbery in DOD. Ruben Colon is a Navy petty officer in the Electronic Warfare rating. That job specialty requires him to have or have had a "secret" security clearance. Colon is alleged to have murdered his ship's disbursing officer while robbing him of ninety-five thousand dollars and twenty-six hundred treasury checks. [Ref. **52**]

2. Optimize Cost

Figures 1 - 3 apply to government and private sector activities as well. However, it might be argued that the government should not optimize personal financial responsibility, as shown in **Figures 1 - 3**, for the following reasons: (1) the government is not concerned with profit and (2) the issue of national security mandates personal financial responsibility be maximized. However, though it is true that profit is not a governmental objective, cost-

efficiency is. Activities operating under budget constraints must necessarily be concerned with cost minimization. [Ref. **53**:p. 121]

It might be analytically difficult or even politically inappropriate to assign a monetary value to public sector loss. However, "it is necessary that dollar values be assigned to the various resources...that...reflect the value of the benefits that could otherwise be produced." [Ref. **53**:p. 122] If cost-benefit analysis is to be applied in determining optimal personal financial responsibility levels for the government, then assignment of some dollar value approximation to implicit cost is essential [Ref. **47**:p 125].

Differences between the public and private sector in the positioning of the "Expected Loss" curve of **Figure 3** would be significantly affected by the sizable dollar values assignable to national security breaches. Such losses would pivot the curve upward compared to the less severe private sector expected loss curve. This, in turn, would shift the total cost curve upward and to the right, as shown in **Figure 4**. Relative to private sector levels, increases would result in the government's optimal personal financial responsibility threshold level from T_O to T_G and optimal total cost from C_O to C_G. This change is beneficial because as it is made, the marginal loss the government would avoid ($L_N - L_G$) by sliding down the expected loss curve is greater than the marginal expense incurred ($E_G - E_O$).

For the same reasons as the private sector, the optimal rather than the maximum or ideal level of personal financial responsibility should be sought by the government. The benefits of achieving a level beyond the optimal would be far outweighed by the incremental costs. The Department of Defense (DOD) estimated that an annual expenditure of $80 *billion* would be required "to perform a full investigation, complete with field interviews, of all personnel and

contractors who have access to classified information." [Ref. 21].

To reduce public sector asset losses, Rosa [Ref. 50] proposes that personal histories of credit, bankruptcies, real and personal property titles, household finances, incorporations, expense records, income tax returns, large bank transactions, and passports and visas be subject to scrutiny before, during, and after granting security clearances.

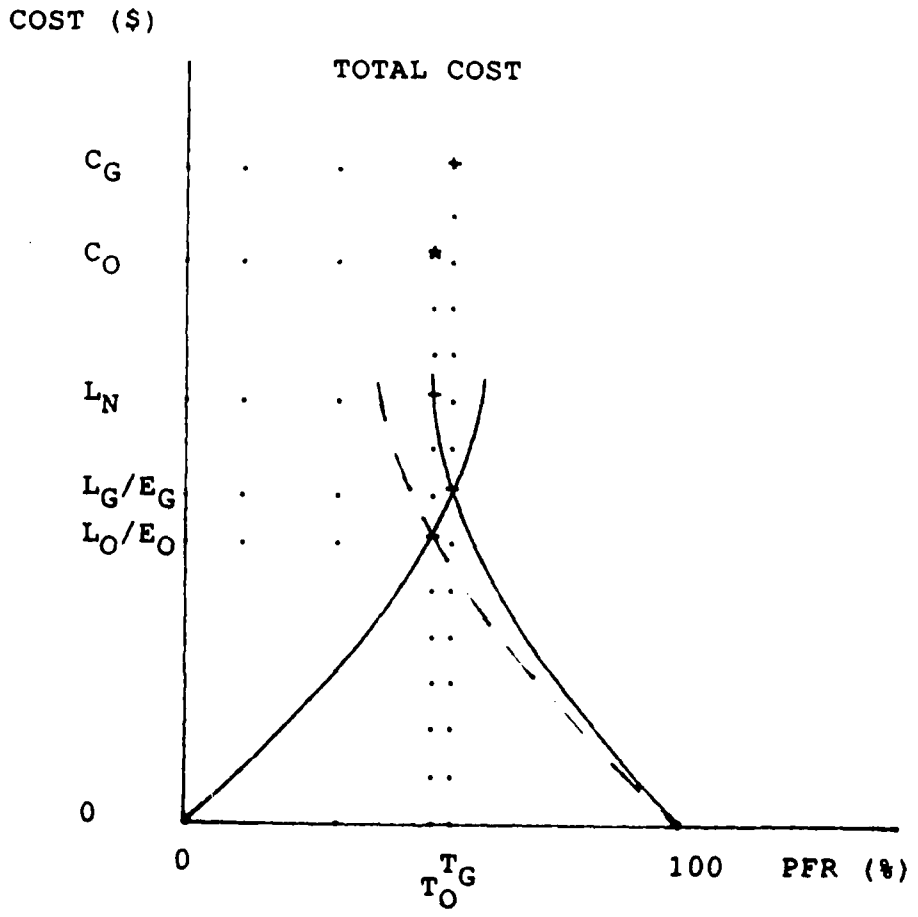


Figure 4.

Effects of National Security Losses on Public Sector Optimal Personal Financial Responsibility

To reduce expense, the Fair, Isaac Companies recently proposed a fully integrated computerized credit evaluation system for DIS. The company provides customized systems of this sort to the private sector for credit granting purposes. For DIS, it would be a decision support system "used to obtain and interpret credit reports for subjects of personal security clearance investigations." [Ref. **54**:p. 1-1]

The system would primarily reduce administrative costs by reducing the number of processing personnel and the time required per routine investigation. Additionally, management would easily be able to change the personal financial responsibility level programmed into the system. The proposal is designed to pivot the "Expense" curve downward, as shown in **Figure 5**. This would also shift the "Total Cost" curve downward and to the right, again increasing the government's optimal personal financial responsibility level to T_G while *decreasing* its total cost to C_G. This change is beneficial because the marginal loss the government would avoid ($L_O - L_G$) by sliding down the expected loss curve is greater than the marginal expense incurred ($E_G - E_N$).

G. SUMMARY

Private sector organizations place the security of their assets in the hands of debtors and employees to generate revenues or conduct operations. To control their risk of asset loss due to loan default or employee fraud, these organizations try to evaluate the trustworthiness of credit and high trust position applicants. One way they can do this is by determining individuals' financial responsibility.

Maximizing the requisite level of personal financial responsibility minimizes the risk of asset loss. But, determining and establishing personal financial responsibility levels incurs the costs of administrative expense and forgone revenue. In accordance with the organization's goal of maximizing its wealth, it should set a policy that minimizes its *total* cost. This can be

accomplished by selecting an optimal personal financial responsibility threshold.

The public sector risks greater loss than the private sector due to the potential damage to national security. If the public sector quantifies its potential losses, it can also benefit by using private sector personal financial responsibility determination methods and choosing an optimal trustworthiness level.

The next chapter surveys which methods are used to determine personal financial responsibility.

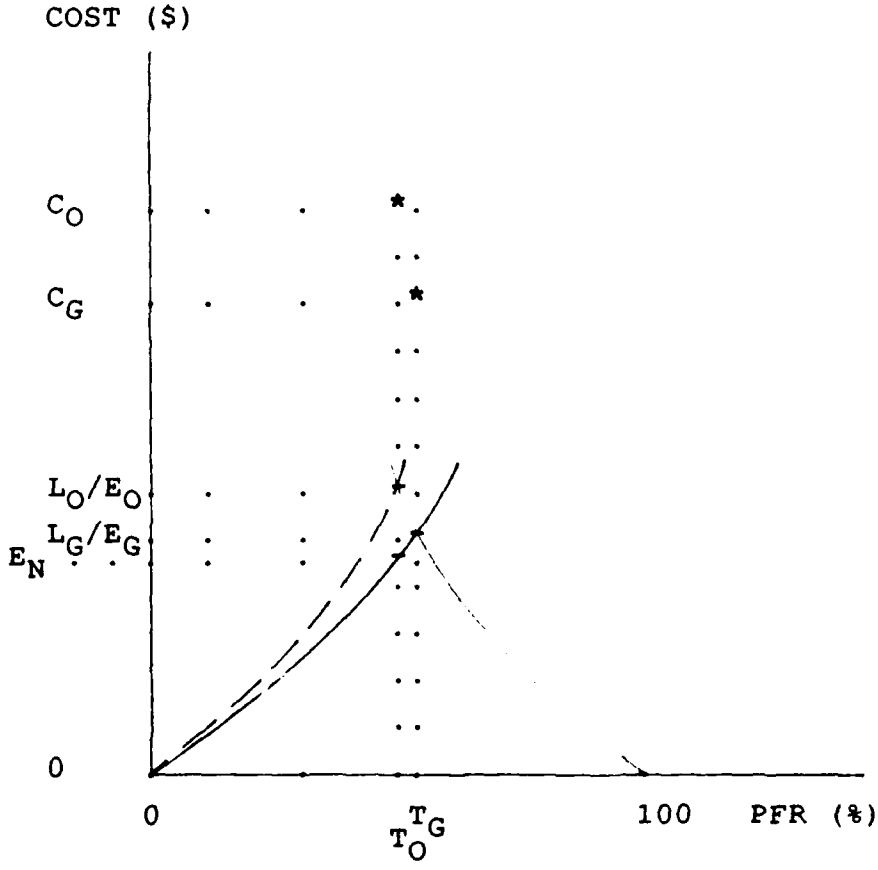


Figure 5.

Effects of Expense Efficiencies on Optimal Personal Financial Responsibility

II. ANALYSIS

A. PROBLEMS REQUIRING PERSONAL FINANCIAL RESPONSIBILITY DETERMINATION

1. Introduction

Chapter I discussed the problem of organizational asset loss due to the violation of trust. The chapter raised the questions: (1) Why, (2) How, and (3) To what extent should personal financial responsibility be determined by an organization?

This chapter discusses operational problems facing an organization that can be addressed by the personal financial responsibility determination process. Specific incidents of trust violations are presented to demonstrate the necessity to develop realistic determination methods that effectively control the organization's level of personal financial responsibility.

2. Credit Risk

If a value-maximizing retailer believes that revenue can be significantly enhanced at a marginal cost that is less than the anticipated marginal revenue, then that marginal cost should be incurred until it equals marginal revenue [Ref. **55**:p. 434]. The retailer may believe that the marginal cost incurred to grant credit may be less than the marginal revenue generated in doing so, and, therefore, decide to become a credit grantor.

Credit grantors incur a marginal cost of capital loaned, which represents the opportunity cost of the next best investment alternative the credit grantor has available for the cash being considered as a loan [Ref. **7**:p. 346], [Ref. **53**:p. 118]. That alternative might be the reduction of the credit grantor's own indebtedness. Or, it might be some investment with a higher return, but too high a risk to be considered preferential.

There are two basic types of consumer credit grantors: (1) retailers that finance the credit sale of their products or services themselves and (2) financial institutions that provide cash to finance credit sales. One difference between them is that

> Merchandising concerns can cancel future credit before the debtor's sum has escalated to significant proportions. In the small financing sector, however, this control is absent in that an appreciable sum commences the transaction. [Ref. 5]

For example, a department store that provides revolving credit to its customers is in effect providing credit on demand up to a limit (e.g., $100 per month with a $300 maximum balance). For the merchandiser to continue providing that limit, it must be satisfied that the consumer has proved to be creditworthy based upon the past performance of the credit agreement. Otherwise, the store can prohibit additional credit purchases. A finance company, however, is providing a single sizable loan (e.g., $1000) all at once, allowing itself less control over the debtor once the loan is executed.

The credit granting retailer has two ways to recover the cost of capital loaned. One way is to apply an interest rate to the loan that is equal to or greater than the return associated with the next best alternative investment. The other way is to apply a lower rate, but have the interest differential imputed in the sales price of the product. Only the first method is available to the financial institution. The latter method is not available to the financial institution because there is, in this case, no product or service being sold by it other than money lending. However, some cost can be recovered in the guise of loan origination fees. Since the private sector organization must recover all costs to be profitable, including the cost of capital loaned, incurring such costs also incurs the risk of nonrecovery of them. The risk of nonrecovery of the cost of capital loaned is defined as *credit risk*.

The cost of capital loaned is recovered through loan repayment. Therefore, credit risk is manifested as the expectation of loan delinquency and bad debt. Since credit risk is an expectation of asset loss, the "Expected Loss" curve of **Figure 1** is similar to the credit risk behavior curve for the credit grantor. As the personal financial responsibility threshold is decreased and more credit is granted, greater expected loss in the guise of cost of capital loaned is incurred.

In order for the credit grantor to formulate a reasonable policy for the amount of credit it will grant, it must have an idea of its optimal personal financial responsibility threshold. As shown in **Figure 3**, this requires knowledge of the expected loss (credit risk) curve. That is, the credit grantor must be able to reasonably predict credit risk at various credit granting levels to determine the optimal amount of credit to grant. Expected nonrecovery of the cost of capital loaned as a function of credit risk is shown in **Figure 6** as the "Credit Risk" curve. As credit risk approaches a maximum moving from R_L to R_H, expected nonrecovery of the cost of capital loaned also increases moving from L_L to L_H respectively. Because the quantity of credit provided is inversely proportional to the personal financial responsibility threshold defined for the population of interest, credit risk is a problem that can be addressed by the determination of personal financial responsibility as discussed in Chapter I.

3. Fraud

a. **Introduction**

In addition to the credit risk problem, private sector organizations are subject to the risk of loss due to fraud. Fraud costs the American private sector upwards of $50 billion per year [Ref. **56**]. Because fraud is a costly violation of trust often committed by debtors or employees, any organization has an interest in determining their

debtors' or employees' trustworthiness. As discussed in Chapter I, one way this is done by determining personal financial responsibility.

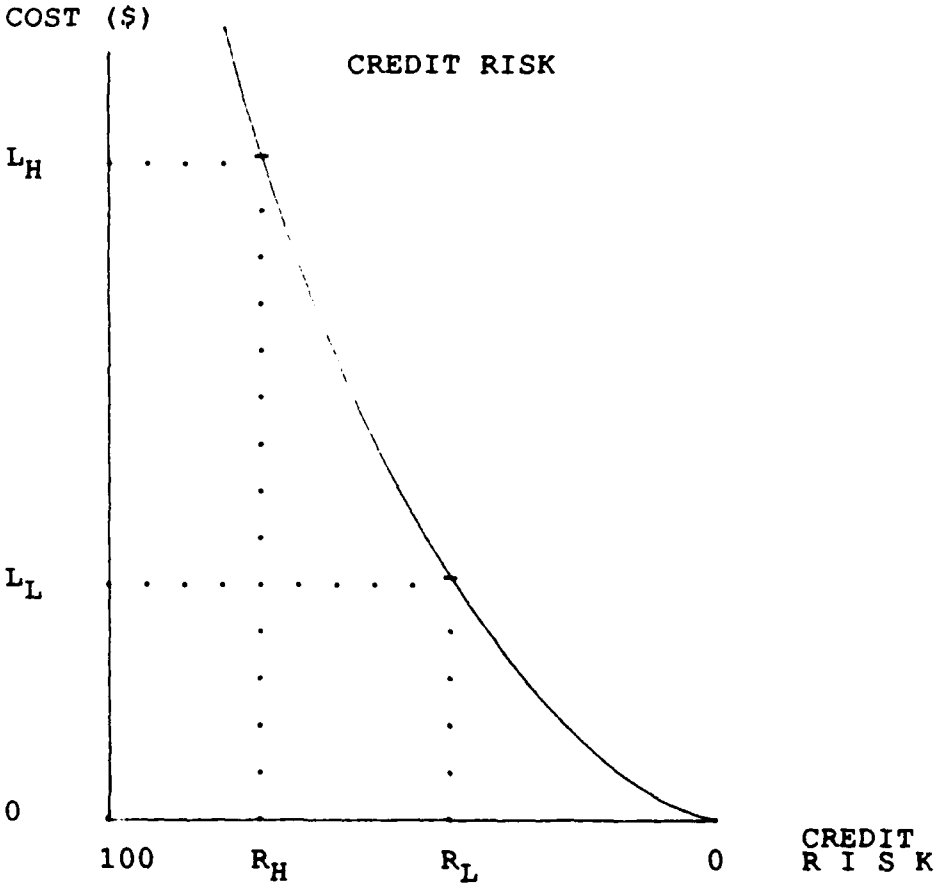


Figure 6.

Expected Nonrecovery of the Cost of Capital Loaned as a Function of Credit Risk

b. **External Fraud**

External fraud, such as shoplifting or industrial espionage, is committed by people not employed by the organization. However, such problems cannot be addressed by personal financial responsibility determination methods because of the lack of any formal "applicant" relationship the organization has with the perpetrator. The organization has no means of gathering predictive personal trait variables about the person before such acts are committed. However, such problems can be addressed by physical security measures.

Credit fraud is a particular type of external fraud that *can* be addressed by personal financial responsibility determination methods. Information on the person committing credit fraud must have first been processed through the organization's credit application process.

There are a variety of credit fraud schemes. Many are designed to defeat the organization's personal financial responsibility determination method. Fischer reports:

> "In most [credit fraud] cases the applicant is trying to avoid association with an adverse credit record. You can be certain that these individuals have only one purpose in mind: to get something for nothing." [Ref. **57**:p. 18]

A private investigator of credit fraud states:

> The ripoff [*sic*] artists are having a field day, and, in their eagerness to make a buck, business people often become their own worst enemies by making themselves attractive targets. .... You can't always allow past performance to dictate present policies. Clever operators may take a year or longer to set up a good "sting" operation. [Ref. **58**:pp. 34-36]

For example, the perpetrator may order merchandise on credit and make timely payments, gradually building up credibility with the creditor. Then, a large amount of credit will be used and the person will skip out.

> A problem credit executives face is that it's possible to fake records, misleading a standard ratings bureau and making one's creditworthiness appear stronger than it is. .... Sometimes people aren't even who they say they are. [Ref. **58**:p. 35]

Often, the birth certificate of a deceased person is obtained, allowing the applicant the use of fraudulent

identification. Credit may then be given to a "nonexistent person." [Ref. **59**:p. 47]

> "Many times the names used are fictitious," says [a bank card application processing company], "while in other situations a person gives a valid name...with a bogus address or fictional credit references. There are cases where an applicant claims to work for a particular employer ...[who] has no knowledge of that individual." [Ref. **57**:p.18]

c. **Internal Fraud**

Internal fraud is committed by an organization's employees. The greater the amount of assets entrusted to the employee, the greater amount of fraud the individual has an opportunity to commit.

An employee must first go through a job application process, giving the organization an opportunity to gather personal trait variables. As an example of why certain personal traits, such as age, are of interest, "a study of 453 employees caught stealing from their company showed that 90% are under 30 years old." [Ref. **60**] Collecting such data permits the application of methods to help determine the job applicant's personal financial responsibility. The methods can also be applied to employees already in positions of high trust to monitor and update their trustworthiness. For high trust employees,

> Continual evaluation is necessary. Specific verification techniques include credit checks and review of charge accounts and bankruptcies, when permissible by law. [Ref. **15**]

Even though credit fraud is primarily external, it can be internal because high trust employees are capable of committing it. For example,

> Tampering with consumer credit ratings is one element of credit fraud. Employees in some credit agencies...are on the payroll of a criminal ring. They have been paid to scrub the records of persons who are willing to pay a fee for a good rating. [Ref. **13**:p. 10]

Another kind of internal fraud is bank fraud. Internal bank fraud is attractive because in many cases it simply involves the movement of information rather than physical goods or currency to transfer assets. For instance, embezzlers were recently caught stealing $69 *million* from the

First National Bank of Chicago [Ref. **61**:p. 45]. They used computers to transfer funds to their own account at a bank in Vienna. Haas states:

> Internal bank fraud is a rather simple clandestine operation for the dishonest employee and often the computer is his best friend and accomplice. Even your most trusted employee may be tempted to embezzle money if his need is great enough, or if the opportunity presents itself. There is no single criterion to be used in the detection of dishonest employees. [Ref. **15**:p. 45]

4. High Trust Employment

a. **Introduction**

One measure of the level of trust required by a position is the amount of asset loss the employee in the position can cause. That is, the sensitivity level of the position is affected by the amount of assets under the employee's purview. For example, a bank teller with access to thousands of dollars in currency might require more trust than a receptionist. Therefore, the teller would be in a more sensitive position and be given more trust in order to perform the job.

A job description does not necessarily articulate the sensitivity level of the position. Kent writes, "people in the most menial jobs can cause serious damage: the guy pushing the broom after hours, for instance, could be an industrial spy." [Ref. **9**] High trust employment, then, involves organization personnel in positions such that they can cause serious asset loss to the organization. Therefore, the higher the sensitivity level of the position, the greater is the need for personal financial responsibility determination.

b. **Employment Measures**

There are massive fraud losses suffered by the private sector. If the organization desires to avoid such losses, it can use either preventive or punitive measures or a combination of both to do so. Regarding punitive measures, a reluctance to prosecute, in many cases, is due to bad publicity and the legal expense of recovery. Preventive

measures, however, are more desirable because the organization *avoids* the loss of assets and does not have to incur the costs of recovery. Advocating preventive measures regarding internal bank fraud, Haas suggests that the anticipation of problems and their prevention via precautionary measures is better than waiting for something to happen [Ref. **15**]. And, Kent also argues that prevention is a better strategy than going to court for recovery [Ref. **9**].

A procedure many organizations use in hiring high trust employees is the background investigation. To be effective in helping to determine personal financial responsibility, the background investigation should include the applicant's financial situation to determine financial stability [Ref. **62**]. Credit checks are typically made part of the background investigation in order to accomplish this.

Proper and adequate background investigations are not only a necessity, but also the most cost-effective part of personnel employment screening [Ref. **62**]. They can be used to validate the information supplied by the job applicant. For example, First National Bank of Atlanta has background and credit reports conducted by an outside agency to discover applicant fabrications [Ref. **63**]. Falsification of a job application may in itself be a predictor of a personal trustworthiness problem. It is not unlikely that there is a connection between falsifying a job application and employee theft [Ref. **12**]. Certainly, such a falsification would at least be an overt act of mistrust on the part of the applicant [Ref. **35**:p. 277].

Even with application validation, the potential for fraud still exists [Ref. **64**]. The primary concern for a background investigation, here, is for the organization to discover any potential abnormalities that may give rise to the applicant exploiting opportunities to violate the trust given because of financial difficulties. As a preventive measure, "The credit check is run because a person who is

heavily in debt is more likely to steal than one who is not." [Ref. **65**:p. 53]

As part of the background investigation, the credit check provides the organization with essential personal financial behavior trait variables. Debt, debt delinquency, bankruptcy, and other indicators of financial difficulty are warning signs to the organization. However, it is perfectly reasonable for an applicant with financial difficulties to be scrupulously honest and trustworthy. Also, financial difficulties can be the result of unforeseen economic circumstances beyond the control of the applicant who used reasonable foresight. Downplaying the implications of inadvertent difficulties, Menkus reports,

> "the existence of personal financial difficulties should not bar an otherwise qualified applicant from employment. But the employer may find it wise to be aware of some of the pressures under which someone in a sensitive position may have to work." [Ref.**17**]

B. **PERSONAL FINANCIAL RESPONSIBILITY DETERMINATION METHODS**

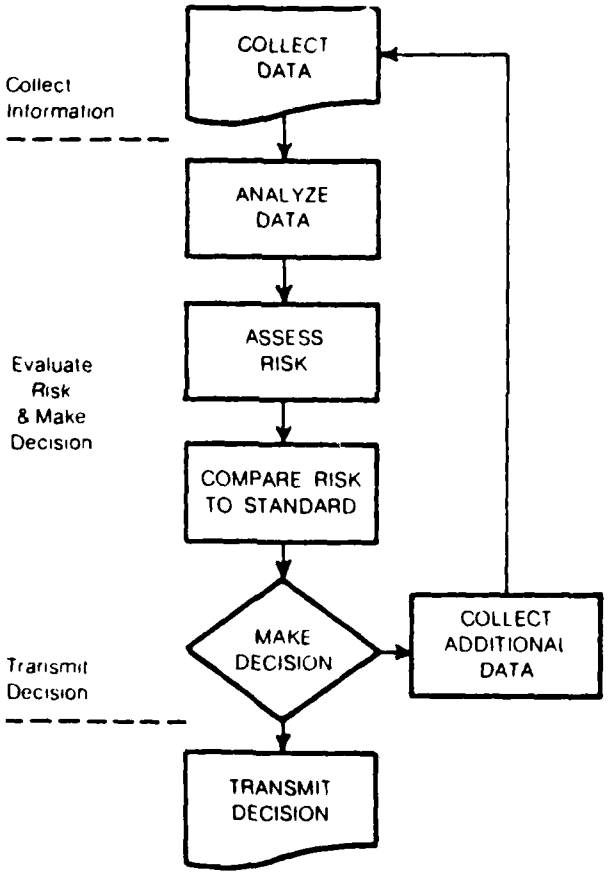
1. Introduction

The ultimate test of a determination method is how well that method differentiates between bad and good credit or employment risks [Ref. **66**:p. 22]. This section presents methods of personal financial responsibility determination identified in the open literature.

In any group of people there will be those who are and who are not trustworthy enough for either credit or high trust employment. Regulation B, which implements the Equal Credit Opportunity Act, was discussed in Chapter I.

> Although Regulation B does not define explicitly the meaning of creditworthy and noncreditworthy applicants, it implies that an absolute dichotomy could be made between these two groups. It often is inferred that creditworthiness is an individual trait that can be measured by an absolute standard: those that are creditworthy pay all their obligations as agreed and those that are noncreditworthy do not.
>
> Creditworthiness is not an individual trait that can be measured by an absolute standard. [It] should be considered to be the probability that an applicant will exhibit a future payment behavior *satisfactory* [italics mine] to the creditor. [Ref. **66**:pp. 16,17]

The determination of one's personal financial responsibility is a decision process that lends itself to a logical flow. Chandler and Coffman describe the credit decision process as shown in **Figure 7**. This process applies regardless of the *method* of executing it. Chandler and Coffman state that in deciding on a method to execute such a process, "The profit motive causes creditors to seek an evaluation system that minimizes the economic costs associated with the two types of errors in granting credit."



Source: Reference **66**, p. 18, Exhibit 1.

Figure 7

Credit Decision Process

[Ref. **66**:p. 16] These errors, incorrectly denying (Type I) and granting (Type II) credit, and economic cost minimization were discussed in Chapter I. The cost of a Type I error is the lost profit that could have been generated from forgone credit granting revenues. The cost of a Type II error is the potential nonrecovery of the capital loaned.

2. Governmental Constraint and Method Definition

Data collected internally for the credit evaluation process are generated by the organization querying the applicant. There are two methods of obtaining the data from the applicant (1) questionnaire and (2) personal interview. A combination of these two methods of data collection may often be used.

The personal financial responsibility determination processes which may be used are constrained by government regulation. Process methods are defined by the Equal Credit Opportunity Act. It specifies only two legitimate methods of determining personal creditworthiness: *judgmental* and *empirically derived* (credit scoring) [Ref. **67**:p. 73]. The judgmental method is the process by which a decision maker uses personal experience and knowledge to *qualify* applicant information, compare it to a standard, and formulate a decision. The empirically derived (i.e., credit scoring) method is the process by which numerical weights are assigned to *quantify* applicant information and compare it to a standard for a preformulated decision.

Regulation B prohibits illegal discrimination and restricts applicant information that can be construed as discriminatory. It also requires the application of an "effects test" to the application process to determine the validity of a decision criterion despite possible discriminatory effects. For example, refusing credit to people living in low income housing is not valid because it is discriminatory in effect to a *class* of consumers--those living in low income housing. The effects test, then, is a

process by which a decision criterion is examined for the existence of a valid business reason for its use in order to legally continue the criterion's use. [Ref. **67**]

> The gist of the effects test is that it is possible to discriminate against a group of people protected by the ECOA without ever intending to do so. Although the effects test concept originated in the employment area, there is little doubt that it applies to lending as well. [Ref. **67**:pp. 73,75]

3. External Personal Financial Behavior Data

Chapter I discussed the sources and uses of general population demographic data and applicant-supplied (i.e., internal) personal data concerned with personal financial behavior. There are both intentional and unintentional biasing of data on the part of the credit or high trust position applicant. Therefore, internal data alone are insufficient to accurately determine personal financial responsibility. To complement internal data, the private sector also obtains personal financial behavior data not supplied (i.e., external) by the applicant. Such information helps provide the organization with a more objective input to and output from its personal financial responsibility determination method.

Credit bureaus are a primary source of determination method external input data [Ref. **66**:p. 18]. Looking beyond the routine credit check provides the credit grantor or employer with information of a more comprehensive nature:

> There is an even more powerful tool available for use in the employment process: employers have a statutory right to receive an investigative consumer report from a credit bureau--a report not merely of credit standing, but of character, general reputation, personal characteristics, and mode of living obtained through personal interviews with neighbors, friends, or associates of the individual being reported on. [Ref. **35**:p. 279]

The public record is a rich and valuable source of external personal financial behavioral data. It provides access to even more detailed applicant information if the organization desires it.

> The quantity of information made available under the Freedom of Information Act and other state legislation is immense. Comprehensive financial investigative reporting can be compiled by using public records. [They help in]

locating assets, obtaining background information, and performing preemployment checks. Public records and some of their uses [include]:

- *Corporate records* [filings]...to determine corporate affiliations.
- *Limited partnerships and assumed name filings*...to determine what other names a subject might be conducting business under.
- *County and state UCC (Uniform Commercial Code)* filings... in obtaining financial information, tracing assets, and locating previously unknown activities.
- *Tax rolls*...in locating assets,...and investigating the background of individuals.
- *Real property records*...in locating assets.
- *Liens and judgments*...in determining the credibility of an individual.
- *County, state, district, and federal court (civil) records* can help determine the credibility of an individual.
- *Criminal court records* are valuable in preemployment checks and background investigations.
- *Miscellaneous personal records* include voter registration, marriage licenses, and city directories... [in] obtaining personal information...such as date of birth, social security number, and home address.
- *Vehicle information*...in locating assets as well as locating the subjects themselves. [Ref. **68**]

4. Judgmental Method

a. **Introduction**

Of the two general methods of determining personal financial responsibility, the judgmental method is the oldest. This section describes the judgmental method.

In the hard sciences (e.g., physics) the *probabilities of effects occurring* are highly predictable when using known input variables (e.g., time). In the social sciences the probabilities of effects occurring can only be *estimated* using known input variables (e.g., number of children in family). [Ref. **69**:p. 30], [Ref. **70**:p. 52]

No two people are exactly alike, even if they are similar in some ways. Therefore, the average behavior of a category of people does not necessarily indicate the behavior of a particular individual within that category. Consequently, determining personal financial responsibility is an inexact science. Since the organization deals with the *individual* applicant, not categories of applicants, it should concern itself with evaluating and predicting individual performance. [Ref. **66**:p. 23] Individual evaluation helps avoid discrimination via stereotyping. The individual's

behavior may change over time, but those changes are not necessarily constant nor predictable with a significant degree of confidence [Ref. **69**].

The judgmental method attempts to predict the *individual's* financial responsibility. The prediction process combines the decision maker's experience in and knowledge of societal financial behavior to formulate a standard against which the individual's credit risk is measured.

The decision maker gradually acquires experience, but the experience gained from his/her last decision can be thought of as incremental. The judgmental method incorporates the decision maker's personal incremental experience into the credit decision process.

Relevant experience is generated by the decision maker's past production record of good and bad credit decisions regarding applicants. However, Chandler and Coffman state that the judgmental method focuses on information biased heavily towards past *bad* accounts and on "*maintaining* an acceptable loss rate, rather than on finding ways to *change* or *improve on* past performance." [Ref. **66**:pp. 19,20]

The decision maker combines his/her corporate experience with internally and externally generated applicant financial behavior data. Internal data may be generated either from questionnaires or interviews. The combined experience and information is "processed" by the analyst to determine the applicant's level of personal financial responsibility. The credit granting decision is then made based upon the decision maker's comparison of that level with the organization's personal financial responsibility threshold.

Chandler and Coffman summarize the judgmental method as follows:

> The judgmental credit evaluation process has been the traditional method of evaluating credit applicants. A

> credit analyst *examines* the credit applicant's characteristics, *evaluates*, the applicant's creditworthiness, and *decides* to approve or to decline the applicant. The judgmental process is based on the experience and human judgement of the individual analyst. The judgmental system also may incorporate "rules" and other *non-empirically* derived credit guides established by company policy. (italics mine) [Ref. **66**:p. 17]

b. **Decision Making**

The judgmental method largely involves human interaction to make individual judgments. Individual judgment has significant potential to use irrelevant personal trait variables in the decision making process. The greater amount of irrelevant information present, the greater the likelihood that some of it will be used [Ref. **66**:p. 20]. Therefore, the greater the degree that the decision making process is judgmental, the more crucial is the need to avoid irrelevant information. At the same time, the quantity of *relevant* information required to evaluate the subject of the decision (i.e., credit or job applicant) increases with the degree of human interaction in the decision making process.

Because the judgmental method of credit evaluation is entirely human-interactive, it requires the collection of a substantial quantity of applicant information to accumulate relevant personal trait variables. Since raw information contains irrelevant as well as relevant data, this requirement also increases the presence of irrelevant variables. The risk of using irrelevant variables and the exposure of the decision process to Type I and II errors increase as the credit decision process becomes more judgmental [Ref. **66**:p. 19]. There is a tradeoff between the quantity of relevant information collected and the probability of avoiding errors. As the quantity of relevant information collected is increased, so is the probability of committing errors due to the corresponding increase in *irrelevant* information.

As a means of generating relevant internal information, the judgmental method readily lends itself to open questioning.

> Open questioning is where the applicant is engaged in a conversation about the topic in hand. There is no predetermined indicators of what are 'desirable', and 'objectional' responses during open questioning. [Ref. **69**]
>
> Open questioning is generally acknowledged as being a more superior method of eliciting information than closed questioning. It allows the respondent to explain things in his or her own words: things they may otherwise find difficult to explain. Open questioning engenders a feeling of relaxation and casualness in the respondent while the interviewer can assess the stability, responsibility, the attitudes and motivations of the respondent. [Ref. **69**]

The applicant is treated as an individual with unique requirements, qualifications, problems, and capabilities. For instance, the interviewer may ask the applicant about intentions for the use of a product being bought on credit. Treating the applicant as an individual, which may or may not favor the applicant as far as a decision is concerned, allows the applicant the opportunity of self expression. Also, if the applicant is not approved by the judgmental method, the applicant may have the opportunity to obtain a specific "individualized" reason for the rejection. In using open questioning, the organization must be careful to avoid reaching the point of applicant discrimination that implies an equal opportunity violation. [Ref. **28**],[Ref. **69**]

The decision maker's level of experience is a crucial factor in the judgmental method. Experience can act as a filter of irrelevant information. Information may contain nonquantifiable relevant variables that give the *experienced* decision maker the opportunity to arrive at a more confident decision than would otherwise be possible [Ref. **66**:p. 20], [Ref. **69**:p. 29]. For example, applicant behavioral attitude during open questioning may provide the decision maker with an uneasy feeling about granting a loan even though other relevant variables indicate the applicant is creditworthy.

Lack of experience on the part of the judgmental decision maker can cause the analyst to distort the importance of relevant personal trait variables and give importance to those that are irrelevant. This may result in

stereotyping and Type I or Type II errors [Ref. **66**:p. 20]. The resultant stereotyping may or may not be discriminatory with respect to the Equal Credit Opportunity Act.

If the inexperienced judgmental analyst is concerned about maximizing the wealth of the organization, as his organization's incentives should have him be, then his/her personal biases should be set aside to avoid any significant stereotyping. Such objectivity should allow the judgmental method of determining personal financial responsibility to produce a more just decision for the applicant and a more profitable one for the organization. Decision making should be based upon the applicant's personal financial responsibility and contribution to organization wealth, not upon assignment to irrelevant categories due to stereotyping.

Using closed questioning tends to categorize people rather than "individualize" them. Therefore, interpreting information gathered through closed questioning tends to stereotype the applicant rather than provide an "objective assessment" of the individual [Ref. **69**]. Hall states:

> Stereotyping is a consequence of holding preconceived views that hypothetical attributes and shortcomings can be subscribed to certain types of people. [It] is based on the notion that as certain manifestations are indicative of behavior, then the character of a person can be judged by such manifestations solely, without taking into consideration any other factors. [Ref. **69**:p. 28]

Interpreting that most people who live in $200 thousand houses are more creditworthy than those living in $100 thousand houses would be an example of stereotyping via categorization. Closed questioning easily facilitates such categorization [Ref. **69**].

Closed questioning resulting in stereotyping may in effect cause discrimination in an equal opportunity sense while purporting to be scrupulously nondiscriminatory in accordance with the Equal Credit Opportunity Act. The interpretation of information obtained by closed questioning

may be discriminatory because of the failure to recognize the complexity of personal trait variables. For example, the low income farmer may in fact be a better credit risk than the high income stockbroker. But the organization may consider high income applicants better risks than low income applicants and stockbrokers better risks than farmers. Considering these factors independently of others, closed questioning may not reveal the farmer as the better risk. The organization's determination model would have to specifically recognize the particular complex variable *low income farmers* for the better decision.

> Closed questioning is not sensitive enough to recognize and differentiate between differences in social values, customs, demarcations of legal definition, the ability or inability of a particular person to express themselves, and the use of symmantics [*sic*] to hide or enhance a particular situation. ...generally closed questioning is an incomplete method of data gathering. [Ref. **69**]

The essential point is that the judgmental method is able to use personal trait variables that are not necessarily quantifiable. The ultimate value of this is measured by the method's effectiveness in determining personal financial responsibility.

5. Empirical Method

a. **Introduction**

Credit scoring has been defined as "a system that mathematically accepts or rejects credit or loan applicants by weighting [*sic*] certain characteristics before granting or denying credit." [Ref. **67**] That is, unlike the judgmental method, the empirical method, in its purest form, does not concern itself with the individuality of the applicant.

Credit scoring is an empirical method of determining personal financial responsibility. It is the newest method and involves quantification of the applicant's personal trait variables to arrive at a score for the individual. The score is compared to a required standard to determine applicant approval [Ref. **66**:p. 17]. Normally, the evaluation is structured so the higher the score, the lower

the risk assigned to the applicant. The organization's weighted average applicant score should not fall below the organization's score-based personal financial responsibility threshold if it is to maintain that threshold. This section describes empirically derived models found in the literature.

Credit scoring attempts to accelerate and automate the credit decision process. Weingartner describes the development of a credit scoring model as a two part process: (1) the statistical derivation of personal trait variable weights and (2) setting a threshold for applicant approval. Applicants scoring below the threshold would not be approved [Ref. **70**]. The objectives of the method are to increase process *efficiency* and *effectiveness* by replacing human interactive decision making involved in each application (i.e., judgmental method) with a preformulated decision process [Ref. **66**],[Ref. **70**],[Ref. **71**].

Process efficiency is increased with the empirical method because less information is required for process effectiveness. Less information is required because the organization's model can be designed to use only relevant personal trait variables. Data gathering for the process via closed questioning fulfills this requirement. Also, the human effort normally expended with each application is reduced. Human effort is directed more towards entering data into the process mechanism (e.g., a computer) than it is towards actual evaluation and decision making [Ref. **71**:p. 36]. Therefore, more applications can be processed using this rather than the judgmental method. [Ref. **72**]. At a given personal financial responsibility threshold, the organization's process expense per applicant is reduced, reducing total credit granting cost and allowing a subsequent increase in the threshold to a higher level, as shown in Chapter I, **Figure 5**.

Process effectiveness is increased because the organization's personal financial responsibility policy and

threshold are quantified and, therefore, more easily defined, adjusted, and adhered to for optimal performance. For instance, two criteria may be established--minimum individual score to be accepted and minimum average score to be maintained. For example, organization policy might state that, for approval, no high trust position applicant's score shall fall below 75. And, the personal financial responsibility threshold for all such employees must be an average score of at least 80. That is, the organization's average score for high trust position employees must be high enough so that a high trust position applicant with a minimum allowable score of 75 can be hired as long it does not cause the organization's average score to fall below 80. Using the two parameters maintains minimum acceptability while at the same time ensuring individuals with higher scores are employed. The threshold can be adjusted to an optimal level as the expected loss and expense curves change. However, since those changes may only be estimates, there may be some doubt as to the *amount* of change required for the threshold to be at an optimal level [Ref. **2**].

b. **Method Objectivity**

The judgmental method is generally considered to be subjective and the empirical method objective [Ref. **66**]. This section analyzes the objectivity of the empirical method. Specifically, process errors and their costs, statistical analysis of variables, asset loss and expense estimation, economic conditions, equal opportunity, and consumer privacy are examined as factors that influence method objectivity.

Chandler and Coffman cite several actual comparisons of the process effectiveness of the empirical and judgmental methods [Ref. **66**:pp. 22,23]. The evidence indicated (but did not prove) that the empirical method is the more effective one *on the average*. That is, using credit

scoring resulted in a lower *rate* of Type I and Type II errors. However, it was also noted that:

> with a system that is based on *average* performance of accounts over the *past* [i.e., empirically derived,]...the system cannot predict the performance of *each* credit applicant. Credit scoring, like any other method of evaluating creditworthiness, will make errors. .... there *may* be specific cases in which judgmental evaluation is superior to empirical evaluation. [Ref. **66**:p. 23]

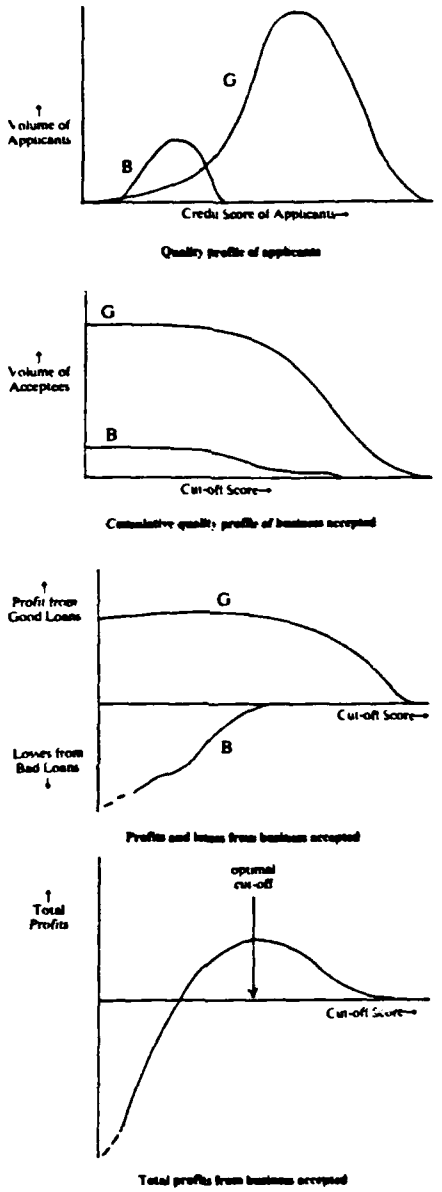
The process is considered empirically derived because it is based solely upon the observation of *quantifiable* personal trait variables without considering applicant *qualities*, such as moral character and integrity [Ref. **66**]. For instance, a credit applicant may have the character, capacity, and collateral to justify loan approval, yet a low score given to a personal trait variable (e.g. home ownership) might disqualify the applicant, resulting in a Type I error.

The behavior of the costs of Type I and II errors is analogous to the "Expense" and "Expected Loss" curves, respectively, in **Figure 3** when the "PFR" axis represents credit score. An optimal score-based threshold for applicant approval should be set where the marginal costs of Type I and II errors are equal. Since it is more likely that more creditworthy than noncreditworthy applicants can achieve the higher scores, raising the threshold would incur more Type I errors than the Type II errors avoided. Since it is more likely that fewer creditworthy than noncreditworthy applicants can achieve *only* the lower scores, lowering the threshold would incur more Type II errors than Type I errors avoided [Ref. **74**]. **Figure 8** shows how (1) credit applicants, (2) credit approvals (3) Type I and Type II error costs, and (4) combined costs are distributed by credit score.

While the execution of the credit scoring process itself is objective in nature, the empirical method does not actually escape subjectivity. Criticizing the presumed objectivity of the method, Hall states:

> All credit scoring does is to substitute the 'characters of words' for the 'characters of figures' [*sic*]. It is not an objective assessment, as the numeric variables used, and the parameters within which they are used, are determined

G: CREDITWORTHY APPLICANTS B: NONCREDITWORTHY APPLICANTS



Source: Reference 74, Figure 2.

Figure 8
Credit Applicants Distributions

> by the *opinion* of the person calculating the numeric values that are attached to pieces of information. In other words the variables and parameters are set *subjectively*. (italics mine) [Ref. **69**]

And corroborating this, Updegrave writes, "The weight given to each scoring question depends on the particular creditor's *experience* and *judgment*." (italics mine) [Ref. **45**:p. 145] The relevancy, and therefore the relative weight, of a personal trait variable may be determined objectively by statistical analysis. However, the criteria to achieve a given score for each variable is subjectively determined when the credit scoring model is formulated and updated [Ref. **73**]. The estimation of the probabilities of effects occurring is manifested as the sum of subjectively determined scores assigned to each independent personal trait variable.

Taking relevant personal trait variable complexity into consideration prior to summation of scores will improve estimation [Ref. **23**:p. ii], [Ref. **70**]. This can be accomplished with multivariate discriminant analysis. This technique of statistical analysis can be used to separate members of a population (e.g., credit applicants) into mutually exclusive groups (e.g., good and bad credit risks) by evaluating the predictive effects of complex variables on the population [Ref. **74**].

A weakness of multivariate discriminant analysis of credit evaluation models is that the historical database it uses is normally based upon the personal trait variables of *approved* credit applicants only. While this is practical, an unbiased "through-the-door" population would allow the analysis to provide a more accurate picture of each variable's significance [Ref. **73**]. To be unbiased, the population of interest should include rejected credit applicants as well as those approved. This, of course, is prohibitive in most cases due to the improbability of determining whether a rejected applicant would have been a good or bad credit risk.

An additional subjective factor that impacts the objectivity of the empirical method is the judgment used in constructing expected loss and expense curves. As a result, setting an optimal personal financial responsibility threshold requires judgment, as does setting the minimum required (cutoff) score for an individual applicant's approval [Ref. **7**:p. 690]. Since construction of the expected loss curve is influenced by macroeconomic conditions, judgment can be used to adjust the cutoff score and compensate for macroeconomic conditions [Ref. **75**]. Setting a cutoff score for an applicant's approval can only be considered objective in the sense of being consistently applied.

Because credit scoring is based solely upon specific quantifiable variables, the method can eliminate equal opportunity discriminatory variables (e.g. sex) from the organization's scoring model [Ref. **76**:p. 39]. This can give the method the *appearance* of being nondiscriminatory. However, because the process uses closed questioning, which can stereotype people by traits, it has a greater probability of failing the effects test and therefore of being discriminatory. For example, the practice of assigning a low score to the variable *previous home ownership* may at first seem to have a valid business reason because of statistical evidence to that effect. But applying the effects test might reveal equal opportunity discrimination in view of demographic studies. Such studies may indicate, for instance, that single women tend more than the population at large to be renters rather than homeowners. Assigning a low score to the variable mentioned, in such an instance, would in effect be discriminatory against single women and contribute to their rate of rejection, despite the applicant questionnaire not inquiring as to the applicant's sex--an inquiry which would have been overtly discriminatory.

Credit scoring tends to be more protective of applicant privacy for several reasons: (1) the process is less human interactive during applicant inquiry, (2) less information is required of the applicant for process effectiveness, and (3) applicant information is *quantified* rather than *qualified* by the process. That is, the applicant is represented by a score rather than by characterization of the individual.

c. **Credit Scoring Models**

Specific credit scoring models designed for individual private sector organizations are proprietary information. It is unlikely that such information would be released for dissemination by the organization [Ref. **77**]. Updegrave notes, "Lenders are notoriously tight-lipped about which items they consider most significant." [Ref. **45**:p. 146] This section, then, is limited to general credit scoring models surveyed in the literature. It describes a sample selection of these models.

(1) Credit Screen. Boggess (1967) presents a general credit scoring model that focuses on deriving an optimal credit applicant cutoff score. While credit scoring is designed to evaluate the probability of a debtor being a good or bad credit risk, the model Boggess describes also "provides management with an ability to refine its policy continuously to produce optimum profits." [Ref. **6**:p. 114] That is, the cutoff score is adjusted for profit maximization. The model accomplishes this by minimizing the combined costs of Type I and Type II errors. Boggess considers such cost avoidance added profit. [Ref. **6**]

For simplicity, the model is a purely mechanical process. No investigation is made into applicants scoring below the cutoff. This prevents further reduction of Type I error costs, but avoids administrative expense. [Ref. **6**]

Boggess acknowledges that in developing a more comprehensive model: (1) incremental administrative expense must be compared to the respective incremental benefits if further applicant investigation is made, (2) factors such as time, product, and geographic region affect the cutoff score, (3) personal trait variable relevance varies by market segment, (4) no model can predict a particular applicant's personal financial behavior with certainty, and (5) any credit scoring model is pointless if it does not reduce uncertainty in the credit granting process as compared to the judgmental method. [Ref. **6**]

The first step in developing a specific model in this mold is to evaluate the relevancy of personal trait variables to good and bad credit risks. This is done by (1) gleaning variables from current debtor accounts, (2) determining the frequency of each variable's occurrence by known good and bad accounts, (3) using multivariate discriminant analysis to evaluate the ability of each variable to discriminate between good and bad accounts, and (4) assigning weights accordingly.

In choosing which variables to use in the model, the importance of complexity is stressed. Boggess writes,

> To make the most efficient use of the multiple-characteristic approach, the most significant characteristics among the dozens available must be selected and mixed in the right proportions at the time an application is screened. [Ref. **6**:p. 116]

The next step is to determine an optimal cutoff score for applicant approval/rejection. This is done by (1) taking another sample of known good and bad accounts and assigning scores to them using the personal trait variable weights derived from the statistical analysis done on the original accounts, (2) ranking the accounts by score, (3) listing the *cumulative* number of good and bad accounts at each score, (4) calculating the total net profit added for each potential cutoff score by rejecting all applicants below

that score, and (5) choosing the score with the highest profit added.

This model is a simple, yet effective, application of the empirical method. It provides for efficient, "hands off," decision making in an uncomplicated credit granting environment where personal trait variables are easily identifiable, relevant, and highly discriminatory between good and bad risks.

(2) Credit Analysis Model. Hentenhouse and Wentworth (1971) describe a general model they call the Credit Analysis Model. It has two basic processing phases which combine the empirical method's "objectivity" in the first phase with the subjectivity of the judgmental method in the second. [Ref. **78**]

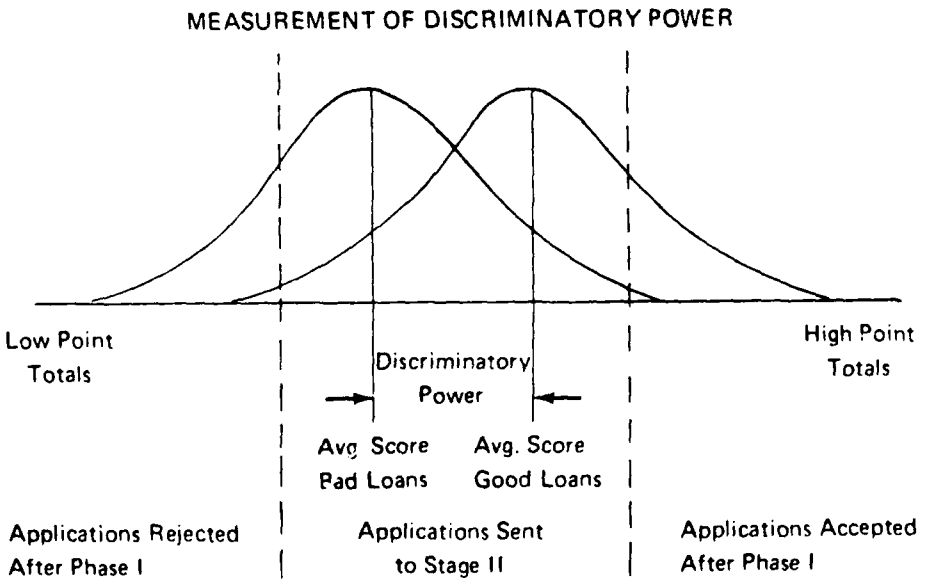
The first phase of the Credit Analysis Model is to automatically classify applicants into one of three categories--accept, reject, or evaluate further. This is done by assigning a credit score to the applicant based upon weights derived from statistical analysis (specifically, stepwise linear regression). The score is then compared to a high score for acceptance and a low score for rejection. If the score is between the high and low decision scores, the application is sent on to the next phase for further evaluation.

The model's accept and reject scores are based upon current good and bad account score distributions. As shown in **Figure 9**, these distributions overlap one another, indicating the potential tradeoff between Type I and Type II errors. The model achieves maximum ability to discriminate good and bad risks at the two scores where the overlap and the total number of Type I and Type II errors is minimized for applicants accepted or rejected in phase I.

Applications referred to further evaluation are subjected to the judgmental method. The decision maker has three sources of assistance at this point to decide upon

acceptance or rejection of the applicant: (1) evaluate the significance of personal trait variables not included in the scoring model, (2) determine the significance of the score's proximity to the acceptance or rejection scores, and (3) compare the applicant to similar past cases. If this phase is unable to produce a confident decision for the organization, then further investigation using additional external data may be attempted.

The Credit Analysis Model takes advantage of both the empirical and judgmental methods of credit evaluation. While the empirical phase leaves a number of applications undecided, the ones that are accepted or rejected are done so with more confidence than a model using



Source: Reference **78**, Figure II.

Figure 9
Credit Risks Distribution

a single cutoff score. Decisions in that phase are based upon scores with greater discriminatory powers. A weakness in the model, however, is that the objective is based upon the minimization of the total *number* of Type I and Type II errors rather than the total *cost* of those errors. This is only valid in the instance of all loans being of the same value. Otherwise, the distribution in **Figure 9** should be in quantity of dollars rather than applicants.

(3) Decision Tree. Conventional credit scoring sums relevant variable scores and is only concerned with the total score. This allows groups of applicants with significantly *different* behaviors to arrive at the same score and be considered equivalent risks.

Makowski (1985) describes a special type of empirical method model that groups applicants with significantly *common* behaviors using decision tree logic. The model's process forces applicants to be routed along a "branch" to a distinct subgroup of applicants with a unique set of behaviors and a unique risk probability. [Ref. **80**]

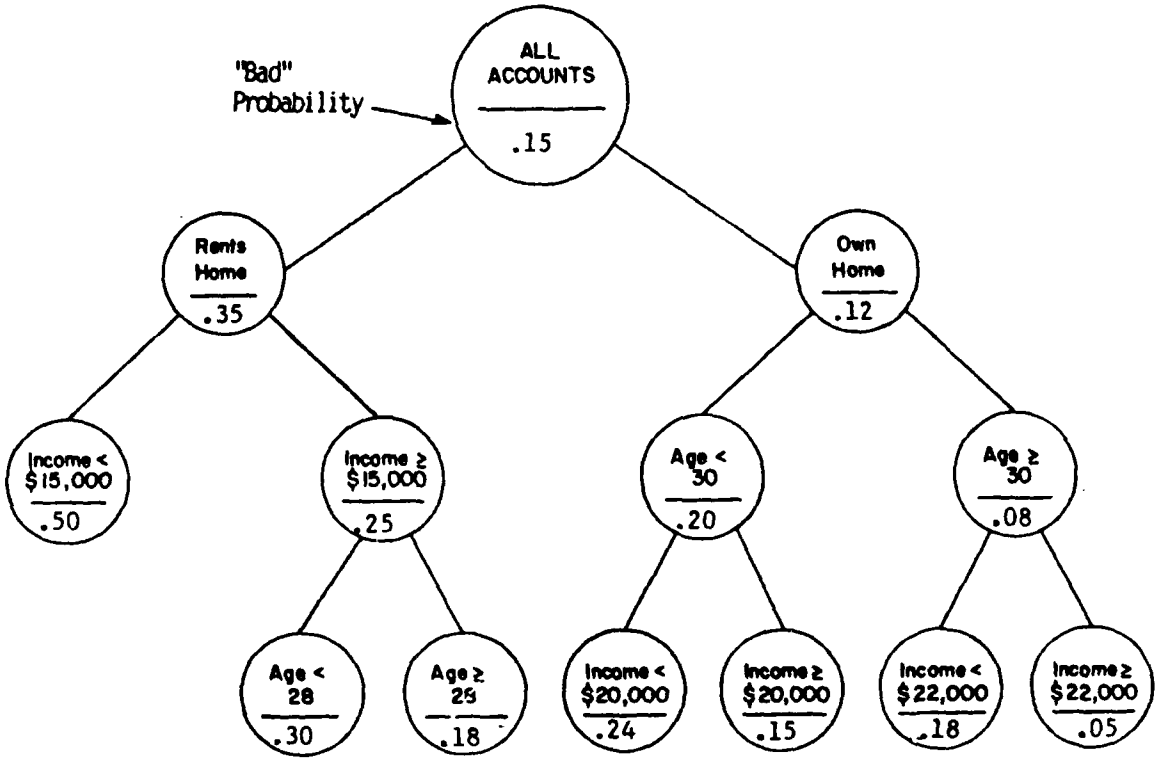
The decision tree process is similar to credit scoring in the way it statistically derives weights of relevant personal trait variables to assign probabilities of effects occurring. Additionally, however,

> a process called augmentation is used to infer what the performance of those applicants rejected in the past would have been had they been accepted. This is important, since the system is designed to apply to all applicants, not just those who resemble the ones approved in the past. [Ref. **80**]

Once weights are derived, a decision tree is "grown" by assigning conditional probabilities of effects occurring along each "branch," terminating at a unique subgroup of applicants with common personal trait variables and weights. The conditions are the traits of the previous subgroup. For instance, in **Figure 10**, an applicant with the personal trait variable "under 30 years old" is assigned a probability of 0.20 where loan default is the effect. This probability is only valid in the condition that the applicant

is also a homeowner. The weighted average probability of loan default for all subgroups immediately under the homeowner variable is 0.12.

An advantage of the decision tree model over conventional credit scoring is its attempt to evaluate variable weights based upon all applicants in the population, not just those applicants approved. The main advantage, though, is that it eliminates a crucial defect normally present in credit scoring--the inability to take relevant variable complexity, beyond that evaluated by statistical analysis during the model formulation process, into effect.



Source: Reference 80, Figure 1.

Figure 10
Sample Decision Tree for Bad Risks

Makowski states, "[credit scoring] systems assign the same number of points to an attribute irrespective of the number of points assigned to other attributes." [Ref. **80**] However, the decision tree model assigns a probability of an effect occurring to an attribute only *after* consideration of the previous
attributes. A decision tree model allows the decision maker to examine the effects of variable complexity as it occurs instead of just seeing "the bottom line." For example a credit scoring model might assign ten points to anyone over 30 years old. The decision tree sample in **Figure 10**, though, would first consider whether or not the applicant was a homeowner *before* considering the applicant's age. The credit grantor's judgment does come into play in deciding upon a default probability cutoff point.

(4) Modified Discriminant Analysis. An early credit scoring study reported by Myers and Forgy (1963) indicated that statistical analysis modified by repetitive application to selected accounts can increase a model's ability to discriminate low score applicants [Ref. **81**].

The study first selected 300 finance company accounts--150 currently good and 150 known bad. It then developed a basic model by first analyzing forty-one personal trait variables associated with the 300 accounts. Twenty-one of the variables were statistically significant in discriminating accounts as either good or bad and assigned weights accordingly. A new sample of 300 accounts (150/150) were then subjected to four independent methods of statistical analysis to determine each of the methods' predictive ability in evaluating accounts as good or bad. The four methods were conventional discriminant analysis, stepwise linear regression, equal weighting, and "modified" discriminant analysis. Three of the methods used the 21 relevant variables and their weights derived from the first analysis. The stepwise regression reduced the number of

required variables for good/bad discrimination to 15. The modified discriminant analysis was applied to the 250 lowest ranking good and bad accounts (125/125) to derive a new set of variable weights for revised ranking. The accounts were rescored using the newly derived weights. This process was repeated at the 200, 150, 100, and 50 lowest ranking account levels for good and bad accounts. The report does not make clear whether the repetitions were independent or incremental. A variety of cutoff scores were examined to determine the number of Type I and Type II errors made by each model.

The results of applying the four scoring models that used weights developed from the first sample of 300 accounts to the second sample is displayed in **Table 1**. The relative ability of each of the four models to discriminate the second sample of 300 accounts by their

TABLE 1

PREDICTIVE EFFECTIVENESS OF VARIOUS CREDIT DECISION MODELS

(1) Weighting System	(2) No. Items	No. bad cases eliminated at cost of indicated no. of good cases				
		0	1	5	10	20
I. Discriminant Analysis	21	10	11	41	59	67
II. Stepwise Regression	15	9	12	39	53	68
	12	15	18	39	54	68
III. Equal Weight	21	13	19	35	52	76
	15	9	13	40	58	77
IV. Discriminant Analysis, selected cases						
(N = 250)	21	17	18	44	52	62
(N = 200)	21	17	19	37	58	64
(N = 150)	21	21	26	42	52	64
(N = 100)	21	21	21	37	40	61
(N = 50)	21	31	35	43	56	67

Source: Reference **81**, Table 2.

proper grouping (good or bad) is indicated by the cost of eliminating Type II errors in terms of incurring 0, 1, 5, 10, and 20 Type I errors, respectively.

The results indicate that when the cutoff score is not or only slightly increased (i.e., the 0 and 1 good cases eliminated column), the modified discriminant analysis model is more efficient in reducing the number of Type II errors. For example, with no increase in Type I errors (0 good cases eliminated) the model eliminates 24 Type II errors for the 150 lowest ranking cases analysis compared to only 15 Type II errors eliminated for the stepwise regression model.

Results of the application of a modified discriminant analysis to the lower scoring accounts were "encouraging." The study shows that designing a model to improve discriminatory power specifically targeted at lower scoring accounts can reduce Type II errors at little or no cost [Ref. **81**]. Such "fine tuning" of credit scoring models allows the organization to further reduce the total costs of personal financial responsibility determination at an optimal threshold.

(5) Expected Profit. Myers (1967) presents a model developed to determine an optimal cutoff score for an organization's loan portfolio. By first calculating the expected profit from each loan approval, the expected profit for its portfolio could be determined by summing the individual expected profits. [Ref. **82**]

In the developmental phase of the model, and prior to using credit scoring, it is assumed that all loan applications are approved. Expected profit is calculated using the expression:

$EP = m_g P_g - m_b P_b$, where EP = expected profit,

m_g = profit potential of a good loan,

P_g = probability that a loan is good,

m_b = loss potential of a bad loan, and

P_b = probability that a loan is bad.

P_g and P_b are ratios representing past experience with good and bad accounts, respectively. An example of applying this simple model is: if a one year, $100 loan at 15 percent simple interest is being considered, P_g = 0.95, and P_b = 0.05, then EP = ($15)(.95) - ($100)(.05) = $9.25.

To maximize expected profit, a credit scoring model is now utilized so that an optimal cutoff score can be identified. This is done by calculating the portfolio's expected profit for each score as if it were the cutoff score. **Table 2** shows what a typical schedule of these values might look like. The loss avoided by establishing a cutoff score is considered a benefit which is added to profit from the good accounts accepted. Losses from incremental Type I and Type II errors resulting from use of the model are subtracted from the expected profit at each cutoff score. For example, assuming a cutoff score of seven causes the model to accept 77 percent of the good applicants and reject 70 percent of the bad applicants, then:

EP_7 = (.77)($15)(.95) (77% of the good accounts accepted)
+ (.70)($100)(.05) (70% of the bad accounts rejected)
- (.23)($15)(.95) (23% of the good accounts rejected)
- (.30)($100)(.05) (30% of the bad accounts accepted)
$9.69.

The score with the highest calculated expected profit is the optimal cutoff score. In **Table 2**, the optimal cutoff score is six because its expected profit of $11.70 is highest.

The value of this model comes not from the good accounts accepted, because they were already being accepted prior to the model's development and use. Rather, the value is derived from the rejection of bad accounts that would have been accepted without the model's use (i.e., Type II error reduction). However, resulting Type I errors do detract somewhat from the incremental expected profit derived from the model's use.

TABLE 2

EXPECTED PROFIT AT EACH SCORE

Reject those scoring	EP
≤13	−9.25
≤12	−8.39
≤11	−6.12
≤10	−3.56
≤9	−1.8
≤8	5.48
≤7	9.09
≤6	11.70
≤5	10.62
≤4	9.98
≤3	9.85
≤2	9.45
≤1	9.25
No system	9.25

Source: Reference **82**, Table 2.

C. **SUMMARY**

Credit grantors incur the risk of nonrecovery of the cost of capital loaned due to default and various types of external and internal fraud schemes. The level of such risk is measured by the amount of funds loaned and the applicant's probability of being a bad risk. Such probabilities are related to the applicant's personal financial responsibility.

Employers also incur the risk of asset loss due to internal fraudulent behavior. The level of such risk is proportional to the level of assets entrusted and the employee's probability of being dishonest. Such probabilities may also be related to the applicant's personal financial behavior. Employers recognize that the prevention of asset loss through employee screening is more effective than punitive measures when all costs are considered.

Private sector organizations desire to minimize all costs any given level of revenue generation. Costs include the depletion of assets entrusted to approved credit or job applicants. To minimize such costs, organizations may use a cost-benefit approach. This is done by comparing the

marginal costs of administrative expense and forgone revenue to discriminate good applicants from bad ones to the marginal costs of asset depletion avoided by such discrimination efforts. The objective of the costs of applicant discrimination is the determination of applicant financial responsibility. The ultimate objective is to reduce asset depletion costs by a greater amount than the marginal costs incurred to do so.

Private sector organizations determine the personal financial responsibility of credit and job applicants, respectively, to approve or reject them. These organizations generate internal and external applicant information for the execution of the decision process. They have two clearly established methods of determining the personal financial responsibility of their applicants: judgmental and empirically derived. Governmental regulation defines these methods and constrains the latitude within which organizations can process applications with respect to equal opportunity and privacy.

The judgmental method is the traditional method. It is used for determining personal financial responsibility unless a decision is made to adapt an empirically derived model for the process. The judgmental method process is slow because the decision making is entirely human interactive and treats each applicant as an individual for evaluation purposes. It incorporates the decision maker's experience and knowledge to evaluate qualitative applicant information in arriving at an approve/reject decision.

The empirical method is the newer method. The empirical method can be faster than the judgmental method because it minimizes human interaction in the decision making process by replacing human evaluators with automatic data processing. The process assigns each applicant to group membership, simplifying the individual evaluation process. Once an empirically derived model is developed and implemented, the

method automatically evaluates quantitative information and compares the applicant's score to a cutoff level for a decision.

There are a variety of empirically derived models, each attempting to provide the decision maker with a means of minimizing the combined costs of rejecting good applicants and accepting bad ones.

D. CONCLUSIONS

The judgmental method of determining personal financial responsibility tends to have relatively low fixed costs and high variable costs compared to the empirical method. Capital investment is minimal and analysts can be utilized for evaluation and decision making as required. As the rate of applicant evaluation increases, human resource (i.e., variable) costs also increase.

The empirical method tends to have relatively high fixed costs and low variable costs compared to the judgmental method. Capital investment in automatic data processing hardware and software can be substantial. As the rate of applicant evaluation increases, human resource costs are not significantly impacted because of the relatively small degree of human interaction required for the process.

Method selection, itself, should be subjected to cost-benefit analysis. Primarily, an organization should evaluate the expected marginal benefits from a change in the process and compare them to the costs required to make the change. The evaluation can lead to a number of recommendations. Possibilities include:

(1) improve current judgmental procedures,

(2) introduce empirically derived procedures as an addition to the current judgmental system,

(3) replace the current judgmental system with an empirically derived system,

(4) improve current empirically derived procedures,

(5) introduce judgmental procedures as an addition to the current empirically derived system, and

(6) do not alter the current system.

In conducting a cost-benefit analysis of possible changes in the current method used to determine personal financial responsibility, the organization must consider interdependent factors that affect the marginal fixed and variable costs of making the changes. These factors are applicant volume and processing rate and the cost of Type I or Type II errors.

Increasing applicant volume taxes the evaluation system. To maintain process effectiveness under such conditions, the system must increase its processing rate so that applicants do not lose interest from delays in response. This is accomplished by making one of the changes mentioned above to the system. With the judgmental method, the system processing rate may be increased by increasing worker productivity, if possible. Fixed costs would not noticeably increase. The marginal variable costs to consider would be increases in manpower costs and the costs of additional Type I and II errors made due to less time spent evaluating each applicant. Another option would be to employ more analysts. This would cause a greater increase in manpower costs, but avoid the marginal Type I and II errors.

An empirical model must be specifically tailored to an organization's requirements. Changing to an empirical method because of increased volume would avoid the higher variable costs inevitable with the judgmental method. But, there would be new fixed costs associated with system development and installation for both hardware and software. The initial investment required for the development and implementation of a credit scoring system, including hardware and software, is an incremental cost that can easily exceed the marginal benefits derived during the life of the system.

The potential costs of Type I and Type II errors should also be considered when selecting an evaluation method. Credit scoring categorizes credit or job applicants. To be entrusted with assets inordinately sizable in value (e.g.,

currency in an armored car or schematic diagrams for cryptographic equipment), applicants should not be considered financially responsible simply because they have a collection of personal traits that indicates they are members of a trustworthy group. The costs of Type I and II errors under a credit scoring system take on greater significance under such circumstances. The judgmental method does not assure elimination of such errors, but on an individual evaluation basis it has a better probability of avoiding them [Ref. **66**]. The organization with these considerations must compare the potential cost savings from reducing significant Type I and Type II error costs with the marginal costs of changing to each system evaluated. The benefit of having the low variable cost of a credit scoring system for evaluating such high trust individuals could be far outweighed by the losses suffered by even one costly Type II error. A combination of both methods, such as the Credit Analysis Model, could prove to be the least costly. For instance, having two extreme cutoff scores with judgmental evaluation for those applicants falling between them might be the optimal solution.

All of the empirically derived models surveyed weigh quantifiable variables in an attempt to label their significance as predictors of good or bad risks. They also utilize a numerical cutoff where the total cost of rejecting good applicants and accepting bad ones is minimized. However, the models do not incorporate the process expense discussed in Chapter I. The models' designers presume such expense is worthwhile if the organization is considering the model for adaptation. The actual costs of adapting these models is affected by the amount of tailoring required by the individual organization.

The particular method and model of determining personal financial responsibility chosen by a private sector organization is a function of the total costs, including lost benefits, of that method. Even the costs incurred to

evaluate the costs of using a particular model must be included in the decision process. The total costs of a particular method are a function of the required applicant processing rate and the significance of Type I and II errors. In selecting an evaluation system, *total cost minimization* is the ultimate criterion.

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