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**Asset Attributes and Portfolio Choice:
Implications for Capital Asset Prices**

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ABSTRACT

A large body of empirical literature in agricultural economics, marketing, and other branches of economics indicates that the qualitative characteristics of goods critically influence consumption decisions. In the literature of financial economics, assets' rate of return and the parameters characterizing their probability distribution have been viewed as the primary attributes affecting portfolio choice decisions. This seems to be a narrow view of the demand for financial assets and there are reasons to expect that other asset characteristics may influence investors' decisions. The aim of this dissertation is to assess this conjecture.

An important justification for the relevance to investors' decisions of a variety of asset attributes comes from existing management compensation schemes, which provide incentives for firm managers to strategically manipulate indicators of a firm's financial performance. Rational investors anticipating such behavior would examine a variety of signals when selecting their portfolios. In chapter two, I construct a general portfolio selection model embodying this type of investor behavior and study the influence of the qualitative attributes of assets on individuals' investment decisions and, consequently, on the market prices of capital assets.

The framework proposed assumes that, in addition to consumption, investors derive utility from the characteristics of their portfolio, which may include the mean and variance of returns. The model has a number of original features. First, a distinction between attributes common to all assets and unique characteristics of assets is made. Hence in considering the stocks of two otherwise identical firms, investors may choose, for example, the stock of the firm that purports to be environmentally responsible. Second, the model allows for differing investment horizons, so that while some investors' portfolio choice may be influenced by consumption in the distant future, others may be concerned with only their current consumption. Third, an equilibrium relationship between asset prices and their attributes is established. The implicit value associated with each attribute may be inferred from this relationship.

Uncertainty regarding the assets' attributes is integrated into the analysis in the third chapter. In a single period setting, I first study investor behavior in the presence of multivariate risk, which is due to randomness of the attributes. I then discuss both risk aversion and stochastic dominance measures that are appropriate for this setting. An important point emerging from this analysis is that, in the presence of risk, the equilibrium asset prices will be dependent upon the parameters of the joint distribution of the attributes. Regulatory policies enacted by public and private agencies can cause changes in these parameters. The chapter concludes by briefly discussing how the welfare effects of changes induced by regulatory policy may be assessed.

Chapter four provides an overview of the existing portfolio choice models in economics and finance. The purpose of this chapter is to demonstrate

that in existing models, the key attributes affecting the demand for assets are the parameters of the joint distribution of asset returns. These utility-based portfolio choice models are shown to be subsumed as special cases of the general attribute model proposed in the previous chapters.

In chapter five, data on financial and accounting characteristics of over 2000 firms are used to evaluate a simplified version of the theoretical model proposed in chapter two. Relying on previous studies, a variety of attributes indicative of a firm's market power, growth potential, degree of diversification, and other characteristics are considered. The implicit value of each attribute is estimated and attributes are ranked according to their contribution to the prices of common stocks.

The empirical examination indicates that a large number of attributes strongly influence asset prices. Among these, attributes that are indicative of a firm's future earnings potential, e.g., retained earnings, dividend payments, advertising expenditures, etc. are the most significant. Qualitative characteristics of firms, such as the exchange at which a firm's stock trades, its audit status, its industry ranking, etc. are also significant determinants of asset prices.

The final chapter of this dissertation summarizes the results and suggests directions for future extension of this work.

Keywords: Portfolio Choice theory, Asset Pricing Models, Investments, Product Attributes, Accounting and Financial Information

Dedicated to the memory of my father Mohammad Reza and my mother Fatemeh Biegum

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1 Introduction

Much of what we know about the determinants of demand for financial assets arises from studies linking various causal variables to asset prices. The majority of these studies are rooted in either a utility based consumption-portfolio choice model or the arbitrage pricing theory. [1] Both theories assign little role for investors' assessment and valuation of distinct *attributes* that differentiate financial assets. [2]

Indeed, in a world characterized by the assumptions of the standard Capital Asset Pricing Model (CAPM) only two attributes, the mean and variance, affect choice, while in the settings of the Arbitrage Pricing Theory (APT) an undetermined number of 'factors' may influence returns.

Since the creation of modern financial assets and institutions, financial statements and 'fundamental' analysis have aimed to assess and discover 'value-relevant' characteristics of assets. The origins of the modern financial services industry can be traced to these types of analysis. This growing sector of the modern economy generates and processes information about assets' attributes under the pretext that this type of analysis reduces the uncertainty associated with portfolio selection.

[1] Arguably, equating asset prices to their expected discounted future earnings is not a formal model of investor behavior but rather a condition for removal of arbitrage opportunities, i.e., the violation of this relation signals the existence of profit opportunities and rational investors would take advantage of such opportunities without regards for the characteristics of the underlying asset.

[2] The words attribute and characteristic will be used interchangeably. Quality is assumed to be objectively measurable. Attributes provide signals about the prospects of an asset's future prices and returns.

The existence of this industry enforces the notion that investors regard the information about asset attributes to be value relevant. Further evidence in support of this view can be found in the prevalent markets for assets that claim to be attribute specific such as 'socially responsible' in the case of environmental funds, 'politically responsible' as in the case of funds not investing in South Africa, and 'patriotic' as with 'war bonds'.

In the academic literature, information about broad attributes of firms or industries has been utilized to predict other important firm characteristics, or the probability that an event may occur. For example, Ou and Penman [84] use aggregate financial statement information to predict the likelihood of increases in a firm's earnings. Others have used such information to forecast the chance of bankruptcy, audit qualification, use of accounting methods, and targeting firms for takeover. [3] Financial information has also been linked to executive compensation and incentive contracts suggesting further a link between asset prices and their attributes. [4]

The link between attributes and asset prices has intermittently been explored in financial economics. Examples include the non-calendar based anomalies in finance (e.g. the size effect, debt structure, etc. [61, 62]); the link between items in financial statements and earnings (or prices) analyzed in the accounting literature

[3] For a summary of this literature see Scoffer [101] and Rao et al. [88].

[4] See [105] and references therein. Capon, Farley, and Hoenig [19] provide a complete survey of the economic literature on the link between measures of a firm's economic performance and its characteristics.

[63]; the influence of qualitative factors such as management style and firm control considered in management science [19]; and the impact of market share, diversification, industry structure, economies of scale and other factors on returns or share prices.

In most of this literature, attributes influence prices indirectly. Further, the treatment is generally ad-hoc in the sense that quality variables are added to the arguments of an existing asset demand model (e.g. the addition of tax effects into CAPM; more on this in chapter 4). The question of what this implies about investor preferences has not been addressed. No formal justification as to why attributes matter is provided. Others, particularly accounting researchers and financial statement analysts, have studied the relationship between asset prices and their qualitative attributes without a formal portfolio selection model.

The subject of this dissertation is how one models portfolio choice behavior when investors' decisions are influenced by their valuation of assets' qualities. We consider the link between asset demand and asset quality within an explicit utility maximization framework. This is a useful approach because it facilitates discussion of normative policy issues, such as the welfare impact of regulatory policies forcing public disclosure of financial information, as well as some positive theoretical considerations such as how attributes influence prices and the demand for assets, or how, in the aggregate, investors trade off qualitative characteristics.

In the economic literature concerned with quality, two ways to model the relationship between quality and demand have been proposed. [5] In the differentiated commodity approach of Lancaster [60, 59], goods with different attributes are treated as distinct commodities. However, the approach proposed by Houthakker [38] and Theil [109] treats those same goods as part of a generalized commodity.

A related distinction has been drawn between models which postulate a discrete versus a continuous spectrum of product quality. Justification for these assumptions may be drawn from the nature of the commodity in question.

The model proposed here allows for both representations; Discrete characterization of quality attributes is used to separate different classes of assets, e.g., stocks versus real estate. Within each class, however, quality indices can be either discrete (e.g., industry ranking) or continuous (e.g., returns). In the case of financial assets, these assumptions seem quite reasonable and their appropriateness will become clear in the chapters that follow.

Drawing on the economic literature on quality, this dissertation proposes a consumption-portfolio choice model in which assets' attributes influence investment choices. The aim of this model is to explain the demand for a large number of closely related assets in terms of a smaller number of attributes that are common to them.

Utilizing a set of standard and very general assumptions, individual investment decision rules are established. The implica-

[5] For a recent survey of this literature see Hanemann [36].

tions of these rules for the market as a whole are considered. The equilibrium market clearing conditions are the basis of the empirical examination of the theory. A useful way of categorizing attributes is also suggested.

The main empirical task undertaken in this thesis is the identification of the relevant attributes and the estimation of the magnitude and direction of their impact on prices. Overall, the combined relevance of a variety of signals is assessed. Included are pieces of information whose release is mandated by law or accounting practices, variables that are commonly believed to affect asset prices, and other available public information.

This empirical examination provides a test of the theoretical model and gives a partial answer to the question what types of attributes influence prices. However, this model and the empirical results are also useful for addressing other issues, including the importance of the attributes in predicting future prices and hence the rate of return, and their use as a guide to improved portfolio decisions. [6] An improved understanding of the role of attributes in determining asset prices may be also useful in designing efficient management compensation schemes.

On this latter point, note that modeling investment behavior as a process in which rational individuals consider a variety of asset attributes in their portfolio decisions provides a rationale for

[6] In principle, given the the attributes of an asset and their associated market value it is possible to identify mispriced securities. This is the sense in which information about attributes can aid in portfolio decisions.

why corporate managers devote scarce resources to the manipulation and control of such characteristics as the firm's capital structure (See Hart and Moore 1991).

Indeed, the standard agency-theoretic models of management behavior, implicitly assume that investors (actual and potential holders of a firm's equity and bonds) and the management place the same value upon a firm's characteristics, such as its debt structure. The Miller-Modigliani [79] dividend irrelevance theorems, which have been fundamental to the design of public and corporate policies in recent decades, provide a good example of this type of implicit assumption.

There are reasons to question this accepted wisdom. For example, management compensation schemes provide incentives for manipulation of certain asset attributes that are often associated with short term profitability and the relatively short tenure of the management in modern firms. [7]

Rational investors may not assign positive value to these attributes but instead focus on those that enhance the long term profitability of the firm. The framework proposed here provides an estimate of the investors' valuation of different attributes. Basing management compensation schemes on these types of information may further the interest of investors and the management.

The model also offers new insights on the analysis of capital market efficiency. The standard definition states that an efficient

[7] Golden parachutes are a good example of incentive structures which unduly favor the management.

capital market is one in which all available information at a point in time is *fully* and *correctly* reflected in security prices [44, 96]. All investors are assumed to possess equal abilities and hence face the same costs of obtaining and processing information.

The model in this thesis suggests that the definition of market efficiency should perhaps be expanded so as to relax the latter assumption. That is, efficient markets should not be viewed from an informational prospective alone, but also on whether the cost of obtaining attributes are equalized across investors. Moreover, from a societal point of view, it may also important that management's and investors' interests coincide and both value the same attributes in a firm.

Note that unlike the traditional notions of efficiency which emphasize the institutional structure of the capital market, the last definitions place greater emphasis on investors' abilities. This is important since to a greater extent investors rather than the institutions determine asset prices.

To state it differently, for any given institutional structure and any pattern of management behavior, capital markets would be more efficient if the ability to obtain attributes from assets is not investor specific. As an example consider the transaction cost associated with the purchase of stocks. Lower dealer commissions is clearly a valued attribute. The capital markets may be more efficient if the commission is equal for all investors.

The attribute approach carries some implications for research in noise trading, defined as trading based on information other than the 'fundamentals', i.e., the generally accepted factors that determine future earnings, such as inventories, sales, and advertising expense. The model proposed here can aid in answering the question of what qualifies an attribute as value relevant and therefore fundamental.

Finally, the proposed attribute model will have important implications for the pricing of derivative securities, whose value is dependent upon the price of other assets. For example, in the widely celebrated option pricing model of Black and Scholes [13], option prices are dependent upon the price of the underlying stock and the the variance of the logarithm of its returns. Clearly, if a systematic link between asset prices and other attributes is established, then it is likely that option prices are also influenced by these attributes. The nature of such interactions will be an interesting area for future research. [8]

It is important to note that a variety of organizations spend much resources to study the importance of asset attributes in security markets. The prevailing professional standards, which the aim to bring about market efficiency through greater informational equity, are based on this research activity. The agencies actively engaged include the Securities Exchange Commission (SEC), the Federal Deposit Insurance Corporation (FDIC), the Financial Ac-

[8] In chapter 4, I show that the attribute model is sufficiently general to nest a variety of portfolio choice models. Because of this property the model provides a valuable pedagogical device for understanding the existing models in finance and accounting.

counting Standards Board (FASB), the institute for Chartered Financial Analysts (CFA), and other private organizations.

Expenditure on such activities further demonstrates the importance of asset attributes in portfolio decisions and provides justification for the present study. The findings here will therefore be of interest to a host of public and private agencies, including the various stock exchanges, accounting and financial associations, financial rating agencies (such as S & P), corporate officers, pension and mutual fund managers, and finally individual investors.

The remainder of the dissertation is organized as follows. The general attribute pricing model is laid out in chapter 2. Duality between utility maximization and cost minimization in portfolio decision is shown to be a key feature of the model presented in this chapter. Testable hypothesis may be obtained from the model are high lighted.

Chapter 3 is devoted to the discussion of how uncertainty about asset attributes influence investor behavior. A key aspect of risk analysis in the model proposed here is the existence of multivariate uncertainty, which is due to the randomness of asset attributes. Many concepts from the univariate risk analysis, e.g., risk aversion and stochastic dominance, have been extended to the multivariate case. In chapter 3 these concepts are applied to the attribute model. Welfare analysis of reduced uncertainty is also briefly discussed.

Chapter 4 provides a brief overview of the existing utility based portfolio choice models in finance and accounting and shows that the attribute model nests these as its special cases. The purpose of this chapter is to demonstrate that the existing models differ from one another simply in their selection of important asset attributes, e.g., mean and variance, and the selection criterion may be somewhat ad hoc.

In chapter 5 we take up the empirical examination of the attribute model. A set of simplifying assumptions which help operationalize the model for estimation purposes are invoked. Data from the stock market is used to assess the influence of firm attributes on the price of their stocks. A large number of studies in economics and other fields are used to identify the relevant attributes.

The final chapter provides a brief summary of the results considers ways of improving the study, and suggests directions for future research.

2 A Generalized Attribute Pricing Model

A general model describing individuals' consumption and investment decisions, where qualitative attributes of assets are assumed to influence choice, is presented in this chapter. The motivation for the present model lies in the household production theory of Becker [10] and Muth [80]. The salient feature of their approach is the treatment of consumers as producers of non-market goods. Other features of this theory will be noted in the course of discussion which follows. [9]

Consider the following characterization of consumers' investment behavior. Individuals derive utility from consumption activities. Financial assets are sought primarily for intertemporal smoothing of income and therefore consumption, i.e. they provide a way to transfer consumption goods across time.

By transferring wealth in an 'optimal' manner, individuals can increase their consumption over time. Optimal transfer of wealth across time is dependent upon the characteristics of the portfolios held, the component of which are assumed to yield flow of services such as security, liquidity, etc. The ability to smooth consumption and enhance utility is thus dependent upon the various attributes of the assets held in an individual's portfolio. Therefore the utility an individual receives is directly dependent upon the *total* of various attributes provided by their portfolio.

[9] The treatment here has benefited from the review of this literature found in Haneman [36] and LaFrance [58].

In a recent study of demand for money and money substitutes Belongia and Chalfant ([11]) propose a model in which individual's utility indirectly depends on the attributes of assets held. In the Belongia and Chalfant model, this dependence arises from the fact that utility is defined over asset holdings (i.e., cash holdings, demand deposits, money market accounts, etc.). In our framework, however, asset characteristics influence portfolio decisions and in turn consumption.

Through their influence on present and future asset prices, these attributes affect future wealth and consumption. This characterization of investment behavior is based on the observation that individuals combine marketed assets, which may include their own labor and human capital, to *produce* utility-bearing non-marketed portfolio attributes (e.g. safety, liquidity, etc.).

Clearly, this characterization of investment behavior is consistent with the existing models of portfolio behavior. For example, the setting envisioned here is consistent with that in the simple mean-variance model of Markowitz [74] and its equilibrium versions due to Sharpe [103] and others, as well as the parameter preference model of Rubinstein [95], Ingersol [41], Kraus and Litzenberger [55], and Litzenberger and Ronn [72]. Further parallels with these and other models will be discussed in chapter 4. The next chapter provides an axiomatic representation of investment choice based on the above characterization of behavior.

2.1 The Asset-Attribute Transformation Frontier

In this and the following section the notation and the assumptions required for the most general version of the attribute model are introduced. The first focus is on establishing the technical relationship between assets and attributes. The representation of asset-attribute transformation technology parallels that of the theory of the firm with the distinctions that here 'production' is undertaken by individual investors, and more importantly, because of the possibility of short sales, 'inputs' may take on negative values.

Let $X \in R^n$ denote the vector of available marketed assets and $x \in X$ a subset of these assets used to form a portfolio. [10] The term marketed assets is used in its broadest context so that X may include most conventional assets such as stocks, bonds, and specific combination of such instruments, i.e. mutual funds, the 'market portfolio', other real investments and a risk free asset. Short sales of assets are represented by negative signs. Restrictions on short sales and other market imperfections are discussed below.

Denote the vector of attribute (quality) parameters associated with X by $\beta \in R^s$; e.g., $b_{ij} \in \beta_i$ is the amount of attribute j in a unit of asset i. We assume there are r possible attributes that characterize assets. A subset of these, $r^* \subseteq r$, are presumed to be common to all assets. [11] The remainder of r is the collection of 'unique' attributes in all assets; i.e., those attributes found in no

[10] In the remainder of the dissertation upper case letters will be used to refer to vectors and sets and lower case letters will be used for elements or subsets.

[11] Since our aim is to explain the demand for a very large number of assets in terms of a much smaller number of common attributes we assume $r^* < n$.

other assets.

To distinguish assets that may be identical with respect to the common attributes we require each asset to have at least one unique attribute. Now any asset may be characterized by a minimum of $r^* + 1$ attributes. Given this characterization, the dimension of attribute space β can be in the range $n \times (r^* + 1) \leq s \leq r^* \times (n-1) + r$.[12]

We assume that from an investors point of view the quality aspects of assets, β, are exogenous and not an object of choice. However, through their choices individuals do determine the attributes in their portfolio. To treat asset attributes as a choice variable would result in a dimensionality problem, where the attribute space would become infinite dimensional. For assets, the finite dimensional attribute space assumption seems reasonable and sufficiently general. Also, although the number of qualitatively differentiated marketed assets are large, note that in actual markets this number is finite.

Denote the vector of utility bearing total attributes produced from portfolios of X by $Z \in R^m$, where $r^* + 1 \leq m \leq r$. Note that m determines the number of arguments which may enter an individual's utility function. At one extreme, an individual's portfolio can be composed of a single asset with one unique attribute and r^* attributes common with other assets $(m = r^* + 1)$.

At the other extreme the individual's portfolio could contain

[12] Assets whose unique attributes change should be regarded as distinct financial instruments. The requirement of one unique attribute can be trivially justified on the grounds that each asset has at least a specific name.

all marketed assets or just the market portfolio (note that $m = r$ for both). This characterization is consistent with the observation that two investors who desire the same characteristics in their portfolio my meet this need by combining different assets.

It is important to emphasize here that although the variety of attributes which distinguish assets may indeed be large, those which enter an individual's utility function (i.e., m) need not be. The discussion of the nature and relevance of both types of attributes will be undertaken in chapter 5.

We assume there exists a technical relation, i.e. a mapping from X to Z, which explicitly depends on the vector β. The dimension of the quality parameter vector β is reflective of the variety of available assets and possible attributes. In addition to being exogenous, β is assumed to be quantifiable and objectively measured by all economic agents. This latter assumption corresponds to the standard 'common knowledge' assumption often invoked in finance literature and implies that there are no differences in information processing abilities of investors.

The assumption that the quality parameters are exogenous can be interpreted in two ways. First, they are exogenous to individual investors but may vary across investors. For instance, elements of β that measure transactions costs (commissions) may be different for institutional versus individual investors. This may indicate an inefficiency in the capital markets in the sense that certain groups of investors possess market power.

Second, the exogenous quality parameters may be the same for all investors, which is also an statement about the efficiency of the capital markets. This is similar in flavor to the standard homogeneous belief assumption in equilibrium finance models. For example in the case of equilibrium CAPM it is assumed that return distributions are the same for all investors. According to this view, markets are efficient when the asset-attribute technology is the same for all individuals.

From the short run perspective of an investor, it may be reasonable to assume that the parameter vector β, which could include the rate of return on an asset, may be nonstochastic. [13] Over time, however, because of market forces, at least some quality parameters are likely to change randomly for all investors. More realistically, over longer horizons the quality parameter associated with an individual's *portfolio* may be influenced by inputs such as human capital and the time devoted to monitoring assets and composing portfolios. [14]

Turning to the formal model, denote any arbitrary pattern of assets-attribute transformations, i.e., an *investment opportunity*, by $y(b) = \{Y \in R^{n+m} : (x, z) \in Y\}$. The set of all *feasible* in-

[13] It seems reasonable that over shorter periods of time there is less uncertainty associated with the attributes including the rate of return and that the uncertainty increases with time. This is the standard practice in continuous time finance where instantaneous returns are assumed to be nonstochastic. Generalised Markovian processes such as the Brownian Motion process are then use to model time increasing uncertainty.

[14] A different way to include investor specific inputs such as time would be through the vector X since labor itself is a marketed asset. This however would be problematic because the dimensionality of the problem will be enhanced without gaining any new insights. As it turns out, we may indirectly account for time spent in composing portfolios by creating at least a dichotomous variable which differentiates between assets that require little monitoring time such as certificates of deposit and others.

vestment opportunities will be denoted by $Y(\beta) = \{Y \in R^{n+m} : (X, Z) \in Y\}$ and called the *Attribute Transformation Set* (ATS). Given β, the ATS is assumed to be compact. Formally, $Y(\beta)$ is assumed to be nonempty, closed, bounded, and to include the origin, $0 \in Y(\beta)$.

The contours of the ATS, denoted by $Y(z;\beta) = \{X \in R^n : z = \bar{Z}\}$, will be called an *asset requirement set*, or (ARS). The ARS is the listing of all portfolios that can generate a given vector of attributes $\bar{Z}$. This set is assumed to be monotonic, i.e., if $x \in Y(.;.)$ and $x' \geq x$, then $x' \in Y(.;.)$.

Monotonicity implies that a given vector of attributes generated by a portfolio may also be generated from another portfolio which contains more of the same assets. Finally, we assume it is possible to generate a given vector of attributes by composing a portfolio from two existing portfolios which generate the same attribute vector independently. This implies that the ARS is convex, i.e., if $x \in Y(.;.)$ and $x' \in Y(.;.)$ then for all $t \in (0,1)$, $tx + (1-t)x' \in Y(.;.)$.[15]

These properties are similar to those posited in the standard production theory discussed in Debreu [22], and they permit the representation of a joint production function, which is an important property utilized below. The justification for these theoretical assumptions is to insure that the solution to the investor's optimization problem exist and are well behaved.

[15]This is much weaker than assuming $Y(\beta)$ to be convex.

Relying on these technical properties, particularly the monotonicity of the ARS, the *efficient* asset-attribute frontier may be represented by a joint transformation function $G(X, Z; \beta) = 0$, which is a mapping from R^s into R^m. The assumed convexity of the asset requirement set implies that $G(X, Z; \beta)$ is monotonic and convex in Z and X. Monotonicity permits us to express the level of 'output' of any attribute z_k in terms of the assets and all other attributes, i.e., $z_k = G_k(X, z_{m-k}; \beta)$. It is possible to show that, holding all other attributes (z_{m-k}) constant, $G_k(..)$ is a quasiconcave function of X.[16]

Furthermore, the assumptions on the ARS imply that for any quality vector β, $G(0, 0, \beta) = 0$, i.e., no attributes can be obtained without assets, and if $G(X, Z, \beta) = 0$ and $Z \neq 0$ then $x_i \neq 0$ for at least one i; to obtain non zero attributes requires non zero quantities of at least one asset.

The function $G(.)$ is a joint transformation function. This jointness captures the possibility that the optimum level of one attribute, say Z_k, may be dependent upon the level of other attributes, as well as on the portfolio composition. An example of this representation is the mean portfolio return, which in an efficient market, may depend upon the portfolio variance, the quantity of the underlying assets, and their expected returns.

When the level of an attribute generated by a portfolio is

[16] To see this note that the ARS is the 'upper contour set' of $G(.)$. By definition the upper contour sets of a quasiconcave function are convex, which is an assumption we invoked earlier.

independent of other attributes obtained from the same portfolio, the transformation functions will be *separable*; $z_k = G_k(X; \beta_k)$. The ATS will now be $Y_k(\beta_k) = \{Y_k \in R^{n+1} : (X, z_k) \in Y_k\}$. This representation appears to be more appropriate for the assets considered here and is adopted in chapter (2.4). However, in the theoretical developments that follow the generality of the model is maintained by permitting jointness.

It will also prove analytically convenient to place some restrictions upon the attribute quality vector. In particular, we assume that $Y(\beta)$ is continuous over the set of all quality vectors B and is compact throughout B. These conditions simply imply that $G(\cdot)$ is continuous in $\beta \in B$, so that 'small' changes in β do not cause 'large' changes in the attribute outputs, i.e., the transformation function is smooth with respect to the quality parameters.

It is likely that beyond a certain threshold, there are decreasing returns in the production of attributes. As an example of an attribute exhibiting this property consider the variance of returns on a portfolio (σ_p^2):.

$$\sigma_p^2 = \sum_i \sum_j s_i s_j \sigma_{ij}$$

where s_i is the share of wealth in asset i, σ_{ij} is the covariance between returns of i and j, and $\sigma_{ii} = \sigma_i^2$ is the variance of returns on i. Now note that for given σ_{ij}, the portfolio variance σ_p^2 is a concave function of the quantity of any particular asset x_i. [17]

Furthermore, suppose wealth is equally divided among the different assets, i.e., $s_i = 1/N$ where N is the number of different assets. Now note that though σ_p^2 decreases through diversification as more assets are added (N rises), it falls at a decreasing rate and level off at some level which depends upon the σ_{ij}'s. Here we have assumed that the covariance terms σ_{ij} are non-zero; otherwise, σ_p^2 could in fact be reduced to zero an N becomes very large.

The structure of the model proposed below permits these types of decreasing returns, although the convexity and monotonicity of the ARS rules out increasing returns to assets. This may seem somewhat artificial since large institutional investors, by virtue of their order size, appear to receive some preferential treatment. In any case, increasing returns is essentially a restriction on the values of β and is therefore empirically testable in this model.

The structure proposed so far is quite general and very flexible in terms of covering a variety of possibilities. Noticeably absent from the above characterization of the attribute technology has been the issue of uncertainty, which is an integral component of investment decisions. The assets-attribute relationship depicted above offers a natural and meaningful way of introducing uncertainty into our analysis. For any given portfolio $x \in X$, an individual's ability to obtain $z \in Z$ is dependent upon the associated quality parameters $\beta \in B$, which, from the perspective of the investors, may be

[17] The shares are concave in x_i's and σ_{ij} is a linear function of shares. Hence, σ_{ij} is also a concave function of x_i's.

random.

Indeed, this is how uncertainty is introduced in the existing portfolio choice models. To support this contention, consider the standard one period consumption-saving model in which individuals maximize their utility from consumption $u(C, C_1)$, subject to constraints $C = W - P'X$ (current consumption) and $C_1 = (1+R)P'X$ (end of period consumption), where W is initial wealth, and $R = P_1/P$ is the rate of return on investment ($P'X$).

Now letting $Z = \{C, C_1\}$ and $\beta = \{P, P_1\} = \{R\}$, we see that uncertainty about returns (end of period price) affects the individual's choice through the vector β. In the third chapter of this dissertation I integrate uncertainty into the model in this manner. Further discussion is postponed to that chapter. To further analyze the investor's portfolio choice problem, under certainty or risk, we need to place some restrictions on individual preferences. We take up this task in the following section.

2.2 The Nature of Preferences

In traditional portfolio choice models in economics and finance, individuals are assumed to derive utility from consumption at each point in time. Portfolio selection is the act of choosing an investment strategy that results in a consumption profile that maximizes lifetime utility. Embedded in this representation of investment behavior are a number of strong assumptions, including stable preferences, time consistency of decisions, and others.

These issues have been discussed extensively in the literature, see for example Ingersoll [42]. Some of the objectionable restrictions of the 'traditional' model, e.g., time additive utility function, may be rendered unnecessary in the attribute model. This can be an important novelty of the attribute approach.

The cornerstone of the attribute model is the conjecture that investors value the characteristics of their portfolio, which is a vehicle for transferring consumption goods across time. Hence at any point in time it is the collection of a portfolio's attributes, Z, that provides utility.

This dependence of utility upon attributes can arise because utility is defined over asset holdings and therefore their attribute as in Belongia and Chalfant [11] or utility is defined over consumption stream which is influenced by asset holdings and in turn their attribute as is assumed here.

Individual preferences over the choice set $Z \in R^m$ are represented by preference ordering $\succeq$, assumed to be a transitive, reflexive, complete, and continuous, i.e., investor's preference ordering is representable by a *continuous*, real-valued utility function, $u : R^m \rightarrow R$. In addition, we assume the preference ordering is *convex*; article [18]

Continuity and quasiconcavity are the *regularity* conditions required for optimization. Positive monotonicity of preferences is not assumed, i.e., more of an attribute may not necessarily better. EmQHΣ . Indeed for certain attributes, such as portfolio variance, common sense (or stochastic dominance arguments) suggest that for a given mean, lower variance will be preferred.

Since the empirical aim of the dissertation is to elicit the aggregate valuation of various attributes, no restrictions are placed on the marginal utility of attributes. This simply implies that the indifference surface (over the attributes) may be non-convex. Alternatively we may assume that attributes are measured in such way that marginal utility of all attributes is positive.

Additionally, the definition of the total attribute vector Z does not preclude the possibility that some or all of the marketed assets may enter the utility function directly. In fact when $m = n$ and $Z_i = X_i$ for all $i = 1, \ldots, n$ then the present model reduces to one in which utility is derived from asset holdings directly. [19]

To establish the connection between the attribute model

[18] A binary relationship is convex if $\{z \in Z : z \succ z'\}$ is convex for all $z' \in Z$. For details see Kreps [56] page 27. Note that when β are non-stochastic the $u(\, . \, .)$ is an ordinal utility, otherwise the utility function will be cardinal [44].

[19] Also for any i and j such that $z_i = z_j$ the function $z_i - z_j$ may be incorporated into the transformation function $G(\, . \,)$. This will reduce the dimensionality of the problem.

and the standard intertemporal portfolio choice model in which utility is derived from consumption [20] one may sequentially define $Z_i = C_t = W_t + Y_t - P'_t X_t$, where C_t, W_t and Y_t are respectively the consumption, initial wealth, and non-asset income at time $t = i = 1, ..., T$ and X_t and P_t are the vector of assets and their prices at t.

These alterations of the general model will reduce the dimensionality of $Y(\beta)$ though its assumed properties will be preserved. To see this note that under the last representation the ATS is becomes $Y(W_0, Y_t, P) = \{Y \in R^{n+T} : (X, C) \in Y\}$. Again, increasing returns to investment is ruled out unless the budget constraint is non-linear in X, which may occur because of say decreasing transaction costs. In the development of the specialized model in chapter 5, this representation will be used to introduce current consumption as an argument into the utility function.

When uncertainty regarding production of all or some attributes is present, it can be captured, we argued, by randomization of the parameter vector β. In that case a *von Neumann – Morgenstern* utility representation will be more appropriate, where the probability distribution of β and consequently Z could be the same for all investors (homogeneous beliefs) or vary across investors (heterogeneous beliefs).

The probability representation choice, subjective or objective, should depend upon the type of attributes envisioned. Addi-

[20] see for example the models discussed in [42]

tionally the choice is an indirect statement of one's beliefs about capital market efficiency. Bagwell [4] provides a recent summary of issues that are related to homogeneity of investors beliefs. I provide a discussion of the influence of uncertainty on investor decisions in chapter 3. Before so doing, however, the next section discusses the types of testable hypotheses that could arise from the above characterization.

2.3 Deriving Qualitative Results

Having completed the discussion of investor preferences and the attribute production technology we now turn to deriving testable hypotheses and qualitative conclusions. These types of results can be obtained from the general model in two basic ways: First, from a utility maximization approach, and second, from the dual approach of expenditure minimization. Exploiting this dual structure of the model, a number of questions may be raised and, in some cases, tested empirically. This chapter provides a general discussion of these issues.

Under the utility maximization approach, an individual's problem is to choose, subject to the transformation constraint $G(X, Z, \beta) \leq 0$ and a budget constraint $P'X \leq W$, a portfolio of marketed assets that will maximize $u(Z)$ where P is the vector of exogenous asset prices and W is individual's wealth.[21] There are no restrictions on short sales, though if necessary these can be easily imposed. The following two propositions characterize various aspects of investor's utility maximization problem or its dual expenditure minimization approach.

Proposition 1 : Suppose $u(Z)$ is continuous and quasi-concave and the assumptions on $G(X, Z, \beta)$ are satisfied. Then there exist a set of n quality augmented asset demand functions

[21] Note that the investment choice may be a subset $s \in X$ of assets. In that case the number of assets in a portfolio will also be an object of choice. I avoid this interesting problem for now by assuming that non-zero amounts of all assets are chosen.

$X = X(P, W, \beta)$, m attribute demand functions $Z = Z(P, W, \beta)$, an indirect utility function $V = V(P, W, \beta)$ and a set of price decomposition equations such that

$$P_i = \sum_{k=1}^{m} \theta_k(P, Z, \beta)[\partial G_k / \partial x_i]. \tag{2.3.1}$$

Proof : The first order necessary conditions (FONC) for the optimization problem, choose x so as to

$$max\ u(Z)$$

subject to

$$G(X, Z, \beta)\ \leq\ 0\ ,$$

and

$$P'X\ \leq\ W$$

are

$$\sum_{k=1}^{m} \frac{\partial u}{\partial z_k} \frac{\partial G_k}{\partial x_i} - \theta\ p_i\ =\ 0 \tag{2.3.2}$$

Given the assumptions on $u(\ .\ )$ and $G(\ .\ )$, the FONC may, in principle, be solved for the quality augmented asset demands (QAAD), $X(\ .\ )$.[22] Substituting these into $G(\ .\ )$, the optimum level of attributes $Z(\ .\ )$ may be expressed as a function of wealth, prices, and the quality parameters. Substituting Z into $u(\ .\ )$ the indirect

[22] Assumptions on $u(\ .\ )$ and $G(\ .\ )$ insure that the second order sufficient conditions for a maximum are met and the constraints are qualified.

utility function obtains. Solving the first order conditions for p_i and utilizing the definition $\theta = \partial u/\partial W$ gives the price decomposition equation where $\theta_k = \partial W/\partial z_k$ is the implicit value or 'shadow cost' of the k^{th} attribute.

This latter relationship is analogous to the hedonic price methodology widely used in the consumer demand literature. It constitutes a method of establishing a link between asset prices and their attributes. Most importantly, this link arises from a theoretically consistent optimizing investor behavior. This relationship is implicit in many seemingly ad hoc studies in finance and accounting in which pries (or returns) are regressed on various financial characteristics of assets.

Since the assumptions on $u(\ .\ )$ are essentially the same as those in the standard consumption saving theory, it can be shown that the properties of $X(\ .\ )$ and $V(\ .\ )$, with respect to P and W, e.g., homogeneity, are similar to those in the standard models. However, a priori, no statements can be made regarding the effect of the quality parameters on investors indirect utility or asset demands. Later, these questions will be addressed empirically.

Relying on the theorems of Rubinstein [97], we can aggregate X over all investors to obtain aggregate demand functions, which in addition to asset prices and aggregate wealth, are also dependent upon the qualitative attributes of assets. This establishes the first theme of the dissertation. In the aggregate, demand for financial assets are determined by their perceived qualitative characteristics. In principle, empirical examination of this hypothesis could proceed by determining the appropriate set of assets and their associated attributes, and statistically examining the link between them.

It is possible to obtain similar results by viewing the investor's choice as the outcome of a two stage optimization problem, which is 'dual' to the previous utility maximization. At the first stage the investor's aim is to minimize the cost of achieving a vector of attributes subject to the technical relation ATS. This generates the efficient frontier between the assets and the attributes. In the second stage utility is maximized subject to the optimum *cost function*. The optimum portfolio is at the tangency of the indifference surface and the cost efficient frontier.

Proposition 2: Given $G(\ .\ )$ there exists an expenditure function $E(P, Z; \beta)$ such that $\partial\ E(\ .\ )\ /\ \partial\ z_k\ =\ \theta_k(P, Z, \beta)$ and $\partial\ E(\ .\ )\ /\ \partial\ p_i\ =\ \bar{x}_i(P, Z, \beta)$.

Proof: Given the assumptions on $G(\ .\ )$, the FONC for the problem, choose x so as to

$$min\ P'X$$

subject to

$$G(\ .\ )\ \leq 0$$

may, in principle, bw solved for the conditional asset demands $\bar{X}(Z, P; \beta)$.

Substituting these into the wealth constraint, the expenditure function $E(P, Z; \beta)$ is obtained. Now consider the problem choose X, P and Z so as to maximize $F(\ .\ ) = P'X - E(P, Z; \beta)$ subject to $G(\ .\ ) \leq 0$. The FONC with respect to p_i and z_k gives the last parts of the proposition. This latter part of proof relies on the envelope theorem.

The second stage of individual's decisions is to choose Z so as to max $u(Z)$ subject to $E(P, Z; \beta) = W$. This optimization yields $X(\ .\ )$, $Z(\ .\ )$, $V(\ .\ )$, and a price decomposition equation, all of which, because of the dual structure of the model, are identical to those in proposition 1.

Notice that for financial assets, market efficiency in the form of increased competition may insure that the attributes are produced at the least cost possible so that investors need not undertake the first stage of this optimization.

In the above representations of investor choice the attribute transformation function was treated as a constraint in the optimization programs. Alternatively it is possible to substitute out Z and obtain the transformed utility function u^* $(X; \beta)$. Optimization can now be undertaken with respect to $u^*(\ .\ )$. [23]

The utility function $u^*(\ .\ )$ enables us to express (translate) individual preferences over non-marketed attributes to the space of marketed assets X and their quality parameters β. It is important to note that $u^*(.)$ conveys information regarding individuals'

[23] The quasi-concavity of $u^*(\ .\ )$ is an important property for obtaining a well behaved solution to utility maximisation. This property is established by the lemma in Appendix A.

preferences and their ability to obtain attributes from the available assets.

The translation of preferences to the space of assets and quality parameters thus permits an alternative expression of individual's choice problem. The next two propositions characterize this second approach.

Proposition 3 : Suppose $u^*(X,\beta)$ is continuous and quasi-concave. Then there exist a unique set of asset demand functions $X^*(P,W;\beta)$, an indirect utility function $V^*(P,W;\beta)$, and a price decomposition equation all identical to those derived in proposition (1).

Proof: The first order conditions for the optimization problem choose x so as to

$$max\ u^*\ (X;\beta)$$

subject to

$$P'X \leq\ W$$

yield $X^*(\ .\ )$, and in turn $V^* = u^*[X^*(\ .\ );\beta]$. The decomposition equation is obtained by solving the FONC for p_i. The second part of the proposition indicates that the portfolio choice functions are invariant to the manner in which the decision problem is viewed provided that the problem is well behaved. The next proposition characterize the dual to this primal utility maximization.

Proposition 4 : Suppose the assumptions on $u^*(.)$ are satisfied. Then there exists a set of asset demand functions $X^*(P; \beta, \bar{u})$ and an expenditure function $E^*(P; \beta, \bar{u})$ such that $\partial E^*(.) / \partial p_i = X^*(.)$ and $\partial E^*(.) / \partial \beta_k = \theta_k^*(.)$.

Proof: The first order conditions for the optimization problem choose x so as to

$$min \; P'X$$

subject to

$$u^*(X, \beta) \geq \bar{u}$$

yield $X^*(.)$. The expenditure function is defined as $E^*(.) = P'X^*(.)$. The derivative conditions are a consequence of the envelope theorem and $\theta_k^*(.)$ is the value of the marginal change in quality of asset k. The expenditure and the indirect utility functions provide a tool for assessing the welfare impact of change in prices and more importantly the qualitative attributes of assets.

It is possible to show that the properties of the indirect utility function and the expenditure functions are identical to those in standard demand theory. For example, one can show $E^*(.)$ is homogeneous, concave and monotonically increasing in P, increasing in u, and continuously differentiable in (P, β, u). The properties follow directly from those of $X^*(.)$.

This completes our brief overview of the general attribute model. As noted, the structure of the model is similar to that of neoclassical demand theory with the exception that our model explicitly accounts for quality. To obtain conclusions regarding the impact of quality on asset demand under any of the earlier representations one must place further structure on the utility function and/or the attribute production technology.

We undertake this task in chapter 5, where we utilize the results of proposition 1 to derive a price decomposition equation that allows us to estimate the shadow price of a number of attributes. Before turning to this task, however, we first discuss the implication of uncertainty regarding the attributes in the following sections and then demonstrate the generality of this model in chapter 4.

3 Risk Analysis in the Attribute Model

In the proceeding analysis we had explicitly assumed that all relevant variables, particularly asset quality parameters and prices, are known with certainty. This may be too strong to assume given the uncertainties associated with portfolio choice decisions. The assumption, however, was invoked so as to facilitate a simple exposition of the dual structure of the portfolio choice model, which basically remains unchanged when risk is integrated into the analysis.

In this chapter we analyze the influence of uncertainty on investor's decisions. This analysis is important because it provides valuable insights into the portfolio choice problem in the presence of a number of random variables, i.e., multivariate risk. This is fundamentally different than the univariate uncertainty associated with wealth alone. Moreover, this analysis makes it possible to consider the welfare implications of factors which may reduce the degree of uncertainty associated with qualitative attributes of assets.

A number of regulatory policies under consideration by the Securities Exchange Commission (SEC), and other governmental and private agencies, e.g., public release of a firm's financial information and the imposition of uniform accounting practices, will have a direct impact on the degree of investor uncertainty.

As was suggested in section 2.1, a natural way of integrating risk into the present model is to introduce uncertainty through randomness in the vector β, which contains asset quality parameter and asset prices. To highlight the key features of the portfolio choice problem in the presence of multivariate uncertainty a simplified version of the general model discussed above is utilized. The results discussed below, however, can easily be extended to the more general framework above.

Consider the following characterization of an investor's behavior in a single period setting. Utility is derived from current consumption of a single consumption good C_0, the end of period wealth W_1, and the characteristics of the portfolios held. [24] Financial assets enable the investor to transfer consumption goods across time and reduce fluctuation in intertemporal utility. Assume that security prices are deflated by the price of the single consumption good, i.e., the consumption good price is the numeraire.

The ability to smooth consumption and therefore reduce fluctuations in utility is dependent upon wealth in each period. Initial wealth W_0, is predetermined and exogenous to the model. Terminal wealth W_1, however, is dependent upon the end of period price of the individual's portfolio, and this, in turn, is influenced by the various attributes of the assets held.

The relationship between the terminal value of a portfolio and its characteristics may be seen as a consequence of the general attribute model, which indicated that asset prices at any point in time will be dependent upon their attributes. This is true for the end of period asset price vector P_1 which will depend upon the

[24] The terminal wealth may be consumed in its entirety at that time or at the end of period the investor could solve a one period problem again.

realization of the attribute vector β.

Ex ante, however, uncertainty about β translates into uncertainty about P_1 and in turn W_1. The fact that portfolio attributes provide the means for anticipating future wealth provides the rationale for their direct introduction into the investor's utility function.

There are other reasons for including asset attributes in the utility function as well. Prominent among these is the observed phenomenon that investors hold certain class of assets for reason that are independent of their potential returns. Some examples of this type of behavior includes the so called environmental funds which are composed of equity of firms that purport to be engaged in production activities that does not harm the environment. A second examples, and one which dates further in time, is holding gold as a hedge for inflation. There are many other examples of this type.

These provide further justification for why the utility an individual receives may be directly and indirectly dependent upon the various attributes provided by their portfolio. This type of assumption has been implicit in previous work dating to the liquidity preference model of Tobin [110] and more recently in Belongia and Chalfant [11]. [25]

[25] Economic models of investor behavior are surveyed in chapter 4

3.1 Uncertainty in a Single Period Setting

In this section the analytical structure of the single period attribute model in the presence of risk is laid out. The investor's preferences are represented by a Von Neumann- Morgenstern utility function defined over current consumption C_0, terminal wealth W_1, and the vector of portfolio attributes Z. The utility function, $u(C_0, W_1, Z)$, is assumed to be continuous, non-decreasing, and quasi-concave in its arguments. The investor begins the period with a non-random initial wealth W_0 and faces a budget constraint that equates the sum of current consumption and investment to initial wealth.

Borrowing and lending, short selling of assets, and transaction costs will influence the wealth constraints. Commissions and transaction costs vary with the size of purchase and will therefore add nonlinearities to the budget constraint. Similarly, differences in borrowing and lending rates adds discontinuities to the terminal wealth constraint. To maintain the focus on the analysis of risk behavior these complications are not added to the model at this point. Because of time and space limitations these refinements, though interesting, are postponed to future research.

In addition to their wealth constraints, investors also face m separable asset-attribute transformation functions Z_m whose parameters β_m are uncertain from the investor's perspective. The general characteristics of the attribute production technology, namely that these functions are well behaved and continuous, was discussed in section 2.1. The formal statement of investors problem is; Choose current consumption C_0 and a portfolio X (a vector with elements x_i being the quantity of asset i held) so as to:

$$Max\ \{Eu(Z)\ =\ Eu(\ C_0, W_1, Z_1, ..., Z_{r^*}, Z_1^u, ..., Z_n^u\ )\} \qquad (3.1.1)$$

subject to

$$C_0 = W_0 - P_0 X$$

$$W_1 = \tilde{P}_1 X$$

$$Z_k\ = G_k(X; \tilde{b}_k), \quad \forall k = 1, ..., r^*$$

$$Z_i^u\ =\ G_i^u(x_i; \tilde{b}_i^u), \quad \forall i = 1, ..., n$$

where the initial wealth (W_0), current asset prices (P_0), and the utility function $u(.)$ and the transformation functions $G(.)$ are known and non-random. The randomness in the investment problem is associated with attributes common to all assets $\tilde{b}_k$, and those unique to each asset $\tilde{b}_i^u$. The expectation operator E is taken with respect to the joint distribution function of all random variables, which are denoted by $\sim$ over them.

For the sake of notational parsimony, let the vector $\tilde{\beta}$ be $(\tilde{P}_1, \tilde{b}_k, \tilde{b}_i^u)$ and denote the subjective joint probability distribution function of element of $\tilde{\beta}$ by $F(\tilde{\beta}; \Gamma)$, where Γ is the parameters of this distribution. We assume that the ex ante beliefs of the individual may be characterized by the distribution function $F(.)$.

Upon substituting the constraints into the utility function (proposition 2 sections 2.2) the investment problem in 3.1.1 may be restated as; Given current asset prices and initial wealth choose the portfolio X so as to:

$$Max \; \{Eu(X;\tilde{\beta}) = \int u(X;\tilde{\beta})dF(\tilde{\beta};\Gamma)\} \qquad (3.1.2)$$

This representation is useful for the discussion of multivariate uncertainty which follows and demonstrates the earlier claim that in general risk may be associated with the quality vector $\tilde{\beta}$. Note that initial consumption, which is the residual of wealth after the investment decision, does not appear in the utility function.

The substitution for C_0 is undertaken so as to place the emphasis of discussion on the portfolio choice decisions. The following two remarks help explore the duality structure of the attribute model under risk. A brief discussion of welfare analysis of reducing attribute uncertainty follows. Characterizing individual's attitude toward risk and issues related to stochastic dominance are discussed in section 3.3.

Remark 1 : The dual structure of the attribute model is not effected by the introduction of uncertainty through the joint probability distribution function $F(\tilde{\beta};\Gamma)$. In particular, the Γ parameters, which characterize the joint distribution of attributes, will become arguments to the functions describing the optimal consumption and investment decisions.

An example will further clarify this point. Consider a one period consumption-saving problem under certainty. Suppose the only attribute that affects investors' utility is the rate of return on this riskless investment (risk free rate is the same for all investments in this economy). The demand for this risk free investment will clearly depend upon the rate of return. With the introduction of uncertainty, say by assuming that rates of return are jointly normally distributed, asset demand will now depend upon the mean , variance, and covariance of returns (Γ).

Remark 2 : The price decomposition equation 2.3.1 will also become a function of Γ. This suggests that in a risky environment asset prices will be reflective of the uncertainty associated with their attributes. I will show in chapter 4 that this is how asset prices are determined in the existing equilibrium asset pricing models in the finance literature (e.g., the mean-variance model).

A more important point in terms of this analysis is the representation of the indirect utility function associated with the attribute model under uncertainty. Consider the investment problem in 3.1.1 (or 3.1.2), for which the optimal consumption and portfolio choice can be characterized by $C_0 = C_0(P_0, W_0; \Gamma)$ and $X = X(P_0, W_0; \Gamma)$.

Substituting these back into the utility function, the indirect utility function $\hat{V}(P_0, W_0; \Gamma)$ is obtained. This is a useful function for constructing monetary measures of the welfare effects of actions that may reduce uncertainty regarding the future asset prices $\tilde{P}_1$ or quality parameters $\tilde{b}_k$ or $\tilde{b}_i^u$.

Improved information and reduction in uncertainty can result when regulatory policies enacted by such agencies as the SEC forces timely and accurate release of financial information that influences asset prices. Alternatively, risk reduction activities such as independent research and monitoring can be undertaken by investors at a cost. In either case the reduction in risk may be represented by changes in Γ and its monetary value may be measured by the change in the expected indirect utility.

Formally, the ***compensating variation*** (CV) measure of a change from Γ to Γ^1, i.e., a change in the joint distribution of $\tilde{\beta}$, may be defined by:.

$$\int \hat{V}(P_0, W_0 \,;\, \Gamma)\, dF(\tilde{\beta} \,;\, \Gamma) = \int \hat{V}(P_0, W_0 - CV \,;\, \Gamma^1)\, dF(\tilde{\beta} \,;\, \Gamma^1)$$

In practice, CV may be approximated by specifying an appropriate functional form for $\hat{V}(.)$ and $F(.)$ and calculating CV for changes in Γ. This is a difficult but clearly interesting task, the implementation of which is beyond the scope of this thesis. In the remainder of this chapter, however, we focus on interpersonal comparisons of risk preferences instead

3.2 Characterizing Risk Preferences

Much of the analysis of decision making under risk is based on the expected utility (EU) theory, which in some form dates back to the last century [100, 73]. The assumptions of EU model have been the subject of much debate and refinement since the work of von Neumann and Morgenstern was first published in 1947 [112].

Within the confines of the expected utility theory a number of analytical tools have been developed that help characterize individual behavior in the presence of risk. These include measure of risk aversion based on individual's utility function, measure based on the parameters of distribution of random variables such as the mean and variance, and finally measures independent of the specific parameterization of utility or distribution functions such as stochastic dominance criteria [8, 33, 34].

Recently, the EU hypothesis has been empirically tested in numerous studies. Based on frequent empirical rejection of the theory a large body of economic literature has been critical of EU model. Machina [73] provides a recent comprehensive survey of this literature. Because of the unsatisfactory nature of the suggested alternatives, the consensus among practitioners still appears to favor the EU model. For the analysis undertaken here the EU model remains to be a useful tool.

In the majority of analysis using the EU model, risky outcomes are associated with a single random variable, often individual's wealth. Accordingly, the analytical tools developed have been appropriate for this univariate risk. Multivariate risk, which is a main feature of the attribute model, has received much less attention until recently. However, most analytical tools of the univariate analysis have been generalized to multivariate case. Hence the contribution of this thesis will not be in developing new analytical tools but rather in surveying and applying the existing tools to problem presented in the attribute model.

The multivariate risk associated with the attribute model can be best analyzed by considering the utility function in 3.1.1;

$$u(C_0, W_1, Z_1, ..., Z_{r^*}, Z_1^u, ..., Z_n^u)$$

Because of the risk associated with the asset characteristics and the terminal asset prices, both the terminal wealth and the portfolio attributes (the Z's) appearing in the utility function are random.

The interdependence between asset prices and the terminal wealth on one hand and the asset characteristic and portfolio attributes on the other, implies that the random arguments in $u(.)$ are jointly distributed. This representation of the utility function captures the trade off between current and future consumption through the attributes of the selected portfolios. That is, higher quality assets may be more costly now but they offer the possibility for greater future appreciation.

The required axioms for the existence of a utility function representing univariate risk, e.g., reflexivity, transitivity, etc., may be generalized to n dimensions. Fishburn [30] has shown that the multidimensional versions of these axioms provide the necessary and sufficient conditions for the existence of a well behaved multivariate utility function. In the construction of the attribute model in section 2.2, it was assumed that individual's preferences satisfy these axioms.

Extending the concepts of risk aversion and stochastic dominance to the multiattribute utility functions has been undertaken in a number of studies. Before proceeding with a discussion of their findings, however, we note that the arguments appearing in the utility function and the reasons for their randomness has varied widely. In the early literature on multivariate risk, e.g., Fishburn [29], Pollak [85], Stiglitz [107], Keeney [47, 48, 49, 50], Kihlstrom and Mirman [53], Levy [66], Duncan [23], Karni [46], and others, utility functions are defined over a vector of commodities consumed. Randomness in consumption of these commodities may be due to errors in optimization or other reasons such as pure noise.

More recently, Epstein [24], Finkelshtain and Chalfant [27, 28], Boyle [14], and other researchers have considered the uncertainty due to randomness of arguments in the indirect utility function, e.g., prices (consumption goods or produced goods) and wealth. Finally, in the finance literature, multivariate risk has been associated with rate of returns (often assumed to be jointly normally distributed), e.g., Cass and Stiglitz [20], Li and Ziemba [69], Rubinstein [94] ; randomness of wealth at different points in time as in Ross [91] ; or the randomness of consumption prices as in Finkelshtain and Chalfant [28].

Efforts in characterizing behavior in the presence of multivariate risk has been directed at generalizing the results obtained in the univariate case. The structure of the utility function, e.g., additive, and the joint distribution of the attributes, e.g., normal, have played an important role in the development of this theory.

Generally, simple analogs of the results similar to those in the univariate case have not been available without strong restrictions on preferences and / or the joint distributions of the random variables. No empirical tests of the validity of such restrictions or the consequences of their violation is offered in this literature. An important example of this type of convenient, but unrealistic, assumption is the time additive utility of consumption representation which is widely used in the analysis of intertemporal consumption-investment model in the literature. This assumption has been criticized as a possible reason for some of the capital market anomalies identified in the empirical finance literature (see Browning [18])

3.3 Measuring Risk Aversion

Arrow [3] and Pratt [86] developed the theoretical foundations for the measurement of risk preferences in the presence of univariate risk. The absolute and the relative risk-aversion functions were developed based on the notion that risk averse agents would be willing to pay a premium so as to avoid uncertainty. The size of this premium and hence the degree of individual's aversion to risk is measured by the absolute risk aversion function.

Risk aversion measures and the concept of risk premium have been generalized to the multivariate case. These generalizations have mostly preserved the definitions and the approach pioneered by Arrow and Pratt. Early work in this area includes Richard [89], Duncan [23], and Karni [46]. In two recent studies, Finkelshtain and Chalfant [27, 28] (hereafter referred to as FC) have synthesized this literature and have defined multivariate measures of risk premia and risk aversion. They also have established the necessary and sufficient conditions under which univariate and multivariate measures of risk aversion coincide.

In this section we utilize the concepts suggested in the CF studies to define measures of risk premium and risk aversion that are suitable for the single period attribute model. While our approach is identical to that of CF, important differences arise and these will be drawn out in the remainder of this chapter.

Consider the utility function in the single period attribute model

$$u(C, W, Z_1, ..., Z_{r^*}, Z_1^u, ..., Z_n^u) = u(C, W, Z_r)$$

where the subscripts on C and W have been dropped. For any given consumption and portfolio choice define the risk premium Π as the maximum monetary value an individual is willing to pay so as to stabilize the end of period wealth while the portfolio attributes remain random. [26] Based on this definition the value of Π may be obtained from the following relationship :

$$Eu(C, W, Z_r) = Eu(C - \Pi, \bar{W}, Z_r) \qquad (3.3.1)$$

This definition is indicative of the fact that in the single period setting once a portfolio has been selected, investors must give up current consumption so as to pay the risk premium required to stabilize terminal wealth at its expected value $\bar{W}$. In the FC studies the premium effects wealth rather than consumption. This is the fundamental difference between the two models. Following FC, the Taylor approximation of 3.3.1 around the mean of the random variables W and Z_r, and the current consumption for a given portfolio choice $\bar{X}$ may be solved for Π ;

$$\Pi = -0.5\sigma_W^2 \frac{u_{WW}}{u_C} - \sum \sigma_{WZ_i} \frac{u_{WZ_i}}{u_C} \qquad (3.3.2)$$

where σ_W^2 is the variance of terminal wealth, σ_{WZ_i} is the covariance of wealth with the $i-th$ portfolio attributes, and u_j is the derivative

[26]Recall that the price of the consumption good is the numeraire and therefore Π is measured relative to this deflator.

with respect to the $j-th$ argument of utility function. [27]

As is apparent, the size of this risk premium is critically dependent upon the curvature of the utility function and the size of the variance and covariance terms. There are two special cases which help determine the sign of Π. First, if individual's utility function is additive in its argument (i.e., $u_{WZ_i} = 0$), and second when portfolio attributes are non-random (i.e.$\sigma_{WZ_i} = 0$). In both cases the second term in 3.3.2 will vanish and the premium will be positive and a function of the Arrow-Pratt measure alone. When the second term in 3.3.2 is non-zero, however, the risk premium measure will be much different in size and possibly sign than its univariate counter part.

Suppose the investors utility function has the following properties: $u_W > 0$, $u_{WW} < 0$, $u_C > 0$, $u_{CC} < 0$, and $u_{WZ_i} < 0$. It follows then that for a given utility function and σ^2_W, the risk premium will decrease if the covariances of wealth and portfolio attributes are negative. This suggest that risk averse investors may prefer portfolios with a larger number of attributes that are negatively correlated with wealth. Note that the covariance structure of the attributes does not affect the size of Π.

Based on the above definition of risk premium, FC define a risk aversion matrix whose elements are the utility curvature terms. They show that if this matrix is positive semi-definite then $\Pi \geq 0$. However, this would imply the utility function is additively separable

[27] As in CF and other studies, terms with Π^2 have been dropped. Hence the measure in 3.3.2 is only an approximation to true Π.

in its arguments, which is indeed a very strong restriction, and as argued earlier, should be tested empirically. [28] The CF studies also explore interpersonal comparison of multivariate risk and the conditions under which two individuals would invest in the same portfolio. We refer the interested reader to their study and briefly discuss the multivariate stochastic dominance measures instead.

[28] Keeney and Raiffa [51] provide a good discussion of other objectives raised against the additive utility functions.

3.4 Stochastic Dominance Measures

Stochastic Dominance (SD) criteria have been an important tool for ordering risky alternative under univariate risk; see [92, 93], [33] and [34]. There are two methods of ordering random outcomes by the SD criteria. One places some minimum restriction on the utility function and rank alternatives for a wide class of distributions, e.g., the first and second-degree dominance (FSD, SSD) [8]. The other ranks alternatives for different specification of the utility function.

In manners reminiscent of the univariate risk, the SD criteria has been extended to the multivariate case by Huang et al [39, 40], Levhari et al [65], Levy and Paroush [68, 67], Russel and Seo [98], and others. These researchers have attempted to place few restrictions on the utility function or the distribution of random variables. We conclude this chapter by describing some of these criteria in the context of the attribute model.

The first multivariate dominance criteria (MDC) we consider is due to Levy [66]. According to his criteria, among the (joint) distributions for attributes and wealth, those with higher probability of wealth for the same level of other attributes will be preferred by risk averse agents. This is a FSD ordering and it requires positive marginal utility of wealth and portfolio attributes. Note that this criteria requires knowledge of the conditional distribution of wealth, which in empirical work may be difficult to estimate.

Huang et al [40] show that if the utility function is additive in its arguments, then both the FSD and the SSD criteria would involve the comparison of the marginal density function of each attribute and wealth. This implies that attribute by attribute dominance is necessary and sufficient for overall FSD or SSD.

In a related paper, Huang et al [39] have shown that identical results can be derived for the case of non-additive utility functions provided that the random variables are statistically independent. Again dominance for each variable in necessary and sufficient for the overall dominance. Needless to say both these assumptions may be suspect in many real world situations.

An important alternative to additivity and statistical independence may be to create a summary measure of all portfolio attributes which could reduce the number of arguments in the utility function to a more manageable size. Also, if terminal wealth could be expressed as a function of all attributes, univariate analysis may be used to rank different alternatives. However, since unique attributes of assets are likely to enter the utility function, these later alternatives should be used carefully.

In the empirical portion of this dissertation, asset prices and their attributes are related in an ex post sense. There it is assumed that the attributes are known with certainty. Before describing the results of the empirical section, however, we discuss the generality of the attribute model in the next chapter.

4 The GAPM as A Unifying Framework

To demonstrate the generality of the attribute model, this chapter shows that several prominent portfolio choice models in finance are subsumed in the present framework. This implies that once the appropriate restrictions are imposed upon the attribute model, the conclusions emerging from it may be consistent with those from other existing models in finance.

The attribute model could shed light on aspects of portfolio choice decisions which are unexplained by the standard models. This is because of the possibility to test alternative asset pricing models as its special case. The attribute framework therefore offers a richer means of obtaining testable hypothesis regarding individual behavior.

4.1 The State-Preference Model

In the state-preference model of Arrow [2], the state of nature, $s \in S$, determines the payoffs to an individual's portfolio decisions $w_s = w(s, x)$, where w_s is the wealth in state s when the individual holds portfolio x. [29] Preferences are formed over these contingent payoffs: $u(Z) = u(w_s) = \sum_{s=1}^{S} f_s u(w_s)$, where the f_s are non-negative numbers.[30]

Utility is maximized via the portfolio choice x and subject

[29] Different versions of this model have been extensively discussed in the seminal works of Rubinstein[96].

[30] For exposition purposes, the utility function was represented in additive form. This representation insures that the state preference model is consistent with the expected utility model: i.e. f_s may be chosen to sum to unity (probabilities) and the u(.)'s are simply subutility functions. This is not necessary for our analysis.

to a budget constraint $W = p'x$ where W is initial wealth and p is the vector of 'spot' asset prices. The individual's wealth in each state is $w_s = p'_s x$, where p_s is the vector of state contingent prices (p_{is} is the typical element). In a manner similar to the developments in section 2.3 (proposition 1), the first-order condition for an optimum portfolio decision may be written as:

$$p_i = \sum_{s=1}^{S} \left(\frac{f_s}{\theta} \frac{\partial u}{\partial w_s} \right) p_{is} = \sum_{s=1}^{S} \theta_s p_{is} \quad \forall\, i = 1, \ldots, N \qquad (4.1)$$

Here θ_s is the Arrow-Debreu price of the payoff in state s. The similarities of the state preference model and the attribute model are readily observable: The payoffs in different states $w(s, x)$ are equivalent to the attributes Z and the Arrow-Debreu prices are the shadow price of these attributes. Note that since the states are uncertain, the payoffs, which are the arguments in the utility function, will be random variables.

4.2 The Parameter Preference Model

The parameter preference model (PPM) was originally formulated as a two-parameter model by Markowitz [74]. A generalized version of the two-parameter model was developed by Rubinstein [95] and others.

The PPM greatly simplified the problem of uncertainty, by assuming that individuals form preferences over a small number of parameters relating to the distribution of asset prices. To see this, consider a two-parameter version of the PPM (the mean-variance preference model) in which utility is dependent on two parameters of the wealth distribution, $F(w)$- the mean, defined as $m(F) = \int_{\delta}^{\gamma} w \, dF(w)$, and other moment measuring the degree of risk, defined as $v(F) = \int_{\delta}^{\gamma} |w - \mu|^{\alpha} dF(w)$.

The parameters μ (a reference level of expected wealth), γ and δ (the range of wealth), and α (a scaling parameter) determine which class of the PPM models is obtained. For example, to obtain the mean-variance model of Markowitz, we set $-\delta = \gamma = \infty$, $\mu = m(F)$ and $\alpha = 2$. Now the utility function defined on wealth takes the form $u(Z) = u(m, v)$ and again the first-order conditions for a maximum may be solved for prices as:[31]

[31] In this model an aversion to risk is equivalent to an aversion to variance. When the utility function is quadratic or the distribution of asset prices is multivariate normal, the mean-variance model is consistent with the expected utility model.

$$p_i = \left(\frac{1}{\theta}\frac{\partial u}{\partial m}\right)\frac{\partial m}{\partial x_i} + \left(\frac{1}{\theta}\frac{\partial u}{\partial v}\right)\frac{\partial v}{\partial x_i} = \theta_m \mu_i + \theta_v \sum_j^N \sigma_{ij} x_j \quad (4.2)$$

where μ_i is the expected price of the i-th asset, σ_{ij} is the covariance between the i-th and j-th asset prices, θ_m and θ_v are the shadow prices of the portfolio mean and variance, and θ is the marginal utility of wealth. Other versions of the PPM are obtained by setting alternative restrictions on δ, γ, μ and α.

The parallels to the attribute model may be drawn as follows: the pricing relationship in 4.2 is linear in the attributes (mean, standard deviation, and covariances) and θ_m and θ_v are the shadow cost of a marginal change in these attributes.

4.3 The Capital Asset Pricing Model

The capital asset pricing model of Sharpe [103] and Lintner is the market equilibrium version of PPM of Markowitz. There are numerous versions of the CAPM in use. We will examine the original version, which assumes homogeneous beliefs regarding the distribution of returns. As noted earlier, this corresponds to a common attribute technology in our terminology.

In the original CAPM, investor preferences are defined over the expected return and variance of wealth, and individuals have homogeneous expectations. The latter assumptions permit the aggregation of asset demand functions across individuals. Upon the imposition of the market clearing conditions (and other restrictions), the resulting mean-variance efficient model takes the form (see Fama [25], pp. 305-313)):

$$p_i = \theta_1 \mu_i + \theta_2 \beta_{iM} \tag{4.3}$$

where $\theta_1 = [1+r_f]^{-1}$, $\theta_2 = -\theta_1 [\mu_M - (1+r_f)p_M]$, $\beta_{iM} = \sigma_{iM}/\sigma_M^2$, r_f is the risk-free rate of interest, and p_M and μ_M are the current and the expected (end of period) values of the market portfolio.

The interpretation of (4.3) is that, in an efficient market the price of each asset embodies two components: an expected end of period market value, μ_i, and the risk factor, β_{iM}. The unit price of these factor are θ_i's, respectively.

The standard CAPM has been improved in a number of ways. Fama (pp. 314-319) relaxes the homogeneous expectations assumption. He shows that, in the case of heterogeneous expectations, the equation corresponding to (4.3) will be:

$$p_i = \theta_1 \mu_i' + \theta_2' \beta_{iM}' \qquad (4.4)$$

where

$$\theta_1 = [1 + r_f]^{-1} \quad , \quad \theta_2' = -\theta_1[\mu_M' \, (1 + r_f) \, p_M],$$

$$\mu_i' = \frac{\sum_h^H \alpha^h \mu_i^h}{\sum_h^H \alpha^h}, \qquad \beta_{iM}' = \frac{\sum_h^H \sigma_{iw}^h}{\sum_h^H \sigma_{Mw}^h},$$

$$\alpha^h = \frac{\partial v^h}{\partial m^h}, \text{ and } \sigma_{iw}^h = \sum_j^N \sigma_{ij}^h x_j^h$$

The superscript h continues to refer to an individual among H investors. Equation (4.4) has the same form as the CAPM and the attribute model and similar interpretations may be attached to μ_i', θ_2' and β_{iM}'. However, in general μ_i' , θ_2' and β_{iM}' cannot be inferred from observed data, since they depend on individual assessments (beliefs).

The recognition that investors may be concerned with other variables in addition to the mean and variance has led to the development of the K-parameter versions of CAPM (with or without the homogeneous beliefs assumption). In general, with K parameters, the efficient frontier will be in a K-dimensional space and in an efficient market, all assets will be represented by points on this surface.

A particularly interesting version of the K-factor model is due to Rubinstein [95], who defines preferences over the n moments of wealth distribution. The first order necessary conditions, which have been aggregated over investors, include shadow prices with respect to the n moments of the wealth distribution and are analogous to the attribute model.

Others have considered factors other than those characterizing the returns distribution. Sharpe [102] considers liquidity, defined as the differential in the cost of buying and selling assets, or their bid-ask spread, as an important parameter effecting portfolio decisions. Denoting this factor by l_i, he derives the equilibrium condition for this version of CAPM as:

$$p_i = \theta_1\mu_1 + \theta_2\beta_{iM} + \theta_3 l_i \tag{4.5}$$

Equation (4.5) defines the security market 'plane' in an efficient market. Given β_{iM}, the greater the bid-ask spread, the lower the expected price, and given μ_1, the greater $\beta_i M$, the greater the liquidity.

An example of other factors that influence preferences are taxes. Brennan [16], Litzenberger and Ramaswamy [70, 71], and others have integrated tax considerations into the CAPM. The motivation for these models is the observation that, because of differential taxes, individuals may prefer capital gains to dividends.

Brennan proposed a version of the CAPM that accounts for the taxation of dividends with constant individual tax rates. Litzenberger and Ramaswamy [71] extended this model to account for progressive taxation. These refinements bring other factors to bear on asset prices and further demonstrate the generality of the attribute model.

4.4 The Intertemporal Capital Asset Pricing Model

Merton [78] extended the simple CAPM to an intertemporal setting in which the investment opportunities set evolves stochastically. Building on Merton's model, Breeden [15] allowed the consumption opportunities as well as investment opportunities to be stochastic. Below we briefly demonstrate the consistency of the attribute framework with these intertemporal models

In Merton's model the stochastic relation between the state variables is determined by a multidimensional Ito process. The state variables considered include the current level of wealth $w(t)$ and a vector of state variables, $S(t)$, which characterizes the changing investment opportunities. The vector $S(t)$ contains the current and expected asset prices, as well as their standard deviations.

Let $J(w(t), S(t), t)$ be the indirect utility function of wealth resulting from following an optimal consumption-investment strategy, $\forall\ t \in [t, T]$. Using Bellman's principle of optimality, Merton shows that at each point in time, $J(.)$ satisfies the following second-order partial differential system:

$$Max\ [u(c,t)\ +\ J_w\, m\ +\ J_t\ +\ \sum_{k}^{K-2} J_k\, n_k$$

$$+\ \frac{1}{2} J_{ww}\, v\ +\ \sum_{k}^{K-2} \sum_{i}^{N} J_{kw}\, \eta_{ik} x_i + \frac{1}{2} \sum_{k}^{K-2} \sum_{l}^{K-2} J_{kl}\, s_{kl}]\ =\ 0 \quad (4.6)$$

where

$$m = \sum_{i}^{N} (\mu_i - (1+r_f)p_i)x_i + (r_f w - c)$$

is the expected value of the portfolio,

$$v = \sum_{i}^{N} \sum_{j}^{N} \sigma_{ij} x_i x_j$$

is the portfolio variance, σ_{ij} is the covariance between the i^{th} and the j^{th} asset prices, n_k is the expected value of the k^{th} element of the state vector S(t), s_{kl} is the covariance between the k^{th} and l^{th} elements of S(t) and η_{ik} is the covariance between the i^{th} price and k^{th} element of S(t). The first-order conditions derived from (4.6) are:

$$u_c = J_w \tag{4.7}$$

$$J_w[\mu_i - (1+r_f)\, p_i] + J_{ww} \sum_{j}^{N} \sigma_{ij} x_j + \sum_{k}^{K-2} J_{kw} \eta_{ik} = 0 \ \forall\, i \tag{4.8}$$

Equation (4.7) implies that the optimal consumption is determined by equating the marginal utility of current consumption and wealth (this is an intertemporal envelope condition). Inverting (4.8) the asset demand functions are obtained;

$$x_i = -\,(J_w/J_{ww}) \sum_{j}^{N} {\sigma_{ij}}^{-1}(\mu_i - (1+r_f)\, p_i)$$

$$- \sum_{k}^{K-2} (J_{kw}/J_{ww}) \sum_{j}^{N} {\sigma_{ij}}^{-1}\, \eta_{jk} \tag{4.9}$$

Merton's model shows that in an intertemporal setting there will be two components to the demand for assets; First the conventional demand, as in the single-period mean-variance model, and second a hedge against the adverse effects of the state variables, which act through their covariance with prices.

Note that (4.9) can be solved for p_i as a function of variance-covariance terms, r_f and other variables to obtain the relation between asset prices and the attributes:

$$p_i = \theta_1 \mu_i + \sum_j^N \theta_j \sigma_{ij} + \sum_k^{K-2} \theta_k \eta_{jk} \tag{4.9'}$$

where $\theta_1 = [1 + r_f]^{-1}$, $\theta_j = [\theta_1 J_{ww} J_w^{-1}] x_j$, and $\theta_k = [\theta_1 J_{kw} J_w^{-1}]$. Again it is simple to determine the attributes which would give rise to a pricing relationship similar to the intertemporal CAPM.

Similar results can be established using Breeden's [15] model, in which consumption opportunities are also stochastic.[32] Breeden points out that in practice it may be difficult to identify the relevant (K-2) state variables. He shows that the multi-beta model is equivalent to a single-beta model in which aggregate consumption is the only state variable. He argues that correlation between asset prices and aggregate consumption is a more appropriate measure of risk than the correlation between asset prices and aggregate wealth.

When consumption opportunities are stochastic, consump-

[32] The discussion here generalises to Breeden's (1984) many consumption goods model as well.

tion has the form $c = c(w(t), S(t), t)$. From the first order conditions above we have $J_{ww} = u_{cc}\ c_w$ and $J_{wk} = u_{cc}\ c_k$. Substituting these into (4.8) and rearranging we obtain:

$$T_c[\mu_i \ - \ (1 \ + \ r_f)\ P_i] = \ \sigma_{iw}\ c_w \ - \ \sum_{k}^{K} \eta_{ik}\ c_k \qquad (4.10)$$

where $T_c \ = \ -u_c/u_{cc}$ is the individual's absolute risk tolerance defined on consumption. From c(w,x,t) we also have; $dc \ = \ c_w dw \ + \sum_k^K \ c_k dS_k$, which shows that changes in consumption are linearly related to changes in wealth and the state variables. Multiplying this expression by p_i and taking expectations gives:

$$\sigma_{ic} \ = \ \sigma_{iw} c_w \ + \ \sum_{k}^{K} \ \eta_{ik} c_k \qquad (4.11)$$

This allows us to substitute for σ_{ic} in (4.9). With this substitution we see that optimal portfolio choice requires that the covariance of each asset price with optimal consumption is proportional to that asset's expected excess return. The price relation obtained from the counter part of (4.9) for the the intertemporal Consumption CAPM is:

$$p_i \ = \ \theta_1 \mu_i \ + \ \theta_2 \beta_{ic} \qquad (4.12)$$

where

$$\theta_1 = [1 + r_f]^{-1},$$

$$\theta_2 = -\theta_1 \, [\mu_M - (1 + r_f) p_M)] / \beta_{Mc},$$

$\beta_{ic} = \sigma_{ic}/\sigma_c^2$, and $\beta_{Mc} = \sigma_{Mc}/\sigma_c^2$ are the asset and consumption betas.

Breeden argues that in equilibrium, the risk associated with an asset may be represented by a single aggregate consumption beta. This is an important simplification relative to the multi-beta relation.[33] The equilibrium pricing relation in (4.12) is clearly an attribute pricing model, in which two principal characteristics, μ_i and β_{ic} determine the returns on asset i.

[33] Cornell (1979) criticised Breeden's model. I should cite this here though his criticism has no relevance for our purposes.

4.5 The Accounting Valuation Models

The valuation models originating in the accounting literature associate asset prices (firm value) with the information contained in financial statements. Accounting models, similar to arbitrage pricing models, are not based on models of investor preferences. Asset prices are assumed to depend upon discounted future earnings of the asset. It follows from this causal relation that asset prices are related to factors which influence expected earnings.

Based on this reasoning, most accounting models simply assume that asset prices are functions of information variables. A variety of models based on this premise have appeared in this literature. Some important work includes Miller and Modigliani [79], Beaver, Lambert, and Morse [9], and Ohlson [82, 83].

In the highly celebrated 'clean surplus' model of Ohlson [82], the market value of firms' common stocks at any point in time, p_t is assumed to be a linear function of earnings realized during the past period e_t, the book value y_t, dividends per share d_t, and a vector of 'other' value relevant information, v_t:

$$p_t = \theta_1 e_t + \theta_2 y_t + \theta_3 d_t + \theta_4 v_t \qquad (4.13)$$

The Miller-Modigliani [79] dividend irrelevancy theorem states that changes in the book value of a firm are off set by its dividend payments. Since asset prices will be reflective of book values, dividend policy should not effect prices. The ***Clean Surplus Equation***, $y_t = y_{t-1} + e_t - d_t$ is a consequence of this theorem and may be substituted in (4.13). This substitution permits one to eliminate dividends and focus solely on accounting earnings, book value, and other variables as determinants of prices.

Future values of these variable are assumed to be generated by a 'linear information dynamics' (a Markovian stochastic process). This enables the researcher to obtain an estimate of the expected value of explanatory variables. Assuming risk neutral agents, the expected price of the asset will be determined by the expected values of these variables and the θ's. Amir [1] provides an empirical examination of this model.

The attribute model provides an important justification for relating asset prices to value-relevant signals. However, the model also suggests that the relation between prices and the value-relevant variables will *not* necessarily be linear (see Das and Lev [21]). In the next chapter we discuss the empirical examination of the attribute model.

5 An Empirical Evaluation

To facilitate a preliminary empirical test of the attribute model we invoke a number of simplifying assumptions:

I. Each asset or group of assets such as common stocks, has only one unique attribute. Now any asset may be characterized by $r^* + 1$ attributes. The dimension of β will be $s = n \times (r^* + 1)$. A portfolio of assets, or the market portfolio, will be characterized by $Z \in R^m$ attributes, where $r^* + 1 \leq m \leq r^* + n$.

II. The transformation functions for portfolio attributes are separable and linear ;

$$z_k = G_k(X;\ b_{ik}, i = 1, ..., n\ ) = \sum_{i=1}^{n} b_{ik} x_i,$$

where b_{ik} is the amount of k^{th} attribute in asset i. Unique portfolio attributes are defined by $z_i^u = G_i(x_i\ ;\ 1) = x_i$.

This simply implies there is one unit of unique attribute per unit of any asset. In an applied study of demand for nutrients Ladd and Suvannant [57] invoke this assumption for foods. It is assumed that the obtainable amounts of attributes in assets represented by β is the same for all investors. Investors are distinguished by superscripts h. There are H investors in the market.

III. To include current consumption decisions into the analysis we assume that one attribute entering the utility function is current consumption: $C = W - P'X$. With this representation, the shadow costs associated with obtaining a portfolio attribute will be measured in terms of foregone current consumption.

In this manner, it is possible to integrate future consumption into the model as well. In that case, the shadow cost will be a measure of exchanging current consumption with attributes and future consumption. For simplicity sake this step will not be adopted.

The formal statement of investor's problem is: Choose X so as to

$$Max \;\; u(Z) \;=\; u(\,C, z_1, ..., z_{r^*}, z_1^u, ..., z_n^u\,) \tag{5.1}$$

subject to

$$C = W - P'X \;, \quad z_k \;= \sum_{i=1}^{n} b_{ik} x_i \text{ and } \quad z_i^u \;=\; x_i$$

where the initial wealth (W), asset prices (P), and the asset quality parameters (β) are assumed exogenous and non-stochastic.

Using these assumptions, the price decomposition equation for problem (5.1), derived in proposition (1), may be written as:

$$p_i = \theta_i^h + \sum_{k=1}^{r^*} \theta_k^h b_{ik} \tag{5.2}$$

where $\theta_i^h \;=\; \partial C \;/\partial z_i^u$ and $\theta_k^h \;=\; \partial C \;/\partial z_k$ are the shadow costs of attributes for individual h, and $\beta_i = (1, b_{i1}, ..., b_{ir^*})$ is the same for all investors.

Equation (5.2) or its equilibrium version derived below, permits us to recognize explicitly a number of issues. First, there are three possible sources of uncertainty that could influence the price decomposition equation: prices, θ's, and β. As we argued in chapter 3, uncertainty induced by a stochastic β seems most reasonable since P represents currently observable prices and investors can be assumed to know their own valuation of any attribute.

As shown in chapter 3, in either of these cases, the maximization of expected utility will require taking the expectation of this relationship with respect to the joint distribution of the random variables. Note also that the stochastic path of prices will be influenced by the path of β and θ vectors.

Second, using equation 5.2, it is possible to see the implication of assuming a separable linear attribute production technology, a linear budget constraint, and homogeneous beliefs. These assumptions permit the aggregation of 5.2 across individuals such that asset prices may be expressed as a weighted linear function of their attributes. The weights are simply the average of the values assigned by the individual investors. Formally,

$$p_i = \bar{\theta}_i + \sum_{k=1}^{r^*} \bar{\theta}_k b_{ik} + \epsilon_i \tag{5.3}$$

where p_i is the price of the i^{th} asset, b_{ik} is the amount of k^{th} characteristic in asset i,

$$\bar{\theta}_i = [\sum_{h=1}^{H} \theta_i^h] \times H^{-1}$$

and

$$\bar{\theta}_k = [\sum_{h=1}^{H} \theta_k^h] \times H^{-1}$$

measure the shadow value of asset i's unique and common attributes, and ϵ_i is a random error term, whose distributional properties will be discussed below. Note that the intercept term in 5.3 is a measure of the shadow cost of holding a particular asset i and indicates the relative importance of two assets which may be identical in every other attribute.

This price decomposition equation is the starting point for the empirical examination of the attribute model. The estimation of the attribute model represented by (5.3) requires explicit consideration of several issues. These are briefly discussed under the following headings.

5.1 Selecting the Relevant Assets

The question of what constitutes the set of marketed assets ($i = 1, ...n$) is an important problem in financial economics. In criticizing the tests of the CAPM, Roll [90] argues that all available assets, including human capital, influence an individual's intertemporal decisions. Therefore the 'market portfolio' proxies used to test the CAPM must account for this fact. He shows that the inability to form such proxies implies that the CAPM is not testable.

In the attribute model, no restrictions are placed on the types of assets which influence individual choice. So long as the purchase or sale of an asset affects the wealth constraint, a relationship between the asset's price (cost) and its attributes is implied (proposition 1, equation 2.3.1).

As noted before, in the general model, the price decomposition equation derived from the first order conditions of the portfolio choice problem implicitly depends upon the demand for other available assets. This dependence will arise from either nonlinearity in the attribute production technology or a nonlinear budget constraint.

In the construction of the model in 5.1 these possibilities were assumed away so that 5.3 is linear in b_{ik}'s. Therefore, estimation may proceed by utilizing time series data on prices and characteristics of a given asset, say the stock of IBM, or a cross-section of asset prices and attribute may be used to estimate shadow prices at a point in time.

Cross-sectional examination of equation 5.3 requires further simplifications. Suppose investors choose among broad classes of assets such as stocks, mutual funds, bonds, real estate, etc. Furthermore, let each category be distinguished by a single unique attribute. Now it is possible to show that equation (5.3) must hold for each *category* of assets.

Focusing on category i, say common stocks, the vector p_i will be the prices of different firms' common equity and the vector b_{ik} will contain their k^{th} attribute and the vector $\bar{\theta}$'s will contain the estimated shadow prices of these attributes at a point in time.

An important feature of the model presented in this dissertation, and one which has not been studied elsewhere, is the fact that the intercept term, $\bar{\theta}_i$, provides an estimate of the price premium associated with common stocks' unique attribute. This premium distinguishes stocks from other assets and could help explain why some investors may not invest in stocks. The foregoing simplifications are incorporated into the model estimated below.

5.2 Selecting the Attributes

Determining the appropriate set of common attributes appears to be a formidable task. Regardless of the care taken, the choice may seem ad hoc. One way to deal with this problem is to directly survey investors through an organization such as the American Association of Individual Investors (AAII) and ask them to list the types of characteristics they value in assets. This would be interesting but is clearly outside the present scope of this work.[34] In the absence of such direct information, we rely on the existing applied literature.

Most empirical tests of asset pricing models assume that the value of factors that determine asset prices (e.g., mean and variance returns) is the same for all individuals, and investors' perceptions regarding the attributes are homogeneous. Similar assumptions underly the analysis in the present study. The amount of attributes obtained from assets is assumed to be the same for all investors and they all know this fact.

It should be noted, however, that studies in consumer economics and marketing indicate that perceptions, which provide important impetus to purchase decisions, are more likely to be heterogeneous. Research shows that in the presence of risk, heterogeneity of individual behavior is a direct result of varied perceptions. [35] Al-

[34] A list of attributes can be provided and participants may be asked to select attributes which effect asset prices. Using the selected attributes and regression analysis the shadow cost of attributes may be estimated. There are obviously many other possible survey designs.

[35] In fact, knowledge of true (objective) risk may play little role in consumption decisions if individuals do not perceive a particular risk as significant (Slovic, et al.[106]). Also Viscusi [111] has shown that, in certain cases (e.g., cigarettes), even upwardly biased perceptions of the actual risk may not influence purchase behavior.

lowing for the heterogeneity of perceptions is one possible direction for improving the attribute model in the future.

The role of perceptions in explaining the observed differences in investor behavior has been long recognized in financial economics and researcher have recently begun to study the consequences of perception heterogeneity for the capital market equilibrium [4]. However, since the aggregate market data provides no information about individual investors' perceptions, it has proved difficult to empirically assess the impact of heterogeneity.

Generally, competition among investors and government regulation have been assumed to result in equal access to information. Furthermore, legal restrictions, institutional rules, and independent ranking agencies (e.g. Standard and Poors) have forced a relatively accurate disclosure of information and reduced the differences in individual perceptions. These institutional characteristics of financial markets provide some justification for assigning a minor role to diversity of perceptions.

Financial markets are characterized by considerable availability and continuous generation of new information. The majority of this information appears in the form of, or is related to the items in a firm's financial statements. The COMPUSTAT financial files are the primary source of such statements for a large proportion of firms. COMPUSTAT provides a combined coverage of over 7000 firms from the period 1950 through 1990. A large portion of the firm specific information (350 items) available for the fiscal year 1988 are utilized for this study. The attribute selection criteria are based on the results of previous studies in different fields of economics.

Capon, Farley, and Hoenig [19] provide a meta-analysis of over 300 published studies relating environmental, strategic, and organizational factors to various indicators of the financial performance of firms. They identify over 200 variables that have been shown to influence several indices of firms' performance (p. 1150).

These explanatory variables include many of those studied in finance, accounting, management sciences, industrial organization, and other branches of economics. Based on this survey, we construct a list of general categories of attributes that should be considered. The attributes selected for this study belong to at least one of the several broad categories that are presented in table 1.

After selecting the basic attributes from the COMPUSTAT data files, new variables are created by combining some of them. These include variables associated with the non-calendar based anomalies such as the size effect, the capital structure, the tax effect and others. This selection process insures that a variety of variables whose importance has previously been considered in isolation will be studied together.

The majority of variables contained in the COMPUSTAT files are accounting data. These are derived from three types of statements: the balance sheet, the income statement, and the cash flow statement.

The balance sheet presents the current financial condition

Table (1): General Classifications of Stock Attributes

Category	Measures
Market Power	Industry Concentration Ratios and Market Share
Growth Potential	Growth in Sales, Size of Assets, and others
Capital Investment	Investment in Land, Machinery, and Technology
Size of Operations	Size of Assets, Sales, and Number of Employees
Sales Expansion	Advertising and Marketing Expenditures, Product Promotion
Diversification	Spatial Dispersion of Operations, Sales, and Production, Variety of Output, Vertical and Horizontal Integration
Product Development	Expenditure on Research and Development, Product Diversification
Production Efficiency	Capacity utilization, Economies of Scale, Inventories, Production Technologies utilized, etc.
Financial Efficiency	Debt Structure, Returns on Equity, Profit Margin, Many others
Quality of Business	Expenditures on Philanthropic Activities, Social Responsibility Environmental Activities, Hiring Practices, etc.
Characteristic of Products	Consumer Versus Durable Goods, Others
Management Control	Public Versus Private ownership, Management Style
Asset Liquidity	The Bid-Ask Spread, The Exchange on which the Stock is Traded International Sales of the Stock, etc.
Others	Number of years in Business, Outside Rankings of the Firm Assets

of the firm, a snapshot at the close of an accounting period. The income statement summarizes profit performance over a specified period, showing how resources were utilized over time to produce a profit or loss. The cash flow statement reports the movement of cash into and out of the company over the year.

We use accounting studies to select variables from all three accounts as desirable attributes. These studies include the classic Ball and Brown [5], Beaver, Lambert, and Morse [9],and Penman and Ou [84], Lev [63], Ball, Kothari, and Watts [6], and the more recent studies such as Finger [26], Shroff [104], Soffer [101], and Hand [35].

The following systematic steps have been taken prior to estimating the attribute model.

I. To reduce the possibility of introducing measurement or estimation error into the analysis we focus on firms whose financial data are in their final updated form rather than management estimates (COMPUSTAT variable UCODE = 3).

II. A total of 68 variables from the 1988 data are selected for a total of 2210 firms. Each variable is assigned a two part name consisting of a letter and their COMPUSTAT item number. Constructed variable are distinguished by an explicit name. Observations with missing values, or negative or zero prices, or negative sales (one firm) have been excluded.

This leaves a total of 2087 firms with no missing variables. Table 2 provides a list and the definition of all selected attributes.

Table (2): Description of the variables extracted from the COMPUSTAT

Var.	Definition	Unit	ES	Mean	Std Dev
The Dependent Variables					
PHI22	The absolute high price for the year-bid for OTC	DC	---	28.02	24.90
PLO23	The absolute low price for the year-bid for OTC	DC	---	14.27	14.67
PCY24	Price on the close of year (31 Dec. 1988)	DC	---	18.14	18.70
PC199	Price on the close of firm's Fiscal year	DC	---	19.12	18.91
The Independent Variables					
b1	Cash and short term investments	MMD	+	188.95	861.80
b2	Receivables-total	MMD	+	120.17	346.64
b3	Inventories-total	MMD	?	123.85	692.76
b4	Current assets-total	MMD	+	302.31	732.86
b5	Current Liabilities-total	MMD	-	208.44	546.95
b6	Assets-total / Liab. & Stkholder Equit.-total	MMD	+	2182.64	6640.92
b7	Prop., Plant, and Equip.(PPE, prod cost)	MMD	?	722.27	2247.91
b8	PPE-total(net) (C7 less of depreciation)	MMD	?	485.19	1520.12
b9	Long-term debt-total	MMD	-	286.26	722.79
b12	Total sales net of Discounts	MMD	+	1019.16	2203.01
b13	Oper. Inc. before depr.(net sale-cost of good sold	MMD	+	133.9	308.76
b14	Depreciation	MMD	?	39.11	91.54
b15	Interest Expense	MMD	?	73.73	308.20
b16	Income taxes	MMD	-	31.52	74.65
b18	Income before extraordinary items	MMD	?	0.46	41.21
b19	Dividends-on prefered stock	MMD	?	50.50	144.94
b21	Dividends-on common stock	MMD	+	24.26	64.75
b25	Number of common shares outstanding	MM	?	28.79	49.99
b26	Dividends per share-ex date	DC	?	0.58	0.73
b28	Common shares traded during the cal. year	MM	?	21.29	40.69
b29	Employees	M	?	7.79	19.55
b30	PPE-Capital expenditure	MMD	+	69.46	170.48
b36	Retained Earnings	MMD	+ ?	276.14	895.34
b41	Cost of good sold	MMD	-	534.50	1435.56
b42	Labor and related expenses	MMD	-	84.02	353.59
b43	Pension and retirement expense	MMD	- ?	5.39	24.97
b45	Advertising expense	MMD	+ ?	13.66	69.79
b46	Research and development	MMD	+	13.83	65.71
b51	Investment tax credit(income Accnt)	MMD	+	0.71	3.81
b58	Earnings per share (primary)	DC	+	1.09	2.62
b59	Inventory valuation method	code	?	16.87	57.69
b60	Common equity-total	MMD	+	434.02	1077.72
b98	Order backlog (sales and others)	MMD	?	131.84	1227.60
b100	Number of common shareholders	M	+ ?	12.68	31.60

The numerical part of the variables are the COMPUSTAT assigned item numbers. ES=Expected Sign of Coefficient. Units: M=Thousands, MM=millions, MMD=Millions of Dollars, DC=Dollars and Cents.

Table (2 Cont.): Description of the variables extracted from the COMPUSTAT

The Independent Variables Continued					
Var.	Definition	Unit	ES	Mean	Std Dev
b107	Sale of PPE-last fis. year-flow of funds stat. (FFS)	MMD	?	3.94	19.62
b108	Sale of common and prefered stocks-(FFS)	MMD	?	13.11	47.18
b109	Sale of investments-(FFS)	MMD	?	51.85	433.22
b110	Total funds from operations-stat. of changes (SC)	MMD	+	63.75	187.37
b111	Long term debt issuance-(FFS)	MMD	-	41.99	113.06
b112	Total sources of funds-(SC)	MMD	?	116.53	750.37
b113	Increase in investments-(FFS)	MMD	?	80.37	652.087
b114	Long term debt reduction-(FFS)	MMD	-	35.47	115.69
b115	Purchase of common and prefered stock-(FFS)	MMD	+	13.75	66.65
b116	Total uses of funds-(SC)	MMD	?	112.29	735.59
b123	Income before ext. items-(FFS)	MMD	?	36.47	127.12
b127	Cash Dividends-(FFS)	MMD	+	17.32	51.52
b128	Capital expenditure-(FFS)	MMD	+	43.73	110.12
b129	Acquisitions-(FFS)	MMD	+ ?	14.24	60.89
b149	Audit / auditor's opinion	code	?	40.32	29.99
b172	Net income (loss)	MMD	+ ?	51.16	148.79
b181	Total liabilities	MMD	-	1713.18	6091.53
b216	Stockholder's equity	MMD	+	462.65	1127.98
b235	Common equity liquidation value	MMD	+	275.76	670.89
b248	Acquisition-Income contribution	MMD	+	-0.04	2.20
b249	Acquisition-sales contribution	MMD	?	7.69	54.65
b279	fortune rank	code	+	42.08	102.43
b280	The S & P Bond rating	code	+	4.042	6.26
b282	The S & P stock rating	code	+	9.81	8.30
b283	The S & P commercial paper rating	code	+	17.84	38.77

The number part of the variables are the COMPUSTAT assigned item numbers. ES=Expected Sign of Coefficient. nUnits M=Thousands, MM=millions, MMD=Millions of Dollars, DC=Dollars and Cents.

All selected variables are independent in the sense that their value can not be deduced by combining other variables on this list. All continuous variables with units of millions of dollars (MMD) have been deflated by the number of outstanding shares (variable b25) so as to obtain b_{ik}; the amount of attribute k per share of stock. The dichotomous variables, described below, have not been deflated.

III. Two types of variables are created using this 'raw' data. These are 'accounting ratios' and a number of qualitative binary variables. The accounting ratios and their definitions are summarized in table 3. The created ratios permit a cross sectional comparison of firms and they are used for this purpose by analysts.

These variables may be grouped in two broad categories known as the 'common size' and the 'financial' ratios. The former corrects for differentials in the size of firms' operations, while the latter measures various aspects of firm financial health. These ratios are widely used by investors. Their relevance is discussed in the standard accounting texts such as Foster [31].

The qualitative variables are defined in table 4. These are designed to measure the influence of a variety of factors. Two variables are constructed to determine if there are price effects associated with the New York (NYSE) or the American stock exchanges(AMEX).

For historical reasons, the NYSE is believed to be a more prestigious exchange. Other motivations for creating these variables arises from studies which associate different costs to the public for

Table (3): Accounting Ratios : Definitions and Means

Common-Size Ratios : Controls for size differences across firms			
A. Components of balance sheet (Assets Side)/ total assets (b6).			
Variable	Definition	Mean	Exp.Sign
b1_6	Cash / Assets	0.10	+
b2_6	Receivable / Assets	0.14	- ?
b3_6	Inventories / Assets	0.14	- ?
b4_6	Current assets / Assets	0.39	?
b7_6	PPE total / Assets	0.58	?
b8_6	PPE net / Assets	0.32	?
B. Components of balance sheet (Liab. Side & others)/ total assets (b6)			
b5_6	Current Liabilities / Assets	0.21	-
b9_6	Debt (long term) / Assets	0.20	- ?
b181_6	Total Liabilities / Assets	0.58	-
b60_6	Common Equity / Assets	0.40	+
b36_6	Retained Earnings / Assets	0.16	?
b216_6	Stockholder's Equity / Assets	0.41	+
b235_6	Common Equ. Liquidation value / Assets	0.35	?
C. Components of income statement / total revenues (b172)			
b12_172	Sale (net) / Net Income (loss)	33.92	?
b13_172	Operating Income / Net Income (loss)	3.14	?
b14_172	Depreciation / Net Income (loss)	1.18	?
b15_172	Interest expense / Net Income (loss)	3.13	- ?
b16_172	Income taxes / Net Income (loss)	0.62	- ?
b41_172	Cost of goods sold / Net Income (loss)	18.24	- ?

Table (3-Cont): Accounting Ratios : Definitions and Means

Financial ratios : Cross Sectional measure of firms financial conditions			
A. Cash position: the higher the ratios, the higher the firms available cash resources.			
Variable	Definition	Mean	Exp.Sign
b1_5	Cash / Current Liabilities	2.32	+
b1_12	Cash / Sales (net)	1.93	+
B. Liquidity: The ability to meet short term financial obligations.			
(b1+b2)_5	"quick Ratio":(cash+Receivable) / Curr. Liabilities	2.45	+
b4_5	"Current Ratio": Curr. assets / Curr. Liabilities	2.22	+
C. Capital structure: Share of nonequity capital in firms assets			
b9_216	Debt (long term) / Stockholder's Equity	0.67	-
D. Debt service: Measure of firm's ability to meet debt service obligation			
b13_15	Operating Income / Interest Expense	39.44	+
b1_15	Cash / Interest Expense	61.64	+
E Profitability: Ability to generate revenues in excess of expenses			
b172_12	Net Income (loss) / Sales (net)	0.25	+
b172_216	Net Income (loss) / Stockholder's Equity	0.10	+
F. Turnover: Measures the efficiency of asset utilization			
b2_12	Receivables / Sales (net)	0.15	+
G. Return on equity: Measures the efficiency of asset utilization			
b172_60	Net Income (loss) / Common Equity	0.10	+

Table (4): Description of the qualitative variables

Variable	Definition	Mean	ES
NYSE	(1) if the firm's stock trades on the New York stock Exchange	0.61	?
AMEX	(1) if the stock trades on the American stock Exchange	0.31	?
FYRD	(1) if firm's close of fiscal year is December	0.64	?
FIFO	(1) if primary inventory valuation method is FIFO	0.28	?
LIFO	(1) if primary inventory valuation method is LIFO	0.19	?
AUDIT	(1) if audited (qualified or unqualified opinion)	0.82	+
FORTUNE	(1) if excluded from Fortune ranking	0.72	- ?
BONDA	(1) if firm's bonds are rated A or higher by the S & P	0.15	+
BONDB	(1) if firm's bonds are rated in the B range	0.17	?
STOCKA	(1) if firm's stock is rated A or higher by the S & P	0.24	+
STOCKB	(1) if firm's stock is rated in the B range	0.34	?
PAPERA	(1).if firm's commercial papers are rated A and higher	0.17	+
C283D	(1) if firm's commercial papers are not rated	0.82	-

ES= Expected Sign of Coefficient

listing or trading on each exchange (see Mayer [75]). Approximately 9% of our sample stocks are traded outside these exchanges and these will be the reference group.

The variables LIFO and FIFO are created to study whether accounting valuation methods are value-relevant as is suggested in Hand [35]. These variables take on the value 1 if all or the largest portion of the firm's inventories are valued by these methods. Approximately 52% of the sample use other valuation methods. They are the reference group for this variable.

The AUDIT variable is intended to capture the degree to which the firm's financial statements can be trusted. This variable may also serves as an indicator of the credibility of the firms financial officers. The Audit variable equals 1 if the firm has been audited by an outside accounting firm and has received a qualified or an unqualified opinion. The reference group, which is about 18% of the sample, does not fall in this category.

The next seven variables measure the impact of the market's assessment of a firm's operations. These include whether a firm has been ranked by FORTUNE, and the Standard and Poor's ranking of the stock, bond and commercial papers issued by the firm.

Descriptive statistics on all variables are generated and examined for their consistency. The means for all variables are reported in the tables. All statistical procedures were performed using the *SAS* and *SHAZAM* statistical packages.

5.3 Estimation and Results

To estimate the price decomposition equation (5.3) consistently, two related issues regarding the distribution of ϵ_i and the functional form of (5.1) must be considered. Considering the former, it seems likely that the residual may be heteroscedastic and correlated across firms, i.e., the residual variance and the covariance may vary say with firm size. It is also possible that prices are related to attributes non-linearly. The two issues are related, since heteroscedasticity may be due to an incorrect functional form or omitted explanatory variables.

Nonlinearity is a common feature of many asset pricing models, as for example in the Litzenberger and Ronn [72] framework or most of the models reviewed in chapter 4. [36] As McDonald [76] has shown, even linear pricing models such as CAPM may be better fitted by nonlinear functions. Nonlinearity in asset pricing models, as is shown in McDonald and Lee [77], may be due to non-normality and heteroscedasticity of the residuals. [37]

The consequences of heteroscedasticity for the least squares estimator are well known; these are a loss in efficiency, and biased estimates of the parameter variance-covariance matrix. This implies that the confidence intervals and tests of hypothesis will be biased and cannot be trusted. Furthermore, in the presence of heteroscedasticity, the least square estimator is no longer the maximum likelihood estimator, even if the residuals are normally distributed,

[36] Sophisticated techniques for obtaining solutions to nonlinear models are discussed in Tauchen and Hussey [108].

[37] Nelson [81] discusses heteroscedasticity in time series test of asset pricing models.

see Judge et al [45].

A typical remedy for correcting for heteroscedasticity is to transform the explanatory variables in a way that might be appropriate in the given context, e.g. changing nominal values to real or converting aggregate values to per capita. For the continuous variables considered here this transformation has already been done by creating variables on per share basis.

Although, this transformation does not necessarily remove heteroscedasticity, our null hypothesis, which will serve as a 'straw man' to be knocked down, is that the residuals are independent and identically distributed normal. Given the linear attribute production technology in 5.1, it is assumed that the price decomposition equation is linear in the attributes. The validity of these conjecture are then tested.

The estimation and testing steps taken are as follows. The four available prices, the annual high, low, close of fiscal year, and the close of calendar year prices, are regressed on explanatory variables, with and without the accounting ratios (8 regressions). The aim is to distinguish between the 'raw' and the created ratios. The latter are widely used by the analysts and regularly reported in financial journals and media. The result of these regression are collected in tables 1 to 8 in Appendix B.

To reduce collinearity and for the sake of parsimony highly insignificant variables (p-values greater than 0.15) were dropped and the relation was re-estimated with the remaining variables (procedure STEPWISE of SAS). A more important purpose of this step was to see which attributes would be selected based on purely statistical measures of the fit. Tables 9 to 16 in Appendix B report on the results of these regressions.

This procedure indicates two startling results. First, the significant explanatory variables selected by the above criterion are essentially the same for all price regressions (compare tables 9 through 16 in Appendix B). Second, the reduction in the explanatory power of each regression as measured by the fall in the R^2 is quite small, usually less than 0.01, despite a large drop in the number of explanatory variables (compare tables 1 and 9, 2 and 10, etc. in Appendix B).

After removing the insignificant variables, each price regression is subjected to seven different tests of heteroscedasticity and two tests for normality of the residuals. These tests include the Lagrange Multiplier, the Chow, the Goldfeld-Quandt, the recursive residual test, and others. They are performed using the DIAGNOS option of SHAZAM version 6.1 [113]. [38] Surprisingly, in no instance was the null hypothesis of homoscedastic and normal residuals rejected.

Using the Box-Cox procedure of the same econometric package, the hypothesis that the pricing functions were linear in the attributes was also tested. The results of this test were less conclusive. For the majority of cases linearity seemed appropriate when the independent and all explanatory variables receive the same power

[38] For a brief discussion of these tests see [45, 113].

transformation (λ).

A priori there are no reasons to believe such restrictions. Further functional analysis, perhaps using non-parametric methods, are required so as to address the linearity hypothesis satisfactorily . This is particularly true since for the Box-Cox test, attributes with negative values must be excluded from the analysis.

Baron-Adesi and Talwar [7] show that asset pricing equations with a larger number of explanatory variables, e.g., the quadratic parameter model of Kraus and Litzenberger, are more likely to be homoscedastic. They also indicate that heteroscedasticity may depend upon the type of securities considered as well as the functional misspecifications of the pricing equation. Our findings are generally in agreement with their conclusions. The preliminary test discussed above suggest that the attribute model may reduce misspecification error.

To place these findings in greater perspective we focus the discussion to the relation between stock prices on the close of the calendar year (PCY24) and the stock attributes. This relation could be viewed with a higher degree of confidence because all firms' financial information have been made public by this date.

Table 5 contains the estimated parameters of this regression with and without the financial ratios. The sign and magnitude of most coefficients seem to confirm the expected influence of the attributes on asset prices. The R^2 for both regressions are unexpectedly high. The inclusion of the accounting ratios improves

Table (5): Regression Results for Price at the Close of Fiscal Year (PCY24)

	Reg.R-Squard	W-Ratio	.778	W/O-Ratio	.770
Variable	Definition	Parameter	P-Val	Parameter	P-Val
Const	Implicit Price Stcks	6.52	0.0001	6.00	0.0001
b2	Receivables-total	0.25	0.0001	0.19	0.0001
b3	Inventories-total	-0.19	0.0001	-0.23	0.0001
b5	Current Liabilities-total	-0.04	0.0001	-0.03	0.0001
b8	PPE-total(net)	-0.14	0.0001	-0.10	0.0001
b9	Long-term debt-total	-0.06	0.0100	-0.06	0.0041
b12	Total sales	-	-	0.07	0.0005
b13	Operating income	0.37	0.0011	0.43	0.0001
b14	Depreciation	0.76	0.0074	-	-
b15	Interest Expense	0.95	0.0001	1.00	0.0001
b16	Income taxes	4.56	0.0001	4.26	0.0001
b18	Income before ext.	-2.03	0.0001	-1.92	0.0001
b25	Number of commons	0.02	0.0001	0.03	0.0001
b26	Dividends per share	3.00	0.0001	2.77	0.0001
b28	Common shares traded	1.36	0.0012	1.12	0.0041
b29	Employees	-0.04	0.0045	-0.05	0.0010
b30	PPE-Capital expen	0.26	0.0291	0.23	0.0529
b36	Retained Earnings	0.34	0.0001	0.31	0.0001
b41	Cost of good sold	-	-	-0.06	0.0021
b42	Labor expenses	-0.18	0.0001	-0.16	0.0001
b45	Advertising expense	0.63	0.0008	0.48	0.0116
b46	Research and devel	1.03	0.0001	1.07	0.0001
b51	Investment tax cred	7.56	0.0301	9.61	0.0055
b58	·Earnings per share	1.34	0.0001	1.41	0.0001
b100	common sharehldrs(#)	-0.03	0.0011	-0.03	0.0012
b110	Total funds oper	0.52	0.0001	0.51	0.0001
b113	Increase in invest	-0.07	0.0001	-0.07	0.0001
b114	LT debt reduc	-0.11	0.0106	-0.09	0.0342
b128	Capital expen	-0.70	0.0001	-0.47	0.0020
b172	Net income	-0.51	0.0075	-0.50	0.0081
b181	Total liabi	-0.03	0.0001	-0.03	0.0001
b235	Com equi liqu. val	0.29	0.0001	0.35	0.0001
b249	Acquis-sales cont	-0.06	0.0024	-0.06	0.0038
AMEX	Amer. Stck Exchange	-1.53	0.0042	-1.72	0.0006
LIFO	Accounting Method	-	-	-1.19	0.0339
FORTUNE	FORTUNE Ranking	-2.05	0.0009	-2.00	0.0010
BONDA	Bond Ranking	1.34	0.0711	1.96	0.0054
BONDB	Bond Ranking	-1.09	0.0759	-	-
STOCKA	Stock Ranking	3.58	0.0001	2.62	0.0001
STOCKB	Stock Ranking	-	-	-1.22	0.0183
B1_6	Com Size (cash/asst)	5.27	0.0063	-	-
B2_6	Com Size (Receiv/asst)	-6.50	0.0026	-	-
B3_6	Com Size (Inventory/asst)	-5.00	0.0029	-	-
B9_6	Com Size (Debt-LT/asst)	2.69	0.0951	-	-
B36_6	Com Size (Ret Earn/asst)	-1.83	0.0412	-	-
B16_172	ComSize(Inc.Tax/NetInc)	-0.10	0.0054	-	-
B9_216	Cap Struc(Debt-LT/StckhldrEqui)	-0.10	0.1149	-	-

All variables with P-value > .15 have been removed from the regression. Parameter=Dollars these regressions considerably. Furthermore, no significant change of magnitudes or sign reversal occur when these ratios are added.

What do these regressions suggest ? Briefly, the intercept provides an estimate of the shadow cost associated with holding stocks rather than other financial assets. All else remaining equal, investors appear willing to pay about $6.52 for the uniques attribute of the average stock.

There are at least two way to interpret this result. First, since the average year end stock price is $18.14, it appears that the average value of the unique attribute of stocks is nearly a third of the average price. This may be high in relation to other assets and a comparison may be quite informative.

Second, the $6.52 estimate seems comparable with the price of stocks when they are first offered to the public through initial public offerings (IPO). [39] This comparison is interesting since the average purchaser of such stock may be initially unaware of other attributes of these assets and hence offering a price reflective of their unique values. Both these interpretations deserve further theoretical and empirical scrutiny.

Turning to the common attributes, i.e., the accounting information, items from the firm's balance sheet and income statement generally dominate the analysis. These items measure both current and changes in various accounting numbers. Most significant variables, statistically and in magnitude, are those that are related to

[39] See Jacklin [43] for related references.

the firms potentials for sustained future earning. Most important among these is the firms retained earnings, which is often devoted to investments in plant and equipments.

Is the timing of the release of financial statements important ? The close of fiscal year for 64% of the sampled firms is in December. For these firms it is likely that the effect of financial statement variables on December 31 prices is more pronounced since the information is more recent. A binary variable designed to capture such effect (FYRD) was found to be statistically insignificant. [40]

Although the majority of accounting numbers have the correct sign, there are some surprises as well. For example with the inclusion of accounting ratios, the firm's accounting methods are no longer significant. Also a number of items from the Flow of Funds Statement (b113, 114, 128, and 172) appear to have the wrong sign. Finally, the ex-date dividend per share (b 26) appears to contribute more to price determination than does the current dividend per share of common stock (b21). In fact this latter variable is found to be statistically insignificant.

Turning to variables that are of general interest in finance, management science, and economics, our results both confirms and rejects previous findings in these areas. For example tax measures are found to affect prices positively (b16 or b51). The size of a firm as measured by its number of employees or its labor costs (b29 , b42)

[40] However, this variable is negative and highly significant for other regressions, particularly for price on close of firm's fiscal year (PC199). Other motivation for using this variable may be found in Korajcsyk [54] and Keim [52].

has a negative sign, while size as measured by assets (e.g., B1_6) is positive. Interestingly size as measured by sales (b12 or b41) does not enter the regressions.

Debt structure of the firms, as proxied by different variables, is significant and has the correct sign (b5, b9, b181,b9_216). The results for measures of the firm's potential for growth are somewhat mixed (b30, b46,b113, b128, b249), though generally positive. Advertising and Research and Development are clearly value-relevant with a positive influence (b 45, b46) as has been found by others (see Berger [12]).

All else being equal, there is a negative premium of $ 1.53 associated with stocks traded on the AMEX. This seems to confirm the prestige story associated with the NYSE noted earlier. Outside ranking of firms operations are important determinant of prices. The coefficient of stock and bond ratings conform with expectations but the ranking of firms commercial paper is insignificant. Lastly, comparing two otherwise identical firms, the stock for the firm with a Fortune Magazine's ranking will be priced at least $2.05 higher !

Suppose we accept the validity of these regression models in terms of the appropriateness of the included variables and ask what is the contribution of each variable to their explanatory power, i.e., change in R^2. Table 6 provides a ranking for the explanatory variables in regressions in table 5. The same information for other regressions may be found in tables (9) to (16) of Appendix (B).

The first ten variables that enter all models are essentially

Table (6): Explanatory Impact of the Exogenous Variables on the R-Squard

Variable	Change in R-Squ	Prob>F	variable	Change in R-Squ	Prob>F
-	PCY24 with Ratios	and	PCY24 without Ratios		
b36	0.5251	0.0000	b36	0.5154	0.0000
b16	0.1140	0.0001	b16	0.1202	0.0001
b26	0.0259	0.0001	b26	0.0251	0.0001
b113	0.0172	0.0001	b113	0.0167	0.0001
b235	0.0130	0.0001	b235	0.0143	0.0001
STOCKA	0.0128	0.0001	STOCKA	0.0136	0.0001
b18	0.0088	0.0001	b18	0.0086	0.0001
b3_6	0.0073	0.0001	b123	0.0064	0.0001
b123	0.0061	0.0001	FORTUNE	0.0055	0.0001
FORTUNE	0.0053	0.0001	b3	0.0064	0.0001
b8	0.0033	0.0001	b15	0.0039	0.0001
b28	0.0026	0.0001	b46	0.0025	0.0001
b3	0.0025	0.0001	b42	0.0027	0.0001
b5	0.0017	0.0003	b5	0.0025	0.0001
b110	0.0033	0.0001	b110	0.0024	0.0001
b4	0.0020	0.0001	b2	0.0024	0.0001
b13	0.0022	0.0001	AMEX	0.0021	0.0001
b15	0.0019	0.0001	b128	0.0017	0.0002
b181	0.0025	0.0001	b181	0.0017	0.0002
b58	0.0018	0.0002	b28	0.0013	0.0008
b42	0.0016	0.0004	BONDA	0.0013	0.0008
b46	0.0017	0.0002	b45	0.0009	0.0049
b25	0.0013	0.0011	LIFO	0.0009	0.0064
b29	0.0011	0.0031	b25	0.0007	0.0151
b45	0.0010	0.0033	b29	0.0017	0.0001
b9	0.0010	0.0032	b100	0.0014	0.0005
b100	0.0009	0.0048	b51	0.0008	0.0083
b128	0.0009	0.0059	b8	0.0006	0.0204
BONDA	0.0009	0.0066	b13	0.0013	0.0006
b16_172	0.0008	0.0077	b9	0.0009	0.0046
b2	0.0007	0.0164	b58	0.0007	0.0143
b2_6	0.0013	0.0009	b172	0.0007	0.0165
b51	0.0007	0.0173	STOCKB	0.0006	0.0228
b172	0.0007	0.0180	b114	0.0005	0.0403
AMEX	0.0006	0.0294	b249	0.0004	0.0754
b36_6	0.0007	0.0167	b30	0.0005	0.0292
b114	0.0006	0.0219	b12	0.0003	0.1139
b249	0.0005	0.0395	b41	0.0011	0.0021
b14	0.0005	0.0324			
b1_6	0.0005	0.0375			
b30	0.0004	0.0495			
BONDB	0.0003	0.1007			
b9_6	0.0003	0.1157			
b9_216	0.0003	0.1149			

the same and appear in the same order. The first two variables, retained earnings (b36) and income taxes (b16) per share, are clear surprises here. It is likely that these variables proxy for the firms earnings and therefore have significant explanatory power. The remainder of variables; dividends per share (b26), increase in investments (b113), book value of the firm (b235), the firm's stock ranking, and others, seem consistent with a priori expectations and the result of previous studies discussed in Capon, Farley, and Hoenig [19].

To conclude this chapter we emphasize that these findings are preliminary and must be subjected to further scrutiny. Three types of refinements and extensions are planned. First, the attributes integrated into the analysis will be expanded by utilizing the CRSP data files. It is likely that in the presence of summary variables, such as a firm's β, some of the present variables will become less important.

Second, a series of diagnostic tests for multicollinearity, misspecification error, and functional form should be undertaken. [41] The model should be also tested using returns rather than prices. Finally, to assess the stability and the overall validity of the model, out of sample forecasts should be generated using data from previous periods. Alternatively, based on the above shadow prices of attributes, mispriced securities (those with non-zero residuals) should be identified and the return to these assets be followed to see if portfolio decision based on the attributes would have been profitable in

[41] Green and Kierman [32] discuss the implication of Multicollinearity in asset pricing models.

the subsequent periods.

6 Summary and Conclusions

This study developed a model of investor behavior in which assets' attributes influence individual choice. The framework proposed is sufficiently general to nest a variety of existing models as its special case. The attribute model provides a useful tool for addressing a variety of positive and normative questions regarding investor behavior and asset prices.

An important implication of the attribute model is that in equilibrium, assets' prices will depend upon their qualitative attributes. Price and attribute data from a cross section of firms generally confirmed this hypothesis. The findings of the dissertation also confirmed those of other studies in the economic literature. However, unlike the previous studies which considered particular attributes (e.g. firm size) in isolation, this study considered the combined effect of a variety of attributes.

A number of findings in the dissertation will be of interest to researchers and practitioners in finance and accounting. For example our results suggest a pricing effect due to stock exchange, number of shares outstanding (b25), number of individuals holding the stock (b100), number of shares traded during the calendar year (b28) [42] and a variety of outside opinions about firms operations. These influences may be ascribed to investors belief's and preferences. It is likely, however, that a variety of 'puzzles' which arise within the

[42]The results regarding the exchange effect, B25 and b28 confirm the theoretical relations suggested in the models of Brennan and Hughes [17] Rydqvist [99], Harris and Raviv [37] and Mayer [75].

confines of the standard asset pricing models, for example the mean reversion phenomenon, may be resolved once the influence of these factors are formally integrated in the analysis.

The empirical research in accounting has almost exclusively focused on earnings (or earnings related variables) as the sole value relevant financial attribute. In assessing this voluminous literature Lev [64, 63] concludes that the level or changes in earnings *alone* play a minor role in explaining the raw or risk adjusted stock returns. He concludes that earnings have little relevance for security valuation.

The results here provide further evidence in support of Lev's conclusions and suggests that earning related variables particularly retained earnings per share (b36) should be closely scrutinized. Our findings also confirm the view among accounting researchers that the inability of earnings to predict prices (returns) may be due misspecification error as well as the exclusion of non-earning information available to the market [87].

Finally, the results of this study are similar to those of Ou and Penman [84], who indicate that non-earning financial information is strongly value-relevant. They, however, utilize aggregate measures which combine a large set of attributes into a single predictor. The present dissertation complements the Ou and Penman study by providing information regarding the influence of specific accounting attributes.

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7 Appendix A

The following lemma establishes the quasi-concavity of $u^*(\, . \,)$.

Lemma 1 If the set $Z(X,\beta) = \{Z \in R^m \ : \ G(X,Z,\beta) \leq 0\}$ is nonempty, the induced utility function, $u^* \ : \ R^n \times R^s \ \rightarrow \ R$, defined by $u^*(X,\beta) = maximum[u(Z) \ : \ Z \in Z(X,\beta)]$ is quasi-concave in X.

Proof of lemma 1: Consider two portfolios, X and X' such that for a given β and any real constant k, $u^*(X,\beta) = k$ and $u^*(X',\beta) \geq k$. Let $X'' = tX + (1-t)X'$ for a $t \in [0,1]$. Corresponding to X, X' and X'' define Z, Z' and Z'' such that $G(X,Z,\beta) \leq 0$, $G(X',Z',\beta) \leq 0$, and $G(X'',Z'',\beta) \leq 0$ with $u(Z) = u^*(X,\beta)$, $u(Z') = u^*(X',\beta)$, and $u(Z'') = u^*(X'',\beta)$. Now the convexity of production possibility set, $Y(\beta)$ implies that $G[tZ + (1-t)Z', X', \beta] \leq 0$, while the quasi-concavity of $u(.)$ implies that $u[tZ + (1-t)Z'] \geq u(Z)$. Hence it follows that $u^*(X'',\beta) = u(Z'') \geq u[tZ + (1-t)Z'] \geq u(Z) = k$, which is the definition of quasi-concavity. *QED*

8 Appendix (B)

- Table (1): Regression results for PHI22 with all variables included
- Table (2): Regression results for PLO22 with all variables included
- Table (3): Regression results for PCY24 with all variables included
- Table (4): Regression results for PC199 with all variables included
- Table (5): Regression results for PHI22 without the accounting ratios
- Table (6): Regression results for PLO22 without the accounting ratios
- Table (7): Regression results for PCY24 without the accounting ratios
- Table (8): Regression results for PC199 without the accounting ratios
- Table (9): Final regression results for PHI22 without accounting ratios
- Table (10): Final regression results for PLO22 without accounting ratios
- Table (11): Final regression results for PLO22 without accounting ratios
- Table (12): Final regression results for PCY24 without accounting ratios
- Table (13): Final regression results for PCY24 without accounting ratios
- Table (14): Final regression results for PCY24 without accounting ratios
- Table (15): Final regression results for PC199 without accounting ratios
- Table (16): Final regression results for PC199 without accounting ratios

Table (1): Regression results for PHI22 with all variables included

Dependent Variable PHI22   R-square = 0.77425210

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	94	980028.52412176	10425.83536300	68.89	0.0000
Error	1888	285745.92912997	151.34847941		
Total	1982	1265774.4532517			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	16.87066158	18.74662546	122.57335794	0.81	0.3683
NYSE	1.90930244	1.34906924	303.15102166	2.00	0.1572
AMEX	-0.16923387	1.47787626	1.98461612	0.01	0.9088
FYRD	-0.39814932	0.65843340	55.34091256	0.37	0.5455
b1	-0.00384130	0.03013060	2.45990557	0.02	0.8986
b2	0.26493470	0.08678771	1410.39021946	9.32	0.0023
b3	-0.18539002	0.04509618	2557.82787415	16.90	0.0001
b4	0.14292811	0.05912583	884.42067834	5.84	0.0157
b5	-0.03325491	0.01241334	1086.20674205	7.18	0.0074
b6	0.69054948	0.33474410	644.08294511	4.26	0.0393
b7	-0.09270068	0.05376600	449.91284098	2.97	0.0848
b8	-0.11317998	0.08863326	246.78789331	1.63	0.2018
b9	-0.01986478	0.03807134	41.20492708	0.27	0.6019
b12	0.11444635	0.03464745	1651.35112284	10.91	0.0010
b13	0.42722289	0.17942664	858.05128722	5.67	0.0174
b14	1.00882805	0.42794379	841.08309341	5.56	0.0185
b15	1.14864048	0.18686726	5718.47040867	37.78	0.0001
b16	5.16120367	0.47739533	17689.83280039	116.88	0.0001
b18	-2.48167356	0.33700598	8207.14585996	54.23	0.0001
b19	-0.15068659	1.40428962	1.74266486	0.01	0.9146
b21	1.19890007	1.15236210	163.81968926	1.08	0.2983
b26	3.67813501	0.87164498	2694.97117858	17.81	0.0001
b28	5.03871725	0.60967116	10337.76690335	68.30	0.0001
b29	-0.01357051	0.01869035	79.78765820	0.53	0.4679
b30	0.23639399	0.19746552	216.90441156	1.43	0.2314
b36	0.66050333	0.06758610	14454.84102907	95.51	0.0001
b41	-0.11932541	0.04063359	1305.18922307	8.62	0.0034
b42	-0.15428078	0.05351419	1257.95117572	8.31	0.0040
b43	-0.93488709	0.65846308	305.09389896	2.02	0.1558
b45	0.41641799	0.27428641	348.84173237	2.30	0.1291
b46	0.91465962	0.41790309	725.01318001	4.79	0.0287
b51	7.17396234	4.83464405	333.24775870	2.20	0.1380
b58	0.46536161	1.08967340	27.60364703	0.18	0.6694
FIFO	0.42163607	0.81020435	40.98872669	0.27	0.6028
LIFO	-1.36743928	0.95569169	309.85502441	2.05	0.1526
b60	-0.43152479	0.23415991	514.00159620	3.40	0.0655
b98	-0.03041953	0.01275430	860.93438843	5.69	0.0172
b100	-0.03074592	0.01145631	1090.09229840	7.20	0.0073
b107	0.03045219	0.35282591	1.12744227	0.01	0.9312
b108	0.25489369	0.18971726	273.20116287	1.81	0.1793
b109	0.04164936	0.05176071	97.99280526	0.65	0.4211

Table (1) Cont. : Regression results for PHI22

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
b110	0.60113411	0.12546276	3474.49060102	22.96	0.0001
b111	0.06485660	0.06682280	142.57295011	0.94	0.3319
b112	-0.10506092	0.04942452	683.87316882	4.52	0.0337
b113	-0.21826902	0.04967126	2922.48269831	19.31	0.0001
b114	-0.30974906	0.08243634	2136.78411367	14.12	0.0002
b115	-0.19376349	0.22831294	109.00864252	0.72	0.3962
b116	0.18948097	0.05579954	1745.21169768	11.53	0.0007
b123	1.30580693	0.79491172	408.41172166	2.70	0.1006
b127	-1.54313360	1.02313220	344.28778297	2.27	0.1317
b128	-0.84560928	0.26350695	1558.59536384	10.30	0.0014
b129	-0.17502157	0.09892083	473.78978642	3.13	0.0770
AUDIT	2.85798001	2.37105931	219.89309868	1.45	0.2282
b172	-0.73357522	0.28676833	990.38711566	6.54	0.0106
b181	-0.73948548	0.33300841	746.32324363	4.93	0.0265
b216	-0.31789961	0.39874256	96.19951302	0.64	0.4254
b235	0.38231751	0.11275105	1740.14439920	11.50	0.0007
b248	0.82053804	1.91904935	27.66962156	0.18	0.6690
b249	-0.11725750	0.03174555	2064.87491488	13.64	0.0002
b278	-0.43798584	2.63454674	4.18298583	0.03	0.8680
FORTUNE	-3.04108334	1.24771186	899.09607409	5.94	0.0149
BONDA	2.02043944	1.13527181	479.36909063	3.17	0.0753
BONDB	-1.21417632	0.86487101	298.29013501	1.97	0.1605
STOCKA	5.02546775	1.03073155	3597.82390082	23.77	0.0001
STOCKB	-0.55988230	0.78207914	77.56577456	0.51	0.4741
b283D	-13.19526836	6.37588984	648.23564206	4.28	0.0386
PAPERA	-12.24739415	6.43888234	547.57608598	3.62	0.0573
b1_6	7.10184628	4.63551854	355.24171061	2.35	0.1257
b2_6	-11.20175532	5.65143600	594.61053315	3.93	0.0476
b3_6	-8.79861678	3.97278772	742.36270747	4.90	0.0269
b4_6	-0.70003659	4.06633658	4.48552107	0.03	0.8633
b7_6	-1.67991579	0.99289161	433.26081318	2.86	0.0908
b8_6	4.21657330	2.75686227	354.05214760	2.34	0.1263
b5_6	-3.25883848	3.51853598	129.83139986	0.86	0.3545
b9_6	-2.59488484	3.23619293	97.30730162	0.64	0.4228
b181_6	9.86120843	17.40740541	48.57024015	0.32	0.5711
b60_6	1.53520323	8.61200459	4.80951528	0.03	0.8585
b36_6	-2.48880350	1.56953366	380.55550785	2.51	0.1130
b216_6	-2.69288553	19.01474026	3.03551967	0.02	0.8874
b235_6	5.77890750	5.55445774	163.82727793	1.08	0.2983
b12_172	-0.00014200	0.00636282	0.07538507	0.00	0.9822
b13_172	0.05294724	0.01999978	1060.75337069	7.01	0.0082
b14_172	-0.07303374	0.03687730	593.61777439	3.92	0.0478
b15_172	0.01120587	0.01863254	54.74251246	0.36	0.5476
b16_172	-0.20793831	0.13007175	386.79526255	2.56	0.1101
b41_172	-0.00076092	0.00821459	1.29861548	0.01	0.9262
b9_216	-0.22894754	0.19253058	214.01814254	1.41	0.2345
b5b9_216	0.02915222	0.09171931	15.28972715	0.10	0.7506
b13_15	0.00362149	0.00164845	730.46355178	4.83	0.0281
b1_15	-0.00244824	0.00107541	784.39840658	5.18	0.0229
b172_12	-0.06173874	0.50931896	2.22389332	0.01	0.9035
b172_60	-0.12306542	0.36327138	17.36951811	0.11	0.7348
b172_216	-0.09274002	0.44715892	6.51011496	0.04	0.8357
b2_12	0.32985132	0.90461905	20.12255150	0.13	0.7154

Table (2): Regression results for PLO22 with all variables included

Dependent Variable PLO23 R-square = 0.81127034

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	94	357245.03775005	3800.47912500	86.34	0.0000
Error	1888	83107.60645188	44.01885935		
Total	1982	440352.64420194			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	9.59045500	10.11005374	39.61049597	0.90	0.3429
NYSE	-0.42976613	0.72755294	15.35938974	0.35	0.5548
AMEX	-1.76805339	0.79701856	216.61706625	4.92	0.0267
FYRD	-0.04032203	0.35509308	0.56759565	0.01	0.9096
b1	-0.00136240	0.01624943	0.30943474	0.01	0.9332
b2	0.11350438	0.04680461	258.87306070	5.88	0.0154
b3	-0.13894595	0.02432037	1436.78038062	32.64	0.0001
b4	0.07079316	0.03188655	216.97321341	4.93	0.0265
b5	-0.02338662	0.00669451	537.20012526	12.20	0.0005
b6	0.45336275	0.18052747	277.61560107	6.31	0.0121
b7	-0.04493134	0.02899600	105.69666378	2.40	0.1214
b8	-0.07744375	0.04779991	115.54664926	2.62	0.1054
b9	-0.02422502	0.02053187	61.27879294	1.39	0.2382
b12	0.05644943	0.01868537	401.74879605	9.13	0.0026
b13	0.26001866	0.09676477	317.84343271	7.22	0.0073
b14	0.77571677	0.23079005	497.29142515	11.30	0.0008
b15	0.67512337	0.10077750	1975.50405204	44.88	0.0001
b16	3.09805201	0.25745927	6373.81040601	144.80	0.0001
b18	-1.49456033	0.18174730	2976.66354859	67.62	0.0001
b19	-0.98877852	0.75733329	75.03480038	1.70	0.1918
b21	1.00052201	0.62146880	114.09153302	2.59	0.1076
b26	2.85994450	0.47007808	1629.34856299	37.01	0.0001
b28	-0.13524067	0.32879561	7.44734328	0.17	0.6809
b29	-0.01403929	0.01007970	85.39522150	1.94	0.1638
b30	0.17653130	0.10649314	120.95921365	2.75	0.0975
b36	0.33049199	0.03644918	3618.97163330	82.21	0.0001
b41	-0.06547397	0.02191369	392.95701427	8.93	0.0028
b42	-0.10787452	0.02886020	615.00390051	13.97	0.0002
b43	-0.76926327	0.35510909	206.56901994	4.69	0.0304
b45	0.38774272	0.14792264	302.45221899	6.87	0.0088
b46	0.50488052	0.22537511	220.90427759	5.02	0.0252
b51	6.37207789	2.60732318	262.91248123	5.97	0.0146
b58	1.50610642	0.58766078	289.13235151	6.57	0.0105
FIFO	0.25814270	0.43694315	15.36415258	0.35	0.5547
LIFO	-0.73938024	0.51540446	90.58955309	2.06	0.1516
b60	-0.22209826	0.12628242	136.15803590	3.09	0.0788
b98	-0.00054969	0.00687839	0.28112674	0.01	0.9363
b100	-0.01256039	0.00617839	181.92582464	4.13	0.0422
b107	0.09984113	0.19027899	12.11926099	0.28	0.5998
b108	0.09396002	0.10231450	37.12364262	0.84	0.3586

Table (2) Cont. : Regression results for PLO22

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
b109	0.01860060	0.02791455	19.54481072	0.44	0.5053
b110	0.34455422	0.06766206	1141.46748313	25.93	0.0001
b111	0.02507054	0.03603753	21.30374716	0.48	0.4867
b112	-0.04007378	0.02665464	99.49785973	2.26	0.1329
b113	-0.12060800	0.02678771	892.31876325	20.27	0.0001
b114	-0.16745071	0.04445791	624.47441984	14.19	0.0002
b115	0.16858346	0.12312915	82.51767059	1.87	0.1711
b116	0.09308818	0.03009269	421.21711930	9.57	0.0020
b123	0.50513349	0.42869583	61.11566973	1.39	0.2388
b127	-0.89893333	0.55177512	116.83407471	2.65	0.1034
b128	-0.63491473	0.14210928	878.66777864	19.96	0.0001
b129	-0.06662011	0.05334800	68.64567413	1.56	0.2119
AUDIT	1.56340456	1.27871211	65.80152724	1.49	0.2216
b172	-0.30515482	0.15465414	171.37841860	3.89	0.0486
b181	-0.48008347	0.17959141	314.55831817	7.15	0.0076
b216	-0.18242916	0.21504183	31.67972555	0.72	0.3964
b235	0.17814744	0.06080663	377.82968523	8.58	0.0034
b248	0.99970450	1.03494317	41.07230482	0.93	0.3342
b249	-0.06564155	0.01712037	647.09808895	14.70	0.0001
b278	0.98165940	1.42081086	21.01299265	0.48	0.4897
FORTUNE	-1.01560599	0.67289091	100.27668537	2.28	0.1314
BONDA	1.50367254	0.61225201	265.51244985	6.03	0.0141
BONDB	-1.09641287	0.46642487	243.23363220	5.53	0.0188
STOCKA	3.36049962	0.55587345	1608.77245301	36.55	0.0001
STOCKB	-0.28297459	0.42177522	19.81397176	0.45	0.5024
b283D	-9.25048544	3.43851693	318.58512890	7.24	0.0072
PAPERA	-9.04897465	3.47248877	298.92058712	6.79	0.0092
b1_6	4.49878332	2.49993481	142.55142700	3.24	0.0721
b2_6	-4.86835845	3.04781902	112.31183617	2.55	0.1104
b3_6	-4.08152462	2.14252413	159.74680593	3.63	0.0569
b4_6	-0.57385733	2.19297502	3.01425011	0.07	0.7936
b7_6	-0.70715545	0.53546637	76.77223333	1.74	0.1868
b8_6	2.49452566	1.48677562	123.91499868	2.82	0.0935
b5_6	-0.79724694	1.89754620	7.77033584	0.18	0.6744
b9_6	0.18748228	1.74527861	0.50796023	0.01	0.9145
b181_6	5.11464022	9.38781246	13.06592474	0.30	0.5859
b60_6	0.09423041	4.64445345	0.01811973	0.00	0.9838
b36_6	-1.67338459	0.84644939	172.03956053	3.91	0.0482
b216_6	0.24850511	10.25464803	0.02585044	0.00	0.9807
b235_6	2.89931578	2.99551865	41.23687700	0.94	0.3332
b12_172	-0.00046961	0.00343147	0.82441557	0.02	0.8912
b13_172	0.03371083	0.01078588	429.99822310	9.77	0.0018
b14_172	-0.04372178	0.01988793	212.74308666	4.83	0.0280
b15_172	0.00621552	0.01004853	16.84178846	0.38	0.5363
b16_172	-0.13269697	0.07014768	157.51942484	3.58	0.0587
b41_172	0.00021604	0.00443013	0.10468272	0.00	0.9611
b9_216	-0.16111722	0.10383173	105.98943569	2.41	0.1209
b5b9_216	0.03250957	0.04946422	19.01423539	0.43	0.5111
b13_15	0.00075558	0.00088901	31.79710152	0.72	0.3955
b1_15	-0.00049559	0.00057997	32.14134255	0.73	0.3929
b172_12	-0.10362243	0.27467568	6.26478115	0.14	0.7060
b172_60	-0.09329021	0.19591223	9.98131655	0.23	0.6340
b172_216	0.03013398	0.24115277	0.68733326	0.02	0.9006
b2_12	0.13603208	0.48786099	3.42238810	0.08	0.7804

Table (3): Regression results for PCY24 with all variables included

Dependent Variable PC24 R-square = 0.78406227

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	94	561244.56960371	5970.68691068	72.93	0.0000
Error	1888	154571.74787031	81.87062917		
Total	1982	715816.31747402			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	16.36466890	13.78790034	115.33106493	1.41	0.2354
NYSE	0.04116388	0.99222296	0.14091011	0.00	0.9669
AMEX	-1.76837338	1.08695885	216.69548094	2.65	0.1039
FYRD	-0.01591514	0.48426924	0.08842505	0.00	0.9738
b1	0.00290211	0.02216066	1.40407549	0.02	0.8958
b2	0.21387606	0.06383124	919.14905566	11.23	0.0008
b3	-0.17261947	0.03316765	2217.57425396	27.09	0.0001
b4	0.04773911	0.04348628	98.66705341	1.21	0.2724
b5	-0.02954350	0.00912985	857.28464552	10.47	0.0012
b6	0.52309715	0.24619995	369.58718390	4.51	0.0337
b7	-0.02595691	0.03954420	35.27510998	0.43	0.5116
b8	-0.12508389	0.06518861	301.43063753	3.68	0.0552
b9	-0.04019824	0.02800097	168.73139381	2.06	0.1513
b12	0.06972551	0.02548275	612.94125949	7.49	0.0063
b13	0.32920636	0.13196597	509.49585971	6.22	0.0127
b14	0.88358851	0.31474712	645.21540405	7.88	0.0050
b15	0.93312268	0.13743845	3773.88909589	46.10	0.0001
b16	4.39990093	0.35111808	12856.04927262	157.03	0.0001
b18	-2.07564045	0.24786354	5741.25841918	70.13	0.0001
b19	-1.62113387	1.03283684	201.69839801	2.46	0.1167
b21	0.24993657	0.84754741	7.11966797	0.09	0.7681
b26	3.03022031	0.64108360	1829.14106538	22.34	0.0001
b28	1.25517182	0.44840525	641.49476707	7.84	0.0052
b29	-0.02317561	0.01374651	232.70501147	2.84	0.0920
b30	0.24845328	0.14523333	239.59899734	2.93	0.0873
b36	0.41876423	0.04970870	5810.35215717	70.97	0.0001
b41	-0.07718128	0.02988548	546.04891166	6.67	0.0099
b42	-0.17251300	0.03935900	1572.83709107	19.21	0.0001
b43	-0.71987542	0.48429107	180.89638447	2.21	0.1373
b45	0.38751473	0.20173411	302.09664384	3.69	0.0549
b46	0.84755459	0.30736232	622.53281019	7.60	0.0059
b51	7.80477940	3.55581811	394.43034310	4.82	0.0283
b58	2.09306463	0.80144068	558.40672967	6.82	0.0091
FIFO	0.14689991	0.59589481	4.97544532	0.06	0.8053
LIFO	-0.77452992	0.70289887	99.40742853	1.21	0.2706
b60	-0.27172154	0.17222158	203.79855844	2.49	0.1148
b98	-0.01174548	0.00938062	128.35305050	1.57	0.2107
b100	-0.00683868	0.00842597	53.93037139	0.66	0.4171
b107	0.04377491	0.25949889	2.32974093	0.03	0.8661
b108	0.23189851	0.13953459	226.13109704	2.76	0.0967
b109	0.02524087	0.03806933	35.99035543	0.44	0.5074

Table (3) Cont. : Regression results for PCY24

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
b110	0.49765750	0.09227623	2381.27476714	29.09	0.0001
b111	0.05107421	0.04914730	88.41623682	1.08	0.2988
b112	-0.06214284	0.03635109	239.26285855	2.92	0.0875
b113	-0.15664459	0.03653257	1505.21504570	18.39	0.0001
b114	-0.21672717	0.06063086	1046.08596697	12.78	0.0004
b115	-0.02132951	0.16792121	1.32092691	0.02	0.8989
b116	0.12633298	0.04103984	775.80112794	9.48	0.0021
b123	0.93433947	0.58464728	209.09788968	2.55	0.1102
b127	-0.32955046	0.75250049	15.70212406	0.19	0.6615
b128	-0.91703631	0.19380595	1833.01899526	22.39	0.0001
b129	-0.10562193	0.07275499	172.54832644	2.11	0.1467
AUDIT	1.47147514	1.74388343	58.29067482	0.71	0.3989
b172	-0.41745595	0.21091440	320.72808433	3.92	0.0479
b181	-0.55999515	0.24492337	427.99254050	5.23	0.0223
b216	-0.24533225	0.29326999	57.29307676	0.70	0.4030
b235	0.24847003	0.08292693	734.99591425	8.98	0.0028
b248	0.87719202	1.41143595	31.62242150	0.39	0.5344
b249	-0.08133919	0.02334844	993.60117562	12.14	0.0005
b278	-0.69009982	1.93767502	10.38460719	0.13	0.7218
FORTUNE	-2.48330174	0.91767592	599.52658334	7.32	0.0069
BONDA	1.65647016	0.83497772	322.21487467	3.94	0.0474
BONDB	-1.21179917	0.63610144	297.12327981	3.63	0.0569
STOCKA	3.25679536	0.75808971	1511.01182594	18.46	0.0001
STOCKB	-0.70081230	0.57520908	121.52904507	1.48	0.2232
b283D	-13.12424523	4.68938444	641.27620502	7.83	0.0052
PAPERA	-12.63020981	4.73571461	582.34213375	7.11	0.0077
b1_6	5.72953165	3.40936388	231.21694742	2.82	0.0930
b2_6	-7.24975201	4.15655802	249.06157816	3.04	0.0813
b3_6	-7.12444611	2.92193394	486.73161092	5.95	0.0148
b4_6	0.68104852	2.99073791	4.24548708	0.05	0.8199
b7_6	-1.12264645	0.73025892	193.49083431	2.36	0.1244
b8_6	3.78866501	2.02763651	285.83824605	3.49	0.0618
b5_6	-0.19670731	2.58783767	0.47303693	0.01	0.9394
b9_6	0.85067226	2.38017801	10.45764255	0.13	0.7208
b181_6	4.31900990	12.80292133	9.31704888	0.11	0.7359
b60_6	0.28196943	6.33401789	0.16224586	0.00	0.9645
b36_6	-1.58886140	1.15437169	155.09893703	1.89	0.1689
b216_6	-1.78407255	13.98509531	1.33236216	0.02	0.8985
b235_6	4.32482044	4.08523176	91.75524315	1.12	0.2899
b12_172	-0.00030419	0.00467977	0.34591223	0.00	0.9482
b13_172	0.04453212	0.01470958	750.36838059	9.17	0.0025
b14_172	-0.05615411	0.02712278	350.93192906	4.29	0.0386
b15_172	0.00652551	0.01370399	18.56360381	0.23	0.6340
b16_172	-0.16334654	0.09566608	238.68877923	2.92	0.0879
b41_172	-0.00046350	0.00604173	0.48183880	0.01	0.9389
b9_216	-0.18058309	0.14160375	133.14743669	1.63	0.2024
b5b9_216	0.04326587	0.06745837	33.67808166	0.41	0.5214
b13_15	0.00144286	0.00121242	115.95110251	1.42	0.2342
b1_15	-0.00107967	0.00079095	152.55010021	1.86	0.1724
b172_12	0.01116567	0.37459750	0.07273905	0.00	0.9762
b172_60	-0.08292387	0.26718140	7.88632683	0.10	0.7563
b172_216	0.04136490	0.32887960	1.29514456	0.02	0.8999
b2_12	0.10596159	0.66533560	2.07655535	0.03	0.8735

Table (4): Regression results for PC199 with all variables included

Dependent Variable PC199 R-square = 0.77647920

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	94	567415.91780369	6036.33955110	69.77	0.0000
Error	1888	163338.90351379	86.51424974		
Total	1982	730754.82131748			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	21.05558271	14.17352567	190.92657706	2.21	0.1376
NYSE	-0.35671306	1.01997384	10.58150862	0.12	0.7266
AMEX	-2.41816948	1.11735934	405.20555415	4.68	0.0306
FYRD	-2.91153860	0.49781347	2959.37135759	34.21	0.0001
b1	0.00442711	0.02278046	3.26741269	0.04	0.8459
b2	0.20042259	0.06561649	807.15129833	9.33	0.0023
b3	-0.16056012	0.03409530	1918.55369095	22.18	0.0001
b4	0.08241558	0.04470252	294.06423423	3.40	0.0654
b5	-0.03191492	0.00938520	1000.43419512	11.56	0.0007
b6	0.54639470	0.25308577	403.24143729	4.66	0.0310
b7	-0.02209199	0.04065019	25.55242123	0.30	0.5869
b8	-0.13206795	0.06701183	336.03112950	3.88	0.0489
b9	-0.03080146	0.02878412	99.06596882	1.15	0.2847
b12	0.06419569	0.02619546	519.57384389	6.01	0.0144
b13	0.30983041	0.13565684	451.28646732	5.22	0.0225
b14	0.85321003	0.32355009	601.61202631	6.95	0.0084
b15	0.89593221	0.14128238	3479.06019731	40.21	0.0001
b16	4.70648666	0.36093829	14710.09229827	170.03	0.0001
b18	-2.06106132	0.25479588	5660.88941831	65.43	0.0001
b19	-2.22643157	1.06172362	380.43756186	4.40	0.0361
b21	0.35814597	0.87125194	14.61908717	0.17	0.6811
b26	2.90689327	0.65901368	1683.28233165	19.46	0.0001
b28	1.36105413	0.46094642	754.28862160	8.72	0.0032
b29	-0.02483400	0.01413098	267.20014203	3.09	0.0790
b30	0.24630166	0.14929527	235.46707889	2.72	0.0992
b36	0.40418133	0.05109897	5412.72300881	62.56	0.0001
b41	-0.07536773	0.03072133	520.68915754	6.02	0.0142
b42	-0.19145752	0.04045980	1937.24680688	22.39	0.0001
b43	-0.71763458	0.49783591	179.77194294	2.08	0.1496
b45	0.54690615	0.20737628	601.72090004	6.96	0.0084
b46	0.81512111	0.31595874	575.79935678	6.66	0.0100
b51	8.23820889	3.65526861	439.45524427	5.08	0.0243
b58	2.38487178	0.82385568	724.96231922	8.38	0.0038
FIFO	0.10677399	0.61256103	2.62857195	0.03	0.8616
LIFO	-0.77334778	0.72255782	99.10421529	1.15	0.2846
b60	-0.25742172	0.17703834	182.91248792	2.11	0.1461
b98	-0.00867849	0.00964298	70.07346142	0.81	0.3682
b100	-0.00523825	0.00866163	31.64173878	0.37	0.5454
b107	0.04670099	0.26675665	2.65160838	0.03	0.8610
b108	0.27961252	0.14343715	328.75895611	3.80	0.0514
b109	0.02188684	0.03913407	27.06099133	0.31	0.5760

Table (4) Cont. : Regression results for PC199

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
b110	0.51095657	0.09485705	2510.24655019	29.02	0.0001
b111	0.04545326	0.05052187	70.02591052	0.81	0.3684
b112	-0.05798259	0.03736778	208.29957096	2.41	0.1209
b113	-0.14610973	0.03755432	1309.56191373	15.14	0.0001
b114	-0.21996420	0.06232661	1077.56798686	12.46	0.0004
b115	-0.10393103	0.17261770	31.36226897	0.36	0.5472
b116	0.11765577	0.04218765	672.88888861	7.78	0.0053
b123	1.04418983	0.60099892	261.15549845	3.02	0.0825
b127	-0.45277064	0.77354671	29.63951320	0.34	0.5584
b128	-0.81199438	0.19922639	1437.14288025	16.61	0.0001
b129	-0.10411647	0.07478983	167.66459597	1.94	0.1640
AUDIT	1.06020315	1.79265703	30.26017295	0.35	0.5543
b172	-0.32713284	0.21681333	196.95361211	2.28	0.1315
b181	-0.58321123	0.25177348	464.21527251	5.37	0.0206
b216	-0.25652417	0.30147228	62.63966791	0.72	0.3949
b235	0.21381096	0.08524627	544.24799513	6.29	0.0122
b248	0.95788253	1.45091154	37.70772043	0.44	0.5092
b249	-0.07975408	0.02400146	955.25264246	11.04	0.0009
b278	-0.80488636	1.99186866	14.12652622	0.16	0.6862
FORTUNE	-2.89746650	0.94334183	816.18067164	9.43	0.0022
BONDA	1.97261294	0.85833070	456.94308275	5.28	0.0217
BONDB	-1.17534490	0.65389217	279.51558576	3.23	0.0724
STOCKA	2.99845937	0.77929226	1280.80572054	14.80	0.0001
STOCKB	-0.97138432	0.59129675	233.48492220	2.70	0.1006
b283D	-11.63167206	4.82053896	503.71020624	5.82	0.0159
PAPERA	-10.92253938	4.86816491	435.51620777	5.03	0.0250
b1_6	6.07821061	3.50471828	260.21534671	3.01	0.0830
b2_6	-6.52120724	4.27281024	201.51920315	2.33	0.1271
b3_6	-7.64833944	3.00365572	560.94676803	6.48	0.0110
b4_6	-0.55231272	3.07438402	2.79216777	0.03	0.8574
b7_6	-1.20919258	0.75068309	224.47362935	2.59	0.1074
b8_6	3.87160729	2.08434623	298.49050558	3.45	0.0634
b5_6	0.51482957	2.66021531	3.24026871	0.04	0.8466
b9_6	0.98534525	2.44674775	14.03091874	0.16	0.6872
b181_6	2.08347557	13.16099839	2.16813739	0.03	0.8742
b60_6	0.14964201	6.51117015	0.04569583	0.00	0.9817
b36_6	-1.33028784	1.18665760	108.72465533	1.26	0.2624
b216_6	-4.90219336	14.37623586	10.05954046	0.12	0.7331
b235_6	5.60969440	4.19948910	154.37363620	1.78	0.1818
b12_172	-0.00186032	0.00481066	12.93760722	0.15	0.6990
b13_172	0.04251045	0.01512098	683.78431877	7.90	0.0050
b14_172	-0.05911866	0.02788136	388.96355971	4.50	0.0341
b15_172	0.00872733	0.01408727	33.20447486	0.38	0.5356
b16_172	-0.15958916	0.09834171	227.83418179	2.63	0.1048
b41_172	0.00193156	0.00621070	8.36801219	0.10	0.7558
b9_216	-0.15929013	0.14556418	103.59919304	1.20	0.2740
b5b9_216	0.04195173	0.06934507	31.66329841	0.37	0.5453
b13_15	0.00116624	0.00124633	75.75252404	0.88	0.3495
b1_15	-0.00097325	0.00081307	123.95834980	1.43	0.2315
b172_12	0.13103826	0.38507439	10.01831290	0.12	0.7337
b172_60	-0.04445505	0.27465403	2.26651091	0.03	0.8714
b172_216	0.14530763	0.33807783	15.98199888	0.18	0.6674
b2_12	0.11708312	0.68394397	2.53533396	0.03	0.8641

Table (5): Regression results for PHI22 without the accounting ratios

Dependent Variable PHI22 R-square = 0.76550482

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	68	990830.59335696	14571.03813760	96.88	0.0000
Error	2018	303518.66906167	150.40568338		
Total	2086	1294349.2624186			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	20.35341481	6.35498081	1542.80247641	10.26	0.0014
NYSE	1.33069398	1.28813777	160.50774682	1.07	0.3017
AMEX	-0.69302616	1.40049226	36.83002978	0.24	0.6208
FYRD	0.69603401	0.62365821	187.34058646	1.25	0.2645
b1	0.01318022	0.02669610	36.66182059	0.24	0.6216
b2	0.16525100	0.06899826	862.73244933	5.74	0.0167
b3	-0.23008202	0.04030323	4901.73674891	32.59	0.0001
b4	0.14325945	0.04891180	1290.27890097	8.58	0.0034
b5	-0.04164111	0.01080005	2235.92515870	14.87	0.0001
b6	0.42819615	0.19615717	716.70661674	4.77	0.0292
b7	-0.10145391	0.04615922	726.58242082	4.83	0.0281
b8	-0.01200397	0.07380125	3.97911584	0.03	0.8708
b9	-0.02410127	0.03300334	80.20993042	0.53	0.4653
b12	0.12713201	0.03201933	2371.09844246	15.76	0.0001
b13	0.49281840	0.17012688	1262.09542912	8.39	0.0038
b14	0.26153833	0.32210786	99.15902986	0.66	0.4169
b15	1.03140265	0.16886885	5610.75936833	37.30	0.0001
b16	4.84964573	0.45694960	16941.33641669	112.64	0.0001
b18	-2.41509225	0.32918110	8095.84003533	53.83	0.0001
b19	0.37840973	1.30438483	12.65835731	0.08	0.7718
b21	0.05065970	1.06871690	0.33795906	0.00	0.9622
b25	0.04186422	0.00780776	4324.11415377	28.75	0.0001
b26	3.58006076	0.83402585	2771.31583064	18.43	0.0001
b28	4.92443464	0.55401227	11883.33211386	79.01	0.0001
b29	-0.05994914	0.02012430	1334.71506033	8.87	0.0029
b30	0.23952155	0.19489660	227.16683460	1.51	0.2192
b36	0.55024482	0.05776108	13649.14810728	90.75	0.0001
b41	-0.12399565	0.03767751	1628.96904683	10.83	0.0010
b42	-0.14675725	0.05280468	1161.76563007	7.72	0.0055
b43	-0.70303594	0.58840552	214.71670036	1.43	0.2323
b45	0.46255420	0.27006741	441.20977755	2.93	0.0869
b46	1.08523987	0.40666732	1071.11769166	7.12	0.0077
b51	10.04458922	4.74943410	672.73632270	4.47	0.0346
b58	-0.09137317	1.02857991	1.18693112	0.01	0.9292
FIFO	-0.65387947	0.73598464	118.71952346	0.79	0.3744
LIFO	-2.63537132	0.89173146	1313.65010639	8.73	0.0032
b60	-0.19072433	0.18599894	158.14502009	1.05	0.3053
b98	-0.02425270	0.01233584	581.36277198	3.87	0.0494
b100	-0.05330399	0.01223385	2855.33805758	18.98	0.0001
b107	0.23505464	0.34695685	69.03208096	0.46	0.4982
b108	0.25861550	0.18666892	288.68840673	1.92	0.1661
b109	0.06166622	0.05033240	225.76864604	1.50	0.2207

Table (5) Cont. : Regression results for PHI22

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
b110	0.56665588	0.12091204	3303.42136188	21.96	0.0001
b111	0.04300892	0.06537438	65.09777688	0.43	0.5107
b112	-0.07856905	0.04826407	398.58367664	2.65	0.1037
b113	-0.18665613	0.04738822	2333.50060082	15.51	0.0001
b114	-0.22625790	0.07998813	1203.42954826	8.00	0.0047
b115	-0.05501936	0.22386575	9.08489853	0.06	0.8059
b116	0.11933454	0.05243678	778.97686058	5.18	0.0230
b123	1.54772638	0.74008313	657.79658150	4.37	0.0366
b127	-0.34193556	0.93445742	20.13880704	0.13	0.7145
b128	-0.50582700	0.25184764	606.72582219	4.03	0.0447
b129	-0.13327611	0.09689093	284.57886489	1.89	0.1691
AUDIT	-0.69750698	1.67329906	26.13450175	0.17	0.6768
b172	-0.80111806	0.27731097	1255.22961520	8.35	0.0039
b181	-0.46550372	0.19501100	857.02268500	5.70	0.0171
b216	-0.33616860	0.25501294	261.36902045	1.74	0.1876
b235	0.47291108	0.09834546	3477.87968358	23.12	0.0001
b248	1.13083095	1.90095036	53.22529369	0.35	0.5520
b249	-0.10940451	0.03115280	1854.98578490	12.33	0.0005
b278	-0.76947715	2.56701383	13.51447842	0.09	0.7644
FORTUNE	-2.81631235	1.21853922	803.42781623	5.34	0.0209
BONDA	1.96433441	1.11550081	466.39653261	3.10	0.0784
BONDB	-1.05299015	0.82746661	243.56333153	1.62	0.2033
STOCKA	4.26563872	0.95798786	2982.03250081	19.83	0.0001
STOCKB	-1.13465874	0.72203175	371.43444677	2.47	0.1162
b283D	-12.17125990	6.14600635	589.86049423	3.92	0.0478
PAPERA	-11.29438107	6.20440027	498.41316457	3.31	0.0688

Table (6): Regression results for PLO22 without the accounting ratios

Dependent Variable PLO23 R-square = 0.800

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	68	359870.51201476	5292.21341198	119.09	0.0000
Error	2018	89678.75357757	44.43942199		
Total	2086	449549.26559233			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	12.60220486	3.45434986	591.46469965	13.31	0.0003
NYSE	-0.73915673	0.70018756	49.52365405	1.11	0.2913
AMEX	-2.04753982	0.76125962	321.49004566	7.23	0.0072
FYRD	0.52659362	0.33899924	107.23144018	2.41	0.1205
b1	0.00807407	0.01451109	13.75794305	0.31	0.5780
b2	0.06371157	0.03750509	128.24029388	2.89	0.0895
b3	-0.16360346	0.02190745	2478.38952916	55.77	0.0001
b4	0.07421210	0.02658678	346.24731025	7.79	0.0053
b5	-0.02447558	0.00587054	772.46446302	17.38	0.0001
b6	0.25905290	0.10662432	262.32085134	5.90	0.0152
b7	-0.04293108	0.02509057	130.10406229	2.93	0.0872
b8	-0.02091459	0.04011583	12.07912142	0.27	0.6022
b9	-0.02501619	0.01793949	86.41530795	1.94	0.1633
b12	0.06593423	0.01740461	637.76649150	14.35	0.0002
b13	0.29645296	0.09247514	456.69887651	10.28	0.0014
b14	0.26180409	0.17508680	99.36065501	2.24	0.1350
b15	0.63313524	0.09179132	2114.25871860	47.58	0.0001
b16	2.91524308	0.24838215	6121.77248205	137.76	0.0001
b18	-1.45822287	0.17893157	2951.49656200	66.42	0.0001
b19	-0.73687384	0.70901891	47.99975697	1.08	0.2988
b21	0.44863692	0.58091789	26.50506808	0.60	0.4400
b25	0.01872950	0.00424403	865.49330620	19.48	0.0001
b26	2.72612328	0.45334788	1606.92724009	36.16	0.0001
b28	-0.28216085	0.30114209	39.01386597	0.88	0.3489
b29	-0.03510638	0.01093888	457.71448121	10.30	0.0014
b30	0.19151878	0.10593911	145.23739702	3.27	0.0708
b36	0.26485916	0.03139694	3162.44964623	71.16	0.0001
b41	-0.07220796	0.02048020	552.42086590	12.43	0.0004
b42	-0.10701134	0.02870282	617.70205423	13.90	0.0002
b43	-0.58755068	0.31983708	149.96897876	3.37	0.0664
b45	0.39128000	0.14679939	315.71497023	7.10	0.0078
b46	0.61021375	0.22105042	338.64890923	7.62	0.0058
b51	8.38811461	2.58162967	469.14730543	10.56	0.0012
b58	1.24543793	0.55910080	220.51206106	4.96	0.0260
FIFO	-0.19937793	0.40005604	11.03775936	0.25	0.6183
LIFO	-1.38579245	0.48471467	363.23898434	8.17	0.0043
b60	-0.13123521	0.10110265	74.87624586	1.68	0.1944
b98	0.00252763	0.00670534	6.31470297	0.14	0.7062
b100	-0.02183346	0.00664990	479.05248164	10.78	0.0010
b107	0.23327551	0.18859386	67.99103236	1.53	0.2163
b108	0.09153148	0.10146683	36.16272534	0.81	0.3671
b109	0.03182580	0.02735897	60.13505969	1.35	0.2449

Table (6) Cont. : Regression results for PLO22

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
b110	0.31387322	0.06572364	1013.52324205	22.81	0.0001
b111	0.01384862	0.03553527	6.74934847	0.15	0.6968
b112	-0.02766243	0.02623469	49.40798542	1.11	0.2918
b113	-0.10193998	0.02575861	696.00525165	15.66	0.0001
b114	-0.12192596	0.04347881	349.46648746	7.86	0.0051
b115	0.24754766	0.12168575	183.91052829	4.14	0.0420
b116	0.05496824	0.02850284	165.27831945	3.72	0.0539
b123	0.59758210	0.40228383	98.06146913	2.21	0.1376
b127	-0.29898232	0.50793904	15.39700427	0.35	0.5562
b128	-0.45451633	0.13689575	489.87744687	11.02	0.0009
b129	-0.05244919	0.05266659	44.07330766	0.99	0.3194
AUDIT	0.18175861	0.90954804	1.77462708	0.04	0.8416
b172	-0.31800200	0.15073675	197.78340241	4.45	0.0350
b181	-0.28176372	0.10600130	313.99025166	7.07	0.0079
b216	-0.11212530	0.13861630	29.07683048	0.65	0.4187
b235	0.23611417	0.05345723	866.96121151	19.51	0.0001
b248	1.10300806	1.03329149	50.63841066	1.14	0.2859
b249	-0.05981145	0.01693359	554.41978586	12.48	0.0004
b278	0.88345282	1.39534078	17.81453734	0.40	0.5267
FORTUNE	-0.82636271	0.66235617	69.17141287	1.56	0.2123
BONDA	1.60370188	0.60634803	310.86493724	7.00	0.0082
BONDB	-0.96150635	0.44978250	203.08020855	4.57	0.0327
STOCKA	2.85567543	0.52072938	1336.47832919	30.07	0.0001
STOCKB	-0.64973100	0.39247173	121.79201917	2.74	0.0980
b283D	-8.80251320	3.34075850	308.52588553	6.94	0.0085
PAPERA	-8.61748566	3.37249943	290.15213501	6.53	0.0107

Table (7): Regression results for PCY24 without the accounting ratios

Dependent Variable PCY24 R-square = 0.77479

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	68	566163.23220969	8325.92988544	102.10	0.0000
Error	2018	164559.66410632	81.54591878		
Total	2086	730722.89631601			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	17.68732773	4.67932527	1165.09196035	14.29	0.0002
NYSE	-0.53604406	0.94848684	26.04597291	0.32	0.5720
AMEX	-2.26238649	1.03121615	392.49706611	4.81	0.0284
FYRD	0.70842276	0.45921455	194.06891227	2.38	0.1231
b1	0.01283700	0.01965698	34.77726864	0.43	0.5138
b2	0.13915606	0.05080508	611.77563869	7.50	0.0062
b3	-0.21898745	0.02967624	4440.41000594	54.45	0.0001
b4	0.06421964	0.03601493	259.28220387	3.18	0.0747
b5	-0.02935718	0.00795234	1111.32546315	13.63	0.0002
b6	0.32517855	0.14443524	413.33259938	5.07	0.0245
b7	-0.02544727	0.03398814	45.71193048	0.56	0.4541
b8	-0.05384615	0.05434164	80.06563859	0.98	0.3219
b9	-0.04473293	0.02430115	276.31410384	3.39	0.0658
b12	0.08267659	0.02357660	1002.77812968	12.30	0.0005
b13	0.40860864	0.12526852	867.62776969	10.64	0.0011
b14	0.19737741	0.23717577	56.47503000	0.69	0.4054
b15	0.90313574	0.12434220	4302.00803011	52.76	0.0001
b16	4.09943628	0.33646299	12105.31011495	148.45	0.0001
b18	-1.98849645	0.24238396	5488.37922694	67.30	0.0001
b19	-1.06793450	0.96044994	100.81891138	1.24	0.2663
b21	-0.15171573	0.78692196	3.03109881	0.04	0.8471
b25	0.02808081	0.00574904	1945.49589992	23.86	0.0001
b26	2.85531388	0.61411330	1762.84018097	21.62	0.0001
b28	1.18280827	0.40793256	685.57375110	8.41	0.0038
b29	-0.05339746	0.01481801	1058.92161681	12.99	0.0003
b30	0.27913039	0.14350705	308.51053281	3.78	0.0519
b36	0.35060100	0.04253087	5541.40535116	67.95	0.0001
b41	-0.08798256	0.02774285	820.14974907	10.06	0.0015
b42	-0.16754471	0.03888136	1514.19173316	18.57	0.0001
b43	-0.50579249	0.43325714	111.13619750	1.36	0.2432
b45	0.39218212	0.19885714	317.17244361	3.89	0.0487
b46	0.95260422	0.29943893	825.29785355	10.12	0.0015
b51	10.50741161	3.49712260	736.15964426	9.03	0.0027
b58	1.57581445	0.75736814	353.01920280	4.33	0.0376
FIFO	-0.36280738	0.54192320	36.54929216	0.45	0.5033
LIFO	-1.51058082	0.65660333	431.60255396	5.29	0.0215
b60	-0.15748832	0.13695549	107.83010834	1.32	0.2503
b98	-0.00741025	0.00908317	54.27405292	0.67	0.4147
b100	-0.02119920	0.00900808	451.62414338	5.54	0.0187
b107	0.21141041	0.25547267	55.84265671	0.68	0.4080
b108	0.23822740	0.13744882	244.96478631	3.00	0.0832
b109	0.04368636	0.03706096	113.30803290	1.39	0.2386

Table (7) Cont. : Regression results for PCY24

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
b110	0.45242086	0.08903044	2105.76747106	25.82	0.0001
b111	0.03635245	0.04813673	46.50680848	0.57	0.4502
b112	-0.04774110	0.03553799	147.16389138	1.80	0.1793
b113	-0.13372248	0.03489309	1197.65646324	14.69	0.0001
b114	-0.16694509	0.05889718	655.17974527	8.03	0.0046
b115	0.07273988	0.16483774	15.87940133	0.19	0.6591
b116	0.07859934	0.03861046	337.93256544	4.14	0.0419
b123	0.99756348	0.54494101	273.26519539	3.35	0.0673
b127	0.12281792	0.68806348	2.59817686	0.03	0.8583
b128	-0.68247745	0.18544148	1104.49836672	13.54	0.0002
b129	-0.09006587	0.07134312	129.96264664	1.59	0.2069
AUDIT	0.33805741	1.23209036	6.13900561	0.08	0.7838
b172	-0.43433663	0.20419074	368.96319804	4.52	0.0335
b181	-0.35807148	0.14359129	507.09048777	6.22	0.0127
b216	-0.21827396	0.18777216	110.19037934	1.35	0.2452
b235	0.33596281	0.07241413	1755.24600975	21.52	0.0001
b248	0.98186801	1.39971549	40.12628122	0.49	0.4831
b249	-0.07436782	0.02293856	857.11715933	10.51	0.0012
b278	-0.96263654	1.89015405	21.15107840	0.26	0.6106
FORTUNE	-2.20256509	0.89723974	491.40857059	6.03	0.0142
BONDA	1.67058904	0.82137009	337.33680010	4.14	0.0421
BONDB	-1.09208342	0.60928358	261.98408828	3.21	0.0732
STOCKA	2.87183142	0.70538951	1351.64336243	16.58	0.0001
STOCKB	-1.00105958	0.53164935	289.11558635	3.55	0.0599
b283D	-12.11424511	4.52545235	584.34717788	7.17	0.0075
PAPERA	-11.69229009	4.56844919	534.15069194	6.55	0.0106

Table (8): Regression results for PC199 without the accounting ratios

Dependent Variable PC199   R-square = 0.76651584

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	68	572425.67643109	8418.02465340	97.43	0.0000
Error	2018	174363.42539782	86.40407601		
Total	2086	746789.10182891			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	20.11373896	4.81669598	1506.68123320	17.44	0.0001
DNUM	0.00012957	0.00013819	75.95950980	0.88	0.3486
NYSE	-0.88526828	0.97633151	71.03778724	0.82	0.3647
AMEX	-2.88265333	1.06148951	637.21744099	7.37	0.0067
FYRD	-2.08812265	0.47269568	1686.09859044	19.51	0.0001
b1	0.01418083	0.02023405	42.43967799	0.49	0.4835
b2	0.13523205	0.05229656	577.75966905	6.69	0.0098
b3	-0.21071247	0.03054744	4111.16649631	47.58	0.0001
b4	0.08639841	0.03707222	469.29781645	5.43	0.0199
b5	-0.03120250	0.00818579	1255.42712181	14.53	0.0001
b6	0.37075076	0.14867542	537.30389608	6.22	0.0127
b7	-0.02570478	0.03498593	46.64176168	0.54	0.4626
b8	-0.05366519	0.05593694	79.52838849	0.92	0.3375
b9	-0.03553068	0.02501456	174.32335498	2.02	0.1556
b12	0.07715067	0.02426874	873.21096630	10.11	0.0015
b13	0.38236950	0.12894602	759.77471376	8.79	0.0031
b14	0.19009600	0.24413853	52.38507064	0.61	0.4363
b15	0.87665184	0.12799250	4053.39994545	46.91	0.0001
b16	4.39315210	0.34634051	13902.09070062	160.90	0.0001
b18	-1.97426402	0.24949961	5410.09550034	62.61	0.0001
b19	-1.63271024	0.98864581	235.65192848	2.73	0.0988
b21	-0.03571724	0.81002359	0.16799438	0.00	0.9648
b25	0.02966852	0.00591782	2171.71568961	25.13	0.0001
b26	2.80028996	0.63214179	1695.55247944	19.62	0.0001
b28	1.32446119	0.41990822	859.61493842	9.95	0,0016
b29	-0.05767662	0.01525302	1235.44173978	14.30	0.0002
b30	0.27916110	0.14771998	308.57841659	3.57	0.0589
b36	0.33915706	0.04377945	5185.55604992	60.02	0.0001
b41	-0.08515667	0.02855730	768.31139114	8.89	0.0029
b42	-0.18504495	0.04002279	1847.02973672	21.38	0.0001
b43	-0.48270645	0.44597625	101.22247845	1.17	0.2792
b45	0.56260728	0.20469497	652.72547734	7.55	0.0060
b46	0.92427414	0.30822954	776.93970177	8.99	0.0027
b51	10.93667362	3.59978744	797.53732696	9.23	0.0024
b58	1.85192086	0.77960215	487.56555765	5.64	0.0176
FIFO	-0.54644574	0.55783241	82.91265592	0.96	0.3274
LIFO	-1.63250475	0.67587920	504.08640166	5.83	0.0158
b60	-0.14692473	0.14097609	93.84975287	1.09	0.2974
b98	-0.00404403	0.00934983	16.16429170	0.19	0.6654
b100	-0.02054345	0.00927253	424.11640833	4.91	0.0268
b107	0.21168047	0.26297257	55.98541326	0.65	0.4209
b108	0.28459825	0.14148389	349.61066160	4.05	0.0444
b109	0.04025072	0.03814895	96.18699797	1.11	0.2915

Table (8) Cont. : Regression results for PC199

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
b110	0.46598550	0.09164410	2233.93215350	25.85	0.0001
b111	0.03224202	0.04954988	36.58420722	0.42	0.5153
b112	-0.04404309	0.03658128	125.24835797	1.45	0.2287
b113	-0.12513858	0.03591744	1048.83177766	12.14	0.0005
b114	-0.17237251	0.06062623	698.47228803	8.08	0.0045
b115	-0.00927786	0.16967687	0.25833606	0.00	0.9564
b116	0.07177903	0.03974395	281.83008193	3.26	0.0711
b123	1.11611282	0.56093882	342.07350427	3.96	0.0468
b127	-0.00802455	0.70826292	0.01109140	0.00	0.9910
b128	-0.57793659	0.19088547	792.04315847	9.17	0.0025
b129	-0.08249593	0.07343754	109.03427898	1.26	0.2614
AUDIT	0.08019821	1.26826077	0.34549873	0.00	0.9496
b172	-0.35130405	0.21018516	241.37730939	2.79	0.0948
b181	-0.40329892	0.14780670	643.28010790	7.45	0.0064
b216	-0.26221128	0.19328458	159.01663619	1.84	0.1751
b235	0.31850358	0.07453999	1577.55397630	18.26	0.0001
b248	1.12786456	1.44080686	52.94641967	0.61	0.4338
b249	-0.07292239	0.02361196	824.12277744	9.54	0.0020
b278	-1.27203605	1.94564320	36.93232640	0.43	0.5133
FORTUNE	-2.72113070	0.92357996	750.03931557	8.68	0.0033
BONDA	1.89185400	0.84548301	432.61313124	5.01	0.0254
BONDB	-1.11463850	0.62717028	272.91749005	3.16	0.0757
STOCKA	2.65698311	0.72609760	1156.96925285	13.39	0.0003
STOCKB	-1.24955422	0.54725695	450.46584225	5.21	0.0225
b283D	-11.04420935	4.65830581	485.67695661	5.62	0.0178
PAPERA	-10.41581368	4.70256492	423.88791608	4.91	0.0269

Table (9): Final regression results for PHI22 without accounting ratios

Dependent Variable PHI22 R-square = 0.76248280

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	38	986919.04396544	25971.55378856	173.01	0.0000
Error	2048	307430.21845319	150.11241135		
Total	2086	1294349.2624186			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	9.26180706	1.62254497	4891.19045132	32.58	0.0001
NYSE	1.81043112	0.63084310	1236.33994422	8.24	0.0041
b2	0.20034169	0.06354195	1492.23812823	9.94	0.0016
b3	-0.23806860	0.03204246	8286.46239002	55.20	0.0001
b4	0.12568565	0.04205124	1341.00503718	8.93	0.0028
b5	-0.05130753	0.00888492	5005.77570777	33.35	0.0001
b7	-0.11623451	0.01760271	6545.27361253	43.60	0.0001
b12	0.13242276	0.02843246	3256.21385177	21.69	0.0001
b13	0.54562341	0.13260774	2541.35218303	16.93	0.0001
b15	0.91825117	0.13743463	6701.11789492	44.64	0.0001
b16	4.96412058	0.41288356	21699.31722404	144.55	0.0001
b18	-2.33816710	0.30470813	8838.92837816	58.88	0.0001
b25	0.04325127	0.00762631	4828.20298944	32.16	0.0001
b26	3.68340100	0.52324466	7438.83604907	49.56	0.0001
b28	4.85253552	0.52395421	12875.59721320	85.77	0.0001
b29	-0.06185789	0.01966621	1485.13256446	9.89	0.0017
b36	0.50811934	0.05011826	15429.65158349	102.79	0.0001
b41	-0.13398032	0.03374286	2366.65374366	15.77	0.0001
b42	-0.13427353	0.05168532	1013.12487830	6.75	0.0094
b45	0.38072014	0.26403695	312.10368228	2.08	0.1495
b46	1.11204437	0.38174327	1273.84927317	8.49	0.0036
b51	10.24648109	4.68633597	717.62778606	4.78	0.0289
LIFO	-2.20341438	0.77392730	1216.77036834	8.11	0.0045
b98	-0.02035542	0.01196847	434.20950259	2.89	0.0891
b100	-0.05401710	0.01131092	3423.60133078	22.81	0.0001
b110	0.55246451	0.11244772	3623.46515856	24.14	0.0001
b113	-0.13149045	0.02535589	4036.89293971	26.89	0.0001
b114	-0.18243231	0.06029284	1374.32245572	9.16	0.0025
b116	0.03839219	0.02313284	413.47030657	2.75	0.0971
b123	1.55767231	0.26251281	5285.27761634	35.21	0.0001
AUDIT	-2.10762841	1.31861562	383.50254899	2.55	0.1101
b172	-0.74090078	0.24074232	1421.77815442	9.47	0.0021
b181	-0.03793104	0.00763282	3707.11752883	24.70	0.0001
b235	0.42241860	0.05063901	10445.57266213	69.59	0.0001
b249	-0.09498406	0.02856119	1660.21870206	11.06	0.0009
FORTUNE	-2.77047086	0.82484553	1693.47396525	11.28	0.0008
BONDA	2.61138585	0.95707135	1117.55797037	7.44	0.0064
STObKA	3.95885590	0.93092000	2714.75891308	18.08	0.0001
STObKB	-1.44642636	0.70442081	632.91430320	4.22	0.0402

Table (10) : Final regression results for PHI22

Dependent Variable PHI22 R-square = 0.770 WITH RATIOS

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	45	975568.38706172	21679.29749026	144.70	0.0000
Error	1937	290206.06619002	149.82243995		
Total	1982	1265774.4532517			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERbEP	10.90183114	1.42037832	8826.07665827	58.91	0.0001
NYSE	1.56574157	0.65641079	852.44349968	5.69	0.0172
b2	0.26069229	0.07523627	1798.78269401	12.01	0.0005
b3	-0.21272646	0.03665018	5047.39839280	33.69	0.0001
b4	0.14359774	0.04623121	1445.44477319	9.65	0.0019
b5	-0.04742318	0.00895117	4205.31710333	28.07	0.0001
b7	-0.14761581	0.02181153	6862.31183099	45.80	0.0001
b9	-0.04908110	0.02884040	433.91321643	2.90	0.0890
b12	0.11215494	0.02884315	2265.31348015	15.12	0.0001
b13	0.56996050	0.15834640	1941.10920485	12.96	0.0003
b14	0.85193936	0.40210995	672.51906385	4.49	0.0342
b15	1.14296384	0.14799858	8935.66270389	59.64	0.0001
b16	5.03955784	0.44766814	18986.69418653	126.73	0.0001
b18	-2.35110519	0.31413452	8392.46729325	56.02	0.0001
b19	1.66130674	0.31463859	4176.88526487	27.88	0.0001
b25	0.04042661	0.00769841	4131.51193755	27.58	0.0001
b26	3.43750507	0.56865664	5474.73784387	36.54	0.0001
b28	4.95713036	0.56423902	11564.08599525	77.19	0.0001
b29	-0.05489017	0.01984888	1145.76162762	7.65	0.0057
b36	0.58508935	0.05715119	15702.57074721	104.81	0.0001
b41	-0.10984907	0.03395665	1567.90626682	10.47	0.0012
b42	-0.14470546	0.05250822	1137.86862684	7.59	0.0059
b45	0.42966685	0.26573984	391.67624371	2.61	0.1061
b46	1.06981458	0.39391460	1105.06983701	7.38	0.0067
LIFO	-1.45660066	0.79025979	509.00037804	3.40	0.0655
b98	-0.02564951	0.01222656	659.36586114	4.40	0.0360
b100	-0.05481888	0.01124170	3562.65125468	23.78	0.0001
b110	0.65243823	0.11321220	4975.87212180	33.21	0.0001
b113	-0.08529661	0.01219693	7327.22730404	48.91	0.0001
b114	-0.17357510	0.06067321	1226.19006446	8.18	0.0043
b128	-0.44256791	0.18014035	904.30451777	6.04	0.0141
b172	-0.95264226	0.27308744	1823.19494385	12.17	0.0005
b181	-0.05155164	0.00794304	6310.85378443	42.12	0.0001
b235	0.39052649	0.05865269	6642.04813587	44.33	0.0001
b249	-0.10773954	0.02908950	2055.20202612	13.72	0.0002
FORTUNE	-2.45450794	0.83425996	1296.88940540	8.66	0.0033
BONDA	2.36804315	0.96762357	897.31145576	5.99	0.0145
STObKA	5.21857071	0.83904297	5795.77618060	38.68	0.0001
b1_6	4.74276483	2.77960042	436.18960372	2.91	0.0881
b2_6	-11.39131314	2.98817767	2177.26661636	14.53	0.0001
b3_6	-7.90479881	2.39224933	1635.85808425	10.92	0.0010
b36_6	-2.43777923	1.37956388	467.82344154	3.12	0.0774
b216_6	-11.06539430	3.66195580	1367.99483224	9.13	0.0025
b235_6	8.52572937	3.50666700	885.62710185	5.91	0.0151
b16_172	-0.09110885	0.04807412	538.11520828	3.59	0.0582
b9_216	-0.15046786	0.08605352	458.06495226	3.06	0.0805

Table (12) : Final regression results for PLO22

WITH RATIOS

PLO23 R^2= ·7982

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	49	355980.06230242	7264.89923066	166.44	0.0000
Error	1933	84372.58189952	43.64851624		
Total	1982	440352.64420194			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERbEP	3.91535415	0.60762622	1812.33543481	41.52	0.0001
AMEX	-1.22963612	0.37652706	465.51139954	10.66	0.0011
b2	0.10300025	0.03893680	305.43976467	7.00	0.0082
b3	-0.15652621	0.01981532	2723.58949744	62.40	0.0001
b4	0.08311735	0.02364136	539.52034802	12.36	0.0004
b5	-0.03355265	0.00483916	2098.37897652	48.07	0.0001
b6	0.41124616	0.12406713	479.57847733	10.99	0.0009
b7	-0.08050773	0.01253145	1801.53096270	41.27	0.0001
b9	-0.03650795	0.01709104	199.16254894	4.56	0.0328
b13	0.32807158	0.08669080	625.11603563	14.32	0.0002
b14	0.79427456	0.21950601	571.50225638	13.09	0.0003
b15	0.59115523	0.07964616	2404.59999398	55.09	0.0001
b16	3.19845502	0.24085467	7697.32519250	176.35	0.0001
b18	-1.42653417	0.17118599	3031.07999555	69.44	0.0001
b25	0.01724522	0.00407020	783.56734033	17.95	0.0001
b26	3.20009608	0.30590579	4776.61379862	109.43	0.0001
b29	-0.02667654	0.01053299	279.97871183	6.41	0.0114
b36	0.32554288	0.03055205	4955.70331128	113.54	0.0001
b42	-0.10830050	0.02826773	640.69079345	14.68	0.0001
b43	-0.57545140	0.34335961	122.59941185	2.81	0.0939
b45	0.52301254	0.13801804	626.78990818	14.36	0.0002
b46	0.70626358	0.20089042	539.49155083	12.36	0.0004
b51	6.09437368	2.54847431	249.61295637	5.72	0.0169
b58	0.97002338	0.15791111	1647.05653562	37.73	0.0001
LIFO	-0.72761176	0.41843799	131.97956537	3.02	0.0822
b100	-0.02555128	0.00613831	756.30574037	17.33	0.0001
b110	0.31335871	0.06470018	1023.86352645	23.46	0.0001
b113	-0.10893304	0.01708445	1774.54385013	40.66	0.0001
b114	-0.14181570	0.03510298	712.41026380	16.32	0.0001
b115	0.18147780	0.11254526	113.49117511	2.60	0.1070
b116	0.05326183	0.01543853	519.50496632	11.90	0.0006
b128	-0.38796607	0.09799131	684.19813061	15.68	0.0001
b172	-0.36163715	0.14396646	275.41836976	6.31	0.0121
b181	-0.42856383	0.12376692	523.34893515	11.99	0.0005
b216	-0.36867370	0.13633243	319.19455281	7.31	0.0069
b235	0.18442734	0.03389376	1292.35113505	29.61	0.0001
b249	-0.05087730	0.01476810	518.04637925	11.87	0.0006
b278	1.96411658	0.96493458	180.84573524	4.14	0.0419
BONDA	1.50410075	0.53753888	341.74611403	7.83	0.0052
BONDB	-0.98771186	0.44069364	219.25850401	5.02	0.0251
STObKA	3.53973212	0.45171972	2680.23065608	61.40	0.0001
b1_6	2.73035290	1.44317678	156.23127941	3.58	0.0587
b2_6	-5.37343011	1.58414795	502.20521004	11.51	0.0007
b3_6	-3.90427483	1.27260554	410.83045570	9.41	0.0022
b9_6	1.93985190	1.19381334	115.24810126	2.64	0.1043
b36_6	-1.82634033	0.66688412	327.36492869	7.50	0.0062
b13_172	0.03762920	0.00956326	675.78318313	15.48	0.0001
b14_172	-0.04998666	0.01633218	408.87372402	9.37	0.0022
b16_172	-0.08337222	0.02631535	438.12090814	10.04	0.0016
b9_216	-0.10367647	0.04684975	213.75452491	4.90	0.0270

Table (13) : Regression Results for PCY24 Without Ratios

Dependent Variable PCY24 R-square = 0.77045687

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	37	562990.47453867	15215.95877132	185.88	0.0000
Error	2049	167732.42177734	81.86062556		
Total	2086	730722.89631601			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	6.00541330	0.86517289	3944.16479523	48.18	0.0001
AMEX	-1.72099987	0.50320863	957.50394551	11.70	0.0006
b2	0.19575821	0.03787909	2186.33094817	26.71	0.0001
b3	-0.22947694	0.02375181	7641.16827881	93.34	0.0001
b5	-0.03520384	0.00646391	2428.08584525	29.66	0.0001
b8	-0.10152501	0.02119623	1878.03598010	22.94	0.0001
b9	-0.05759843	0.02003835	676.35177316	8.26	0.0041
b12	0.06695708	0.01932336	982.88551904	12.01	0.0005
b13	0.42713411	0.10156588	1447.79763379	17.69	0.0001
b15	.0.99977920	0.10426831	7526.24838461	91.94	0.0001
b16	4.25815666	0.30410008	16050.37753967	196.07	0.0001
b18	-1.91820267	0.22870806	5758.39048738	70.34	0.0001
b25	0.02794295	0.00559761	2039.92677366	24.92	0.0001
b26	2.77595696	0.38991644	4149.13369230	50.69	0.0001
b28	1.12436965	0.39085774	677.41664354	8.28	0.0041
b29	-0.04779085	0.01446734	893.27901683	10.91	0.0010
b30	0.23261372	0.12008902	307.14193533	3.75	0.0529
b36	0.30843066	0.03639342	5879.55528867	71.82	0.0001
b41	-0.06734157	0.02184756	777.74233388	9.50	0.0021
b42	-0.16470858	0.03838979	1506.87086395	18.41	0.0001
b45	0.48403090	0.19151659	522.88769454	6.39	0.0116
b46	1.07108509	0.26658045	1321.49772434	16.14	0.0001
b51	9.61483357	3.45652742	633.40077139	7.74	0.0055
b58	1.40958227	0.21175324	3627.40294886	44.31	0.0001
LIFO	-1.18799009	0.55964057	368.87763059	4.51	0.0339
b100	-0.02677402	0.00827143	857.71085692	10.48	0.0012
b110	0.51390572	0.08113959	3283.79717416	40.11	0.0001
b113	-0.06658166	0.00880036	4685.79774182	57.24	0.0001
b114	-0.09315224	0.04394679	367.79637825	4.49	0.0342
b128	-0.47271909	0.15279852	783.50726434	9.57	0.0020
b172	-0.50502875	0.19067525	574.27329958	7.02	0.0081
b181	-0.03444973	0.00549910	3212.65076651	39.25	0.0001
b235	0.35137468	0.03530259	8109.66523803	99.07	0.0001
b249	-0.06457191	0.02225391	689.20685900	8.42	0.0038
FORTUNE	-1.99736093	0.60726303	885.59360011	10.82	0.0010
BONDA	1.96129633	0.70414835	635.08690822	7.76	0.0054
STObKA	2.62473892	0.68308914	1208.62764262	14.76	0.0001
STObKB	-1.21919504	0.51618847	456.67247726	5.58	0.0183

Table (14) : Regression Results for PCY24 with all Variables

Dependent Variable PCY24 R-square = 0.77827362

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	42	557100.95928402	13264.30855438	162.13	0.0000
Error	1940	158715.35819000	81.81204030		
Total	1982	715816.31747402			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERbEP	6.51908203	1.04742147	3169.18193993	38.74	0.0001
AMEX	-1.52836155	0.53278341	673.23711430	8.23	0.0042
b2	0.25427598	0.03950827	3388.84548534	41.42	0.0001
b3	-0.18996369	0.02614063	4320.42365629	52.81	0.0001
b5	-0.03737277	0.00647584	2724.80965886	33.31	0.0001
b8	-0.14581894	0.02405340	3006.71335309	36.75	0.0001
b9	-0.05995900	0.02325845	543.70656857	6.65	0.0100
b13	0.37331981	0.11437759	871.56023324	10.65	0.0011
b14	0.76755561	0.28624505	588.24866491	7.19	0.0074
b15	0.95152853	0.10715170	6451.53016063	78.86	0.0001
b16	4.56325824	0.31649299	17007.44652918	207.88	0.0001
b18	-2.03153554	0.23193111	6276.94090858	76.72	0.0001
b25	0.02535814	0.00557261	1694.08349500	20.71	0.0001
b26	3.00168131	0.40937989	4398.38641246	53.76	0.0001
b28	1.36734181	0.42232539	857.58472024	10.48	0.0012
b29	-0.04039269	0.01420971	661.07776061	8.08	0.0045
b30	0.26250767	0.12023531	389.97533113	4.77	0.0291
b36	0.39927361	0.03815190	8960.37241071	109.52	0.0001
b42	-0.18327034	0.03854899	1849.16478488	22.60	0.0001
b45	0.63059274	0.18697692	930.54881560	11.37	0.0008
b46	1.02920468	0.26899846	1197.62579411	14.64	0.0001
b51	7.56266175	3.48529092	385.20197723	4.71	0.0301
b58	1.34459079	0.21474685	3207.33168764	39.20	0.0001
b100	-0.02705420	0.00830059	869.09873289	10.62	0.0011
b110	0.51704797	0.08253322	3210.85969297	39.25	0.0001
b113	-0.06899867	0.00885780	4964.17724023	60.68	0.0001
b114	-0.11431580	0.04467524	535.66845690	6.55	0.0106
b128	-0.70141590	0.16321993	1510.85256976	18.47	0.0001
b172	-0.51245729	0.19150610	585.82423441	7.16	0.0075
b181	-0.03026852	0.00527377	2694.98926068	32.94	0.0001
b235	0.28737045	0.03462039	5636.86492072	68.90	0.0001
b249	-0.06501065	0.02141884	753.69262958	9.21	0.0024
FORTUNE	-2.04872098	0.61363741	911.92515414	11.15	0.0009
BONDA	1.34666210	0.74571458	266.80209145	3.26	0.0711
BONDB	-1.08855553	0.61284478	258.11747928	3.16	0.0759
STObKA	3.58095881	0.62175616	2713.78655994	33.17	0.0001
b1_6	5.27632787	1.92954694	611.74450824	7.48	0.0063
b2_6	-6.50291457	2.15996124	741.55164560	9.06	0.0026
b3_6	-4.99835089	1.67584353	727.78612502	8.90	0.0029
b9_6	2.69349476	1.61308026	228.10643666	2.79	0.0951
b36_6	-1.83151312	0.89652315	341.43990068	4.17	0.0412
b16_172	-0.09891454	0.03549466	635.34771395	7.77	0.0054
b9_216	-0.10067614	0.06383544	203.49164305	2.49	0.1149

Table (15): Regression Results for PC199 Without Ratios

Dependent Variable PC199   R-square = 0.76100416

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	36	568309.61449951	15786.37818054	181.32	0.0000
Error	2050	178479.48732940	87.06316455		
Total	2086	746789.10182891			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERCEP	8.40542401	0.94155684	6938.42049469	79.69	0.0001
AMEX	-2.14643733	0.51864128	1491.20282271	17.13	0.0001
FYRD	-2.22114982	0.45964627	2033.02483463	23.35	0.0001
b2	0.14543248	0.04546657	890.78480077	10.23	0.0014
b3	-0.23399523	0.02514954	7536.82444518	86.57	0.0001
b4	0.07846418	0.02998786	596.05483311	6.85	0.0089
b5	-0.03990443	0.00666648	3119.49199463	35.83	0.0001
b8	-0.09645286	0.01960374	2107.59247489	24.21	0.0001
b9	-0.04580221	0.02062762	429.24896722	4.93	0.0265
b13	0.43309168	0.10623175	1447.05648356	16.62	0.0001
b15	0.84948566	0.10367686	5844.97787200	67.13	0.0001
b16	4.51584504	0.31743439	17619.94582206	202.38	0.0001
b18	-1.91336244	0.23505101	5769.05537449	66.26	0.0001
b25	0.02864947	0.00571834	2185.38214843	25.10	0.0001
b26	3.09361656	0.39228773	5414.49515539	62.19	0.0001
b28	1.15750902	0.40392501	714.95997911	8.21	0.0042
b29	-0.05384638	0.01453756	1194.44109344	13.72	0.0002
b36	0.35506260	0.03562270	8649.49128996	99.35	0.0001
b42	-0.20031152	0.03933163	2258.19990032	25.94	0.0001
b45	0.75055734	0.19252306	1323.23412406	15.20	0.0001
b46	1.06298077	0.27230143	1326.73876049	15.24	0.0001
b51	10.31508508	3.56277363	729.79959693	8.38	0.0038
b58	1.21605793	0.21727883	2727.14456186	31.32	0.0001
LIFO	-1.44523097	0.57508414	549.85247165	6.32	0.0120
b100	-0.02383009	0.00850742	683.10917078	7.85	0.0051
b108	0.24013362	0.13068049	293.98072613	3.38	0.0663
b110	0.45238910	0.08224945	2633.86012390	30.25	0.0001
b113	-0.06914758	0.00885026	5314.67472375	61.04	0.0001
b114	-0.12037534	0.04524388	616.29664396	7.08	0.0079
b172	-0.35976791	0.19681678	290.90756876	3.34	0.0677
b181	-0.02292327	0.00498397	1841.77848571	21.15	0.0001
b235	0.26673485	0.03400801	5355.88892323	61.52	0.0001
b249	-0.04095757	0.02019443	358.12892467	4.11	0.0427
FORTUNE	-2.11056263	0.62052150	1007.20359083	11.57	0.0007
BONDA	2.37587158	0.72454576	936.15709554	10.75	0.0011
STObKA	2.64094762	0.70605173	1218.09450394	13.99	0.0002
STObKB	-1.39051552	0.53807427	581.43568202	6.68	0.0098

Table (16) : Regression Results for PC199 with All Variables

Dependent Variable PC199 R-square = 0.77137180

	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	45	563683.66390204	12526.30364227	145.23	0.0000
Error	1937	167071.15741544	86.25253351		
Total	1982	730754.82131748			

Variable	Parameter Estimate	Standard Error	Type II Sum of Squares	F	Prob>F
INTERbEP	11.33009998	1.16583583	8146.37774407	94.45	0.0001
AMEX	-1.70073305	0.54533541	838.91268834	9.73	0.0018
FYRD	-2.98812170	0.48166782	3319.50372500	38.49	0.0001
b2	0.20170567	0.05375338	1214.49728641	14.08	0.0002
b3	-0.18939926	0.02788868	3978.07069935	46.12	0.0001
b4	0.06061203	0.03322763	287.00589661	3.33	0.0683
b5	-0.03869728	0.00676553	2821.81677660	32.72	0.0001
b8	-0.14081848	0.02488742	2761.41316746	32.02	0.0001
b9	-0.05189228	0.02188926	484.74690475	5.62	0.0179
b13	0.35254030	0.11987964	745.93074681	8.65	0.0033
b14	0.66949098	0.29844365	434.04689044	5.03	0.0250
b15	0.93588010	0.11049606	6187.54952271	71.74	0.0001
b16	4.67159716	0.33132829	17146.89878922	198.80	0.0001
b18	-2.05227110	0.23838374	6392.75477919	74.12	0.0001
b25	0.02650761	0.00578565	1810.54478969	20.99	0.0001
b26	3.08053415	0.42744264	4479.89901273	51.94	0.0001
b28	1.50206341	0.43724798	1017.87109055	11.80	0.0006
b29	-0.04779239	0.01473937	906.84157714	10.51	0.0012
b30	0.23896918	0.12686442	306.03843146	3.55	0.0598
b36	0.37994992	0.03745992	8873.41798110	102.88	0.0001
b42	-0.20317324	0.03963110	2266.90181601	26.28	0.0001
b45	0.72919316	0.19322370	1228.38993637	14.24	0.0002
b46	1.00071884	0.27820884	1115.97420498	12.94	0.0003
b51	8.46993994	3.58487210	481.48769280	5.58	0.0182
b58	1.21530894	0.22160204	2594.16591687	30.08	0.0001
b100	-0.02631714	0.00855067	817.05016034	9.47	0.0021
b108	0.22736860	0.13333665	250.80360258	2.91	0.0883
b110	0.50632663	0.08480303	3074.75618622	35.65	0.0001
b113	-0.06793092	0.00913958	4764.90228885	55.24	0.0001
b114	-0.12802144	0.04612271	664.51943375	7.70	0.0056
b128	-0.59364783	0.16836461	1072.32891890	12.43	0.0004
b172	-0.42217187	0.19834054	390.77563580	4.53	0.0334
b181	-0.03161570	0.00536699	2993.06563380	34.70	0.0001
b235	0.28151359	0.03777224	4790.98927099	55.55	0.0001
b249	-0.06557337	0.02200156	766.16061561	8.88	0.0029
FORTUNE	-2.36108181	0.63517314	1191.81727811	13.82	0.0002
BONDA	1.89419285	0.76669176	526.47609339	6.10	0.0136
BONDB	-0.99881886	0.62974491	216.97815086	2.52	0.1129
STObKA	2.75572426	0.72633342	1241.57034004	14.39	0.0002
STObKB	-1.02895949	0.55673193	294.62945116	3.42	0.0647
b1_6	4.31842759	2.08208644	371.04418892	4.30	0.0382
b2_6	-6.66373638	2.23378104	767.58463697	8.90	0.0029
b3_6	-6.81513427	1.81386639	1217.61533433	14.12	0.0002
b216_6	-2.69838420	1.26085408	395.04791549	4.58	0.0325
b16_172	-0.09866104	0.03646093	631.55002397	7.32	0.0069
b172_216	0.36329901	0.22800402	218.98545725	2.54	0.1112