

Quality Attributes and Asset Prices*

CYRUS A. RAMEZANI

College of Business

California Polytechnic State University

San Luis Obispo, CA 93407

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Email: cramezan@calpoly.edu

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Much of what is known 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 While in the standard Capital Asset Pricing Model (CAPM) the mean and variance of returns are the only factors affecting asset prices, under the Arbitrage Pricing Theory (APT) an undetermined number of ‘factors’ may assume this role. Both these theories assign little role for investors’ assessment and valuation of distinct *attributes* that differentiate financial assets. The word attributes or characteristics—used here interchangeably—refers to a variety of measures that are believed to contribute to an asset’s quality, though no theoretical model for how this is achieved may exist. Examples include a variety of accounting ratios such as debt, cash flow, and profitability ratios, which as is argued, provide signals about the prospects of an asset’s future earning and hence prices.

Since the inception of modern financial 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 economy generates and processes information about assets’ attributes under the pretext that this type of analysis is value relevant. Further evidence in support of the view that investors value information other than rate of return can be found in the prevalent markets for assets—primarily mutual funds—that claim to be attribute specific, for example ‘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 economic literature, information about broad attributes of firms or industries have been utilized to predict other important firm characteristics, or the probability that an event may occur. For example, Ou and Penman ? use aggregate financial statement information to predict the likelihood of earning increases. Others have used such information to forecast the chance of bankruptcy, audit qualification, use of accounting methods, and targeting firms for takeover (see Scoffer ? and Rao, et al. ?). Financial information has also been linked to executive compensation and incentive contracts suggesting further a link between asset prices and their attribute. ²

The link between attributes and asset prices has intermittently been explored in the financial economic literature. Examples include the non-calendar based anomalies in finance (e.g. the size effect, debt structure, etc. (?, ?)); the link between items in financial statements and earnings (or prices) analyzed in the accounting literature (?); the influence of qualitative factors such as management style and firm control considered in management science (?);

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). 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 the 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 paper 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 a 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 such as liquidity and risk.

Drawing on the economic literature on quality (e.g., ?), this paper proposes a consumption-portfolio choice model in which assets' attributes influence investment choice. 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. The main empirical task undertaken is the identification of the relevant attributes and the estimation of the magnitude and direction of their impact on prices. Overall, the relevance of a variety of signals is assessed. Included are information whose release is mandated by law or accounting practices, variables that are commonly believed to affect asset prices, and other available public information. The empirical examination provides answer to the questions regarding what types of attributes influence prices and in what order. The results prove useful for portfolio selection decisions.

The paper is organized as follows. A general attribute pricing model is proposed in section two, where it is shown how 'testable hypothesis' may be obtained from the model. The steps taken for empirical examination, including the simplifying assumptions that facilitate estimation are discussed in section three. The final section provides a brief summary of the results and suggest directions for future research.

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 section. The motivation for the present model lies in the model proposed by (?), which itself is based on household production theory of Becker ?. The salient feature of their approach is the treatment of consumers as producers of non-marketed goods. Consider the following characterization of consumers' investment behavior. Individuals derive utility from consumption activities. Financial assets are sought primarily for intertemporal smoothing of consumption, providing the means to transfer consumption goods across time. The ability to smooth consumption and enhance utility is dependent upon the various attributes of the assets held in an individual's portfolio. Thus the utility an individual receives is directly dependent upon the *total* of various attributes provided by their portfolio.

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.). Through their influence on present and future asset prices, these attributes are perceived to affect future wealth and consumption. Clearly, this characterization of investment behavior is consistent with the existing models of portfolio behavior, for example the simple mean-variance model of Markowitz ?, as well as the parameter preference model of Rubinstein ?. This paper generalizes these models to include qualitative attributes into a portfolio choice model consistent with the investment behavior described above. We describe the assumptions of the model next.

The Asset-Attribute Transformation Frontier: The first focus in developing the proposed model is on establishing the technical relationship between assets and *portfolio attributes*. The representation of the process of creating portfolio attributes parallels the production theory of the firm (?) with the exception of three distinctions. First, 'production' is undertaken by investors who face constraints that are different than those faced by firms. Second, the possibility of short sales implies that assets as 'inputs' to attribute production could take on negative values. Third, portfolio attributes result from joint production function where an attribute will influence the availability of other attributes (e.g., liquid assets have lower transactions costs).

Let $X \in R^n$ be vector of marketed assets (e.g., stocks, bonds, 'market portfolio', risk free asset, etc.) and $x \in X$ a subset used to form a portfolio. The following assumptions are made with regard to existing assets:

A1: Assets may be characterized by r possible quality attributes. $r^* \subseteq r$ are assumed to be common to all assets. The remainder are ‘unique’. It is assumed that the number of marketed assets (n) exceeds the number of attributes that are common to all assets, $r^* < n$.

A2: Quality parameters are denoted by $\beta \in R^s$; $b_{ij} \in \beta_i$ is the amount of attribute j in a unit of asset i . Each asset has at least one unique attribute. The vector β is exogenous to investors. The dimension of attribute space β can vary across markets and is determined by the following inequality:

$$n \times (r^* + 1) \leq s \leq r^* \times (n - 1) + r$$

A3: Individuals are assumed to derive utility from the attribute of their portfolio, which we denote by the vector Z . The $Z \in R^m$ utility bearing *portfolio* attributes are related to the selected assets X via a joint transformation function $G(X, Z; \beta) \leq 0$, i.e. a mapping from R^s into R^m , which explicitly depends on the vector β . The number of attributes of an individual’s portfolio (m) depends on the number of assets selected and will fall with the range: (holding a single asset) $r^* + 1 \leq m \leq r$ (holding all assets or the ‘market portfolio’)

A4: $G(X, Z; \beta)$ is monotonic and convex in Z and X . Monotonicity implies that we can represent a portfolio’s k^{th} attribute as a function of its constituent assets and other attributes, i.e., $z_k = G_k(X, z_{m-k}; \beta)$. Also, holding all other attributes (z_{m-k}) constant, it is assumed that $G_k(\cdot)$ is a quasiconcave function of X .

When the level of an attribute generated by a portfolio is independent of other attributes obtained from the same portfolio, the transformation functions is said to be *separable*; $z_k = G_k(X; \beta_k)$. The structure proposed so far is most general and very flexible in terms of covering a variety of possibilities.

The Nature of Preferences: Next the preferences of a ‘representative’ individual for portfolio attributes are described.

A5: Individual preferences over $Z \in R^m$ is representable by a continuous, real-valued utility function, $u : R^m \rightarrow R$. Attributes are measured in such way that marginal utility of all attributes is positive.

Deriving Qualitative Results: The theoretical structure outlined above provides the means to obtain testable hypotheses from the model. Utility maximization implies investors would choose $x \in X$ to maximize $u(Z)$ subject to $G(x, Z, \beta) \leq 0$ and $P'x \leq W$, where P is the vector of asset prices and W is individual’s wealth and short sales are allowed.³

Proposition 1 : There exist a set of n quality augmented asset demand functions $X = X(P, W, \beta)$, 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

$$p_i = \sum_{k=1}^m \lambda_k(P, Z, \beta) [\partial G_k / \partial x_i]. \quad (1)$$

where all variables are defined as above and $\lambda_k = \partial W / \partial z_k$ is the implicit value or ‘shadow cost’ associated with the k^{th} attribute. The proof of the proposition is given in the appendix.

This latter relationship is analogous to the hedonic price methodology widely used in the literature of real estate and consumer demand. 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 prices (or returns) are regressed on various financial characteristics of assets.

Equation (1) provides a method for linking asset prices to their attributes and is the basis for the empirical section of paper. It can be easily shown that all utility based portfolio choice models and their corresponding asset pricing functions are special case of the model proposed above and the price decomposition relation in (1), which is highly nonlinear.

To operationalize this model and facilitate an empirical test a number of simplifying assumptions are made. First, each asset, or groups of assets such as Common Stocks, assumed to have 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 just the market portfolio, will be characterized by $Z \in R^m$ attributes, where $r^* + 1 \leq m \leq r^* + n$.

Second, the transformation functions for portfolio attributes are assumed separable and linear ; $z_k = G_k(X; b_{ik}, i = 1, \dots, n) = \sum_{i=1}^n b_{ik} x_i$, 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. 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.

Third, to include current consumption decisions into the analysis it is assumed that only current consumption, $C = W - P'X$, enters the utility function. With this representation, the shadow costs associated with 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 for specific attributes and future consumption.

Given these assumption, the investor's optimization problem can be restated as: Choose the set of assets X so as to

$$\text{Max } u(Z) = u(C, z_1, \dots, z_{r^*}, z_1^u, \dots, z_n^u)$$

subject to ;

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

where the initial wealth (W), asset prices (P), and the asset quality parameters (β) are assumed exogenous and non-stochastic. The price decomposition equation from this portfolio choice model can be written as:

$$p_i = \theta_i^h + \sum_{k=1}^{r^*} \theta_k^h b_{ik} \quad (2)$$

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 $\beta_i = (1, b_{i1}, \dots, b_{ir^*})$ is the same for all investors. Equation (2), can be aggregated across individuals to obtain the market clearing price-attribute relationship:

$$p_i = \bar{\theta}_i + \sum_{k=1}^{r^*} \bar{\theta}_k b_{ik} \quad (3)$$

where the market average of the 'shadow cost' associated with the unique and common attributes are $\bar{\theta}_i = [\sum_{h=1}^H \theta_i^h] \times H^{-1}$ and $\bar{\theta}_k = [\sum_{h=1}^H \theta_k^h] \times H^{-1}$, respectively. Equation (3) is be the basis for empirical examination that follows.

Empirical Evaluation

The starting point for the empirical examination of the attribute model is the price decomposition equation (3) ;

$$p_i = \bar{\theta}_i + \sum_{k=1}^{r^*} \bar{\theta}_k + \epsilon_i \quad (4)$$

Where p_i is the price of the i^{th} asset, b_{ik} is the amount of k^{th} characteristic in asset i , $\bar{\theta}_i$ and $\bar{\theta}_k$ measure the market averaged shadow cost of asset i 's unique and common attributes, and ϵ_i is a random error term. The distributional properties of ϵ_i will be discussed below. The estimation of the attribute model represented by (4) requires explicit consideration of several issues. These are briefly discussed under the following headings.

Selecting the Relevant Assets: The question of what constitutes the set of marketed assets ($i = 1, \dots, n$) is an important problem in financial economics. In criticizing the tests of the CAPM, Roll ? argues that all available assets, including human capital, influence 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 relation between the asset's price (cost) and its attributes is implied. In principal, once this relation is established, as was in equation (4), estimation may proceed by utilizing time series data on prices and characteristics of any asset, without considering demand for other assets.

Cross sectional examination of equation (4) requires further simplifications; Suppose investors choose among broad classes of assets such as, stocks, mutual funds, bonds, real estate, etc. Furthermore let these categories be distinguished by a single unique attribute. Now it is possible to show that equation (4) must hold for each category of assets. Focusing on category i , say stocks, p_i and b_{ik} will then be a cross section of stock prices and attributes at a point in time, and $\bar{\theta}$'s will be shadow prices at that time. An interesting interpretation of $\bar{\theta}_i$ is now possible: This intercept term provides an estimate of the price premium associated with stocks' unique attribute. This premium distinguishes stocks from other assets. In the preliminary examination presented below the foregoing simplifications are assumed.

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 such organization

as the American Association of Individual Investors(AAII) and ask them to list the types of characteristics they value in their portfolios. This will be most interesting but is clearly outside the present scope of this work. In the absence of such direct information, we will seek guidance in the applied literature.

Most empirical tests of asset pricing models assume that the value of factors which determine asset prices (e.g., mean, variance, etc.) are universal to all individuals, and investors' perceptions regarding the attributes are homogeneous. The present study also relies on this assumption, though, it should be noted that studies in consumer economics and marketing indicate that perceptions, which provide important impetus to purchase decisions, are, for the most part, heterogeneous across individuals.

The role of perceptions in explaining the observed differences in investor behavior has been long recognized by financial economists (?). However, since aggregate market data provides limited information about investors' perceptions, this role has proved difficult to assess empirically. 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 perception. These institutional characteristics of financial markets provide some justification for assigning a minor role to diversity of perceptions.

Financial markets often permeate in 'information'. The majority of this information appears in the form of financial statements. The COMPUSTAT financial files are the primary source of such statements. COMPUSTAT provides coverage for 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. Our selection criteria is based on the results of previous studies in different subfields of economics.

Capon, Farley and Hoenig ?, provide a meta-analysis of over 300 published studies relating environmental, strategic and organizational factors to financial performance of firms. They identify over 200 variables that have been shown to influence several indices of firms' performance (page 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 are considered. These broad categories are presented in table (1).

All attributes selected from the COMPUSTAT data falls within one of the categories in table(1). For certain categories, we construct new variables from those in the COMPUSTAT files. 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 have been previously considered in isolation will be studied together.

The majority of variables contained in the COMPUSTAT files are accounting numbers. 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 of the firm, a snapshot at the close of an accounting period. The income statement summarizes profit performance over a specified period, a movie 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 variable from all three accounts as desirable attributes (?).

The steps involved in preparation of the variables are summarized as follows. First, 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 (COMPUSTAT variable UCODE = 3). A total of 68 variables from the 1988 data are selected (2210 observations). 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 observations. Table (2) provides a list and the definition of all selected variables. Most selected variables are independent in the sense that their value cannot be deduced by combining other variables on this list. All continuous variables that are not on per share basis (MMD units) have been deflated by the number of outstanding shares (b25) to obtain (b_{ik}) the amount of attribute k per unit of asset i .

Second, 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. 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 standard accounting texts such as Foster ?.

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). The motivation for creating these variables arises from studies which associate different costs to

the public for using each exchange (see Mayer ?). Approximately 9% of the sample are traded outside these exchanges.

Two variables are created to study whether accounting valuation methods are value relevant as is suggested in Hand ?. 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.

The AUDIT variable is intended to capture the degree to which the firm's financial statements can be trusted. The variable equals 1 if the firm has been audited by an outside accounting firm and has received a qualified or an unqualified opinion. About 18% of the sample do 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. Last, descriptive statistics on all variables are generated and examined for their consistency. The mean and standard deviation for all variables are reported in Table 2.

Estimation and Results:

To estimate equation (4) consistently, two related issues regarding the distribution of ϵ_i and the functional form of (4) 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 incorrect functional form or omitted explanatory variables.

Nonlinearity is a common feature of many asset pricing models, (for example Litzenberger and Ronn ?) and sophisticated techniques for obtaining solutions to nonlinear models have been proposed (Tauchen and Hussey ?). As McDonald ? 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 ?, may be due to nonnormality and Heteroscedasticity.

The consequences of Heteroscedasticity for the least square estimator (LS) are well known; these are loss in efficiency, biased estimates of the parameter variance-covariance matrix which implies confidence intervals and hypothesis testing under LS can not be trusted, and when normality is assumed the LS estimator is no longer the maximum likelihood estimator (?).

A standard 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 variables considered here this transformation has already been done by converting variables to *per shares* outstanding basis. For this reason, the ‘straw man’ hypothesis is that the residuals are independent and identically distributed normal variables, and the functional relation is linear. The validity of these conjecture are then tested. The estimation and testing steps taken are as follows:

1. The close of fiscal year price is regressed on explanatory variables, with and without the accounting ratios. The aim is to distinguish between the ‘raw’ and the created variables (ratios).
2. All variables with P-Values above (0.15) are dropped and the relation is re-estimated with the remaining variables.
3. The regressions in step 2 are subjected to different tests for Heteroscedasticity, normality of the residuals, and functional specifications. In no instance the null hypothesis of Homoscedastic and normal residuals could be rejected. The Box-Cox transformation

test for functional specification generally suggested a linear specification, though these findings were less conclusive.

Table (5) contains the estimated parameters of the linear price decomposition (4) with and without the financial ratios. The sign and magnitude of most coefficients 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 the regressions considerably. Furthermore, no significant change of magnitudes or sign reversal occur when these ratios are added to the regressions.

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, the \$6.52 estimate seems comparable with the price of initial public offerings (IPO), see Jacklin ?.

Beginning with 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. Does the timing of publishing these statements matter ? ?) and ?) provide evidence that it should. 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. Surprisingly the binary variable that captures such effect (FYRD) was found to be statistically insignificant.

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) have 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 are significant and have the correct sign (b5, b9, b181,b9_216). The results for measures of the firm's potentials 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 (?). All else being equal, there is a negative premium of \$ 1.53 associated with stocks traded on the AMEX. 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 papers are insignificant. Lastly, comparing two otherwise identical firms, the stock for the firm with a fortune 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 an answer for the regression in Table 5. 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 ?.

To conclude we emphasize that these findings, though preliminary, demonstrate the importance of considering the simultaneous impact of both qualitative and quantitative attributes on asset prices. A number of extensions can further improve the study. First, the attributes integrated into the analysis may be expanded by utilizing the CRSP data files. It is likely that in the presence of summary variables such as a firms β some of the present variables will become less significant. Second, more powerful diagnostic tests for multicollinearity, misspecification error, and functional specification may be undertaken. The model may be also tested using returns rather than prices. Finally, out of sample forecasts could be generated using data from previous periods.

Summary and Conclusions

This study developed a model of investor behavior in which assets' attributes influence individual choice. The framework is very general, nesting a variety of existing models as its special case, and providing a framework for addressing positive and normative questions regarding investor behavior and asset prices. An important implication of the proposed model is that in the equilibrium asset 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 paper 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 collective effect of a variety of attributes.

A number of findings in the paper 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) and a variety of outside opinions about firms operations. These results confirm the theoretical relations suggested in the models of Brennan and Hughes ? and Harris and Raviv ?.

These influences may be ascribed to investors belief's and preferences. It is likely, however, that a variety of "puzzles" which arise within the confines of the standard asset pricing models, for example the mean reversion phenomena, 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 ? conclude that the level or changes in earnings *alone* play a minor role in explaining the raw or risk adjusted stock returns. Lev suggests that earning have little relevance for security valuation. The results here provide further evidence in support of these 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 to misspecification error as well as the exclusion of non-earning information available to the market (?).

Finally, the results of this study are similar to the seminal paper of Ou and Penman ? which indicates 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 paper complements the Ou and Penman study by providing information regarding the influence of specific accounting attributes.

Notes

¹ Pricing assets based on the discounted expected future cash flows such as dividends or earnings is a tautological relationship rather than a formal model of behavior. In so far as a violation of this relation may signal the existence of a ‘money machine’, the discounted present value formulation may be considered as an arbitrage relationship.

² See ?) and references therein. Capon, Farley, and Hoenig ? provide a complete survey of the economic literature on the link between measures of a firm’s economic performance and its characteristics.

³Note that P could be the vector of after tax and after commission prices as well.

Appendix: Proof of Proposition 1

Proof The first order necessary conditions (FONC) for the program:

$\max [u(Z) \text{ subject to } G(X, Z, \beta) \leq 0, \text{ and } P'X \leq W]$ are ;

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

Given the assumptions on $u(\cdot)$ and $G(\cdot)$, the FONC can be solved for the quality augmented asset demands. $X(\cdot)$. The assumptions on $u(\cdot)$ and $G(\cdot)$ insure that the second order sufficient conditions for a maximum are met and the constraints are qualified.

Substituting $X(\cdot)$ into $G(\cdot)$, the optimum level of attributes $Z(\cdot)$ may be expressed as a function of wealth, prices, and the quality parameters. Substituting Z into $u(\cdot)$ the indirect utility function obtains. Solving the first order conditions for p_i and substituting $\partial u / \partial W$ for the Lagrange multiplier gives the price decomposition equation (1) where $\lambda_k = \partial W / \partial z_k$ is the implicit value or ‘shadow cost’ of the k^{th} attribute.