"A MARKET BASED APPROACH TO THE VALUATION OF THE ASSETS IN PLACE AND THE GROWTH OPPORTUNITIES OF THE FIRM"

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Comments welcome

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Abstract

Newly traded financial instruments are used in this paper to study and test the fundamental decomposition of the firm into assets in place and growth oppportunities. A model is developed and its implications are examined. The model is then tested with two recently traded securities, primes, and scores. The generalization of the approach to other securities is finally discussed.

1 Introduction

Newly traded financial instruments are used in this paper to study and test the fundamental decomposition of the firm into assets in place and growth oppportunities.

Miller and Modigliani (1961) separate the value of the firm into a discounted finite stream of dividends and the value of growth. Myers (1977) decomposes the assets of the firm into its assets in place and the value of its growth oppportunities. The growth oppportunities materialize only if the firm decides to make additional investments. In that sense, growth opportunities can be seen as real options, and consequently should be valued with the models used to price financial options.[1] Mason and Merton (1985), and Kester (1984) show the generality of the concept of real options and present the various forms the options can take. Others, like Myers and Majd (1983), Majd and Pindyck (1987), and McDonald and Siegel (1985,1986) focus on specific cases of real options and present valuation models for these options. The magnitude of the real option component is probably substantial in many cases and has important implications for the financing policy of the firm, such as the level of the its debt to equity ratio, the behavior of its stock around changes in the firm's financial structure, and the maturity of its bonds.[2]

Empirical tests of this decomposition are difficult. Paddock, Siegel and Smith (1982) use the example of oil leases to show that real options are valued by the market and that the real option component of the firm is non trivial. They find that the value of the options imbedded in a lease could be from two to five times the value of the asset without any option. Kester (1984) estimates the real option component of the equity of the firm by substracting the value of a perpetual earning flow from the market value of the equity of the firm. Williamson (1981) and Long and Malitz (1983) relate the debt–equity ratio to proxies for growth opportunities, like the R&D and marketing expenses of the firm. Most real options, let alone the

[1]There are, however, some differences between real and financial options. See for example Ingersoll (1982).

[2]See Myers (1977), Myers and Majluf (1984), and for the special case of financial intermediaries, Herring and Vankudre (1987).

complete portfolio of real options of a firm, is prohibitely complex to value. The real option component of the firm can only be estimated in very crude ways.

The main idea of the paper is to show how to use the *market prices* of actively traded securities to estimate the two components of a firm's value. The paper suggests a simple model of the firm. The asset side is decomposed into assets in place and a growth opportunity. The liability side is similarly decomposed into two hypothetical securities which have specific characteristics. The objective is to express each component on the asset side *solely* in terms of the components on the liability side and of their attributes. The conditions under which this formulation is possible are derived. An equivalence is then established between these two hypothetical securities and two newly traded securities called "primes" and "scores".

Primes and scores basically separate the components of return of a given stock into dividend income and capital appreciation.[3] A prime entitles its holder to the underlying stock's dividends and the stock's market value on a future date up to a preset maximum. The score entitles its holder to all the appreciation above that maximum.[4] Unlike stocks options, primes and scores have a long maturity. They are terminated five years after their registration statement is effective. Further, unlike warrants which are also long maturity instruments, primes and scores are not issued by the firm.[5] Primes and scores on 26 blue chips trade as separate instruments on the American Stock Exchange.[6]

Once the equivalence between the two hypothetical securities and primes

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[3]The valuation of primes and scores are examined by Jarrow and O'Hara (1988), and Gerard and Hillion (1988).

[4]Prime stands for "prescribed right to income and maximum equity" and score for "special claim on residual equity".

[5]Some of the underlying companies, like IBM, General Motors, Texaco, and Procter & Gamble, were even opposed to the concept and they made known their concerns to the regulators, the exchanges, and underwriters. See the March 29, 1984 edition of the *Wall Street Journal*. The New York Stock Exchange refused to list the Americus Trusts for that reason. As discussed in section 6, "stock stripping" has regained interest since.

[6]Primes and scores can be compared to dual purpose funds. See Ingersoll (1977) for an extensive study of dual purpose funds. There are two main differences, however. First, dual purpose funds represent portfolios, not individual issues. Second, unlike dual purpose funds, a prime and a score can be exchanged for one share of stock held by the trust at any time before the termination date.

and scores is established, the model and its implications can be empirically tested. The model yields a first set of propositions pertaining to the variance of each security. They are tested with the observed market prices of the prime, the score, and the underlying security. A second set of propositions is obtained from the comparative statics of the model. An event study type of methodology applied to the three securities is used to test them. Finally, estimates of the assets in place and growth opportunities of the firm are directly obtained from the model using the market prices of primes and scores and the underlying securities. These estimates are then related in a cross-sectional way to more traditional estimates, or proxies, of the two components of the firm's assets.

The paper is organized as follows. A simple theoretical model is developed in section 2. The implications of the model are examined in section 3. Following a brief presentation of primes and scores, section 4 shows how primes and scores can be used to estimate the assets in place and growth components of the firm. The model is empirically tested in section 5. Section 6 discusses some extensions of the model and section 7 concludes the paper.

2 The model

A simple discrete time model is developed in this section. The model assumes no uncertainty except for the state of the world to prevail at a future date. The uncertainty is resolved at this future date. The time today is denoted by $t = 0$. At time T, two states are possible, a good state and a bad state, with a probability of occurence equal to π_g and $(1 - \pi_g)$, respectively. The assets and liabilities of a pure equity firm, denoted by V, are examined and then matched. The market value of V at time t is equal to $V_t = S_t = nS_t^*$, where n is the number of shares outstanding and S_t^* is the market value of a share at time t.

2.1 The asset side of firm V

The firm has two kinds of assets, some assets in place and a growth opportunity, denoted by A and G, respectively. The assets in place are riskless and the growth opportunity is risky.[7] The assets in place are composed of a physical asset, like a machine, and cash. Their values are the same in both states of nature. The physical asset provides an infinite constant stream of cash flows of D_1 per period. The growth opportunity gives the firm the opportunity to invest at time T an amount I in another physical asset, for example a second machine, if the good state prevails. The second machine is assumed to generate a infinite constant stream of cash flows of D_2 per period starting at time $(T+1)$ in the good state. The stochastic processes governing the two streams of cash flows are hypothesized to be different. The second machine does not yield any cash flows in the bad state. Therefore, the value of the growth opportunity is zero if the bad state prevails.

The firm is assumed to have just enough cash to invest in the new project without having to raise new equity or debt. The amount in cash at time $t=0$ is equal to the present value of the investment to be made at time T if the good state occurs, *i.e.*, $I(1+r)^{-T}$, where r is the assumed constant risk-free rate of interest. If the bad state occurs, the firm does not invest at time T and keeps the cash. The dividend policy of the firm can be summarized as follows: Up to T, the firm pays a constant dividend payment of D_1. After T, the dividend policy of the firm depends on the state of the world that prevailed at T. The firms pays a dividend equal to $(D_1 + rI)$, if the bad state occured, and $(D_1 + D_2)$, if the good state occured.[8]

[7] This decomposition is similar spirit to that of Rubinstein (1983). Rubinstein's model is a continuous-time model, however. Also, he does not analyze the option behavior of the risky component of the firm.

[8] The model can be illustrated as follows. Suppose firm V is a pharmaceutical company which produces and sells several profitable products, like vitamins, aspirin-like tablets, that have a insured market share. They are produced by the same machine, and yield a infinite safe stream of cash flows equal to D_1. The assets in place of firm V are composed of the machine and cash in an amount equal to $\frac{I}{(1+r)^{(T-t)}}$. Firm V has also developed a revolutionary medication which cures colds. The new medication is protected by a patent. It needs to be approved by the Food and Drug Administration before the firm starts producing it. Let π_g be the probability of the FDA approving the medication. A decision

At time t, with $0 \leq t < T$, the value of the firm is equal to the sum of the assets in place and the growth opportunity, namely,

$$V_t = A_t + G_t, \qquad \forall t \in [0, T[. \tag{1}$$

The assets in place are the sum of 1) the infinite constant stream of cash flows generated by the first physical asset, and 2) cash in an amount equal to the present value of the investment to be made at time T if the good state prevails, that is,

$$A_t = \frac{D_1}{r} + \frac{I}{(1+r)^{(T-t)}}, \qquad \forall t \in [0, T[. \tag{2}$$

The value of the growth opportunity at time t is a function of 1) the net present value of the second physical asset, assumed to be strictly positive, if the good state prevails, and 2) the probability of occurence of the good state, that is,

$$G_t = \frac{\pi_g}{(1+r)^{(T-t)}} \left(\frac{D_2}{r} - I \right), \qquad \forall t \in [0, T[, \tag{3}$$

with,

$$\left(\frac{D_2}{r} - I \right) > 0. \tag{4}$$

The growth opportunity is a real option with maturity T and exercise price I. The underlying security is a physical asset which has a value at time t equal to zero or $\frac{D_2}{r}(1+r)^{-(T-t)}$ depending on which state of nature prevails at time T.[9] The distribution of this physical asset is, therefore, binomial, and so will be the real option on this asset.[10] Using the definition of the variance of a binomial distribution, the variance of the underlying security price is equal to,

$$\sigma_t^2 = \left[\frac{1}{(1+r)^{(T-t)}} \left(\frac{D_2}{r} \right) \right]^2 (1 - \pi_g)\pi_g, \qquad \forall t \in [0, T[. \tag{5}$$

is expected five years from now. If the medication is approved, the firm will invest the amount I in a new machine. The cold medication will then generate a perpetual safe cash flow of D_2 per year, starting six years from now. If the medication is not approved, the firm will distribute an extra dividend equal to rI, starting six years from now.

[9]It is a European style option since the investment decision is taken at time T.

[10]Rubinstein (1983) assumes in his model that the risky asset follows a lognormal distribution.

which is also the variance of the firm.

2.2 The liability side of firm V

Let's now suppose that two securities S_1^* and S_2^* are created independently of the management of the firm V. The two securities are assumed to replace part or all the equity of the firm, namely a share of stock S^*, is exchanged for a portfolio of one S_1^* and one S_2^*. The shares of stock need not be all concerned by the exchange. Let m be the fraction of stocks transformed into these two securities.[11] The market value of the firm at time t is equal to $V_t = S_t = (n-m)S_t^* + m(S_{1t}^* + S_{2t}^*)$ with $0 < m \leq 1$. The security S_1^* confers to its holder 1) the right to all the cash distributions paid between now and the future date T, and 2) the right to the value of the stock at time T up to a given amount, called the termination claim, denoted by X^* with $X = nX^*$. The security S_2^* confers to its holder the value of the stock at time T exceeding the termination claim X^*.

At time $0 \leq t < T$, the price of S_{1t} is equal to,

$$S_{1t} = DM_t + \frac{1}{(1+r)^{(T-t)}}\left[(1-\pi_g)\text{Min}\left(\frac{D_1}{r} + I, X\right) + \pi_g \text{Min}\left(\frac{D_1 + D_2}{r}, X\right)\right], \quad (6)$$

with DM_t defined as,

$$DM_t = \sum_{\tau=t}^{\tau=T} \frac{D_1}{(1+r)^{(T-\tau)}}. \quad (7)$$

Similarly, at time $0 \leq t < T$, the price of S_{2t} is equal to,

$$S_{2t} = \frac{1}{(1+r)^{(T-t)}}\left[(1-\pi_g)\text{Max}\left(0, \frac{D_1}{r} + I - X\right) + \pi_g \text{Max}\left(0, \frac{D_1 + D_2}{r} - X\right)\right]. \quad (8)$$

The two securities S_1 and S_2 can be viewed as portfolios of options. More precisely, S_1 is a portfolio of a riskless asset, namely DM_t and an option. The security S_2 is an option, and is, therefore, likely to be more risky than S_1. The parameter X plays the role of the exercise price in option pricing theory and is, therefore, an important determinant of the price of these

[11] Firm V is assumed to be unaffected by the issuance of of these two securities.

two securities. In the extreme case where X is set equal to zero, the holder of S_1 gets only the dividend stream up to time T, *i.e.*, $S_{1t} = DM_t$, and is indifferent about the outcome of the state of nature. When X is set equal to a large value, the holder of S_1 receives the dividend stream up to T, and also most of, if not all, the capital gains when they materialize. The holder of S_2 then receives virtually nothing. It can easily be seen from equation (8) that the security S_2 is worthless whenever X exceeds $\frac{(D_1+D_2)}{r}$. In that case, the security S_1 is equivalent to the stock S. Two interesting intermediary cases are obtained when the termination claim X is set to a value lower and higher than $(\frac{D_1}{r} + I)$, respectively. Simple relationships between the liability and the asset sides of firm V are derived below in each of these two cases.

2.3 Matching the asset and liability sides of firm V

The value of each security S_1 and S_2 is expressed here as a function of A and G, the assets in place and the growth opportunity of the firm, respectively. A system of equations is first derived in the case where $0 < X < (\frac{D_1}{r} + I)$, then in the case where $(\frac{D_1}{r} + I) \leq X \leq (\frac{D_1+D_2}{r})$, and finally in both cases simultaneously.

- <u>Case 1</u>: $\quad 0 < X < (\frac{D_1}{r} + I) < (\frac{D_1+D_2}{r})$

Let's define,

$$\gamma = \frac{X}{(\frac{D_1}{r} + I)}, \qquad \text{with } 0 < \gamma < 1, \tag{9}$$

Also let,

$$\begin{aligned} APM_t &= A_t - \sum_{\tau=t}^{\tau=T} \frac{D_1}{(1+r)^{(T-\tau)}}, \\ &= A_t - DM_t, \qquad \forall t \in [0, T[, \end{aligned} \tag{10}$$

be the present value of the assets in place at maturity. The variable APM is referred to, henceforth, as the net asset in place. Then, from equation (6), the value of S_{1t} is equal to,

$$\begin{aligned} S_{1t} &= DM_t + \frac{1}{(1+r)^{(T-t)}} \left[(1-\pi_g)X + \pi_g X\right], \\ &= DM_t + \frac{1}{(1+r)^{(T-t)}} X, \qquad \forall t \in [0, T[. \end{aligned} \tag{11}$$

Similarly, from equation (8), the value of S_{2t} is equal to,

$$\begin{aligned} S_{2t} &= \frac{1}{(1+r)^{(T-t)}} \left[(1-\pi_g)\left(\frac{D_1}{r} + I - X\right) + \pi_g \left(\frac{D_1 + D_2}{r} - X\right)\right], \\ &= \frac{1}{(1+r)^{(T-t)}} \left[\frac{D_1}{r} + I + \pi_g \left(\frac{D_2}{r} - I\right)\right], \qquad \forall t \in [0, T[. \end{aligned} \tag{12}$$

Finally, substituting equations (9) and (10) into (11) and (12) yields the system of equations,

$$\begin{cases} S_{1t} = DM_t + \gamma APM_t, & \forall t \in [0, T[, \\ S_{2t} = (1-\gamma) APM_t + G_t, & \forall t \in [0, T[. \end{cases} \tag{13}$$

• <u>Case 2</u> : $\quad (\frac{D_1}{r} + I) \leq X \leq (\frac{D_1 + D_2}{r})$

Let's define,

$$k = \frac{X - \left(\frac{D_1}{r} + I\right)}{\left(\frac{D_2}{r} - I\right)} \qquad \text{with } 0 \leq k \leq 1, \tag{14}$$

Then, it can be easily shown using equation (6) that the value of S_{1t} is equal to,

$$S_{1t} = DM_t + (1-\pi_g) APM_t + \pi_g X, \qquad \forall t \in [0, T[. \tag{15}$$

Similarly, the value of S_{2t} is equal to,

$$S_{2t} = \frac{\pi_g}{(1+r)^{(T-t)}} \left[\frac{D_1 + D_2}{r} - X\right], \qquad \forall t \in [0, T[. \tag{16}$$

Finally, substituting equations (14) and (10) into (15) and (16) yields the system of equations,

$$\begin{cases} S_{1t} = A_t + kG_t, & \forall t \in [0,T[, \\ S_{2t} = (1-k)G_t, & \forall t \in [0,T[. \end{cases} \tag{17}$$

The system of equations specified in (17) shows that, when $X = (\frac{D_1}{r} + I)$, the value of S_1 and S_2 are exactly equal to the assets in place and the growth opportunity, respectively *i.e.*, $S_{1t} = A_t$ and $S_{2t} = G_t$.[12]

- <u>A general formulation</u> :

General formulas to value S_1 and S_2 in the two cases can also be derived. By redefining the two parameters γ and k as,

$$\gamma = \text{Min}\left(1, \frac{X}{(\frac{D_1}{r} + I)}\right), \tag{18}$$

$$k = \text{Max}\left(0, \frac{X - (\frac{D_1}{r} + I)}{(\frac{D_2}{r} - I)}\right), \tag{19}$$

yields,

$$X = \gamma A_t + kG_t, \qquad \forall t \in [0,T[. \tag{20}$$

The values of S_{1t} and S_{2t} can then be expressed as a function of the parameters γ and k and the different components of the firm's assets, that is,

$$\begin{cases} S_{1t} = DM_t + \gamma APM_t + kG_t, & \forall t \in [0,T[, \\ S_{2t} = (1-\gamma)APM_t + (1-k)G_t, & \forall t \in [0,T[. \end{cases} \tag{21}$$

In the systems of equations (13), (17), and (21), the values of S_{1t} and S_{2t} at time t depend on the three variables, DM_t, APM_t, and G_t, previously defined, and on the two parameters γ and k. The parameters γ and k can be interpreted as follows. In case 1 and case 2, the security S_1 is a function of the dividend stream to maturity DM, and the net asset in place APM, with $A = DM + APM$, as specified in equation(10). The parameter γ is the fraction of the net asset in place imbedded in S_1. Similarly, in both cases, the security S_2 is a function of the growth opportunity G. The parameter k is the fraction of the growth opportunity imbedded in S_1, when the value of S_2 depends solely on the growth opportunity.

[12] Further, when $X = (\frac{D_1+D_2}{r})$, $k = 1$ and $S_{1t} = S_t$ and $S_{2t} = 0$, $\forall t \in [0,T[$

The ability to express the value of each security S_1 and S_2 in terms of the different components of the asset side of the firm V is interesting but not innovative. An attractive feature of the model, however, lies in its relative simplicity. Either one of the two parameters γ or k is equal to zero in the systems of equations (13) and (17), associated with case 1 and case 2, respectively. Similarly, the variable DM_t appears only in S_{1t} in the system of equations (21).

The simplicity of the model is an important feature, since it makes it possible to express under certain conditions the components on the asset side *solely* in terms of the components on the liability side of firm V. In case 1, the system specified in (13) involves three components on the asset side, namely DM_t, APM_t, G_t, and the parameter γ. In case 2, only two components, namely A_t, G_t, and one parameter k are involved. The two components on the liability side, are the securities S_1 and S_2. There are four and three unknowns in case 1 and case 2, respectively, and only two knowns in both cases. Two additional equations are, therefore, needed in the first case, and one in the second case to invert the systems and formulate the assets in terms of the liabilities. This is examined next.

3 The implications of the model

The goal of this section is to show how to use the model to 1) derive testable propositions and 2) formulate the firm's assets in terms of the firm's liabilities.

3.1 Implications for the variances of the three securities

Certain properties pertaining to the distributions of the prices and returns on the three securities S, S_1, and S_2 can be derived from the model presented in the previous section. In particular, the model has important implications for the variance of each of the three securities' prices and returns. The variance of the prices and the variance of the returns are both examined. The variance of returns in more conventional than the variance of prices in the finance literature. However, the variance of prices provides an interesting approach to the estimation of the parameters of the model.

The variance of *the price* of each security is first examined. Let σ_S^2, $\sigma_{S_1}^2$, and $\sigma_{S_2}^2$ denote the variance of the stock S, the security S_1, and the security S_2 prices, respectively. From the assumptions underlying the model, the only source of uncertainty stems from the growth opportunity. Therefore, the variance of the stock price is always equal to the variance of the growth opportunity,

$$\sigma_S^2 = \sigma_G^2, \tag{22}$$

where σ_G^2 is the variance of the growth opportunity. The variance of the price of the two remaining securities, S_1 and S_2, can be easily derived. Using equation (22) and the two systems of equations specified in (13) and (17), one obtains,

The variance of S_1 and S_2 prices

	$0 < X < (\frac{D_1}{r} + I)$	$(\frac{D_1}{r} + I) \leq X \leq (\frac{D_1+D_2}{r})$
$\sigma_{S_1}^2$	0	$k^2\sigma_S^2$
$\sigma_{S_2}^2$	σ_S^2	$(1-k)^2\sigma_S^2$

This table leads to three new testable propositions.

- Proposition 1: The variance of the price of S_1 is less than or equal to the variance of the stock price,
- Proposition 2: The variance of the price of S_2 is less than or equal to the variance of the stock price,
- Proposition 3: The variance of the price of S_2 is larger than the variance of the price of S_1, for values of k smaller than $\frac{1}{2}$ in case 2, and is larger in case 1.

The results hold because k is bounded above by 1. Further, when $(\frac{D_1}{r} + I) \leq X \leq (\frac{D_1+D_2}{r})$, the parameter k can be estimated as,

$$k = \frac{\sigma_{S_1}}{\sigma_S}, \qquad \text{and} \quad (1-k) = \frac{\sigma_{S_2}}{\sigma_S}, \tag{23}$$

with $\sigma_{S_1} + \sigma_{S_2} = \sigma_S$.

The variance of the *returns* on the three securities can also be easily derived. Let $\sigma_S^{2'}$, $\sigma_{S_1}^{2'}$, and $\sigma_{S_2}^{2'}$ denote the variance of the stock S, the security S_1, and the security S_2 returns, respectively. The variance of the stock returns can be easily expressed in terms of the variance of the stock prices namely,

$$\sigma_S^{2'} = \frac{1}{(A+G)^2}\sigma_S^2. \tag{24}$$

Similarly, using the two systems of equations specified in (13), (17), and (24), the variance of the returns on S_1, and S_2 are equal to,

The variance of S_1 and S_2 returns

	$0 < X < (\frac{D_1}{r} + I)$	$(\frac{D_1}{r} + I) \leq X \leq (\frac{D_1+D_2}{r})$
$\sigma_{S_1}^{2'}$	0	$\frac{k^2}{(A+G)^2}\sigma_S^2$
$\sigma_{S_2}^{2'}$	$\frac{1}{((1-\gamma)APM+G)^2}\sigma_S^2$	$\frac{1}{G^2}\sigma_S^2$

The variance formulations are slightly more complex than in the previous case. This table leads to two new testable propositions.

- Proposition 4: The variance of the returns on S_1 is less than the variance of the stock returns,

- Proposition 5: The variance of the returns on S_2 is larger than the variance of the stock returns.

Propositions 4 and 5 imply that,

$$\sigma_{S_1}^{2'} \leq \sigma_S^{2'} \leq \sigma_{S_2}^{2'}. \tag{25}$$

This result is intuitive since the most risky security, *i.e.*, S_2, is found to have the largest variance and the safest security, *i.e.*, S_1, has the smallest variance.

3.2 The comparative statics

The comparative statics of the model are examined next. The partial derivatives are both computed for the prices and the returns on the three securities S, S_1, and S_2, with respect to the termination claim X, the probability of occurence of the good state π_g, and the cash flows generated by the first and second physical assets D_1 and D_2, respectively. They are reported in appendix 1. From the relationship between prices and returns, the signs of the partial derivatives are similar when computed for prices and returns. They appear in the table below.

Signs of the partial derivatives with respect to X, D_1, D_2 and π_g for the prices and returns on S, S_1, and S_2

	X	D_1	D_2	π_g
S	0	>0	>0	>0
S_1	>0	>0	0	≥ 0
S_2	<0	>0	>0	>0

Most results in the above table are self-explanatory. As suggested by the option characteristics of S_1 and S_2, apparent in equations (6) and (8), respectively, the prices and returns of S_1 rise and of S_2 fall with increases in X. Further, from the assumptions underlying the model, an increase (decrease) in the value of D_1, D_2, and π_g implies an increase (decrease) in the value of the firm. As the value of the assets of the firm rises, the value of the partial claims on those assets, i.e., S_1 and S_2, also increase. There is one exception, however. The security S_1 is unaffected by a change in D_2 because the increase in G is counterbalanced by a decrease in k, i.e., the value of the growth opportunity component imbedded in S_1 decreases. The fact that k is a function of D_2, and does not depend on π_g explains why this result holds for D_2 and not for π_g.[13]

The comparative statics can be used to predict 1) the change in the price of the three securities, S, S_1, and S_2, and 2) the relative price change across

[13]As shown in appendix 1, the partial derivative of S_1 with respect to π_g is zero in case 1, and is strictly positive in case 2.

securities, to a given change in D_1, D_2, and π_g.[14] To be consistent with the empirical literature in finance, these predictions should be formulated in terms of unexpected changes in the variable, D_1, D_2, and π_g, and in terms of abnormal returns rather than returns. The table above suggests five additional testable propositions.

- Proposition 6: The announcement of an unexpected increase (decrease) in D_1 yields positive (negative) abnormal returns for S, S_1, and S_2,[15]

- Proposition 7: The announcement of an unexpected increase (decrease) in D_2 yields positive (negative) abnormal returns for S and S_2 and zero abnormal returns for S_1,

- Proposition 8: Same as proposition 6 with π_g replacing D_1.

Beyond the signs, the partial derivatives generate useful information about the relative sensitivity of the three securities to a given change in the parameter of the model. Appendix 1 shows that the sensitivity of the three securities can be ranked without ambiguity for changes in D_2 and π_g. This suggests two additional propositions.

- Proposition 9: The announcement of an abnormal increase (decrease) in D_2 yields higher positive (negative) abnormal returns for S_2 than for S,[16]

[14] No proposition is formulated for X. As shown in the following section, the variable X is in fact a fixed parameter.

[15] Suppose firm V announces an unexpected increase in its sales and earnings. This can be interpreted as an increase in the revenues generated by the assets in place, *i.e.*, a rise in D_1. Proposition 6 claims that the three securities S, S_1 and S_2 should all react favorably to the annoucement of this news and should display positive abnormal returns.

[16] Suppose firm V has a patent for a new type of truck that will be manufactured only if the firm gets a contract from the Army. While the firm is waiting for the Army's decision, it finds a new process to produce the truck at a lower cost. If firm V gets the Army's contract, this lower cost should generate a higher D_2. Proposition 7 claims that S and S_2 should display a positive abnormal return on the day firm V announced that it found a cheaper alternative to manufacture the trucks. Also, proposition 10 claims that the abnormal returns should be higher for S_2 than for S.

- Proposition 10: The announcement of an unexpected increase (decrease) in π_g yields higher positive (negative) abnormal returns for S_2 than for S, and higher for S than for S_1.[17]

Unfortunately, unlike D_2 and π_g, no such ranking across securities can be obtained for D_1.[18]

3.3 The formulation of the firm's assets in terms of the firm's liabilities

The components on the asset side of V are now expressed in terms of the components on the liability side and their attributes.

This can be easily done when $(\frac{D_1}{r} + I) \leq X \leq (\frac{D_1+D_2}{r})$. In that case, as the system of equations specified in (17) indicates, there are three unknowns, G_t, A_t and k, and two knowns S_1 and S_2. However, the system can be inverted using equation (23). One obtains,

$$\begin{cases} G_t = \frac{\sigma_S}{\sigma_{S_2}} S_{2t}, & \forall t \in [0,T[, \\ A_t = S_{1t} - \frac{\sigma_{S_1}}{\sigma_{S_2}} S_{2t}, & \forall t \in [0,T[, \end{cases} \tag{26}$$

where it is implicitely assumed that $\sigma_{S_2} S_{1t} \geq \sigma_{S_1} S_{2t}$, $\forall t \in [0,T[$.

The system of equations specified in (13), corresponding to case 1, cannot be easily inverted. The number of unknowns, *i.e.*, DM_t, APM_t, G_t and γ, exceeds the number of knowns, *i.e.*, S_1 and S_2. Unfortunately, the parameter γ, unlike k, cannot be expressed in terms of variances. Two equations are missing for the system to be invertible. As shown in appendix 2, the system can be solved only under the assumption that two variables, like r and D_1, are known. This solution offers little interest, however. The

[17] Suppose firm V growth opportunity is to produce and sell a revolutionary medication which is being reviewed by the Food and Drug Administration. Suppose that the FDA suddenly approves the firm's proposal for the medication. This news can be interpreted as an unexpected increase in the probability π_g. Proposition 8 claims that, on the FDA announcement day, the returns on the three securities S, S_1, and S_2 should all be positive. Proposition 10 claims that the return on S_2 should be higher than the return on S, itself higher than the return on S_1.

[18] The ranking depends on the relative magnitude of the parameters of the model. See appendix 1.

components on the asset side of firm V can be expressed in terms of the securities S_1 and S_2 only in case 2. This is not necessarily a weakness of the model, however. In section 4, the model is shown to be testable with existing securities. It is, therefore, necessary to discuss the conditions, if possible, under which case 2 is more likely to prevail than case 1, i.e., why X is likely to be larger than $\left(\frac{D_1}{r} + I\right)$.

Under the assumptions that 1) the two hypothetical securities S_1 and S_2 exist and are traded, and 2) case 2 is more likely to prevail than case 1, the growth component and the assets in place of a firm can be directly estimated from the system of equations specified in (26), *i.e.*, from the variables S_1 and S_2 and also their attributes, namely their variances, $\sigma^2_{S_1}$ and $\sigma^2_{S_2}$, and finally the variance of the underlying security, σ^2_S. The estimate of the growth component can then be compared cross–sectionally to proxies, such as R&D and marketing expenses, or to other estimates suggested in the literature. Kester (1984), for example, estimates the growth component of the firm by substracting a perpetuity of earnings from the market value of the equity of the firm. Apart from simple cross–sectional comparisons, important propositions about the relationship between growth opportunities and the debt equity ratio of the firm can also be tested using the estimate of G obtained from (26). This can be done, however, only after introducing some debt in the liability side of firm V. Extensions of the present model are examined in subsequent section.

4 Is the model testable?

The model developed in section 2 is formulated in terms of two securities denoted by S_1 and S_2. These securities are not hypothetical. This section shows that they are equivalent to securities recently introduced and actively traded on the American Stock Exchange, called primes and scores, respectively. The existence of these two securities allows one to test the model.

4.1 Primes and scores: description

A pure equity product appeared in 1983 with the introduction of the Americus Trusts. The trust is basically a vehicle which enables shareholders to separate the capital gains from the dividend stream. The concept is simple. The trust acts as a repository for common shares which are exchanged for a certificate, called the unit. A limited number of shares is accepted into each trust. The assets of the trust consist initially of shares in an amount which cannot exceed more than 5% of all outstanding shares of the underlying security.[19] Shares can be tendered only during a limited period of time. The offer expires on a prespecified date, known as the offer or expiration date.[20] Each trust terminates five years after the registration statement is effective. This date, known at the time of the initial offering, is called the termination date.

The unit is divisible into two parts. One part, the prime, entitles the holder to 1) all the income up to the termination date and 2) the net asset value of the trust up to a predetermined price at the termination date.[21] The other part, the score, entitles the holder to all the net asset value of the trust above the predetermined price at the termination date. The score can be viewed as a European call option with a long maturity. The net asset value of the trust is based on the underlying stock's price adjusted for splits, stock dividends and other actions that occured during the trust's

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[19]The prospectus specifies that the maximum number of shares accepted in the trust is the lesser of N or 1 share less than 5% of the shares outstanding on the Offer Expiration date. N varies from trust to trust. The lowest and highest value of N is equal to 3.5 million, for Xerox and Merck, and 45 million for AT&T Series A. Note, however, that the 5% limit was not specified in AT&T Series A prospectus.

[20]The offer is subject to a minimum number of shares being tendered. Also, because of a tax ruling, the offer is suspended on any date on which the value of a share exceeds the termination claim. Subject to these conditions, all valid tenders of shares are irrevocable. The tendering period may terminate before the offer expiration date, however. This occurs whenever the maximum number of shares to be tendered is reached. Also, Americus Trust, in its sole discretion, can amend the period of time for which the offer is to remain open.

[21]The prime retains full voting privileges. It receives the full dividend less a $0.05 annual administration fee. If an extraordinary cash dividend is paid out of earnings, and is taxable, it goes to the prime holder. If it comes out of retained earnings and is untaxed, it goes to the trust. Non–cash distributions of less than 5% go to the prime holder. Non–cash distributions of more than 5% go to the trust.

lifetime. The predetermined price, set at the time of the initial offering, is called the termination claim. On the termination date, prime and score holders return their securities to the trust. In exchange, they receive shares of stock, the number of which depends on the trust's net asset value in relation to the termination claim.[22]

Certain characteristics of units, primes, and scores, are also worth mentioning. In particular, the prime, or the score, cannot be redeemed separately. However, any prime and any score when recombined, can be redeemed at any time during the life of the trust, without charge, for a full share of stock.[23] Therefore, the score can be exercised before maturity only together with a prime. The IRS and the SEC consider each of the new securities to be separate, distinct, and marginable. Neither component constitutes an option for Federal Income Tax purposes. Income taxes on any appreciation are owed only on the outright sale of the units, primes, or scores, not on exchanges.[24]

The three securities, the unit, the prime, and the score, are listed on the American Stock Exchange. The first Americus Trust was introduced in October 1983. Units were exchanged for pre–divestiture AT&T common stock placed in the trust. Shares of Exxon were exchanged for Americus Trusts Units in September 1985. Since then, 25 additional trusts have been created, most of them in the third quarter of 1987. The 25 underlying securities are all blue chips. Information concerning the names of the underlying securities, the termination claim, relevant dates, *i.e.*, the first trading date of the units, primes, and scores, the offer expiration date, the termination date, and finally the maximum number of shares accepted in the trusts appear in table 1.

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[22]With cash in lieu of fractional shares of stock.

[23]Apart from fees levied on dividends, there are some costs incurred in acquiring trust units. When the shares are deposited with each trust for exchange, there is a 1.2% charge. No charges are incurred when converting units into primes or scores or reconverting the units into stock.

[24]The favorable 1984 tax ruling, which authorized the non–taxable exchanges of Americus shares for prime and score components, was revoked in August 1987. This explains why Americus Trust rushed to introduce 28 new trusts before this date. (See the February, 5 1987 edition of *Wall Street Journal*). No new trusts are likely to be created.

4.2 The equivalence between S_1 and S_2 and primes and scores

The two securities S_1 and S_2 were initially defined to be equivalent to a prime and score, respectively. The parameters X and T are the termination claim and the termination date, respectively. The parameter X is contractually fixed for each trust and differs from one trust to another.[25] The parameter T is set equal to five years for all the trusts, after their registration statement is effective. The parameter m, the proportion of shares exchanged for units, is bounded above by 5%.

The model and its implications, developed in section 2 and 3, can now be formulated in terms of primes and scores. The parameters γ can be interpreted as the fraction of net assets in place imbedded in the prime. Similarly, the parameter k can be viewed as the fraction of the growth opportunity imbedded in the prime when the value of the score depends solely on the growth opportunity. Therefore, in case 2, for values of the termination claim higher than $(\frac{D}{r}+I)$ and less than $(\frac{D_1+D_2}{r})$, the system of equations specified in (26) implies that the assets in place and the growth opportunity can easily be estimated from the market price of the prime and the score, and the variances of the stock, the prime, and the score. Also, as pointed out before in section 2.3, the isomorphism is perfect when the termination claim is set equal to $(\frac{D}{r}+I)$, *i.e.*, the asset in place of the firm exactly corresponds to the prime, and the growth opportunity to the score. Unfortunately, in case 1, for values of the termination claim less than $(\frac{D}{r}+I)$, the assets in place and the growth opportunity cannot be expressed in terms of primes and scores and their possible attributes, like their variances.

A critical issue is, therefore, to know which of case 1 or case 2 is most likely. Stated differently, is the termination claim smaller or larger than $(\frac{D}{r}+I)$? Unfortunately, no information or no contractual arguments can be used to to answer that question. The fact that the 27 scores were and are traded, and have non–zero values, suggests that the termination claim was set, and still is, equal to a value strictly less than $(\frac{D_1+D_2}{r})$.[26] This

[25] For this reason, the comparative statics with respect to X have little interest.

[26] See footnote 11.

does not answer the question, however. Also, the fact that X was set to a value higher than the stock at issue does not necessarily imply that the termination claim X is larger than $(\frac{D}{r} + I)$. At this point, there seems to be little evidence that can be used to state that one case is more prevalent than the other. Evidence, about the value of the termination claim relative to $(\frac{D}{r} + I)$, can only be obtained *empirically* with, for example, the tests of proposition 3 in section 3.1.

Another potential problem with the model pertains to the assumption that $S = (S_1 + S_2)$. The sum of the prices of the prime and the score need not be equal to the price of the stock. A prime and a score can always be rebundled and exchanged for a share of the underlying security any time before maturity. Therefore, ignoring transaction costs and other market imperfections, the price of the portfolio composed of a prime and a score cannot sell for less than the price of the underlying stock by arbitrage. However, the price of the portfolio can sell at a higher price. The difference between the value of this portfolio and the stock may correspond to possible debundling gains. Though their statistical significance is not established yet, their presence would obscure the relationships between assets in place/ growth opportunies and primes/scores, especially if they are reflected in the price of only one of the two securities.[27]

Primes and scores are two actively traded securities. The model and its implications can, therefore, be empirically tested. The empirical tests are presented below.

5 Empirical tests

The model is empirically tested using the market prices of primes and scores. The results of the empirical tests are reported in this section.

[27]See Jarrow and O'Hara (1988) and Gerard and Hillion (1988).

5.1 The data

The stock prices come from the CRSP daily return tape up to December 3?, 1987. Starting in January 1988, the stock prices have been handcollected from the *NewYork Stock Exchange Price Record.* The market prices of units, primes, and scores, do not appear in any of the well-known data base. Their prices have been handcollected from the *American Stock Exchange Price Record* for all firms. One exception, however, is AT&T series A for which the data have been handcollected from the *NewYork Stock Exchange Price Record.*[28] The amount and ex-dividend dates of dividends, stock splits, stock dividends, rights, have been handcollected from the *Moody's Dividend record: Annual Cumulative Issues.* The market value of rights on ex-days have been collected from the *Wall Street Journal.* The information concerning dividends has been doublechecked with the *American Stock Exchange Price Record*, the *NewYork Stock Exchange Price Record* for AT&T series A, and also with the CRSP Monthly Master tape. The characteristics of the units, primes, and scores, like the termination claim, the tender termination date, the termination date of the trust, the maximum number of shares accepted by the trust, originate from the 27 prospectus, and the

[28]As mentioned earlier, units, primes, and scores started trading for AT&T in October 1983 before AT&T divestiture. When AT&T was split into seven new companies, the AT&T trust received parts of the seven new firms. After the divestiture, the AT&T units and primes holders received dividends from these seven companies and also from the new AT&T. The AT&T series A trust was terminated in October 24, 1988. In 1987, Americus Trust initiated the trust AT&T series 2 with the new AT&T as the underlying asset. AT&T Series 2 started trading in February, 17, 1987. Two AT&T trusts co-existed for a while. However, the two trusts, *i.e.*, AT&T series A and AT&T series 2 have two different underlying securities that distribute different dividends with different ex-dates. They also have different termination claims. The units, primes, and scores of AT&T series 2 are traded on the American Stock Exchange. Therefore, it is not a total of 26 but 27 trusts that were created by Americus Trust. The sample size is, therefore, 27. Three additional trusts, Texaco, Philip Morris, and 3M, were originally planned by Americus. The Texaco trust was cancelled because investors did not tender enough shares to meeet Amex listing rules. (See the August, 9 1987 edition of *the Wall Street Journal*). The Philip Morris trust was also cancelled because of the Tax ruling that the offer is suspended on any date on which the value of a share exceeds the termination claim. Philip Morris stock traded at a higher price than the termination claim during a long period of time. (See the August, 18 1987 and September, 8 1987 editions of *the Wall Street Journal*). 3M did not attract enough interest.

occasional amendments and supplements, published by Americus Trust for each individual trust.

The CRSP procedure is used to compute the returns from the prices, and to adjust the returns for dividends, stock splits, and stock dividends. The adjustments and their timing, however, are not necessarily similar for the stocks, and the units, the primes, and the scores. Regarding the dividends, the ex–dates of the units and the primes need not match the ex–dates of the stocks.[29] The ex–dates of the units and the primes lag by at most one trading day in approximately 10% of the cases.[30] The ex–dates specific to each security are used. Apart from the ex–dates, the dividends paid to the stockholders, the unitholders, and the primeholders differ by an annual and contractual fixed amount of \$.05, *i.e.*, \$.0125 quarterly. Table 2 reports information on the distribution policy of the firms in the sample since the different components of the Americus trust started trading. Table 2 displays the dividends distributed in dollars, the dividend yield, and shows the proportional impact of the fixed commission costs of \$.05. Regarding stock splits, the adjustment differs for the stocks, and for the units, the primes, and the scores. As specified in the prospectus and their amendments published by Americus, a split implies a new definition of the unit, the prime, and the score, that entitles the owner of each security post–split to its right pre–split multiplied by the split factor. Therefore, unlike the stock prices and their dividends, the unit prices, the prime prices, and their dividends, and finally the score prices need not be adjusted by the split factor.

Table 3 presents information concerning the number of trading versus non–trading days for the stocks, the units, the primes, and the scores, over the period extending from October 26, 1983, when the first Americus Trust started trading, to June 30, 1988.[31] A non–trading day corresponds to a day without any trade recorded, or to a day with a very low volume of trade. In the latter case, the Wall Street Journal reports no price information at all, whereas the American Stock Exchange Price Record reports a price with a

[29]The declaration dates are also different.

[30]Each case was doublechecked with 1) *the American Stock Exchange Price Record* for the primes and the units, and the *NewYork Stock Exchange Price Record* for the stocks, and 2) the *Moody's Dividend Record: Annual Cumulative Issue*, where the ex–dates are recorded for the stocks, the units and the primes.

[31]The data base is regularly updated.

sign indicating a low trading volume. These observations are removed from the sample. When the price at time t is not available, the return between $[t-1, t]$ *and* the return between $[t, t+1]$ are reported as missing values.[32]

5.2 Results of the empirical tests

6 Directions for future research

The model developed in section 2 captures the most important characteristics of the decomposition of a firm's assets. The model is too simple in many respects, however. The assumptions about the lack of uncertainty of the assets in place, and the inexistence of debt are unrealistic.[33] So are the assumptions about the number of growth opportunities. The match between the maturity of the growth opportunity and the termination date of the Americus trusts is also a very stringent assumption. Finally, the static, as opposed to dynamic, feature of the model is perhaps its most serious limitation. Still, the model is robust to the relaxation of several assumptions.

- Extension 1: The model assumes that the firm has no debt. Similar results are obtained when the liability side of V is assumed to be composed of equity and *riskless* debt.[34] The case of *risky* debt is more complicated even when agency problems are assumed away, *i.e.*, the firm invests in a growth opportunity even when that decision increases

[32]This procedure differs from the one used by CRSP. In that particular case, CRSP would report a two–day return.

[33]Note, however, that the assumption of uncertainty for the assets in place is tenable if a strong relationship exists between the assets in place and the dividend policy of the firm. For example, Aharony and Swary (1980) find dividends to be fairly stable over a period of five years.

[34]Under the assumption that the value of the stock does not change with the value of the debt, the comparative statics show that, in case 2, the parameter k and the value of the score increase with the amount of the debt. Conversely, the value of the prime decreases as the amount of debt gets larger.

the wealth of the bondholders at the expense of the shareholders.[35] When risky debt is introduced, the value of the assets, from the equityholder standpoint, is the maximum of zero and the net assets of the firm, *i.e.*, the assets of the firm minus the debt payments. Analytical expressions for S_1 and S_2, or indifferently for primes and scores, depend on the relative magnitudes of the termination claim, the assets in place and the debt payments.[36] The security S_2, or the score, is solely a function of the growth opportunity and not of the assets in place, as in case 2 of the model developed in section 2, only when the termination claim is greater than the assets net of debt in all states of nature.

Once debt is introduced in the model developed in section 2, the estimates of the assets in place and growth opportunities, obtained from a system of equations similar to the one specified in (26), can be used to test a few propositions pertaining to the financial structure of the firm. The existence of growth opportunities is known to have important implications in corporate finance. It should explain better both the observed level of the debt equity ratio of a firm, and the behavior of the firm around changes in the debt equity ratio. Myers (1977), for example, contends that a firm with a relatively large growth component should, all other things equal, prefer a low debt to equity ratio.[37] This proposition can be further tested by relating in a cross–sectional regression the new *market based* estimate of the growth component, G, to the debt–equity ratio of the firm. Also, announcements of changes in the capital structure of the firm are perceived differently by the market in function of the magnitude of the growth opportunity of the firm. According to Myers and Majluf (1984) model, the market value of the stock price of the firm should decrease less at the announcement

[35] See for example Myers and Majluf (1984) for the complexity introduced by the existence of simple agency problems. No closed–form solutions are available in general for the value of the firm.

[36] Seven cases need then to be considered. In the model developed in section 2, only two cases are investigated. They correspond to the cases where $0 < X < (\frac{D_1}{r} + I)$ and $(\frac{D_1}{r} + I) \leq X \leq (\frac{D_1+D_2}{r})$.

[37] Williamson (1983), and Long and Malitz (1983) find evidence consistent with this theory.

of a new equity issue for a firm with a relatively larger growth opportunity. This suggests running cross–sectional regressions between the risk–adjusted abnormal returns at the issue announcements and the magnitude of the growth component of the firm.[38]

- Extension 2: More generally, the formulation of each component on the asset side of firm V in terms of the components on the liability side is more complicated when several sources of risk are introduced, especially when they are correlated. The existence of several assets in place and growth opportunities could be assumed. A non–zero correlation between the assets in place and the growth opportunities could be allowed. An interesting extension is the case where the risk from the assets in place is only systematic, and the risk from the growth opportunity is only specific.

- Extension 3: After relaxing the assumption of a single growth opportunity, the next improvement is to move from a static to a dynamic environment. In this new environment, existing growth opportunities could be continuously exercised or expire worthless, and new growth options could continuously emerge before the termination date of the trust.[39] This would relax the stringent assumption that the firm's timing decision about the growth component exactly matches the termination date of Americus trust.

- Extension 4: Another interesting issue is to find out to what extent the decomposition of the firm into assets in place and growth opportunities can be estimated from other traded securities. The most obvious candidates are the equity and the debt of the firm. However, the amount of debt carried by a firm is influenced, among others, by taxes, bankruptcy costs, and/or agency considerations, which may have little to do with the composition of the assets of the firm. Such problems are avoided with primes and scores since they are not issued by the firm. Additionally, the market prices of risky debt are not eas-

[38] See Asquith and Mullins (1986), Dierkens (1988), and Mikkelson and Partch (1986).

[39] See for example Baldwin (1982) for a discussion of the arrival of new growth opportunities.

ily available.[40] Warrants and stock options are two other potential candidates. Like scores, warrants have a long maturity. Unlike scores, however, they are issued by the firm, and are American, rather than European, options. Signalling effects, taxation, early exercise and dilution effects are likely to contaminate the estimate of the growth opportunity obtained from observed warrant prices. Like scores, and unlike warrants, stock options are not issued by the firm. Their short maturity is likely to be a serious handicap, however. Stock options have a maturity less than nine months. According to the model developed in section 2, the maturity of the grow component would have to be equal to at most nine months.[41]

The decomposition of the firm into assets in place and growth opportunities could also be estimated from the recent package of securities to be swapped in the near future for a share of stock.[42] Four corporations, American Express Co., Dow Chemical Co., Pfizer Inc., and Sara Lee Corp, have recently offered to swap between 6.3% and 20% of their stock for a new package of securities similar to primes and

[40]The case of equity and riskless debt is of little interest. This case corresponds to case 1, since the debt payments need to be covered by D_1 in all cases.

[41]Stock options could still be used to value the growth component of the firm using Rubinstein's (1983) displaced diffusion option pricing model. Rubinstein (1983) decomposes a firm's assets into a riskless asset and a risky asset. The parameter α is the proportion of the total value of the firm invested in the risky asset. Similarly, he decomposes the firm's liabilities into equity and riskless debt. The parameter β is the debt to equity ratio. Only one uncertain state variable is assumed to move this whole structure. He then derives an option pricing model from the fundamental characteristics of the firm. Relative to the Black Scholes model, the pricing model has two additional parameters which depend on α, β, and δ. The parameter δ is a dividend yield, assumed to be a deterministic fraction of the value of the risky asset at each ex-dividend date. The growth opportunity component of the firm can be estimated under the assumptions that 1) Rubinstein's (1983) displaced diffusion option pricing model is used by the market to price call options, and 2) there exists a perfect match between the assets in place/growth opportunities and the riskless/risky assets of the model. The methodology of Bossaerts and Hillion (1988), based on the methods of moments, could be used to test the model and estimate jointly the parameters α, β, and σ_r, the volatility of the risky asset. The parameter α could then be used as an estimate of the growth component of the firm, provided the model is not rejected by the data.

[42]These new securities, called Unbundled Stock Units are to be underwritten by Shearson Lehman Hutton Inc. See the December 6, 1988 edition of the *Wall Street Journal*.

scores.[43] These new securities are 1) a 30–year bond that pays interest at the stock's current dividend rate, 2) a preferred stock that pays any dividend increases on the company's common stock during that 30–year period, and 3) a third security that allows investor to profit if the stock soars. Unlike primes and scores, this portfolio of securities is issued by the firm. Their issue implies a change in the capital structure of the firm, namely an increase in its debt to equity ratio, and, normally, a decrease in its tax bill. Further, the introduction of Unbundled Stock Units changes the control structure of the firm and allows new potential "games" among the security holders of the firm. This could also influence the value of the securities.[44] This new package of securities is an interesting alternative to primes and scores to estimate the firm's assets decomposition. The assets in place and growth opportunities could be estimated from three securities instead of two, *i.e.*, the prime and the score. Further, a better estimation of the long term growth opportunities could be obtained, since the package has a longer maturity than primes and scores, 30 versus 5 years. Empirical work will be possible if more than four companies initiate this swap. A more general problem is to find the conditions under which firms could design claims that exactly correspond to the decomposition of the total assets of the firm into assets in place and growth opportunities.

7 Conclusion

[43]Note that primes and scores already exist for American Express Co. and Dow Chemical Co.

[44]The stock price of these four securities have strongly reacted on the swap's announcement date. Pfizer stock jumped $1.875, Dow stock $2.00, American Express $.625, and Sara Lee $.875.

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Table 1

Characteristics of the Americus Trusts

#	Company Name(*)	Initial trading Date(a)	Tender Offer Date(b)	Termination Date(c)	Termination Claim(d) ($)	Max Size(e) in Million	Number of units outstanding(f)
1	American Home Prdts.	12/23/86	11/26/87	12/20/91	90	7.5	1.93
2	Amoco	04/01/87	03/30/88	03/30/92	105	10.0	2.63
3	Atlantic Richfield	07/06/87	05/10/88	07/01/92	116	10.0	1.96
4	American Express	07/13/87	06/28/88	08/24/92	50	7.5	5.33
5	Bristol-Myers	02/17/87	12/01/87	02/14/92	110	5.5	2.20
6	Chevron	06/15/87	05/10/88	07/01/92	75	10.0	2.84
7	DuPont	01/28/87	12/22/87	03/27/92	110	10.0	2.98
8	Dow Chemical	04/23/87	04/04/88	05/18/92	110	7.5	1.87
9	Eastman Kodak	04/28/87	04/20/88	04/15/92	92	7.5	2.17
10	Ford	05/27/87	04/27/88	06/30/92	104	10.0	3.08
11	General Electric	04/27/87	04/09/88	05/11/92	140	10.0	4.58
12	General Motors	07/06/87	05/31/88	06/30/92	107	10.0	3.98
13	GTE	04/27/87	06/26/88	07/15/92	44	7.5	6.23
14	Hewlett-Packard	07/29/87	06/21/88	07/27/92	90	10.0	2.80
15	IBM	07/20/87	06/28/88	06/30/92	210	10.0	8.18
16	Johnson & Johnson	08/13/87	06/21/88	06/30/92	118	7.5	1.78
17	Coca-Cola	07/15/87	06/14/88	07/15/92	56	5.0	3.76
18	Philip Morris	07/29/87	06/14/88	07/27/92	110	5.0	1.71
19	Mobil	07/01/87	06/07/88	06/30/92	60	10.0	4.01
20	Merck	03/26/87	03/23/88	04/14/92	200	3.5	2.77
21	Procter & Gamble	05/15/87	04/26/88	06/01/92	105	7.5	1.64
22	Sears & Roebuck	06/22/87	05/26/88	07/15/92	64	10.0	4.55
23	AT&T Series A	10/25/83	02/15/84	10/24/88	75	45.0	N.A.
24	AT&T Series 2	02/17/87	04/01/87	02/14/92	30	10.0	8.95
25	Union Pacific	05/07/87	04/27/88	04/15/92	87	5.0	1.29
26	Exxon	07/30/85	12/09/85	09/20/85	60	10.0	2.17
27	Xerox	07/29/87	06/07/88	07/15/92	97	3.5	1.37

Remarks

(*) The sample is sorted by the firm stock ticker symbol.

(*a*) Source: This date corresponds to the "When Issued Date" reported in the *American Stock Exchange Price Record* for all trusts except for AT&T Series A. The "When Issued Date" is obtained from the *NewYork Stock Exchange Price Record* for AT&T Series A.

(*b*) Source: Americus Trust prospectus, amendments and supplements. This date was amended for the following trusts: American Home, Bristol Myers, Dupont, AT&T Series A, and Exxon. For these five trusts, the initial tender offer termination dates were initially, 03/02/87, 04/01/87, 03/16/87, 11/22/83, and 11/12/85, respectively. Further, the *effective* tender offer termination date might have occured at an earlier date. This happens whenever the maximum number of securities to be tendered is reached.

(*c*) Source: Americus Trust prospectus.

(*d*) Source: Americus Trust prospectus.

(*e*) Source: Americus Trust prospectus. The maximum number of units is equal to the lesser of the number in the last column or 1 share less than 5% of the shares outstanding on the offer expiration date, except for AT&T Series A where the 5% limit was not specified.

(*f*) in million. Date 09/29/88. At this date, the tender offer period had expired for all trusts. Source: Zurack, M. and L. Kusch, 1988, "Primes and Scores, What they are, How to use them," *Goldman Sachs, Stock Index Research.*

Table 2

Dividend payouts for the Americus Trusts for the underlying stocks, primes, and units(*)

#	Company Name(**)	Total # of Dividends Paid(a)	Total Dividend Amount(b)	Total Dividend Amount(c)	Average Dividend Amount(d)	Average Dividend Amount(e)	Fees(f) %
1	American Home Prdts.	6	5.14	5.0650	.8566	.844	1.48
2	Amoco	5	4.225	4.1625	.845	.8325	1.50
3	Atlantic Richfield	4	4.00	3.95	1.00	.9875	1.26
4	American Express	3	.57	.5325	.19	1.775	7.04
5	Bristol-Myers	6	4.62	4.545	.77	.7575	1.65
6	Chevron	4	2.45	2.40	.6125	.60	2.08
7	DuPont	5	4.30	4.2375	.86	.8475	1.47
8	Dow Chemical	5	2.85	2.7875	.57	.5575	2.24
9	Eastman Kodak	4	2.65	2.60	.6637	.6500	2.1
10	Ford	4	3.95	3.90	.9875	.975	1.28
11	General Electric	5	3.42	3.3575	.684	.6715	1.86
12	General Motors	4	5.00	4.95	1.25	1.2375	1.00
13	GTE	4	2.52	2.47	.63	.6175	2.02
14	Hewlett-Packard	4	.26	.21	.065	.0525	23.8
15	IBM	4	4.40	4.35	1.10	1.0875	1.14
16	Johnson & Johnson	3	1.34	1.3025	.446	.4341	2.87
17	Coca-Cola	4	1.16	1.11	.29	.2775	4.5
18	Philip Morris	3	2.70	2.6625	.90	.8875	2.27
19	Mobil	4	2.25	2.20	.5625	.55	2.27
20	Merck	5	4.07	4.0075	.814	.8015	1.55
21	Procter & Gamble	4	2.75	2.70	.6875	.675	1.85
22	Sears & Roebuck	4	2.00	1.95	.50	.4875	2.56
23	AT&T Series A						
24	AT&T Series 2	6	1.80	1.725	.30	.2875	4.34
25	Union Pacific	5	2.50	2.4375	.50	.4875	2.56
26	Exxon	11	10.36	10.275	.9418	.934	.083
27	Xerox	3	2.25	2.20	.5625	.55	2.27

Remarks

(*) The table only includes cash dividends. Bristol Myers, Coca-Cola, and AT&T Series A had also stock dividends during the period considered. Stock splits also happen to Bristol Myers, Eastman Kodak, Exxon, General Electric, Merck, and Ford.

(**) The sample is sorted by the firm stock ticker symbol.

(a) Total number of dividends paid by the stock since the trusts started trading up to June 30, 1988.

(b) Total amount of dividends paid by the stock since the trusts started trading up to June 30, 1988.

(c) Total amount of dividends paid by Americus Trust to unit and prime holders since the trusts started trading up to June 30, 1988.

(d) Average amount of dividends paid by the stock since the trusts started trading up to June 30, 1988.

(e) Average amount of dividends paid by Americus to unit and prime holders since the trusts started trading up to June 30, 1988.

(f) Impact of the fees levied by Americus on the average amount of dividends paid by the stock since the trusts started trading up to June 30, 1988.

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