Retroactive Price Regulation: Excess Profits Tax and the "Fair Rate of Return"

Neil Doherty
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Neil Doherty, Professor
Department of Finance
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Neil A. Doherty
University of Illinois
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Abstract

Excess profits taxes are used to prevent accumulation of monopolistic rent. We show that current operation of such taxes for property liability insurance does not, except by coincidence, result in an ex ante fair return on equity. Derivation of the tax threshold required to deliver a fair return is illustrated using option pricing and multi-period capital asset pricing models. This tax creates incentives for avoidance by reducing the variance of the tax flows and we suggest that its simultaneous use with direct price regulation results in a system of "double taxation," which likely will cause deficient returns to constituent insurers.
I. **INTRODUCTION**

The regulation of prices in industries such as utilities and insurance is guided by some notion of a fair price. In utility regulatory hearings the notion of a fair price is usually linked to that of a "fair" or competitive rate of return on equity. Historically, the return on equity concept was not used directly in insurance price regulation though in those states that require prior approval of insurance premiums the use of a target rate of return on equity is increasing. Nowhere is this more evident in states such as Massachusetts and North Carolina in which courts have upheld the use of the capital asset pricing model (CAPM).

An alternative method of regulation used to prevent the accumulation of economic rent is to tax abnormally high realized profits. The surplus above the tax threshold is then returned to consumers in terms of future price reductions. Such retroactive regulation does not directly constrain prices; rather it prevents the producer from reaping a "windfall" return on equity should realized profits exceed some target level. The tax has the effect of truncating the distribution of earnings of the firm. The implication is that untaxed earnings will represent a return to the firm's owners that meets the standards of acceptability in the regulatory law; e.g., to provide a competitive rate of return on equity.

Excess profits taxes have been used to prevent windfall profits. Examples are the use of windfall profits taxes during the Korean War. Further, extensive debate of such taxes was undertaken during the Carter Administration in connection with oil companies. Excess profits
taxes have been used for insurance regulation in several states (e.g., Florida, New York, Louisiana, Massachusetts) in some cases supported by specific statutes.\(^2\) Outside the United States, excess profits taxes are used for insurance regulation in West Germany and Japan.\(^3\)

Our concern here is to examine the use of such taxes. Specifically we will see whether a tax threshold can be established such that the expected return on equity is "fair" or competitive. We show the derivation of the "fair" excess profits tax using single period option pricing model and then by use of a multiperiod asset pricing model. The economic properties of excess profits tax are discussed in Section V.

Notation

- \(E(\quad)\) expectations operator
- \(\tilde{Y}_t\) pre tax earnings in year \(t\)
- \(V_t\) value of firm at time \(t\) if no EPT is in place
- \(V'_t\) value of firm at time \(t\) if subject to EPT
- \(\lambda\) incremental risk premium on priced factor \(M\)
  \[ \lambda = (E(\tilde{R}_M) - R_f)/\sigma^2_M \]
- \(\tilde{R}_M\) return on factor \(M\)
- \(R_f\) risk free rate
- \(I_t\) capital investment at time \(t\)
- \(r\) expected internal rate of return
- \(k\) cost of capital after tax
- \(Y^*\) threshold level of earnings for excess profits tax
- \(T\) rate of corporate income tax (assume constant average rate)
C(\tilde{V}, X) \text{ is the price of a European call option on an asset having terminal value } \tilde{V \text{ and striking price } X}

EPT \text{ excess profits tax}

II. CURRENT ILLUSTRATIONS OF EXCESS PROFIT TAX

The use of excess profits tax, EPT, may be illustrated with reference to the New York law. (See Mintel [chapter 11] and Williams [1983b] for comparisons with other laws.) The following extract from Section 667(5) of the New York State Insurance Law (also quoted by Williams) captures the general flavor of such laws.

"An excess profit shall be a profit beyond such percentage rate of return on net worth attributable to such policies as is determined by the superintendent to be so far above a reasonable average profit as to amount to an excess profit (taking into consideration the fact that losses or profit below a reasonable average profit will not be recouped from such policyholders)."

This statement lends itself well to a confidence interval interpretation. For ease of exposition consider that profit \tilde{Y} is normally distributed with known variance \sigma^2(\tilde{Y}). Realized profit is \tilde{Y} and the "reasonable average profit," which we interpret to be a "fair" or competitive rate of return, is R. In such circumstances \tilde{Y} is viewed as not being drawn from a distribution having expected value R and variance \sigma^2(\tilde{Y}) if it exceeds a threshold \(Y^*\) defined by

\[ Y^* = R + Z_c \sigma(\tilde{Y}) \]

where \(c\) is the confidence level at which the statement is made and \(Z\) is the standard normal variate. Selection of an appropriate confidence level permits the regulator to set the tax threshold at \(Y^*\). Such an
approach was, in fact, selected in New York (New York State Regulation No. 105 (11 NYCRR 166)) and a similar approach appears to have been adopted in Florida (Williams [1983b], pp. 452-454).

The implementation of EPT in this manner has several factors of interest:

First, the distributional form and all of its parameters except expected value are assumed to be known in advance. Normality is not necessary and other specific distributional forms can be used or approximation methods used. For example, the normal power approximation method permits closer approximations than the normal when the distribution exhibits moderate skewness. In this case \( Y^* \) is selected by

\[
Y^* = R + \left[ Z_c + \frac{1}{6} a_3(\tilde{Y})(Z_\alpha^2 - 1)\right] \sigma(\tilde{Y})
\]

where \( a_3 \) is a skewness measure.

Second, the confidence interval approach to EPT will not, in general, lead to profit levels that are compatible with the predefined profit target. Consider that expected profit is \( R \), the target "fair" level plus some value \( K \) which indicates the level of monopolistic rent.

\[
E(Y) = \int_{-\infty}^{\infty} \tilde{Y} f(\tilde{Y}) d\tilde{Y} = R + K.
\]

After the tax is imposed at threshold \( Y^* \) the expected profit is;

\[
E(Y') = \int_{-\infty}^{Y^*} \tilde{Y} f(\tilde{Y}) d\tilde{Y} + Y^*(1-F(Y^*))
\]

which, in general, will not equal \( R \). An example will illustrate the point. Suppose no monopoly rent is expected, i.e., \( K = 0 \). Clearly to achieve a "fair" expected return, \( Y^* \) should be set at the maximum possible value of \( Y \) such that the expected burden of tax is zero. However, the confidence interval requires that \( Y^* \) be set below the maximum value of \( Y \). Consequently, with \( Y^* < \text{Max}.Y \),

\[
E(Y') < R.
\]

Third, an apparent solution to the fair return issue is to set \( E(Y') \) equal to \( R \). However, this approach ignores the effects of truncation on systematic risk. Derivation of a fair return solution requires specification of the appropriate asset pricing model.
Thus the E.P.T. is demanding in terms of the required data for selection of the tax threshold yet it is imprecise in adjusting profits to the targeted level. Given comparable data input, more direct methods can be used such that the post tax distribution has an expected value equal to that targeted on "fair" return principles. This is displayed in the following sections using alternative asset pricing models. Whether such approaches are compatible with the statutes is a matter of judicial interpretation in each particular case. Our purpose is simply to reconcile the concept of EPT directly with the "fair" rate of return principle and, in doing so, we illustrate some of the main features of this tax.

III. SINGLE PERIOD ANALYSIS WITH OPTION PRICING MODEL

The single period model will be used to examine the main features of such a tax. The advantage of this model is that it permits us to consider a tax on cash flow and a tax on value as synonymous. This feature permits valuation of the firm subject to such a tax using the option pricing model. To further simplify analysis (though this has no material effect on the insights of this section) we assume an all equity (no debt) firm.

The excess profit tax (EPT) is defined to truncate the after tax cash flow of the firm at some value $Y^*$. 

\[
EPT = \begin{cases} 
0 & \text{if } \tilde{Y}_{t+1} \leq Y^* \\
(\tilde{Y}_{t+1} - Y^*)(1-T) & \text{if } \tilde{Y}_{t+1} > Y^* 
\end{cases}
\]

Since the model is single period and there is no debt, the after tax cash flow at $t+1$ is identical to the firm's value at that time. Thus the EPT may be considered to be a European call option written on that
underlying value. The current value of the EPT is the equilibrium price of such an option

(2) \[ V_{\text{EPT},t} = C(Y*; \tilde{V}_{t-1}) \]

The firm subject to such an EPT may be valued as a covered call. Essentially the firm has a long position in the cash flow but has written a call option with striking price \( Y^* \).

(3) \[ V'_t = V_t - C(Y*; \tilde{V}_{t-1}) \]

The regulatory task is to select the striking price for this option \( Y^* \) such that \( V'_t \) attains some desired level. More specifically, we will interpret current EPT regulation to imply that \( V'_t \) should yield a "fair" rate of return on equity invested and we consider such a "fair" return to be that which would prevail in a competitive equilibrium.

The expected rate of return on invested equity after tax is expressed as some multiple, \( q \), of the cost of capital. The relationship is expressed in terms of holding period returns.

\[(1+r)(1-T) = q(1+k)\]

Multiplying both sides by the value of invested capital \( I \) and rearranging yields

(4) \[ V_t = \left[ \frac{(1+r)(1-T)}{1+k} \right] I = qI_t \]

or \[ q = \frac{I_t}{V_t} \]

if \( I_t \) is defined as the replacement cost of employed capital resources, \( q \) is none other than Tobin's "q". If \( q = 1 \) the investment \( I \) will yield
a competitive rate of return. With \( q > 1 \) monopolistic rates of return are secured on the investment. Consequently we will interpret the purpose of an EPT regulatory law to be;

\[
(5) \quad \text{select } Y^* \text{ such that } V'_t = I_t
\]

Furthermore, such a tax should only operate if;

\[
(6) \quad V_t > I
\]

Using this criterion and the O.P.M. valuations of equations (2) and (3), gives the value of the firm as the value of a covered call

\[
(7) \quad V'_t = V_t - C(Y^*; V_t') = I_t
\]
or equivalently, and using (2), (3) and (4)

\[
(8) \quad V_{EPT, t} \equiv V_t - V'_t = C(Y^*; V_t) = (q-1)I_t
\]

Either form (7) or (8) might be used to provide an implicit solution for the tax threshold \( Y^* \). Unfortunately, available option pricing models based on Black and Scholes, do not yield a closed form solution for the striking price. Nevertheless the main properties of the tax are immediately apparent from (8).

(i) If \( q = 1 \), a fair return is being earned in the absence of the EPT. Therefore \( X \) must be set such that the call has no value, i.e.,

\[
Y^* > \text{Max}(\tilde{Y}_{t+1})
\]

Lower values of \( Y^* \) are required if \( q > 1 \); the relationship being negative monotonic.
(ii) It is well known that the value of the call is positively related to the variance of the underlying stock value. Thus from (8), the burden of tax will fall differentially on firms having the same expected rate of return but having differing variances. Ceteris paribus, firm's will be able to reduce the burden of E.P.T. by actions that reduce the variance of cash flows.

The option pricing model is useful for analyzing properties of the excess profits tax but it does not, in general, provide a solution to the selection of the tax threshold. In the single period case the end of period cash flow is identical to the end of period value, therefore we can treat the tax on earnings as a tax on value. This is not so in the multiperiod case. The tax specifically is levied on cash flow. Two other features of the option pricing model may be noted before moving to a multiperiod model.

(i) the derivation of the EPT threshold did not rest upon any particular pricing model for the underlying stock. However,
(ii) the use of OPM assumes that the stock value is terminally distributed as log normal.

We now use a stock valuation approach that assumes normality but, with simplification, permits a solution of the EPT threshold in a multi period context.

IV. MULTI PERIOD ANALYSIS WITH STOCK PRICING MODEL

Consider the firm to have a multi period lifespan in which it earns (before corporate tax) $\tilde{Y}_{t+j}$ in year $j$. The current period still is $t$. Instead of a continuous time asset pricing model (e.g., Merton [1973])
we use discrete time to correspond with the discrete periodic imposition of the EPT. The model used is essentially that of Fama [1977].

\[ V_t = V_t(\tilde{Y}_{t+1}) + V_t(\tilde{Y}_{t+2}) + \ldots \]

For simplicity, we proceed with a single factor model and we will assume the priced factor is the standardized correlation with the market portfolio, \( \beta \). Thus we have a discrete time multi period capital asset pricing model. Our result can be routinely generalized to a multi factor model.

\[
V(\tilde{Y}_{t+j}) = \frac{E(\tilde{Y}_{t+j})(1-\lambda_{t+j}X_{t+j}) \prod_{s=1}^{j-1} (1-\lambda_{t+j}\epsilon_{t+j-s})}{\prod_{s=0}^{j} (1+R_f,t+j-s)}
\]

where \( X_{t+j} = \text{Cov}(\tilde{Y}_{t+j}; \tilde{R}_M,t+j)/E(\tilde{Y}_{t+j}) \)

\[ \lambda_{t+j} = \frac{E(\tilde{R}_M,t+j) - R_f,t+j}{\sigma^2(\tilde{R}_M,t+j)} 
\]

\[ \epsilon_i = \text{Cov}(e_i,\tilde{R}_M,i) \]

\[ e_i = \frac{E(\tilde{Y}_{t+j}) - E(\tilde{Y}_{t+j})}{E(\tilde{Y}_{t+j})} \]

\( E(\cdot) \) is expectation taken at time \( i \)

\( \text{Cov}(\cdot) \) is covariance taken from distributions estimated at time \( i \)
We achieve considerable simplification by assuming that the market risk premium is constant over time, as is the relative covariance of each cash flow with the coincident return on the priced factor $\tilde{R}_M$. We further assume that revisions of expectations are uncorrelated with the return on the priced factor. The risk free rate also is assumed to be constant over time

\begin{align*}
X_j &= X = \text{constant for all } j \\
\lambda_j &= \lambda = \text{constant for all } j \\
\varepsilon_j &= 0 \text{ for all } j \\
R_{fj} &= R_f \text{ for all } j
\end{align*}

With these simplifications we can combine (9) and (10) to state the multi period valuation model. We also include a proportionate income tax; thus

\begin{equation}
V_t = \left[(1-\lambda X) \sum_{j=1}^{n} \frac{E(\tilde{Y}_{t+j})}{(1+R_f)^j}(1-T)\right] (1-T)
\end{equation}

For convenience we have dropped the time descriptor from the expectations operator noting that all expectations are taken at time $t$. Similarly we will omit the descriptor from the covariance expression.

We now address the imposition of EPT, noting that without the tax,

\begin{equation}
V_t = q^t
\end{equation}

The cash flows are now truncated such that the post EPT value is reduced to

\begin{equation}
V'_t = I_t
\end{equation}
No unique solution exists! There is an infinite number of possible ways of truncating the future cash flows such that their capitalized value is reduced by a known value. However, convenient solutions can be illustrated. For example, consider the case where the distribution of earnings is stationary over all future periods

\[ E(\bar{\gamma}_{t+j}) = E(\bar{\gamma}) \quad \text{for all } j \]

The solution is to select a set of values \( Y^*_{t+j} \) such that 7 is satisfied. An obvious and convenient solution is one in which the tax threshold is itself constant

\[ Y^*_{t+j} = Y^* \quad \text{for all } j \]

Imposing a stationary distribution of earnings and truncating earnings at \( Y^* \), (11) transforms to

\[ V'_t = \left\{ \left[ E(\bar{\gamma}) - \lambda \text{Cov}(\bar{\gamma}; \bar{\gamma}_M) \right] \sum_{j=0}^{\infty} \frac{1}{(1+R_f)^j} \right\} (1-T) = I_t \]

Using the properties of a truncated normal distribution, and noting that an annuity of $1 in perpetuity at the risk free rate reduces to \( 1/R_f \), equation (12) reduces to

\[ V'_t = \left\{ \left[ E(\bar{\gamma}) F(Y^*) - \sigma^2(\bar{\gamma}) f(Y^*) - \lambda \text{Cov}(\bar{\gamma}; \bar{\gamma}_M) F(Y^*) \right] \frac{1-T}{R_f} \right\} \]

\[ = I_t \]

Rearranging and substituting from (11) gives;

\[ V'_t = F(Y^*) V_t - \left[ \sigma^2(\bar{\gamma}) f(Y^*) \right] \frac{1-T}{R_f} = I_t \]
or, in terms of the "q" ratio, we may substitute from (4) for $V_t$

$$I_t - \left[ \sigma^2(Y) f(Y^*) (1-T) \right] / R_f(qF(Y^*)-1) = 0$$

Thus we have an implicit solution for $Y^*$ in terms of $q$; the solution depending on the normal distribution function and the normal density function both evaluated at $Y^*$. A solution will yield to numerical analysis. When earnings are expected to grow, a convenient solution is for the tax threshold to grow at a sympathetic rate. This solution can be developed along similar lines.

The tax threshold identified with the asset pricing model here behaves much the same way as that derived with option pricing. Specifically, the threshold required to deliver a fair expected return is related to the variance of the firm's earnings. We now examine the behavioral incentives conveyed through this feature.

V. ECONOMIC PROPERTIES OF EXCESS PROFITS TAX

a) On the Incidence of Tax and Tax Avoidance

The burden of E.P.T. ex ante is directly related to the variance of the firm's cash flows. If the tax threshold is determined uniformly across all firms in the industry, it will discriminate between firms according to the variance of pretax earnings. Thus, firms will reduce the ex ante tax burden by undertaking activities that reduce variance. Examples of such activities include: reductions in leverage, conglomerate merger; selection of low risk projects and hedging activities. In the case of insurance companies, a specialized form of hedging is available, notably reinsurance. Since the reinsurance market is well
developed, this market provides a simple and quick method for stabilizing the direct insurers' earnings. E.P.T. may be expected to increase reinsurance activity.

A related effect of an industry-wide tax threshold is that it discriminates between small and large insurers. Given similar portfolio composition and low correlations between policies, an insurer writing a large number of policies will hold a more diversified portfolio than its smaller counterpart. The lower variability in the former's insurance portfolio will result in a lower prospective tax burden than that for the small firm.

An alternative to the blanket tax threshold is to fit the threshold to the estimated density function of earnings for the individual firm. Thus, given equality of expected earnings, the firm with higher variance in earnings would have a higher tax threshold than the firm with more stable earnings. If the tax is declared at the beginning of the year, the firm then has an incentive to change the risk profile of its earnings distribution. This "moral hazard" problem would result in excessive reinsurance or similar risk reducing activity in similar fashion to the case where the tax is determined at the industry level. The severity of this problem will depend upon the degree of ex post "settling up." For example, if the regulatory authority calculates the earnings distribution on the basis of historical earnings, any risk reducing actions adopted by the firm after the announcement of the tax in year "t" will simply serve to reduce the estimated variance in the probability distribution for year "t+1." Consequently, the tax threshold would be lowered for the subsequent year. This issue is identical
to that of moral hazard in insurance contracts in which premiums are experience rated. (See Rubinstein and Yaari.)

The "variance effect" has other implications. In the absence of high serial correlation, the mean earnings over a number of consecutive years will tend to exhibit lower relative variance than the earnings for any single year. Thus, a tax levied on the average earnings over several years will provide fewer opportunities for the above tax avoiding strategies than a tax levied on the earnings of a single year. Both the New York and Florida systems do adopt a multi-year "moving average" approach though apparently this solution was achieved through slightly different reasoning; namely to improve the confidence interval on the statement that "earnings exceeding the threshold are not drawn from a distribution having the target return as its mean."

Finally, the incentive to reduce the variance of earnings reinforces another objective of the insurance regulatory authorities. In addition to concern for a fair price, regulators also aim to contain the probability of bankruptcy (or "ruin") to some acceptable level. For any given portfolio composition and capital structure, the ruin probability will be positively related to the variance of its earnings. Thus, E.P.T. complements regulatory restrictions on leverage (in insurance leverage typically is measured by the ratio of premiums to surplus) and similar solvency controls.

b) Dual Regulation and Double Taxation

In states such as New York and Florida, E.P.T. supplements an existing regulatory vehicle that aims at achieving fair prices. In
each of these states, automobile insurance rates can only be implemented with the prior approval of the insurance commissioner who therefore has a direct control of prices. We now examine briefly the combined incidence of a dual regulatory system.

We assume, for the time being, that regulators correctly identify the behavioral model that describes expected equilibrium returns required by investors and that there is consensus between regulators and investors in their estimation of each firm's earnings distribution. If the regulator sets price such that the expected return on equity is equal to the required return, the regulatory target will be met, economic rent will not accrue _ex ante_, and the "q" value of the firm should equal unity. The realized profit may turn out to be higher or lower than the expected level but this uncertainty is known at the time rates are set and may (for example, if the risk is systematic) be priced into the required rate of return. The introduction of an EPT (which is not empty in the sense that its expected burden is positive) will reduce expected return below the level considered appropriate for direct price regulation. This "double taxation," will result in loss of equity value causing the "q" ratio to dip below unity.

Now drop the assumption of a shared asset pricing model and homogeneous expectations. It follows that E.P.T. can now be used to correct either for misspecification of the asset pricing model used in direct pricing regulation or for the regulator's inability to replicate the earnings distribution estimated by investors at the time prices were regulated. Both roles appear rather trivial: a more obvious solution to such problems is to reform the system of direct price regulation.
Then the supplementary use of prior approval would appear to be explicable only on the principle that "two wrongs make a right." This reasoning does not imply that EPT will be inappropriate as a substitute for direct price regulation.

Summary

Excess profits taxes currently are used in conjunction with direct price regulation for property-liability insurance. The current forms adopted in states such as New York and Florida, do not provide a tax burden compatible with the fair or competitive expected rate of return. We demonstrate a fair return solution to EPT using both the option pricing model and a simplified multi period capital asset pricing model.

E.P.T. can be partially avoided if the firm reduces the variance of its earnings following the setting of the tax threshold. The potential for such avoidance is reduced both by ex post "settling up" and by imposing tax on a multi period basis. We also show that the simultaneous use of EPT and direct price regulation is inconsistent with the fair return target if direct regulation is properly conceived and implemented. EPT is more properly viewed as an alternative for, not a complement to, direct price regulation.
Footnotes


3 See Williams [1983a].

4 The firm might announce the tax threshold at the end of the tax period rather than at the beginning. However, it is difficult to see what is gained from this delay. True, another observation of actual earnings will be to hand, i.e., that for the tax year. However, the issue is whether this realized value is taken from a distribution having an expected value $R$ and variance $\sigma^2(Y)$. Since we are using the statistical test to answer this question, we cannot use the realized profit to estimate the parameters of the distribution.

5 $\alpha_3(Y)$ in the third moment about the mean standardized by the cube of the standard deviation. For exposition of this method see Beard et al [1968].

6 See Winkler, Roodman and Britney [1972]. For applications using the capital asset pricing model see Lintner [1977].

7 To see the effect of changes in variance on the tax threshold yet we may use the implicit function theorem on equation (14)

\[ Z = F(Y*)V_t - \sigma^2(\tilde{Y}) f(Y*) \frac{1-T}{R_f} - I = 0 \]

\[ \frac{dY^*}{d\sigma} = - \frac{\partial Z/\partial \sigma}{\partial Z/\partial Y^*} = - \frac{[(1-T)/R_f]f(Y^*)}{V_t f(Y^*) - \sigma^2(\tilde{Y})[(1-T)/R_f]f'(Y^*)} \]

From the normal distribution,

\[ f'(Y^*) = \frac{Y^* - E(\tilde{Y})}{\sigma^2(\tilde{Y})} \]

Substituting, we find $dY^*/d\sigma$ to be positive over the range

\[ Y^* > E(\tilde{Y}) - V_t \frac{R_f}{1-T} \]

Which is, in fact, most of the range of the distribution. EPT is likely to be adopted when excess profits are the exception rather than the rule, indeed the language of the New York Statute implies this to be the case. Consequently, we are most interested in value of $Y^*$ above $E(\tilde{Y})$. Thus, for practical purposes, we assume that the above condition is satisfied and that the tax threshold increases with the variance of the firm's earnings.
This motivation for hedging is similar to that addressed by Smith and Stultz (1984) in connection with Federal corporate taxation. Using Jensen's inequality they make the point that a concave tax schedule will induce hedging. Concavity in the Federal tax code arises both from the progressivity in marginal rates and from the effects of tax shields and tax credits.

Notice that this feature is similar to the carry back-carry forward features in the Federal Tax Code. See Smith and Stultz for hedging incentives under carry back-carry forward provisions.

The issue is not whether a better estimate of realized earnings is achieved at the time EPT is set. If we divide time into discrete periods with all contracts lasting one period, the value of equity at the beginning of the period will be determined by expectations held by investors at the beginning of the period. It is the expectation held at this time, not the subsequent realization of profit, that motivates capital decisions.
References


