DEPARTMENT OF COMMERCE ★ NATIONAL BUREAU OF STANDARDS

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Evaluating the Impact of Securities Regulation on Venture Capital Markets

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Evaluating the Impact of Securities Regulation on Venture Capital Markets

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Foreword

Center for Field Methods

The Experimental Technology Incentives Program

The Experimental Technology Incentives Program (ETIP) of the National Bureau of Standards pursues an understanding of the relationships between government policies and technology-based economic growth. The pursuit of this objective is based on three premises:

- Technological change is a significant contributor to social and economic development in the United States.
- Federal, State, and local government policies can influence the rate and direction of technological change.
- Current understanding of this influence and its impact on social and economic factors is incomplete.

ETIP seeks to improve public policy and the policy research process to facilitate technological change in the private sector. The program does not pursue technological change per se. Rather, it examines and experiments with government policies and practices to identify and help remove government-related barriers and to correct inherent market imperfections that impede innovation.

ETIP helps other government agencies to design and conduct policy experiments. Key agency decisionmakers are intimately involved in these experiments to ensure that the results are incorporated in the policymaking process. ETIP provides its agency partners with both analytical assistance and funding for the experiments while it oversees the evaluation function.

Because all government activities can influence the rate and direction of technological change, ETIP works with a wide variety of agencies, including those that have regulatory, procurement, R&D, and subsidy responsibilities. Programs are currently underway with the General Services Administration, Food and Drug Administration, Veterans Administration, Securities and Exchange Commission, Department of Energy, Environmental Protection Agency, Occupational Safety and Health Administration, other Federal agencies, and State and local agencies.

The accompanying report was prepared by NBS staff. This document represents the views of the originating organization and does not necessarily reflect those of the National Bureau of Standards.

Director
Center for Field Methods
National Engineering Laboratory
National Bureau of Standards
U.S. Department of Commerce

Contents

Evaluating the Impact of Securities Regulation on Venture Capital Markets

James R. Barth, Joseph T. Cordes, and Gregory Tassey

A detailed and analytical assessment is provided of the economic techniques used by researchers to evaluate the efficiency of capital markets. The application of these techniques to that portion of the capital market which supplies venture funds to small, technology-based firms is emphasized. The primary elements of such analysis are the "efficient market hypothesis" and the "capital asset pricing model." The empirical analogue of the latter is commonly referred to as the "market model."

There have been several previous reviews of capital market theory but this is the first one to apply these techniques to a particular segment of the capital market and the existing policy structure affecting its operation. This policy structure is the set of regulations imposed on venture capital flows by the Securities and Exchange Commission. The important SEC regulations and the analytical approaches to assessing their impacts on capital market efficiency are discussed. Because such analysis cannot be effectively utilized by policymakers such as the SEC if it is conducted on an ad hoc basis or in isolation of the decision-making process, a monitoring system is described, which is based on the market model and which is designed to provide timely and decision-relevant information to the SEC.

Key words: Capital asset; capital market; market model; pricing model; SEC regulations; venture capital.

1. Introduction

In recent years, numerous criticisms have been voiced concerning the lack of adequate assessment of the benefits and costs of regulation. Most regulatory functions were defined in terms of protecting some element of society. This focus on protection (the "benefits" of regulation) tend to bias the activity of the institution charged with carrying out the regulatory function away from considerations of the "costs" of regulation. In the case of security markets, the Securities and Exchange Commission (SEC) was established to carry out the function of protecting investors from fraud and other potential abuses arising from the issue and subsequent trading of securities. The act of protecting investors imposed certain costs on various participants in securities markets, including investors in some cases. Without an accurate measure of the relative magnitudes of the benefits and costs resulting from the regulation of securities market, it has not been possible for the SEC to systematically determine when and under what conditions it was facilitating or inhibiting the primary function of a capital market which is to finance economic activity. To answer this fundamental policy question, economists have developed a number of analytical tools derived from capital market theory. Until recently, however, these tools have not been systematically applied to securities regulations for the direct purpose of developing policy.

In February 1977 the Experimental Technology Incentives Program (ETIP) within the National Bureau of Standards agreed to collaborate with the Securities and Exchange Commission (SEC) in examining the impacts of financial market regulations on small, technology-based firms. This study has made significant headway. In this report, we endeavor to provide a description and evaluation of analytical elements of a system for monitoring the capital market impacts of securities regulations. The ETIP–SEC project is a prototype and therefore is used as a case study of such a system.

1.1 Motivation for the ETIP/SEC Study

Ultimately, the motivation for the ETIP/SEC effort is the same as that which led to the establishment of ETIP itself; namely, concern about the extent and quality of technological innovation in the U.S. economy. It is, of course, difficult to quantitatively measure either levels or trends in innovation. Innovation is best viewed as a process, rather than a single output.[1]

[1] For an excellent discussion of innovation as a process, see National Research Council (1978), pp. 11–17.

It is, however, possible to measure levels and trends of some inputs into innovation. Examples of such measures are: (a) statistical series of research and development (R&D) outlays; (b) data on the employment of R&D personnel; and (c) data on the formation of small, technology-based firms. With little exception, each of these measures points to a reduced flow of sources to technological innovation. R&D spending as a share of GNP has declined fairly steadily since the middle 1960s.[2] The number of technical R&D personnel per 10,000 population declined between 1969 and 1972, and has remained virtually constant in recent years.[3] Finally, the formation rate of small, high-technology firms has declined significantly since 1969.[4]

The ETIP/SEC study is an analytic response to the decline in the formation-rate of small, high technology firms. Government policymakers have been concerned with this phenomenon for at least two reasons. First, there is a political ethic which has been supportive of small-business generally, regardless of whether small firms are technologically or nontechnologically oriented. Second, it is widely believed that small, technology-based firms (STBFs) play a particularly important role in the innovation process.

Some observers have gone so far as to argue that STBFs, in particular industries, have a much higher propensity to innovate than do their larger, more established counterparts. Others have been more cautious, citing cases in which an initial invention was developed by an STBF, but then subsequently developed by a larger firm, or vice versa. Under either view, however, it is clear that small technology-oriented enterprises plan an important role in the overall development of technological innovations.[5] Those concerned with U.S. technological innovation should, therefore, be legitimately concerned about the recent difficulties experienced by entrepeneurs who wish to form STBFs.

Those wishing to form an STBF must typically do so within the institutional framework of domestic capital markets. In obtaining financing for the activities of an STBF, choices must be made between alternative financial *instruments*. Broadly defined, funds may be obtained through the sale of ownership rights in the firm, "equity financing"; or through borrowing, "debt finance." In addition, choices must be made between alternative sources of funds. That is, equity shares may be sold to individual investors, institutional investors, banks, and so forth; debt may be issued to a similar variety of institutions.

A recent study undertaken by Charles River Associates (CRA) for ETIP found that STBFs depend rather heavily on particular financial instruments and a particular group of investors. These findings, which in large part motivated the ETIP/SEC effort, are summarized below.[6]

An important finding of the CRA study was that equity has recently become the most important source of external finance for STBFs. As shown in table 1, this source accounted for 48 percent of all funds raised in 1970–74 versus 34 percent in 1960–63. Moreover, as shown in table 2, small technology-based firms are much more dependent on equity as a source of finance than are small nontechnological firms. The relevant figures are 48 percent for technology-based firms and 14 percent for non-tecnnology-based firms.

Moreover, as shown in table 3, equity is especially important as a means of finance for technology-based firms in their start-up years. During the first 4 years, approximately 60 percent of all external funds received come from equity.

Finally, the findings of the CRA study suggest that venture capitalists are an important source of equity finance for STBFs in their early years. The term *venture capitalist* refers to the group of investors specializing in the financing of newer and/or riskier enterprises. The CRA study found that this type of investor contributed between 15 and 93 percent of total equity raised by STBFs in their early years.

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[2] National Science Board (1977), p. 2 and p. 95.
[3] *Ibid.*, p. 2.
[4] U.S. Department of Commerce (1976), p. 15.
[5] See Charles River Associates (1976), Jewkes *et. al.*, (1969), and National Research Council (1978).
[6] See, generally, Charles River Associates (1976).

Table 1. *Composition of external financing of small technology-based firms.*

	(1) 1960–63 (percent)	(2) 1964–67 (percent)	(3) 1968–71 (percent)	(4) 1970–74 (percent)
Equity	34	22	54	48
Long-Term Debt	31	28	16	15
Short-Term Debt	23	30	22	25
Trade Debt	12	20	8	12

Source: Columns (1)–(3): Charles River Associates, *op. cit.*, p. 13. Column (4): *Ibid.*, p. 18.

Table 2. *Composition of sources of all financing of a sample of small firms making initial public offerings 1970–1974.*

	Technology-Based (percent)	Non-technological (percent)
Equity	48	14
Long-Term Debt	15	26
Short-Term Debt	25	18
Trade-Debt	12	16
Internal Funds	less than 1	25

Source: Charles River Associates, *op. cit.*, p. 18.

Table 3. *Composition of net external funds received by small technology-based firms*
[Percentage distribution by source of funds and by stage]

Source of Funds	1	2	3	4
Equity	75. 4	34. 5	67. 2	5. 2
Short-Term Debt	1. 1	17. 0	2. 9	3. 5
Long-Term Debt	11. 0	26. 6	6. 6	—
Trade-Debt	9. 2	12. 2	11. 5	5. 8
Other Current Liabilities	3. 3	9. 7	11. 8	20. 0
Total external	100. 0	100. 0	100. 0	34. 5
Internally Generated	—	—	—	65. 5
Total	100. 0	100. 0	100. 0	100. 0

where stage 1=first year; stage 2=second and third years; stage 3=fourth through seventh years; stage 4=eighth year and after.

Source: Charles River Associates, *op. cit.*, p. 299.

The SEC is the major government agency involved in the regulation of capital markets. In principle, the regulatory mandate of the SEC extends to all financial instruments and to all investors. It is, however, widely believed that the incidence of SEC regulation falls more heavily on some segments of the U.S. capital market than on others. Two such segments are the *equity capital market* generally, and the *venture capital market* in particular.

It is noteworthy that these two segments of the capital market, believed to be particularly sensitive to SEC regulation, were identified in the CRA study as important sources of funds for STBFs. It is therefore plausible to expect SEC regulation to affect the ability of STBFs to raise needed capital. Unfortunately, little is known quantitatively about the relationship between SEC regulation and the flow of funds to STBFs, and/or the functioning of venture capital markets. The ETIP/SEC effort is designed to provide more precise information about these relationships.

1.2 The General Scope of the ETIP/SEC Study

There has been considerable conjecture in financial circles about the impact of SEC regulations on the ability of STBFs to raise capital. For example, William Casey, former chairman of the SEC, has argued that certain SEC regulations (to be discussed in detail) have discouraged venture capitalists from investing in new, unproven enterprises.[7] This conclusion is shared by Charles Smith who argues that certain SEC regulations represent a "threat to technological innovation." [8]

Prior to the ETIP/SEC project, little evidence was available to either substantiate or to refute such claims. The available evidence was of two main types: anecdotal case studies and econometric analyses conducted at a fairly high level of aggregation. Both sources of evidence provided some information about the impact of SEC regulation on financial markets. However, there was neither an adequate data set, nor a satisfactory analytic approach for determining the impact of *specific* SEC regulation on *venture capital* markets, or for determining the impact of specific changes in SEC regulations on the flow of funds to STBFs.

The absence of a framework for rigorously analyzing SEC regulatory policies is striking when compared with other segments of the federal government. For example, the use of econometric models has permitted the Executive Branch, Congress, and the Federal Reserve System to assess the impacts of alternative monetary and fiscal policies. Considerable progress has been made in developing models that permit the impacts of alternative income-maintenance (welfare) policies to be simulated. Finally, the economic methodology of cost-benefit analysis has been usefully applied to evaluate government regulation of product quality, occupational health and safety, and environmental quality.

One objective of the ETIP/SEC study is to develop a sound framework for determining the impact of SEC regulations on venture capital markets. More ambitiously, the ultimate aim of the ETIP/SEC project is to develop a system for monitoring SEC regulations that: (a) is based on sound economic theory; (b) is easily used by SEC decisionmakers; and (c) is capable of responding quickly to shifts in SEC policies and/or the general economic environment.[9]

1.3 Summary

In sum, the ETIP/SEC project should help determine whether SEC regulatory policies have impeded the flow of funds to STBFs, thereby contributing to the "innovation recession" observed in recent years. More generally, the project is an attempt to develop an analytic system that may be effectively used to monitor the economic impact of SEC regulations and to describe the results of the analyses in a form that can be readily used by decisionmakers. The critical elements of such a system are: (1) identification of particular SEC regulations that are most relevant for the economic sector under evaluation; (2) identification of certain "critical"

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[7] Casey (1977).
[8] Smith (1973).
[9] For a thorough discussion of these issues, see Tassey, (1978, 1979) and Experimental Technology Incentives Program (1977).

questions that must be answered in order to evaluate the performance of SEC regulations; (3) development and estimation of appropriate models of financial markets; and (4) development of a framework for policy analysis that utilizes information generated by the models. The following section describes the regulations that have been analyzed by the SEC monitoring system. Next, the basic economic tools upon which the system is based are described, followed by an analysis of their limitations. Finally, the process of aggregating the resulting impact information into a decision-oriented framework based on benefit-cost analysis is described.

2. SEC Regulations of Particular Relevance to Small Technology-Based Firms and Venture Capitalists

2.1 Introduction

The Securities and Exchange Commission (SEC) draws its regulatory mandate from the Securities Act of 1933 and the Securities Exchange Act of 1934. The 1933 Act regulates the amount and nature of information to be disclosed in connection with initial offerings and sales of securities. The 1934 Act established the SEC as the agency responsible for regulating disclosure of financial information and also designed a system for continuous disclosure of financial information for publicly traded securities.

As a result of SEC regulation, financial statements filed by firms must, unless exempted, meet certain standards as to specific form and content. Such compliance with SEC guidelines is costly. Since firms that wish to raise new capital through sale of equity must satisfy SEC disclosure standards, SEC regulation increases the cost to the firm of obtaining equity capital.

If SEC compliance costs are not uniformly distributed among firms, SEC regulation may unintentionally discriminate in favor of some investments and against others. In particular, concern has been expressed that the extra burden of SEC regulation falls relatively more heavily on small firms in general, and small technology-based firms in particular. This concern has focused around proposals for change in SEC regulations of particular importance to small firms: Regulation A, Rule 144, and Rule 146.[10]

2.2 Regulation A

The costs of complying with SEC disclosure regulations are largely "fixed" costs. That is, the costs of gathering the information required by the SEC are relatively insensitive to the amount of capital to be raised. Consequently, SEC disclosure costs per dollar decline with increasing size of the offering. Failure to recognize this fact would introduce a regulatory bias in favor of larger issues—presumably issued by "larger" firms—and against smaller issues—presumably issued by smaller firms.

In recognition of the fact that costs of SEC registration may constitute a significant part of the proceeds of small securities offerings, Rule 254 under Regulation A specifies that offerings below a certain ceiling amount are exempt from full SEC registration requirements. Small companies issuing securities under Regulation A must still provide information in the form of an offering circular provided to the prospective purchaser at least 48 hours prior to the confirmation of any sale. However, the offering circular need not be filed or used in connection with an offering of securities.

The exemption ceiling imposed by the SEC on Regulation A offerings has been changed several times since 1933. At the start of the ETIP/SEC project, it was $500,000. This was widely criticized as being so low as to effectively preclude most small offerings from obtaining relief from SEC disclosure requirements. It has since been raised to $1.5 million, and it has further been proposed that it be further raised to $3 or $3.5 million.

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[10] For a more detailed discussion of these SEC regulations, see Barth and Cordes (1978).

Clearly, raising the Regulation A exemption ceiling would exempt more small issues from costly full SEC disclosure requirements. This would presumably benefit small firms in general, especially new small firms. Increasing the Regulation A exemption ceiling might, therefore, stimulate the formation of all small enterprises, including small technology-based firms. However, relaxing the Regulation A ceiling would also permit additional new issues to be offered without full SEC disclosure. It is, therefore, possible that some investors would be induced to purchase small new issues of poor quality because of inadequate financial disclosure.

The trade-off involved in relaxing the Regulation A ceiling may be stated more precisely. Exemption from SEC disclosure standards reduces the costs of raising equity capital for both "good" and "bad" issues. Relaxing the Regulation A ceiling would make it easier for both "good" and "bad" ideas to obtain financing through sale of small, new issues. Relaxing the Regulation A ceiling would, therefore, be desirable or undesirable depending on whether the net social benefits financed by "unusually good" issues exceeded the net social costs incurred by allowing unproductive ventures to be financed.

At present, there is very little evidence on the nature of this trade-off. For example, it is not known whether relaxing the Regulation A would significantly facilitate the sale of new issues by *STB's* as opposed to small firms generally. One purpose of the ETIP/SEC project is to obtain better information on the precise impact of relaxing the ceiling on Regulation A issues.

2.3 SEC Rules 144 and 146

Regulation A is one means of obtaining exemption from SEC disclosure requirements. Securities transactions that are legally defined as "non-public," or "private" offerings are also exempt from SEC registration requirements. Rules 144 and 146, which became effective in 1972 and 1974, respectively, both deal with non-public offerings (restricted securities) within the meaning of the Securities Act of 1933.

Although promulgated after Rule 144, it is conceptually appropriate to first discuss Rule 146. Rule 146 provides some standards for determining when a new security issue is exempt because it is a "private" offering. These standards define the manner of offering, the nature of the offerees, the information to be furnished about the issue, and number of purchasers, and the subsequent disposition of securities acquired pursuant to the Rule.

With respect to the manner of offering, the rule prohibits the issuer from offering or selling the securities through any form of general advertising or general solicitation. Moreover, any meetings or written communication can only involve offerees and their representatives.

The rule also requires that the issuer must have reasonable grounds to believe that the offeree is capable of evaluating the merits and risks of the prospective investment, and/or that the offeree can bear the economic risk of the investment. Important considerations are whether the offeree could afford to hold unregistered securities for an indefinite period, and whether, at the same time of the investment, he could afford a complete loss.

The rule also stipulates that the offeree must have access to information of the type registration would otherwise disclose. This would occur if the offeree: were an employee of the issuer; were related to the issuer; or had the economic bargaining power to obtain the information required to evaluate the risks and merits of the investment. Presumably, "outsiders" could be offerees.

The rule requires that there be no more than 35 purchasers in any offering. For purposes only of counting the number of purchasers, those who purchase or agree in writing to purchase securities for $150,000 or more would be excluded.

Finally, the rule requires that the issuer set standards of minimum care to see that purchasers are not really involved in a distribution of the securities. This would then be a public offering and the exemption would be lost.

Rule 144 regulates the distribution (or re-sale) of restricted securities after initial sale. Hence, Rule 144 complements Rule 146 in insuring that "purchasers are not involved in a distribution of the securities." Rule 144 was ostensibly designed to reduce these uncertainties by providing objective criteria for maintaining exemption from registration when a previously unregistered security is resold. These criteria pertain to: (a) the length of holding period, (b) limitations on the amount of securities sold, and (c) the manner of sale and the availability of information.

Until recently there was one uniform holding period requirement, namely, that the seller must have owned the security for at least 2 years prior to sale. The acquisition during the 2-year period of other securities of the same issues, whether restricted or non-restricted, would not restart the holding period.

There is also a limitation on the amount of securities that may be sold in any 3 month period. If the securities are traded on a registered national securities exchange, the amount sold may be the greater of: (a) the average weekly volume of sales of that security on all exchanges for the 4 weeks prior to the sell order, or (b) 1 percent of the outstanding shares or units of the class of stock as most recently published. If the securities are not traded on an exchange, the amount sold must not exceed 1 percent of the outstanding units in its class.

However, a recent change in this Rule makes it possible to sell restricted securities without any limitations on the rate of sale if the stock has been held at least 4 or 5 years and if the holder is not "affiliated" with the issuer. The category of "non-affiliation" determines which holding period applies.

Rule 144 also requires that adequate public information about the issuer be available. Furthermore, the securities must be sold in brokers' transactions and the person selling the securities must not solicit or arrange for the solicitation of buy orders.

2.4 Impacts of Rule 144 and Rule 146

The practical impact of Rules 144 and 146 depend in part on the amount of capital raised through non-public offerings. This is difficult to calculate because of its private nature. However, one source estimates that of the $349 billion in corporate bonds issued from 1946–1973, some $132.6 billion, or 38 percent, were private placements.[11] Another source estimates that in 1972 gross proceeds from corporate private offerings were $10.8 billion. Only a small portion of this amount represented equity stocks since roughly 96 percent of the gross proceeds were from privately placed corporate bonds. Institutions purchased the largest share of privately offered securities, with individual investors purchasing less than 10 percent.[12]

Rules 144 and 146 themselves were ostensibly designed to make it easier for firms to seek and obtain private placement exemptions from SEC regulations by reducing uncertainties associated with issuing unregistered securities. However, the costs of meeting the requirements of Rules 144 and 146 may be high enough to deter small firms from seeking private placement exemptions.

This point is elaborated upon in table 4. Under SEC regulation, it is not possible to simply issue a security, as would be the case in the absence of regulation. Rather, one must either issue restricted securities or unrestricted securities. In order to transform a security into either of these two forms, certain criteria must be satisfied. Meeting such criteria imposes costs on the issuer. If one chooses to issue a restricted security, the costs of formal SEC registration need not be incurred. However, as pointed out by William Casey, in exchange for this exemption, the issuer must bear the costs of meeting the requirements of Rule 144 and Rule 146.[13] These costs include the transactions costs of complying with the rules, and the costs of higher interest premiums paid to compensate purchasers for the reduced liquidity of restricted securities.

[11] Arthur (1974).
[12] U.S. Securities and Exchange Commission (1969).
[13] Casey (1977).

TABLE 4. *Options facing issuer of securities under SEC regulations.*

Qualify for Private Placement and Sell "Restricted Securities"	Qualify for Public Offering and Sell "Unrestricted Securities"
Criteria to be Met if Chosen	*Criteria to be Met if Chosen*
(1) *Regarding Initial Sale:* Compliance with Rule 146. (a) Manner of Offering—no advertising or solicitation; restrictions on general meetings. (b) Nature of Offerees—sell only to those "able to bear risk." (c) Provision of Information—sell only to those with access to the sort of information disclosed by registration. (d) Number of Investors—sell to no more than 35 purchasers. (2) *Regarding Re-sale:* Compliance with Rule 144. (a) Hold security for at least 2 years; (b) sell security in restricted amounts, unless not affiliated in which case one can hold securities four to five years before being able to sell in unrestricted amounts; (c) sell at "arms length" through a broker, without solicitation by the seller; (d) existence of public information about issuer.	Compliance with registration procedures set forth by the SEC.
Costs of Choosing Option	*Costs of Choosing Option*
(a) costs of meeting the criteria above; (b) costs of higher premium demanded by purchasers to compensate for reduced liquidity due to resale restrictions; (c) expected costs of legal actions arising from unregistered nature of restricted securities.	Costs imposed by SEC registration procedures.
Benefits of Choosing Option	*Benefits of Choosing Option*
(a) Avoidance of costs imposed by full registration with the SEC.	(a) Benefits of ability to sell unrestricted securities. (b) Legal benefits of registration. (c) Image or "goodwill" benefits of being a public company.

Moreover, if unregistered securities decline in value after initial purchase, it may be possible for the buyer to sue for recovery of the initial investments simply because the securities are unregistered, even though such securities were issued in compliance with Rule 146. Hence, in exchange for the exemption from registration, the issuer must also bear the expected costs of such legal actions.

The liquidity effects of Rule 144's restrictions on the re-sale of unregistered securities have been viewed as particularly vexing by venture capitalists. Indeed, it has been claimed that any cost savings due to exemption from SEC registration requirements may be largely offset by the cost of higher interest premiums that must be paid to compensate purchasers for the reduced liquidity of restricted securities.

Smith has also argued that the incidence of Rules 144 and 146 has not been neutral across all firms.[14] With respect to Rule 146, he notes that the most useful information about technical innovation is not contained in financial statements. Rather, it may be necessary for the potential investor to understand the problems and potentials of the innovation considered. As a result, STBFs may find it difficult to satisfy the "equivalent information" requirement for exemption under Rule 146. With respect to Rule 144, he notes that: (a) the requirement that new securities be sold at arms length, and (b) the restrictions on re-sale of restricted securities make it difficult

[14] Smith (1973).

for STBFs to qualify for exemption from registration requirements. The arm's length requirement makes it difficult for STBFs to provide important qualitative information about the innovation being financed through new issues. Application on the volume restriction on resales would require that each partner in a venture keep track of the sales of every other partner. When the number of partners is large, this may impose large enough transactions costs to offset the cost savings gained through registration. Furthermore, there are impacts on competition as a result of mergers which may be induced by the demand for liquidity.[15]

Thus, although Rules 144 and 146 may make it easier for some new issues to qualify for exemption, they may make it harder for others to qualify. Specifically, these rules may make it harder for STBFs to obtain exemption from SEC registration requirements when they attempt to raise equity capital through the issue of new securities in private placements to venture capitalists.

At present, statements concerning the impact of Rules 144 and 146 on the flow of funds to STBFs and on venture capital markets are largely conjectural. A major part of the ETIP/SEC project is to develop and estimate an economic model that may be used to systematically determine the impact of Rules 144 and 146 on STBFs and on venture capitalists.

3. The Efficient Markets Model and the Capital Asset Pricing Model

3.1 Introduction

In order to evaluate the impact of SEC regulations on particular markets, one must understand how these markets function. More specifically, it is necessary to understand how prices and quantities are determined in the market to be regulated. Two economic models that have been quite useful in analyzing the behavior of securities markets have been the *efficient markets model* and the *capital asset pricing model.*[16]

These models form the analytical basis for the monitoring system that is to be developed by the ETIP/SEC project. This section describes these models in some detail, and discusses how they may be applied to the empirical analysis of securities markets.

3.2 The Efficient Markets Model

The efficient markets model describes the determinants of the *absolute* price of a security under the assumption that security prices "fully reflect" all available information. A market is described as efficient when security prices embody all available information. This definition of efficiency is clearly so general as to be untestable. However, the concept of market efficiency implies that security prices will display certain properties in equilibrium if they embody "full" information. The presence or absence of these properties therefore provides some evidence about the efficiency of securities markets.

Individuals who purchase securities do not generally know the future price of those securities with complete certainty. Purchasers therefore base their decisions on the expected price of securities. Any model of security prices must take this into account. If the market is efficient, all available information will be used in determining the equilibrium *expected* price.

Suppose it is assumed that the expected price of a security is determined by its expected percentage return. Then the relationship between information and the equilibrium expected price can be formally expressed as:

$$E(P_{t+1}|I_t)=[1+E(r_{t+1}|I_t)]P_t, \tag{1}$$

[15] See Tassey (1977) for a discusion of this point.

[16] For a survey of these models, see Fama (1970), Barth and Cordes, forthcoming, Jensen (1972) and Vasicek and McQuown, (1972).

where E is the expected value operator, P_t is the price of a security at time t, P_{t+1} is its price at $t+1$, r_{t+1} is the one period percentage return and I_t represents all the information available at time t.

The time subscript attached to the information set implies that additional information is eventually reflected in the expected price and return. Expected prices and returns therefore respond to new information, at least all relevant new information. Presumably, this response occurs over a short period of time. It should be noted that P and r are random variables. That is, forecasts of future security prices and returns will err, even when all available information is used. One does, however, make the best possible predictions on the basis of the information set I_t.

The major implication of the efficient markets model is that trading systems (that is, rules for buying and selling securities) which rely only on information in I_t will not earn expected profits that exceed equilibrium expected profits.[17] In short, if the market price already embodies all available information, it is impossible to systematically "beat the market."

To express this mathematically, let

$$X_{t+1}=P_{t+1}-E(P_{t+1}|I_t), \tag{2}$$

where X_{t+1} is the excess market value of a security at time $t+1$. This amount is the difference between the observed price at time $t+1$ and the expected price at time $t+1$ that was projected based upon information available at time t. Since the expected price would not always equal the actual or observed price, X_{t+1} is itself a random variable.

The efficient markets model implies that the expected value of X is zero, given the information set I_t. That is,

$$E(X_{t+1}|I_t)=0. \tag{3}$$

When this equality holds, the sequence $\{X_t\}$ is said to be a "fair game" with respect to the information sequence $\{I_t\}$. This means that one cannot use currently available information to outperfoım the market. In other words, the market is efficient.

Eq. (1) implies that eq. (2) may be equivalently expressed in teıms of returns as:

$$z_{t+1}=r_{t+1}-E(r_{t+1}|I_t) \tag{4}$$

where z is the excess percentage return at time $t+1$. If the sequence $\{z_t\}$ is a fair game with respect to the information set I_t, then,

$$E(z_{t+1}|I_t)=0. \tag{5}$$

When this condition is satisfied one cannot expect to earn excess returns by using trading rules that are based solely on the information set I_t.

3.2.1 Submartingale and Martingale Models

Thus far, P has simply been defined as a random variable. The "fair game" efficient markets model makes no specific assumption about the path which the price sequence $\{P_t\}$ follows. In the submartingale and martingale models, the price of a security is assumed to follow a particular path.[18] These models are therefore viewed as special cases of the efficient markets model.

The price sequence for a security follows a submartingale when the expected value of next period's price, projected on the basis of all currently available information, is equal to or greater than the current price. If the two are strictly equal, the sequence is said to follow a martingale. A martingale is clearly a special case of a submartingale. Formally, a price sequence $\{P_t\}$ follows a submartingale with respect to the information sequence $\{I_t\}$ when

[17] This, of course, requires that all relevant information be readily and freely available to everyone.
[18] This is also true of the random walk model.

$$E(P_{t+1}|I_t) \geq P_t, \tag{6}$$

for all t and I_t.[19] When the strict equality holds, the price sequence $\{P_t\}$ follows a martingale.

We now show that both of these models imply a fair game. To do so, it is convenient to rewrite eq. (6) as:

$$E(P_{t+1}|I_t) = (1+\alpha)P_t, \tag{7}$$

where α is greater than or equal to zero. When α is greater than zero, P follows a submartingale. When α is equal to zero, P follows a martingale. Eq. (2) may therefore be rewritten as:

$$X_{t+1} = P_{t+1} - (1+\alpha)P_t. \tag{8}$$

Assuming the information set I_t consists of P_t, the expected value of X_{t+1}, conditional upon P_t becomes:

$$E(X_{t+1}|P_t) = E(P_{t+1}|P_t) - (1+\alpha)E(P_t|P_t) \tag{9}$$

or

$$E(X_{t+1}|P_t) = (1+\alpha)P_t - (1+\alpha)P_t = 0. \tag{10}$$

Since this last expression holds when α is greater than zero as well as equal to zero, both the submartingale and martingale models are "fair game" efficient markets models.

When α is less than zero the price sequence $[P_t]$ does not follow either a submartingale or a martingale. However, eq. (10) still holds. This demonstrates that the submartingale and martingale models are indeed special cases of the "fair game" efficient markets model.

The submartingale model has an important implication as to the choice of trading rules. In this model one may expect next period's price to exceed the current period's price. If the market price embodied all available information, one would always expect the price to rise. Hence, the "best" trading system, based only on the information set I_t, would be a simple "buy and hold" strategy. Comparing various trading systems with a buy-and-hold strategy therefore provides evidence on the "fair game" efficient markets model. *If* a trading system could be found that was superior to a policy of always buying-and-holding a security, *and* the price sequence of that security followed a submartingale, the market would be inefficient. Of course, one may find such a system *ex post*, but not *ex ante*.

3.2.2 The Random Walk Model

The random walk model is a version of the efficient market model that has received considerable attention. In this model, successive price changes or one-period returns are assumed to be independent and identically distributed. It is further assumed that the distribution of price changes or returns is independent of the information set I_t. In spite of this assumption, information does play a role in this model. Indeed, since the mean and other moments of the distribution are not conditional upon the information set, past prices and returns provide an excellent source of information.

The random walk model is more restrictive than the "fair game" efficient markets model. In the latter, the distribution of price changes is not necessarily independent of the information set. Moreover, price changes need not be independent to constitute a fair game. For these reasons, the random walk model is also a special case of the efficient markets model. This implies that evidence inconsistent with the random walk model does not automatically refute the efficient markets model.

We now show that the random walk model implies a fair game. When the price of a security follows a random walk, it may be written as

$$P_{t+1} = P_t + \epsilon_{t+1}' \tag{11}$$

[19] This is equivalently expressed in terms of returns as $E(r_{t+1}|I_t) \geq 0$.

where the expected value of ϵ_t is equal to zero and the pair ϵ_t, ϵ_{t-s} (for $s\neq0$) are independent. The fact that the pair ϵ_t, ϵ_{t-s} (for $s\neq0$) are independent implies that they are also uncorrelated. However, if the ϵ_t are uncorrelated, they are not independent, unless the pair ϵ_t, ϵ_{t-s} (for $s\neq0$) come from a bivariate normal distribution. This means that the random walk model imposes rather stringent restrictions upon the ϵ_t.

The expected value of P_{t+1} conditional upon P_t is given by

$$E(P_{t+1}|P_t)=E(P_t|P_t)+E(\epsilon_{t+1}|P_t) \tag{12}$$

or

$$E(P_{t+1}|P_t)=P_t. \tag{13}$$

Assuming that the information set consists of P_t, substitution of eq. (13) into eq. (2) yields:

$$X_{t+1}=P_{t+1}-P_t. \tag{14}$$

The expected value of X_{t+1} conditional on P_t is therefore:

$$E(X_{t+1}|P_t)=E(P_{t+1}|P_t)-E(P_t|P_t); \tag{15}$$

or

$$E(X_{t+1}|P_t)=P_t-P_t=0. \tag{16}$$

The random walk model, therefore, is a "fair game" efficient markets model. If the price of a security follows a random walk, this would be evidence consistent with the efficient markets model.

The random walk model is also a special case of the martingale model. A security price sequence follows a martingale when:

$$E(P_{t+1}|P_t)=P_t. \tag{17}$$

This is exactly eq. (13). Thus, when P_t follows a random walk it also follows a martingale. The converse is not true, however. This can be seen by examining eq. (12). So long as $E(\epsilon_{t+1}|P_t)$ is equal to zero, P_t will follow a martingale. All that one need assume for this condition to hold is that the pair ϵ_t, ϵ_{t-s} (for $s\neq0$) be uncorrelated.[20] Since the pair ϵ_t, ϵ_{t-s} (for $s\neq0$) may be uncorrelated without being independent (though the reverse does not hold), the price sequence $\{P_t\}$ may follow a martingale but not a random walk. The random walk model requires that the pair ϵ_t, ϵ_{t-s} (for $s\neq0$) be independent. Since it is extremely difficult to test for independence, some researchers have mistakenly examined serial correlation coefficients to test the random walk model.

3.2.3 The Information Set and Tests of the Efficient Markets Model

The information set I_t has not yet been discussed in any detail. In empirical tests, specification of the information set is extremely important. It is therefore necessary to discuss the assumptions made in empirical work about the information set.

Three basic sets of information are used to test the efficient markets model. These sets are: (1) all available information, including that possessed by individuals or groups who have monopolistic access to information, (2) all publicly available information, and (3) information only available in current and past security prices. Empirical tests of the efficient markets model using information sets (1), (2), and (3) are classified as strong form, semistrong form, and weak form tests, respectively. The more information used in testing the model the "stronger" the test of

[20] Assume, for example, that $\epsilon_t=\rho\epsilon_{t-1}+u_t$, where the u_t are independently and identically distributed with zero mean and constant variance. If ρ is unequal to zero, then ϵ_{t+1} and P_t are correlated. See Theil (1971), p. 413.

that model. Clearly, tests of the random walk model are weak-form tests of the efficient markets model since only historical prices are used. The number of weakform tests of the efficient markets model is quite large, whereas there are substantially fewer semistrong form tests and only a few strong form tests. Evidence from weak and semi-strong form tests are generally consistent with the efficient markets hypothesis. There is, however, limited evidence against the hypothesis in the strong form tests.

3.3 The Capital Asset Pricing Model

Thus far, the analysis has focused on the determinants of the absolute price of a security. The determinants of relative security prices are also important. An investor, for instance, might be concerned about the performance of a single security relative to the performance of the market portfolio (defined as a portfolio consisting of all securities in the market). In this particular case, the random walk model does not apply (nor, for that matter, do the submartingale and martingale models). Instead, the appropriate framework would be the capital asset pricing model.

The capital asset pricing model is based on a number of assumptions. Earlier versions of the model assume that: (1) investors are price-takers who may borrow and lend any amount at an exogenously determined risk-free rate of interest; (2) investors are risk-averse; (3) investors form the same estimates of expected return and risk; (4) all assets are perfectly divisible and liquid, though in fixed supply; and (5) there are no transactions costs and taxes.

Many of these assumptions have recently been relaxed. As a result, there are many versions of the capital asset pricing model. The one described here is the more widely known version, based on the above assumptions.

3.3.1 The Efficient Frontier

One important element of the model is the efficient frontier, depicted by the curved line *AB* in figure 1. In figure 1, $E(r)$ represents the expected return and $\sigma(r)$ the standard deviation of that return or risk. All points on or below *AB* are obtainable portfolios of assets given an individual's wealth. That is, an individual can obtain portfolio *A*, *B* or *C*, but not *D*, with his available wealth. Each portfolio is completely characterized by its expected return and standard deviation or riskiness. The efficient frontier *AB* thus contains portfolios with maximum expected return for any given level of risk, or alternatively with minimum risk for any given expected return.

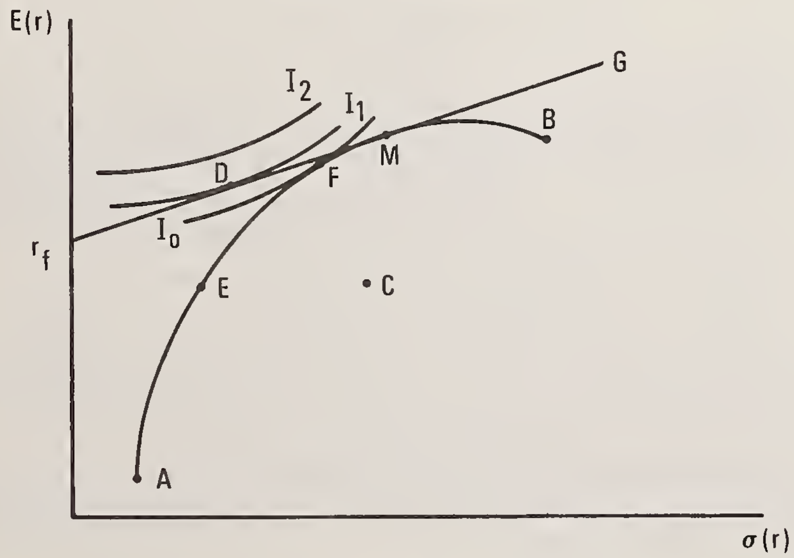

FIGURE 1.

Points on the frontier are preferable to points, such as C, which are inside the frontier. By reallocating his wealth among securities, an individual could move from point C to point M, and increase the expected return without adding to risk. Alternatively, risk could be reduced without reducing the expected return by reallocating wealth so as to move from point C to point E.

Since utility for a risk-averse investor is positively related to expected return and negatively related to risk, the rational investor would always choose a portfolio of risky assets on the efficient frontier. However, there are an infinite number of obtainable portfolios on the efficient frontier. Hence, the investor must also choose among the various efficient portfolios.

Once the set of efficient portfolios is identified, one must trade off greater expected return for greater risk in selecting a specific portfolio. The optimal combination of $E(r)$ and $\sigma(r)$ is that which maximizes expected utility. In figure 1 this combination is attained at F, where the individual enjoys the greatest level of utility, I_0, given his wealth. The three indifference curves I_0, I_1, and I_2 represent successively higher levels of utility and are positively sloped because individuals are assumed to be risk averse.[21] To hold utility constant, an increase in risk must be matched by an increase in expected return.

This analysis is extended by allowing an investor to purchase a risk-free security as well as risky securities. This case is shown in figure 2. If the risk-free return were r_f, portfolio return would be r_f when total wealth was allocated to the risk-free asset while the standard deviation or risk would equal zero.

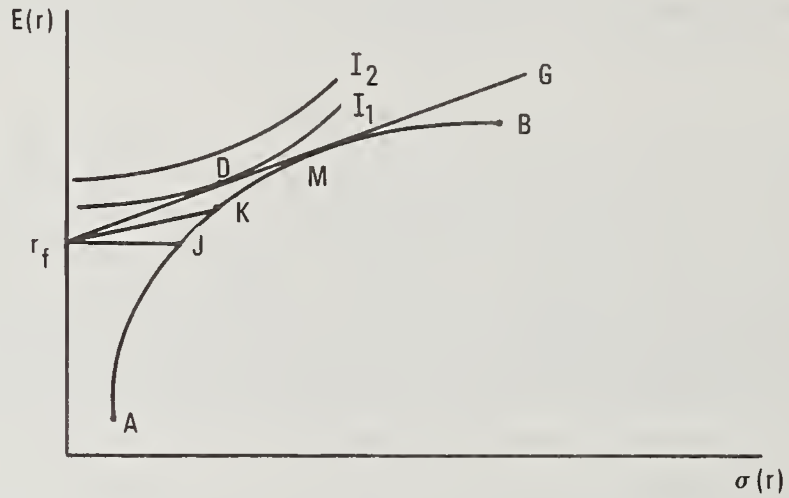

Figure 2.

An individual could also allocate total wealth to any portfolio of risky securities on the efficient frontier. For example, at J the individual would allocate total wealth to portfolio J and expect a return of r_f, but with a positive amount of risk. However, the rational investor would never choose portfolio J (or any portfolio on the efficient frontier below J), since r_f may be earned without *any* risk by allocating total wealth to the risk-free asset.

Similarly, total wealth could be allocated to portfolio K so as to earn an expected return greater than r_f, in exchange for greater risk. Alternatively one could obtain any combination of $E(r)$ and $\sigma(r)$ along the line r_fK. This process would be repeated until point M was attained. At this point one could combine the risk-free security and portfolio M so as to obtain any mix of $E(r)$ and $\sigma(r)$ along the line r_fG. Of all the lines generated in this way, r_fG contains the most preferable combinations of $E(r)$ and $\sigma(r)$ because for any line below r_fG the expected return is always lower for any given level of risk.

[21] The indifference curve would be horizontal for individuals whoe are risk neutral and negatively sloped for individuals who are risk-seekers.

The line r_fG is tangent to the efficient frontier, and is called the market line. Every individual will allocate his wealth between the risk-free security and portfolio M, producing a combination of $E(r)$ and $\sigma(r)$ somewhere along the line r_fG. Since everyone will hold only the risky securities in portfolio M, this portfolio must consist of all of the securities supplied. Portfolio M is therefore referred to as the market portfolio.

The optimal combination of $E(r)$ and $\sigma(r)$ along the market line is located at point D where the individual maximizes expected utility. In this case expected utility is maximized by allocating some fraction of wealth to the market portfolio and the remaining fraction to the risk-free security.

3.3.2 Determinants of the Return of a Single Security

We may now determine the return paid to a single security.[22] The expected return of a portfolio on the market line is given by:

$$E(r)=Xr_f+(1-X)E(r_m), \tag{18}$$

where $E(r)$ is the expected return on the entire portfolio (consisting of both risk-free and risky securities), r_f is the return on the risk-free security, $E(r_m)$ is the expected return on the market portfolio, and X is the fraction of wealth allocated to the risk-free security. The standard deviation of r or the risk of the total portfolio is:

$$\sigma(r)=(1-X)\sigma(r_m), \tag{19}$$

since the standard deviation of the risk-free asset is zero. Solving eq. (19), one obtains:

$$X=1-\frac{\sigma(r)}{\sigma(r_m)}. \tag{20}$$

Substituting this expression into eq. (18) yields the equation for the market line,

$$E(r)=r_f+\frac{E(r_m)-r_f}{\sigma(r_m)}\,\sigma(r). \tag{21}$$

The slope of this line is

$$\frac{dE(r)}{d\sigma(r)}=\frac{E(r_m)-r_f}{\sigma(r_m)}, \tag{22}$$

which indicates the trade-off between expected return and risk.

Assume now that shares of security j are added to or subtracted from the market portfolio M. If α is the proportion of the market portfolio *diverted* to security j, then $(1-\alpha)$ is the proportion of the *market* portfolio remaining after the transaction. When α is equal to zero, there is no alteration in the composition of the market portfolio.

The expected return on this portfolio is

$$E(r)=\alpha E(r_j)+(1-\alpha)E(r_m) \tag{23}$$

and the risk or standard deviation is

$$\sigma(r)=[\alpha^2\sigma^2(r_j)+(1-\alpha)^2\sigma^2(r_m)+2\alpha(1-\alpha)\ \text{cov}\ (r_j,r_m)]^{1/2} \tag{24}$$

Given these two equations, we can solve for the trade-off between expected return and risk. This trade-off may be expressed as:

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[22] This derivation is found in Jean (1970), pp. 165–169, and Francis and Archer [2, pp. 134–143].

$$\frac{dE(r)}{d\sigma(r)}=\frac{dE(r)}{d\alpha}\cdot\frac{d\alpha}{d\sigma(r)} \tag{25}$$

From eqs. (23) and (24), it follows that

$$\frac{dE(r)}{d\alpha}=E(r_j)-E(r_m) \tag{26}$$

and

$$\frac{d\alpha}{d\sigma(r)}=\{1/2[2\alpha\sigma^2(r_j)-2(1-\alpha)\sigma^2(r_m)+2(1-2\alpha)\ \mathrm{cov}\ (r_j,r_m)]$$
$$[\alpha^2\sigma^2(r_j)+(1-\alpha)^2\sigma^2(r_m)+2\alpha(1-\alpha)\ \mathrm{cov}\ (r_j,r_m)]^{-1/2}\}-1 \tag{27}$$

Since we wish to determine the return of security j in relation to the market portfolio, M, we evaluate (27) at $\alpha=0$, obtaining:

$$\frac{d\alpha}{d\sigma(r)}=\frac{\sigma(r_m)}{\mathrm{cov}\ (r_j,r_m)-\sigma^2(r_m)} \tag{28}$$

Substituting (26) and (28) into (25) therefore yields

$$\left.\frac{dE(r)}{d\sigma(r)}\right|_{\alpha=0}=\frac{E(r_j)-E(r_m)}{\mathrm{cov}\ (r_j,r_m)-\sigma^2(r_m)}\ \sigma(r_m) \tag{29}$$

Since (29) is evaluated at point M (where $\alpha=0$), it must also equal the slope of the market line. Hence, we have

$$\frac{E(r_m)-r_f}{\sigma(r_m)}=\frac{E(r_j)-E(r_m)}{\mathrm{cov}\ (r_j,r_m)-\sigma^2(r_m)}\ \sigma(r_m) \tag{30}$$

Solving this equation for $E(r_j)$, one finds that

$$E(r_j)=r_f+\frac{E(r_m)-r_f}{\sigma(r_m)}\ \frac{\mathrm{cov}\ (r_j,r_m)}{\sigma(r_m)} \tag{31}$$

This equation is extremely important because it states that the expected return on security j is equal to the rate of return on a riskless asset plus a "risk premium" that is proportional to $\mathrm{cov}(r_j,r_m)/\sigma(r_m)$.[23] The premium, $E(r_m-r_f)/\sigma(r_m)$ is typically referred to as the market price of risk. Eq. (31) shows that the expected return of a security depends not upon its own risk (standard deviation), but only its contribution to the overall risk of the market portfolio. The former type of risk is referred to as *specific* and the latter as *systematic*. An individual is not compensated for specific risk, only for systematic risk.[24]

3.3.3 Capital Asset Pricing Model and the Efficient Markets Model

It is easily shown that the capital asset pricing model is a special case of the "fair game" efficient markets model. From eq. (31), the expected return on security j at time $t+1$ is:

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[23] The covariance can also be expressed in terms of standard deviations. For example, the covariance between x and y may be written as $\mathrm{cov}(x,y,)=r_{x\,y}\sigma_x\sigma_y$, where r_{xy} is the simple correlation between x and y, σ_x is the standard deviation of x and σ_y is the standard deviation of y.

[24] It has been shown by Whitmore (1974) that

$$\sigma^2(r)=C+\frac{V-C}{C}$$

where V is the average variance and C is the average covariance for the N securities in the market portfolio. As N goes to infinity, then $\sigma^2(r)=C$, which demonstrates that the individual standard deviations in variances (V) contribute nothing to the overall riskiness of the market portfolio $[\sigma^2(r)]$. Such risk has been diversified away as N becomes infinitely large.

$$E(r_{j,t+1}|I_t)=r_{f,t+1}+\frac{E(r_{m,t+1}|I_t)-r_{f,t+1}}{\sigma(r_{m,t+1}|I_t)}\ \frac{\text{cov}\ (r_{j,t+1},\ r_{m,t+1}|I_t)}{\sigma(r_{m,t+1}|I_t)} \tag{32}$$

where I_t is the information set at time t.

This may be rewritten as

$$E(r_{j,t+1}|I_t)=[a+b\,E(r_{m,t+1})\,|I_t], \tag{33}$$

where

$$a=\left[1-\frac{\text{cov}\ (r_{j,t+1},\ r_{m,t+1}|I_t)}{\sigma^2(r_{m,t+1}|I_t)}\right]r_{f,t+1}\ \text{and}\ b=\frac{\text{cov}\ (r_{j,t+1},\ r_{m,t+1}|I_t)}{\sigma^2(r_{m,t+1}|I_t)}$$

Substituting eq. (33) into eq. (4) yields

$$z_{j,t+1}=r_{j,t+1}-[a+b\,E(r_{m,t+1}|I_t)]. \tag{34}$$

If the information set consists of r_f, $E(r_m)$, $\text{cov}(r_j,\ r_m)$, and $\sigma(r_m)$, the expected value of $z_{j,t+1}$, conditional upon this information set, is:

$$E[z_{j,t+1}|a+bE(r_{m,t+1})]=E(r_{j,t+1}|a+bE(r_{m,t+1})]-E[a+bE(r_{m,t+1})\,|a+bE(r_{m,t+1})] \tag{35}$$

or

$$E[z_{j,t+1}|a+bE(r_{m,t+1})]=a+bE(r_{m,t+1})-[a+bE(r_{m,t+1})]=0 \tag{36}$$

It therefore follows that the capital asset pricing model is a "fair game" efficient markets model. Thus, if the price of a security conforms to the capital asset pricing model, this would be evidence consistent with the efficient markets model.

3.3.4 Tests of the Capital Asset Pricing Model

To test the capital asset pricing model, many researchers have regressed the average returns for a cross-section of securities against each security's covariance with a representative index of the market portfolio. That is, one can rewrite eq. (31) as

$$E(r_j)=a_j+[E(r_m)]\beta_j, \tag{37}$$

where

$$\beta_j=\frac{\text{cov}\ (r_j,\ r_m)}{\sigma^2(r_m).};\ a_j=\left[1-\frac{\text{cov}\ (r_j,\ r_m)}{\sigma^2(r_m)}\right]r_f$$

The term B is usually referred to as the "beta" of a security. Since the beta of the market portfolio is unity, beta indicates the relative riskiness of a security. Securities whose betas are less (greater) than unity have less (more) systematic risk than the market as a whole.

A model often encountered in the literature is the "diagonal" or "market" model. This model is written as:

$$r_{j,t}=a_j+B_jr_{m,t}+U_{j,t} \tag{38}$$

where the parameters can vary across securities. The expected value of the random error term $U_{j,t}$ is assumed to be zero. Eq. (37) is not equivalent to eq. (38). The latter equation is stated in terms of expectations, while the former is stated in terms of realized observations. However, if eq. (38) satisfies the usual assumptions of regression analysis, the market model is the empirical analog of the capital asset pricing model.

3.3.5 Capital Asset Pricing Model and the Role of Information

In the capital asset pricing model, the expected return on a security depends upon specific variables and also presumably all information at a point in time. Thus, if available information is not fully reflected in expected returns, predicted returns should systematically deviate from actual returns. Unless this information is immediately embodied in the expected return, as the information set changes over time, there should be noticeable and systematic movements in the

U's from eq. (38). For example, stock splits, mergers and announcements of financial reports by firms should have only a temporary impact on the U's in the market model. If there is a persistent and systematic movement in the U's (or the residuals in a regression using the market model), then this is evidence against the efficient markets model. Tests of whether this is so are semi-strong form tests of the efficient markets model, because information other than just the historical return sequence is being included in the information set. These types of tests, though limited in number, appear to lend support to the notion that the stock market is efficient.

3.4 Testing the Impact of SEC Regulations on Security Prices

In this section, we discuss how models of security pricing may be used to assess the impact of various SEC regulations. Typically, empirical studies of SEC regulation have relied on the "market model" of eq. (38).

Two key elements of this model are the slope coefficient, B_j, and the disturbance term, $U_{j,t}$. B_j is the systematic risk or relative nondiversifiable risk of security j. The term $U_{j,t}$ measures security j's "extraordinary" or "abnormal" return. If the SEC adopts regulations which make new information available to investors about firm j, such information should be reflected in j's price if it alters expectations about j's future performance. This has the important implication that any event specific to firm j should be reflected in $U_{j,t}$, unless it has no impact on the future performance of the firm.

Before discussing the tests which are performed using the market model it is important to recall what is meant by market efficiency. If a capital market is efficient, security prices should fully and instantaneously reflect all available information. According to the efficient markets hypothesis, at each point in time prices should fully adjust to all available information. This means that if an event (such as the adoption of an SEC regulation) occurs which is specific to firm j, its impact should be reflected immediately and fully in the price of security j.

Consequently, favorable or unfavorable impacts of regulation should be reflected in "abnormal" movements in security prices during the period in which the regulation is adopted. These price movements are captured in the estimated residuals of the market model regression:

$$\hat{U}_{j,t} = r_{j,t} - \hat{a}_j - \hat{B}_j r_{m,t} \tag{39}$$

where $\hat{a}_j$ and $\hat{B}_j$ are the ordinary least squares estimates of a_j and B_j.

Now assume that the SEC has adopted a regulation which may affect the price of security j. Further assume that this regulation is adopted in time period zero ($t=0$). If capital markets are efficient, this regulation should be reflected in the price of security j. This means that if the regulation is firm specific, $\hat{U}_{j,t}$ should be affected during the period when the information about the regulation becomes available. If the regulation is interpreted as being favorable, $\hat{U}_{j,t}$ should be unusually large and positive. If the regulation is interpreted as being unfavorable, $\hat{U}_{j,t}$ should be unusually large and negative.

To assess the impact of a particular SEC regulation on the price of security j, one would estimate eq. (38) and calculate the residuals $\hat{U}_{j,t}$ for a selected time period. In estimating this equation, the period in which the residuals are to be calculated is eliminated. That is, the period in which the residuals might behave abnormally is eliminated from the estimation period. Otherwise, there might be a bias in the estimated parameters. The exact time period chosen for the calculation of $\hat{U}_{j,t}$ is somewhat arbitrary. One would attempt to pick a period which excludes the earliest possible date ($t=-m$) the regulation could be reflected in the price of security j and the latest possible date ($t=+N$). Since $\hat{U}_{j,t}$ may be abnormal in periods other than the one affected by the SEC regulation, the empirical results may be sensitive to the interval of time chosen.

One would then examine the residuals for the chosen time period. If the SEC regulation had no systematic impact, the residuals would follow a random pattern with roughly alternating positive and negative values. One could also cumulate the residuals over successive time periods. If the SEC regulation had little impact, these cumulative residuals

$$\left(\sum_{t=-m}^{t=N} \hat{U}_{jt}\right)$$

should also vary little from zero during the relevant sub-period. If this is so, one could infer that the SEC regulation did not cause investors to significantly alter their expectations about the future performance of firms affected by regulation.

Often, a number of security prices are examined simultaneously. One then obtains estimates of many $\hat{U}_t$'s, one for each security. If this procedure is adopted, one may wish to calculate an average residual for each time period ($t=-m, \ldots, 0, \ldots, +N$) for all of the included securities. The pattern of these average residuals would then be examined. If the SEC regulation had no impact, the residuals would be distributed randomly around a mean of zero. Similarly, if the average residuals are cumulated starting at period $t=-m$, this cumulated series should differ little from zero over the interval $t=-m$ to $t=+N$.

In sum, to assess the impact of an SEC regulation, one examines the residuals obtained from the market model.[25] If these estimated residuals vary randomly around zero and/or cummulate to an amount little different from zero over the appropriate time interval, one infers that the regulation in question did not alter investors' expectations enough to produce abnormal or unexpected price movements.

3.5 Empirical Studies of SEC Regulation

We now briefly review the empirical literature on the impact of securities regulation. With few exceptions, this literature deals with impact of SEC regulation in general, rather than the impact of specific provisions such as Regulation A, Rule 144, or Rule 146. Nevertheless, a review of this literature is useful for at least two reasons. First, evidence on the overall impact financial disclosure requirements may be useful for assessing the impact of specific disclosure provisions. Second, the methodology of such general studies may be applicable to the analysis of Regulation A, Rule 144, and Rule 146.

3.5.1 Stigler and Friend/Herman Studies

Presumably, investors must have certain necessary information if capital markets are to function well. An implicit assumption of the 1933 and 1934 Acts was that sufficient information would not be provided to investors in the absence of explicit regulation. Hence, a major purpose of mandatory registration and disclosure requirements was to improve the functioning of capital markets by improving the flow of information to investors.

In order to assess whether SEC regulation has achieved this goal, one must develop an operational measure of market performance. In early studies of SEC regulation, the price behavior of new securities before and after regulation was used for this purpose. If, in the absence of regulation, sellers of new securities were able to misinform potential buyers, investors would overestimate the value of new issues. However, investors' estimates would be revised downward over time as more accurate information about such securities became available, and their price would fall below the purchase price over time. If registration and disclosure requirements made

[25] Schwert (1977) examines the impact of SEC regulations on the price of seats on both the New York and American Stock Exchanges. Schwert makes use of a procedure referred to as "intervention analysis." Briefly, Schwert uses Box and Jenkins techniques to transform his data to unexpected or abnormal components. He then relates these components of different variables to each other using ordinary least squares techniques. However, a dummy variable is inserted into the regression equation to capture the impact of an SEC regulatory change. This variable takes on a value of one at the time of the change. As Schwert points out, his approach is analogous to the analysis of outliers from the residuals from an equation like eq. (38) in the text.

it more difficult to misinform investors, investors would, *ceteris paribus*, be less likely to overestimate the value of new issues than they would in the absence of SEC legislation. Thus, if SEC regulation were successful, one would expect the prices of new securities to "hold-up" better over time, than they would without such regulation.

This proposition is examined by Stigler (1964) and Friend/Herman (1964), who compare the 5-year price performance of new issues sold during a period prior to SEC regulation (1923–1928) with the performance of new issues sold during a period following SEC regulation (1949–1955). In order to control for the effect of overall market conditions, the ratio of the market price of a new issue in year t (p_t) to its offering price (p_0) is divided by the ratio of the market average in year t (M_t) to the market average prevailing in year o (M_0). The basic results of the Stigler and Friend/Herman studies for new issues of common stock are summarized in table 5.

TABLE 5. *New Stock Prices Relative to Market Averages* $\frac{p_t}{p_o} \frac{M_t}{M_o}$: *Common Stocks*

(Issue Year=100)

	Year After Issue				
	1	2	3	4	5
Stigler					
Pre-SEC:					
Average	81.9	65.1	56.2	52.8	58.5
Standard Deviation	43.7	46.7	43.7	48.5	65.1
No. of Issues	84	87	88	85	84
Post-SEC:					
Average	81.6	73.3	[1] 72.6	[1] 71.9	69.6
Standard Deviation	23.9	27.7	31.0	30.9	38.9
No. of Issues	47	47	47	47	47
Friend-Herman					
Pre-SEC:					
Average	79.2	64.8	56.3	50.7	53.8
Standard Deviation	40.2	46.7	44.5	47.9	64.6
No. of Issues	78	81	81	82	81
Post-SEC:					
Average	83.8	[1] 76.1	[1] 76.4	[1] 75.1	[1] 73.2
Standard Deviation	20.9	26.1	29.1	28.4	37.2
No. of Issues	45	45	45	45	45

[1] Difference between relative price performance in post-SEC and pre-SEC periods is statistically significant.

Source: Stigler (1964), Table 1, Friend and Herman (1964), Appendix 1.

In both studies, the computed price relatives perform better in the post SEC period. Moreover, the standard deviations of the new issue price relatives are lower in the post SEC period. However, these findings are given rather different interpretations by the two authors. Since the difference in price relatives is statistically insignificant for one, two, and five years after initial sale, Stigler argues that SEC regulations were of little relevance to investors in new issues. Moreover, he interprets the reduction in price dispersion as resulting from the removal of *both* unusually *good* and unusually *bad* issues from the market. In contrast, Friend/Herman interpret their findings as basically favorable to SEC regulation. Since their price relatives perform significantly better in the post-SEC period for 2, 3, 4, and 5 years after initial sale, they conclude that SEC regulations significantly improved the flow of information to investors.

In an important paper, Benston (1973) uses the analytical framework of the efficient market model and the capital asset pricing model to assess the impact of SEC disclosure on stock prices. Two issues addressed by Benston seem praticularly relevant. The first is whether the information contained in SEC-mandated disclosure statements is useful to investors. The second is whether the overall flow of market information is improved by the presence of SEC disclosure requirements.

In order to address the first issue, Benston draws on the market model, in which the return to security j in month t is determined by

$$r_{jt}=a_j+B_j r_{Mt}+U_{jt} \tag{40}$$

where

r_{jt}=return to security j in month t
r_{Mt}=return on a market index in month t
a_j=constant
U_{jt}=random disturbance

Since r_{Mt} controls for changes in general market conditions, U_{jt} reflects changes in r_{jt} caused by events other than general market fluctuations at time t. Such events might include: changes in expected dividend payments made by firm j that are announced at time $t(\Delta_{jt})$, changes specific to the industry of which firm j is a part that occur at time $t(I_{Kt})$, and receipt of unexpected, new information about firm j at time $t(F^*_{jt})$. SEC disclosure requirements are assumed to affect the last variable (F^*_{jt}), in one of four ways:

(i) Financial statements contain information about actual sales of firm j that may differ from expected sales. At the time of disclosure, t, F^*_{jt} would thus represent the difference between actual and expected sales revealed by SEC disclosure;

(ii) Financial statements contain information about actual cash flow net income of firm j that may differ from expected cash flow net income. Hence F^*_{jt} could be defined as the difference between actual and expected cash flow net income revealed by SEC disclosure;

(iii) Financial statements contain information about actual operating income of firm j that may differ from expected operating income. Thus, F^*_{jt} could be defined as the difference between actual and expected operating income revealed by SEC disclosure at time t;

(iv) Finally, financial statements provide information about net income after extraordinary gains and losses. Thus, F^*_{jt} could be defined as the difference between actual and expected net income after extraordinary gains and losses revealed by SEC disclosure.

The quantitative impact of financial statement information is estimated through a two-step procedure. First, estimates of U_{jt} are obtained. This is done by fitting eq. (40) to data that excludes months when the financial statements were made public, using the regression estimates to generate predicted values of r_{jt} for the months when such statements were made public; and then using the difference between predicted and actual values to compute estimated residuals for the months when financial statements were made public. That is, $\hat{U}_{jt}$ is used as a proxy for U_{jt} where

$$\hat{U}_{jt}=r_{jt}-\hat{a}_j-\hat{B}_j r_{mt} \text{ and } t=\text{time of disclosure.} \tag{41}$$

Having thus estimated U_{jt}, Benston proceeds to estimate a regression of the general form:

$$\hat{U}_{jt}=f(F^*_{jt}, \Delta_{jt}, I_{Kt}, Q_{jt}, U_{jt}) \tag{42}$$

where Q_{jt} represents the impact of third quarter financial data required by the NYSE, and U_{jt} is a random variable.

A number of different regressions are estimated, corresponding to different definitions of income (that is, to alternative measures of F^*_{jt}), and to different specifications of the manner in which expectations of income and sales are formed. In all the regressions, the coefficient of F^*_{jt} is statistically significant. However, with the exception of sales data, the elasticity of stock prices with respect to changes in financial information is small. A 100-percent change in annual sales revealed by SEC disclosure results in a 10.4-percent change in stock prices during the month of disclosure. In contrast, a 100-percent change in income results, on average, in a 2-percent change in stock prices during the month of disclosure. Based on these results, Benston concludes that the evidence

> . . . is not consistent with the underlying assumption that financial data made public are timely or relevant, on average.[26]

These results suggest that much of the data made public in SEC financial statements may be anticipated by investors on the basis of preliminary information contained in preliminary reports, press releases, and so forth. This suggests that changes in SEC disclosure requirements may not significantly affect the flow of useful information to investors. However, such information may be reliable only because of the discipline imposed by SEC disclosure requirements. Impacts of this sort would not be captured by the procedure just discussed. Instead, a comparison of the behavior of stock prices/returns before and after the introduction of SEC is necessary.

The procedures used by Benston for making such a comparison may be outlined as follows. First, corporations traded on the NYSE prior to the 1934 Securities Act are grouped into two categories: disclosure corporations and nondisclosure corporations. The group of disclosure corporations consists of those firms who reported all of the information required by the 1934 Act, including sales, while the group of nondisclosure corporations consists of those firms who reported all of the information required by the 1934 Act, except sales. Thus, the major difference between "disclosure corporations" and "nondisclosure corporations" is that the former disclosed sales while the latter did not. Second, Benston proposes five testable hypotheses about the behavior of nondisclosure corporations in the absence of SEC regulation relative to disclosure corporations.

Hypothesis 1: Managers of nondisclosure corporations deliberately withheld information to hide poor performance;

Hypothesis 2: Managers of nondisclosure corporations failed to provide information because they did not realize its value to investors;

Hypothesis 3: Required disclosure imposed a cost on nondisclosure corporations without providing compensating benefits to stockholders;

Hypothesis 4: Required disclosure produces benefits to the market as a whole because investors prefer registered to unregistered stock. However, some costs are imposed on nondisclosure firms in order to achieve this "certification."

Hypothesis 5: Required disclosure did not impose sufficient costs or benefits to be measured.

Each of these hypotheses may be tested through the market model. More specifically, each hypothesis has certain implications for the behavior of U_{jt}, B_j, and $\sigma^2(U_j)$ during the initial period of disclosure. These implications, and their interpretations are summarized in table 6.

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[26] Benston (1973), p. 139.

TABLE 6. *Behavior of market model statistics of disclosu: e and non-disclosure corporations during initial period of SEC disclosure.*

	U_j [residual returns to security j]	B_j [systematic portfolio risk of security j]	$\sigma^2(U_j)$ [specific risk of security j]
Disclosure Firms:			
Hypothesis 1, 2, 3, and 5	no impact	no impact	no impact
Hypothesis 4	$\Delta U_{jt}>0$	no impact	no impact
Non-Disclosure Firms: Hypothesis:			
1	$\Delta U_{jt}<0$	$\Delta B_j>0$	$\Delta\sigma^2>0$
2	$\Delta U_{jt}\lesseqgtr 0$	$\Delta B_j\gtreqless 0$	$\Delta\sigma^2\gtreqless 0$
3	$\Delta U_{jt}<0$	no impact	no impact
4	$\Delta U_{jt}<0$	no impact	no impact
5	no impact	no impact	no impact

Benston first examines the behavior of the B_j's in the pre- and post-disclosure periods. His data indicate that the B_j's of all firms in the pre-disclosure period differ from those of the post-disclosure period. However, the differences in behavior of the B's of the disclosure and nondisclosure firms are consistent with neither hypothesis 1 nor 2. Moreover, Benston views the measured differences as small enough to justify treating the B_j's as constant for the entire pre- and post-disclosure sample period.

In examining the behavior of the residuals, Benston employs a methodology that closely parallels that discussed earlier. That is, Benston first runs the market model regression for each security j excluding the period from February 1934 through June 1935. This estimated regression is then used to compute estimated residuals $\hat{U}_{jt}$ for the period from February 1934 through June 1935. That is, $\hat{U}_{jt}$ is given by:

$$\hat{U}_{jt}=r_{jt}-\hat{a}_j+\hat{B}_j r_{mt} \tag{43}$$

where:

r_{jt}=return to security j actually observed during period t (February 1934–June 1935)

$\hat{a}_j$, $\hat{B}_j$=estimated coefficients of market model regression for security obtained for time period excluding (February 1934–June 1935).

Benston then computes two different summary statistics of residuals for both the disclosure and nondisclosure groups. One such statistic is the algebraic mean residual for each month of the j securities. That is for each month of the disclosure period, he calculates the statistics:

$$U_t=\sum_1^n U_{jt/n} \tag{44}$$

where

t=month
n=number of securities.

The second statistic represents the average of the absolute values of the residuals. That is, Benston calculates:

$$|U_t| = \sum_{1}^{n} |\hat{U}_{jt}|/n \tag{45}$$

These summary statistics are used to examine the impact of required disclosure. The behavior of the average residuals of the non-disclosure firms is not statistically significantly different from the average residuals of the disclosure firms. Moreover, the average algebraic residuals of both disclosure and nondisclosure firms are not significantly different from zero. This suggests: (a) that contrary to Hypotheses 1, 2, 3, and 4, SEC disclosure did not significantly affect the behavior of firms not disclosing all information prior to SEC; and (b) that the advent of SEC disclosure did not result in abnormal returns for either disclosure or nondisclosure firms.

Benston also cumulates residuals over time for each of the j securities. That is, he computes

$$U_j = \sum_{t=1}^{17} \hat{U}_{jt} \tag{46}$$

for each security j.

Again, the behavior of $\hat{U}_j$ for the nondisclosure firms does not differ significantly from that of the disclosure firms. Moreover, neither the cumulative residuals of the disclosure firms nor of the nondisclosure firms differs significantly from zero.

Finally, Benston examines the behavior of the residual variances. Though the residual variances of the post-SEC period are less than those computed for the pre-SEC period, the differences are not statistically significant. Moreover, the pre- and post-SEC behavior of the residual variances for disclosure firms are not significantly different from the behavior of variances of nondisclosure firms. Hence, Benston concludes that the 1934 Act did not significantly reduce the specific risk of securities traded on the NYSE.

Thus, using the framework of the market model, Benston draws the following conclusions about the desirability of SEC disclosure provisions.[27]

(1) The "additional" information revealed by SEC-mandated financials is neither timely nor useful in the sense that stock prices change relatively little in response to such information.

(2) The introduction of SEC disclosure requirements during 1934–1935 did little to improve the flow of information to investors in the sense that market prices/returns were reevaluated in any systematic fashion during the initial period of disclosure. This was so both for firms whose disclosure was unaffected by SEC and for firms who were required to disclose "more" information as a result of SEC.

(3) The introduction of SEC disclosure did not reduce the specific risk of securities traded on the NYSE.

(4) The introduction of SEC disclosure did not make markets more fair and/or efficient in the sense that prices/returns "better" reflected all available information after SEC regulation than before.

Benston's analysis suggests a useful framework for evaluating the impact of SEC regulation. However, the results do not pertain to the impacts of specific SEC regulations. In the next section, we briefly discuss the results of empirical studies of one such provision, Regulation A.

3.6 Evidence on Impact of Specific SEC Regulation

Of the SEC regulations identified as most relevant to small technology-based firms, Regulation A has received the most attention. In their general analysis of SEC regulation, Friend and Herman (1964) present evidence on the impact of Regulation A on the price performance of small issues. We reproduce these results in table 7. These results are consistent with those presented in table 5.

[27] For a criticism of Benston's analysis, see Friend and Westerfield (1975).

TABLE 7. *New stock prices in fifth year after issue relative to averages in 1958 (issue year = 100)*

Size of Issue	$\frac{p_5 M_5}{p_o M_o}$
EXEMPT	
<300,000	82.6
Number of Issues	7
NON-EXEMPT	
300,000–5,000,000	90.2
Number of Issues	15

Source: Friend and Herman (1964), table 2.

That is, the relative price performance of new small issues not exempt from registration and disclosure was superior to that of small issues exempted from such requirements under Regulation A.

More recent work by Stoll and Curley (1976) provides further indirect evidence on the impact of Regulation A. In testing for the presence or absence of a small business equity gap, Stoll and Curley compare the rates of return on new small issues floated under Regulation A with the return on a portfolio of large firm stocks represented by Standard & Poor's Industrial Average. While the short-run price appreciation of Regulation A issues was considerably greater than the appreciation in the Standard & Poor's index, small issues floated under Regulation A provided lower long-run rates of return than the Standard & Poor's portfolio. Stoll and Curley interpret these findings as consistent with those of Friend and Herman. That is, investors in small issues may initially overvalue new small issues relative to established securities. However, with the passage of time, this overvaluation is corrected. It should, however, be noted that Stoll and Curley do not compare the relative performance of small issues which were and which were not subject to SEC regulation.

3.7 Conclusions

Some conclusions may be drawn about the relevance of security pricing models for assessing the impact of specific SEC regulations such as Rules 144 and 146 and Regulation A. First, the general framework of the market model, applied by Benston to evaluating general impacts of SEC regulation, is also applicable to assessing the impact of specific SEC regulations. Second, the studies suggest testable hypotheses that merit further examination.

For example, suppose one assumes that increasing the Regulation A ceiling and/or liberalizing the sales restrictions of Rule 144 makes it easier to obtain exemptions from full disclosure. An hypothesis consistent with the Stigler and Friend/Herman studies would be that the dispersion of subsequent market prices about the offering price would be greater for issues qualifying for exemption.

Alternatively, it has been conjectured that Rules 144 and 146 make it harder for small technology-based firms to obtain exemption from SEC registration. Suppose one could distinguish between the securities of "technology-based" and "non-technology based" firms in a sample of firms all of whom were affected by Rule 144. If so, the hypothesis of differential impacts on technology-based firms could be tested by using a framework similar to that used by Benston for assessing the impact of SEC on disclosure and non-disclosure firms.

Thus, security pricing models based on the efficient markets and capital asset pricing models provide a useful empirical framework for evaluating SEC regulations. However, these models also have significant conceptual and empirical limitations which should be acknowledged. These are discussed in the next section.

4. Some Limitations of the Efficient Markets Hypothesis

4.1 Introduction

The efficient markets model or hypothesis is an extremely important proposition in economics which has been supported by numerous scholarly studies. As has already been noted, this model may prove useful in assessing certain impacts of various SEC regulations on small, technology based firms. If so, this methodology can contribute to a determination of which disclosure requirements are least valuable to prospective buyers of securities issued by STBFs. In particular, it can contribute to an analysis of the costs and benefits of securities regulations. To the extent that the costs of meeting any disclosure requirement are greater than the benefits one is in a position to argue for the removal of this particular regulation.

Of course, the use of the efficient markets hypothesis is not without its limitations and to better understand the usefulness of this hypothesis it is worthwhile discussing some of the important ones. At present, it is the best objective model for providing the necessary information for assessing the impact of SEC disclosure requirements on SBTFs. But by being aware of the limitations of the efficient markets model, one is better able to intrepret the usefulness of the results obtained by using this model.

4.2 Major Limitations of the Efficient Markets Hypothesis

The efficient market hypothesis essentially states that a market is efficient with respect to the information set I_t if it is impossible to use that information to make economic profits. Under perfect competition in a static and certain world, firms are also assumed not to make any economic profits. The efficient markets hypothesis extends this result to speculators in a dynamic and uncertain world. In this particular setting, the markets for securities become fair games for those participating in these markets.

One limitation of the efficient markets hypothesis involves testing for market efficiency. Any test of market efficiency necessarily involves the use of a particular model. If one uses the two-parameter market model, then the test of market efficiency is really a test of a joint hypothesis. In other words, one is testing both a particular model and the efficient markets hypothesis. But, if this is the case, it becomes difficult for one to know what to conclude on the basis of the test results. Does one conclude that the market is inefficient based upon the use of a particular model, or that the particular model was inappropriately used to test for market efficiency?

Another limitation concerns the information set, I_t, used to test for market efficiency. As earlier noted, there are three forms in which the efficient market hypothesis is expressed, each depending upon the amount of information which is presumed to be available. These three forms are: (1) weak form, (2) semistrong form, and (3) strong form. The information set is taken to be only the information contained in past prices for the weak form, all publicly available information in the semistrong form, and all information known to anyone in the strong form. If one tests for market efficiency, one must base the test upon one of these three information sets. Clearly, unless one performs a strong form test, one cannot claim that there is no evidence of market inefficiency. If one performs a weak form test, for example, and finds that the results are consistent with market efficiency, it is still possible that a stronger form test would produce results which are inconsistent with market efficiency. This type of concern is quite important because it is extremely difficult to conduct strong form tests of the efficient markets hypothesis.

It is also possible that SEC regulations have altered the boundaries which separate these forms of the efficient markets hypothesis. That is to say, the SEC may have increased the amount of information which is publicly available, while simultaneously reducing the amount of information which is only known by insiders. One may then conclude that the market is efficient based upon a semistrong form test, but not fully realize that this result applies to a larger information set due to the SEC. This would mean that if the market is inefficient when performing a strong form test, it should be "less" inefficient due to the smaller information set. In short, the SEC may have reduced the magnitude of the departures from a fair-game, even though most strong form tests provide evidence which is inconsistent with the efficient markets hypothesis. In any event, more attention should be given to the exact position of the boundaries so that one fully realizes the applicability of any empirical results.

Another limitation is the particular variable which is chosen for the return on the market portfolio (see eq. (38) in sec. 3.3.4.). Indeed, Roll (1977) states that ". . . the critical issue of contention will always be the identity of the true market portfolio" (p. 147). Researchers have typically used the NYSE index, the Dow Jones index, the OTC index or the Standard and Poor's index to represent the market portfolio. But clearly the market portfolio would also consist of marketable land and durable goods. In any event, any results obtained from the use of one proxy for the market portfolio might be quite different when one employs a different proxy. According to Roll (1977) ". . . even a small mis-specification of the proxy's composition can lead to the wrong conclusion" (p. 158).

A further limitation is the extent to which the results from any given empirical test can be used to generalize to other market situations. One may find, for instance, that an SEC regulation does not appear to be useful because it has no impact on the price or return of a given security or group of securities. If the required disclosure of information were useful, presumably, this would be reflected in the value of securities. However, this type of finding would be specific to the security or group of securities analyzed, the particular time period chosen, the SEC regulation examined, and the estimation technique used. Perhaps a different statistical or econometric technique would produce varying results. Or perhaps the results would be sensitive to the group of securities or time period chosen. Of course, this point can be made about any empirical study. Nevertheless, it does mean that the extent to which any results can be extrapolated to these other situations is somewhat limited.

Furthermore, all of the empirical results generated are based upon historical data. Such results are therefore most relevant for evaluating the repeal of existing rules. If a new SEC regulation is implemented, there is always the question as to how long it will take to be able to assess its impact. It is not clear that past studies provide a reliable guide as to the length of time it will take to conduct an "impact analysis" which will generate more than highly tentative and perhaps reversible results. In any event, a critical question is whether any meaningful results can be generated in time to be of use in regulatory proceedings.

A related point is that if a regulation is implemented at one point in time and at a later point, when analysis is desired, relevant data has "perished." Subsequent changes in the regulation may be relatively small as compared to the initial intervention. This means that efficient market tests of these changes may lead to no discernable impacts on prices or returns, thus leading to erroneous conclusions about the entire regulation.

Still another possible limitation of the tests of the efficient markets hypothesis concerns inflation. Since these tests are conducted over a number of time periods, it is not clear what impact inflation has on the results when, say, the inflation rate is very high in one-half of the time span and very low in the other half. In short, does one obtain the same results whether one uses real rates of return or nominal rates of return in tests for market efficiency?

There is also the limitation, as Mendelson (1978) notes, that even though SEC disclosure regulations may be shown to have no impact on market efficiency, these regulations may redistribute wealth. If one considers equity as well as efficiency criteria, one might view SEC regulations quite differently. In other words, tests of market efficiency provide no evidence bearing on the issue of equity. If this issue is deemed to be important, one must therefore go beyond the results obtained solely from tests of the efficient markets hypothesis.

One may also be interested in the extent to which SEC regulations affect aggregate investment, output employment and/or R&D expenditures. It is not clear that tests of the efficient markets hypothesis tell us anything about these broader effects. SEC regulations may generate aggregate effects on economic activity not captured in tests of market efficiency. If so, one might wish to consider these effects before deciding upon the merit of any particular SEC regulation.

Finally, any decision to remove or add a particular regulation should involve a cost-benefit analysis. Whether done implicitly or explicitly, one weighs the benefits against the costs to arrive at a decision. Unfortunately, the efficient markets hypothesis is unable to provide nice, neat measurements of these costs and benefits. Tests of the efficient market hypothesis should therefore be viewed as providing important, but not the only, evidence bearing on decisions about the desirability of SEC disclosure regulations.

5. Benefits and Costs of Securities Regulation

5.1 Introduction

The ultimate aim of the SEC–ETIP project is to develop a model that can be used to *evaluate* SEC regulatory policies. Models such as the efficient markets model and the capital asset pricing model permit one to ascertain *whether* certain SEC regulations have had an impact on financial markets and *what* the impact has been. However, these models do not, by themselves, permit one to determine whether the impact of SEC regulation is *beneficial.*

Benefit-cost analysis is a formal framework for policy analysis that is widely used to evaluate whether public actions have a beneficial economic impact. This section discusses the way in which benefit-cost analysis may be used to evaluate securities regulation. The next section identifies both the uses and limitations of benefit-cost analysis. The third section discusses a number of general conceptual and definitional issues which arise when attempting to use benefit-cost analysis. These concepts are then used in the fourth section to identify the major social costs and benefits of (SEC) regulations. Finally, we examine whether existing models of securities markets may be used to assess the costs and benefits of SEC regulation.

5.2 Cost-Benefit Analysis: A General Overview

5.2.1 Introduction

As Peter Steiner (1974) has recently pointed out, the term "benefit-cost analysis" is susceptible to several interpretations, many of which are potentially misleading. At one extreme, cost-benefit analysis may simply be viewed as a formal definition of rational behavior. That is, once all the "desirable and undesirable" consequences ("benefits" and "costs") of any given public activities have been identified, an appropriate strategy would be to choose among the possible activities so as to maximize the positive difference between benefits and costs. This view of cost-benefit analysis is, of course, too general. At another extreme, the contribution of a public program to "social income" or GNP, measured in terms of the difference between that program's economic benefits and its economic costs, may be viewed as the only "acceptable" indicator of performance.

The correct view of cost-benefit analysis undoubtedly lies somewhere between these alternatives. Cost-benefit analysis is simply a social accounting framework for determining whether or not a particular program expands the aggregate production and consumption potential of an entire society. As such, it contains certain rules for determining which program effects ought properly to be viewed as social benefits and social costs. Since "benefits" and "costs" have a fairly precise meaning within this accounting framework, cost-benefit analysis can provide some fairly specific information to a decisionmaker about a program's attributes. It is this very specificity, however, that limits the power of cost-benefit analysis as a decision-making tool. When properly used, cost-benefit analysis can provide information as to whether or not a particular program increases the aggregate dollar value of production and/or consumption for society as a whole. Generally, this is but one attribute that is of policy interest. Decision-makers may be equally interested in evaluating the distribution of a program's aggregate benefits and costs among individuals. However, economists have tended to view this as a problem separate from that of determining whether total economic benefits exceed total economic costs. As a result, the distributional issue is usually viewed as being outside the scope of the formal accounting framework of cost-benefit analysis. Similarly, decisionmakers may be interested in the impact of a particular policy on psychological, cultural, or legal variables. Such impacts will often be difficult to quantify in terms of the dollar values which are required for rigorous application of formal cost-benefit calculations.

Cost-benefit analysis should therefore be viewed as a set of accounting rules that: (a) defines which program impacts ought properly to be viewed as social benefits and/or costs; and (b) sets forth procedures to be used in order to consistently aggregate different costs and benefits. The value of using cost-benefit analysis is that it allows a variety of different programs to be compared with each other in terms of a common performance indicator: the ratio of aggregate economic benefits to aggregate economic costs. However, it must be emphasized that this performance indicator measures program performance in only one dimension, namely, the impact of the program on aggregate production and consumption possibilities.

5.2.2 The Welfare Economic Basis of Cost-Benefit Analysis

Normative economics has long been preoccupied with developing criteria by which to judge the desirability of alternative and competing resource allocations. A well known social welfare criterion is that proposed by Vilfredo Pareto which holds that any change in the social state is "desirable" if at least one person is made better off because of the change, while no one is made worse off.

This so-called Pareto criterion has gained wide acceptance as a basis for evaluating public policies. However, in its strict form, it is applicable to few, if any, public policy decisions that must be made in the real world. Change in trade policies, regulatory policies, and public facility siting decisions, to mention only a few public actions, simultaneously impose costs on some individuals and benefits on other individuals, while causing shifts in resource allocation. Since such policies inevitably make some individuals worse off, while making others better off, the Pareto criterion in its strict form cannot be used to evaluate the desirability of such policies.

Due to this limitation of the Pareto criterion, economists have attempted to develop welfare criteria that are still broadly consistent with the Pareto criterion, but which are of greater applicability. One such criterion is that proposed by both Nicholas Kaldor (1939) and J. R. Hicks (1939) which states that a change in resource allocation is desirable if the Pareto criterion is met *or* those who gain by the resource allocation could compensate those harmed by it so as to leave the losers at least as well off as they would have been in the absence of the reallocation. The former case would represent an *actual* Pareto improvement, the latter case would represent a *potential* Pareto improvement.

Benefit-cost analysis is a tool for determining whether particular public policies represent potential Pareto improvements.[28] This point, as well as the role played by compensation in linking the concepts of potential vs. actual Pareto improvements, can be readily illustrated by a simple example.

For simplicity only, consider the case of a public program that confers benefits (B) on one group of individuals ($i=1 \ldots m$), while imposing losses (C) on a different group of persons ($j=1 \ldots n$). In this case, row 1 of table 8 would represent the impact of the program on the "gainers" and the "losers."

According to the Kaldor-Hicks hypothetical compensation criterion, the program represented in table 8 would be desirable if the gainers *could* fully compensate the losers for their losses, and still be better off. This would require that gainers be able to pay the losers an amount at least equal to

[28] For an excellent discussion of the welfare economic foundations of cost-benefit analysis, sec Mishan (1976),p. 382

$$\left(\sum_{j=1}^{n} C_j\right),$$

and still show a net gain from the program after making such side payments, $(\Sigma B_i - \Sigma C_j > 0)$.

TABLE 8. *Comparison of benefits and costs.*

	Gainers	Losers
Gains or Losses Before Compensation	$\sum_{i=1}^{m} B_i$	$\sum_{j=1}^{n} C_j$
Amount Paid or Received if Full Compensation Made	$\sum_{j=1}^{n} C_j$	$\sum_{j=1}^{n} C_j$
Net Gain or Loss After Full Compensation	$\Sigma B_i - \Sigma C_j$	0

From table 8 it is easily seen that the Kaldor-Hicks criterion would be satisfied only if the total benefits of the program $(\Sigma\ B_i)$ exceeded its total costs $(\Sigma\ C_j)$. Moreover, if compensation were paid, the program would represent an actual Pareto improvement in the sense that, through compensation, no one would be made worse off, while some would be made better off.

Thus, determining that a public program has a benefit-cost ratio greater than one implies that the program constitutes a potential Pareto improvement. Whether compensation is actually paid or not, most benefit-cost analysts view this potential improvement in welfare, by itself, as desirable on economic efficiency grounds.

5.2.3 Definition of Social Benefits and Costs

Given the welfare economic foundations of cost-benefit analysis, it is appropriate to distinguish between those program impacts that expand or contract the total production and consumption potential of society as a whole and those effects that do not expand the total potential, but rather increase the income of some segments of society at the direct expense of others. The former types of impacts are often referred to as the "real" benefits or costs of a program, while the latter are referred to as the pecuniary benefits or costs.[29] For purposes of computing benefit-cost ratios, it is the "real" impacts of a program that are treated as social benefits or costs.

The distinction between real and pecuniary effects of policy changes can be illustrated by a simple regulatory example. It has recently been argued that federal regulation of the trucking industry may have the effect of restricting competition in that industry, with the result that trucking services are provided at a price that exceeds marginal cost. Assume that this proposition is correct. Further assume that deregulation would generate enough competitive pressure so that trucking services were provided at a price equal to marginal cost. Using the simple supply-demand framework of figure 3, the benefits and costs of this policy change would be those depicted in table 9.

From both the figure and the table, two distinct types of impact can be identified. First, ignoring output changes, deregulation would enable consumers to purchase the pre-deregulation output level (Q_1), at a lower price, P_2, rather than the noncompetitive price of P_1. This cost saving would produce a benefit to consumers of P_1P_2BD. However, this gain to consumers would occur at the direct expense of producers since their profits would fall by an amount exactly equal to the consumers' gain. This particular impact of deregulation would be an example

[29] For an excellent discussion of issues relating to the definition of social benefits and social costs, see Haveman and Weisbrod (1975).

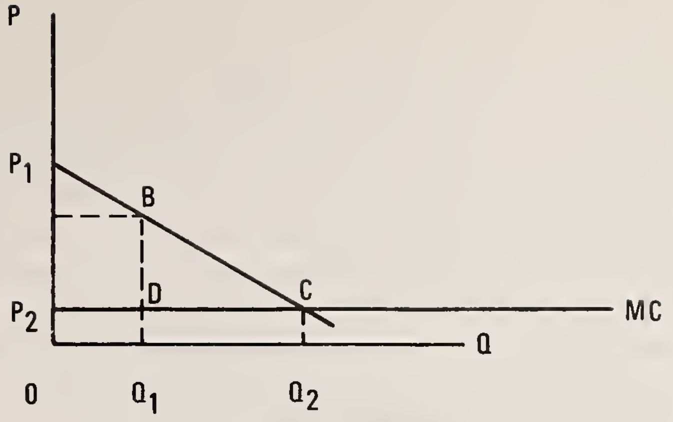

FIGURE 3.

TABLE 9. *Impacts of deregulation*

Benefits	Costs
Consumer gains due to fall in the price of Q_1 units (amount produced prior the deregulation) BP_1P_2D	Loss in monopoly profits earned on units sold at price above marginal cost prior to deregulation BP_1P_2D
Value of Additional Services Produced After Deregulation BQ_1Q_2C	Opportunity Cost of Resources Used to Produce $(Q_2–Q_1)$ Extra Units DQ_1Q_2C

of a *pecuniary* impact. That is, it does not represent an expansion of total potential income, but rather a redistribution of an existing amount of income. If both truckers and consumers derived the same utility per dollar of income gained or lost, this particular impact would leave potential welfare unchanged since the pecuniary gains (P_1P_2BD) would just be sufficient to provide compensation for the pecuniary losses (P_1P_2BD).

In addition to lowering the price of the good, deregulation would also result in increased output of the good. This impact of deregulation would clearly affect the allocation of resources between trucking and other activities. Specifically, deregulation would withdraw resources from other activities worth DQ_1Q_2C to produce services valued by consumers at BQ_1Q_2C. These impacts of deregulation would be examples of "*real*" effects. That is, such policy-induced output changes would affect the production and consumption potential of the entire society, and hence would be viewed as social costs (DQ_1Q_2C) and social benefits (BQ_1Q_2C) of deregulation.

To the extent that certain impacts of programs can be readily identified as being "pecuniary" in nature, such impacts need not be included as either social benefits or as social costs for purposes of making cost-benefit calculations. The rationale for this convention can be explained in two different ways. First, since such impacts can be identified, *a priori*, as not affecting potential welfare, there is no need to include them in the analysis. Alternatively, it is easily seen that "pecuniary effects," if correctly imputed to both the cost and benefit sides of the account, would automatically cancel out in any comparisons made between aggregate benefits and aggregate costs.

Once program impacts have been determined, and the real social benefits and costs identified, it is necessary to aggregate consistently individual costs and benefits. Though seemingly straightforward, this aspect of cost-benefit analysis has provoked considerable controversy among economists.

The reason for this controversy is that many public expenditures produce non-synchronous time flows of costs and benefits. As a result, it is necessary that a consistent method be used for aggregating and comparing costs and benefits that occur at different points in time. This is accomplished by first transforming all future benefits and costs into current dollars through the technique of discounting. Under this procedure, dollars of future benefits and/or cost are adjusted or discounted to reflect society's appraisal of the relative values of dollars received today versus dollars received at some future date. The adjustment, or discount factor applied, is based on some "appropriate" interest rate, since interest rates are viewed as providing information about the effect on values of time and waiting. Once all present and future social benefits and costs have been transformed into current dollars, total present values of benefits may be compared with total present values of costs.

The ratio of the present value of social benefits to the present value of social costs, however, can be quite sensitive to the value of the interest rate chosen. This is seen in table 10, which shows the impact of using different interest rates on estimated present values of social benefits and costs.

TABLE 10. *The effect of discounting on the evaluation of an investment, under alternative discount rates.*

	Interest Rate (in percent)			
	0	3	5	10
Value today of Total Benefits	\$15, 000	\$10, 448	\$8, 456	\$5, 442
Value today of Total Costs	\$7, 500	\$6, 741	\$6, 409	\$5, 906
Benefit-Cost Ratio	2. 0	1. 55	1. 32	0. 92
Excess of Benefits Over Costs	\$7, 500	\$3, 707	\$2, 047	\$—464

Source: Haveman and Margolis (1977), p. 18.

Though the issue of what constitutes the appropriate social discount rate has not been fully resolved at the theoretic level, most economists agree that the "appropriate" interest/discount rate is the opportunity cost rate implicit in the private spending that is displaced or affected by public expenditure.[30] In the case of SEC regulation, this suggests that the appropriate interest rate would be based on the return to private capital, since SEC regulations may have important impacts on private investment flows.

5.3 Costs and Benefits of SEC Regulation

In this section we apply some of the concepts discussed in Section A to identify a number of social costs and social benefits of SEC regulation. The distinction between real and pecuniary effects seems particularly applicable for this type of regulation. The reason is that the imposition of, or changes in, regulation of securities transactions will inevitably alter the distribution of income among buyers and sellers of securities. While acknowledging that such distributional effects may have important political and policy implications, it should also be recognized that they need not represent social benefits or social costs of regulation. That is, the losses suffered by some are redistributed dollar for dollar as gains to others. In general, SEC regulations will generate social costs and/or social benefits only to the extent that investors are compelled to behave in ways that lower or raise total production and consumption potential.

[30] See Baumol (1968).

There are three distinct ways in which SEC regulation may lower the total production and consumption potential of society, and hence impose social costs. These potential social costs can be attributed to: (1) the administrative requirements of complying with SEC regulations; (2) any reduction in total private savings and capital formation attributable to SEC regulation; and (3) any detrimental change in the composition of private investment due to differential impacts of regulation.

SEC regulations have been widely criticized for imposing substantial administrative costs on firms that must comply with a myriad of registration and reporting requirements. In a fully employed economy, any resources used up in the process of complying with SEC disclosure requirements would have to be withdrawn from alternative production and/or consumption activities. Hence, the costs of compliance would be a social cost of SEC regulation.

However, the analyst should take care that only those *additional* compliance costs *directly attributable* to SEC regulation are counted as social costs. To illustrate this point, let D represent the total value of resources, public and private, devoted to enforcing and complying with SEC disclosure requirements. Similarly, let F represent the value of resources that would be devoted to voluntary disclosure of information in tbe absence of any SEC regulation. The correct estimate of the compliance costs resulting from SEC regulation would be given by $(D-F)$, not D, as is sometimes implied in criticisms of SEC disclosure rules. To argue that D represents the social costs associated with enforcement and compliance is to assume that no resources would be devoted to disclosure activities in the absence of SEC regulation ($F=0$). However, this assumption is inconsistent with empirical evidence and a variety of theoretical disclosure models.[31]

To the extent that increased compliance costs reduce the level of private capital formation, SEC regulation would generate additional social costs. This point is illustrated in figure 4, where the horizontal lines S and S' represent the cost of obtaining capital with and without SEC disclosure requirements, and D represents the demand for capital, where the price that the firm is willing to pay for additional units of capital is assumed to equal the value of the marginal product produced by those units. In the absence of SEC regulation, the cost of capital facing the firm would equal S, the equilibrium capital stock would be K^*, and the net social gain would be given by ABC. With SEC regulation, the real cost of obtaining capital facing the firm would

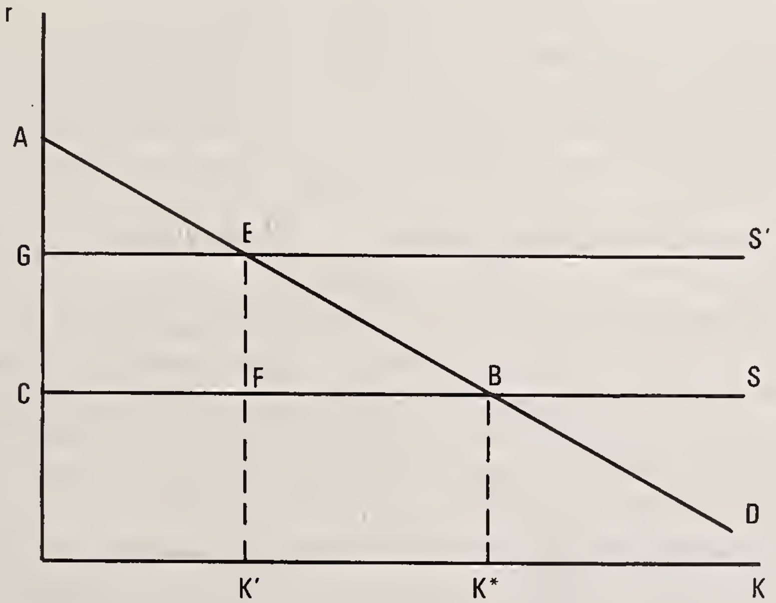

FIGURE 4.

[31] See, for example, Benston (1973), and Barth and Cordes (1980).

rise to S' due to increased costs of complying with SEC disclosure rules, the equilibrium capital stock would fall to K', and the net social gain to investment by the firm would fall to AEG.

In terms of figure 4, the social cost of regulation would be given by the area CGEB. Part of this social cost, represented by area CGEF, occurs because additional resources must be devoted to satisfy the disclosure requirements for obtaining K' units of capital. The remaining component of social costs, area BEF, would represent a reduction in net social income due to reduced capital formation.

Finally, SEC regulation may lower the level of income, and hence impose social costs if disclosure requirements unintentionally discriminate against some investments and in favor of others. This could, for example, occur if economies scale permitted larger firms to spread disclosure costs over larger amounts capital obtained. This point is illustrated in table 11.

TABLE 11. *SEC regulation and investment impacts*

	Investment Option A	Investment Option B
Return Per $100 of Capital	$8	$7
SEC Disclosure Costs Per $100 of Capital Obtained	$2	$0. 50
Maximum That Firm Could Pay Potential Investors	$6	$6. 50

In the absence of SEC disclosure requirements, investment option A, paying a return of 8 percent, would clearly be preferred to option B, paying a return of 7 percent. However, with disclosure requirements alternative B would be preferred. Thus, if SEC disclosure requirements produced an incentive for investors to purchase option B, rather than A, the social cost of such regulation per $100 of capital would equal the additional costs of such disclosure ($0.50 per $100) *plus* the increment in output foregone due to investment in B rather than A ($1 per $100).

5.3.2 Benefits of SEC Regulation

While it is relatively easy to identify some important social costs of SEC regulations, it is more difficult to identify potential benefits. Ostensibly, the major output of SEC regulations is "information." However, economists disagree as to whether the information provided by disclosure leads to a superior allocation of investment resources as well as resources totally (investment versus consumption), and hence produces social benefits, or whether access to such information merely redistributes income between buyers and sellers of securities, and hence produces pecuniary effects.

Hirschleifer (1971), and Fama and Laffer (1971), argue that allocating resources to information-gathering will be "wasteful" if such information is used solely for trading purposes, because the information obtained will not affect the level of income, but only its distribution among traders. However, this view has been challenged by Barzel (1977), as well as by Gonedes (1975), who considers the impact of information gathering in a general equilibrium model in which information flows are used to make resource allocation decisions.

The debate concerning the nature of the "benefits" provided by information-gathering is sufficiently complex so as to preclude its detailed discussion here. However, the theoretical debate has important policy implications. If the Hirschleifer-Fama-Laffer view is accepted, SEC regulation can be critized as inefficient on purely theoretical grounds. If SEC disclosure only serves to redistribute income among traders in securities markets, but does so while generating identifiable social costs, the ratio of social benefits to social costs would be close to zero, since pecuniary effects would not be viewed as social benefits. However, if the Gonedes-Barzel view is accepted, information-gathering may produce social benefits in the form of improved resource allocation in capital markets. In this case, determining the efficiency of SEC regulation would be an empirical issue, requiring comparison of estimated social benefits with estimated social costs.

5.3.3 Models of Securities Markets and Cost-Benefit Evaluations

We conclude by examining whether empirical tests of market efficiency and/or empirical studies based on the market model can provide information about the benefits and costs of SEC regulation. In general, it will be shown that empirical studies of SEC regulation based on existing models of securities markets can *at best* provide evidence on the *presence* or *absence* of certain benefits or costs. However, such studies cannot be expected to yield estimates of the *size* of the benefits and/or costs resulting from SEC regulation.

Consider first tests of market efficiency. Suppose, for sake of illustration, it was found that markets behave as a fair game in the presence but not the absence of SEC regulation. This would permit one to conclude that SEC regulation prevented some traders from making abnormal profits. Whether this would imply that SEC regulation produced real benefits is, however, uncertain. If SEC regulation did not change the underlying "information set" of financial markets, but only access to that information, the impact of regulation would be distributional in nature. That is, the same investments would continue to be made, but the prices charged by traders would differ. Some traders would gain and others would lose, while underlying investment flows would remain the same. In this case, SEC regulation would be "beneficial" only if the group of traders who gained as the market became more fair were regarded as "deserving." On the other hand, if SEC regulation altered the underlying information set, investment flows would change. In this case, SEC regulation would affect real output. However, without additional data, one could not determine whether this real impact was a cost or a benefit. It is conceivable that SEC regulation could improve access to information, while distorting the information set. In this case, SEC regulation would make the securities market more fair, but at a price.

In fact, the available evidence indicates that securities markets will behave as a fair game in the absence of SEC regulation. This simply means that SEC regulation cannot be credited with reducing abnormal trading profits. However, this would not necessarily imply that SEC regulation was of no social benefit. For example, if SEC regulation improved the underlying quality of the information, social benefits would result from improved portfolio choices made by investors. However, if regulation did not change the underlying information set, or distorted it, SEC regulations would generate social costs in addition to any administrative costs of compliance.[32]

We have discussed how the pattern of estimated residuals from market model regression may provide some information about the impact of SEC regulations. Presumably the signs of such residuals indicate whether particular SEC regulations have had a favorable (positive residuals) or unfavorable (negative residuals) effect on the price of particular securities. It is tempting to interpret the signs of such residuals as indicators of whether changes in SEC regulations impose benefits or costs. However, caution should be exercised in making such inferences. For example, if the introduction of some SEC regulation caused unfavorable information to be disclosed that would otherwise have been withheld, securities prices would fall, and the estimated residuals would be negative. However, in this case, SEC regulation would have discouraged investors from making an inferior investment. While SEC regulation would impose some costs on those selling the affected securities, society would benefit from an improved allocation of investment resources.

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[32] This conclusion has recently been drawn by Benston (1977).

However, it is also possible that the prices of some securities might fall because SEC regulation unintentionally made some securities less attractive as investments relative to others. (An example of this might be the liquidity restrictions associated with Rule 144.) In this sase, the presence of negative residuals would indicate that SEC regulations imposed a cost. Thus, in order to determine whether SEC regulation was beneficial or harmful, it would not be sufficient to examine the pattern of residuals. Rather, analysis of residuals would have to be combined with additional information about the impact of the regulation in question.

6. Summary and Conclusions

This report has described both the objectives and the methodology of the ETIP/SEC study of SEC regulation. The ETIP/SEC study endeavors to determine whether SEC regulations have a significant effect on the ability of small, technology-based firms to raise capital. This emphasis is particularly appropriate at a time when policy makers are concerned by manifestations of an "innovation recession." Small technology-based firms have historically depended more on equity as a source of finance than other firms. SEC regulations affect the terms under which small, technology-based firms can raise equity capital. These firms may therefore be particularly sensitive to SEC regulations.

Although there has been considerable conjecture in financial circles about the impact of SEC regulations on the ability of small, technology-based firms to raise capital, there is, at present, no empirical model for systematically assessing the impact of securities regulations on "venture" capital markets. The ETIP/SEC project hopes to develop such a model. More specifically, the project aims to develop an easily used system for monitoring the impact of SEC regulations on small, technology-based firms.

Three specific SEC regulations which observers believe to be particularly important to small, technology-based firms are Regulation A, Rule 144 and Rule 146. Regulation A exempts "small" issues from SEC registration requirements. In principle, it is designed to reduce the cost of regulation imposed on small firms. In practice, the ceiling amount that defines a "small" issue may be too restrictive to permit many firms to qualify for the Regulation A exemption. Rules 144 and 146 govern the terms under which capital may be raised through a "private" offering. Private offerings require less SEC disclosure than do public offerings. However, Rules 144 and 146 together impose some restrictions on the resale of private securities that reduce their liquidity. Some important issues which were discussed are: the severity of these restrictions, and the impact on venture capital markets of relaxing them.

Assessing the impact of these and other SEC regulations on small, technology-based firms is a difficult task. The ETIP/SEC approach relies on some formal models of security-pricing. The models most widely used are the efficients markets model, the capital asset pricing model and the market model. These models have been widely used to determine the quantitative impact of "changes in the environment" on securities prices. Changes in SEC regulations are one way in which the environment may change. Hence, these models are clearly useful for determining the quantitative impacts of SEC regulations on securities prices. These models are, naturally, subject to several important limitations which have been identified and discussed.

6.1 Output of the ETIP/SEC Project and Policymaking

As a result of the ETIP/SEC project, an extensive data base has been developed. This data base makes it possible to estimate empirical models that, in turn, can be used to determine how SEC regulation affects various securities prices. Using the output of the ETIP/SEC monitoring system to assess policy requires an additional step. This step involves determining whether estimated impacts are *desirable* or *undesirable.*

Benefit-cost analysis is a widely used methodology for determining whether government expenditure programs and regulations are desirable. Empirical studies of SEC regulation based on existing models of securities markets are of some value in performing benefit-cost analyses.

Specifically, these models can be used to determine whether certain regulations have positive or negative effects. However, these models do not lend themselves readily to estimating the dollar magnitudes of benefits and costs.

Such models should, however, be quite useful in performing regulatory analyses of the sort recently required by *Executive Order 12044: Improving Government Regulations*. Essentially, this order requires that agencies first determine whether proposed regulations are likely to have a substantial economic impact. If they have such an impact, the agencies must conduct regulatory analyses of the proposed regulations.

The models developed by the ETIP/SEC project should be quite useful in complying with the first phase described in the Executive Order. For example, the pattern of estimated residuals from market model regressions could be used to determine whether particular SEC regulations had a significant impact on securities prices at the time they were imposed. This evidence could then be used to assess whether proposed regulations similar to those analyzed would have a significant impact.

The ETIP/SEC monitoring system should also facilitate compliance with the requirement that "significant" regulations be subjected to a regulatory analysis. As part of the regulatory analysis, agencies must attempt to: (a) justify the need for the proposed regulation; and (b) choose the least burdensome means of attaining the regulatory objective. Determining the presence of market inefficiency would presumably offer a plausible rationale for certain SEC regulations. Estimates of the market model could, in principle, be used to compare empirically the impact of alternative regulations on security prices and returns. The results of such simulations would be of considerable value in identifying regulatory options that were less burdensome than others.

Thus, like all empirical approaches to policy analysis, the ETIP/SEC monitoring system is subject to important limitations. However, once fully developed, this system can be expected to contribute significantly to the systematic evaluation of government policies toward securities markets.

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16. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

A detailed and analytical assessment is provided of the economic techniques used by researchers to evaluate the efficiency of capital markets. The application of these techniques to that portion of the capital market which supplies venture funds to small, technology-based firms is emphasized. The primary elements of such analysis are the "efficient market hypothesis" and the "capital asset pricing model." The empirical analogue of the latter is commonly referred to as the "market model."

There have been several previous reviews of capital market theory but this is the first one to apply these techniques to a particular segment of the capital market and the existing policy structure affecting its operation. This policy structure is the set of regulations imposed on venture capital flows by the Securities and Exchange Commission. The important SEC regulations and the analytical approaches to assessing their impacts on capital market efficiency are discussed. Because such analysis cannot be effectively utilized by policymakers such as the SEC if it is conducted on an ad hoc basis or in isolation of the decision-making process, a monitoring system is described, which is based on the market model and which is designed to provide timely and decision-relevant information to the SEC

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