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THEORETICAL DEVELOPMENT OF ASSET PRICING MODELS AND THEIR EMPIRICAL RESULTS: A CRITICAL EXAMINATION OF FACTOR BASED MODELS IN THE CONTEXT OF META ANALYSIS APPROACH

Şaban ÇELİK

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2009

YEMİN METNİ

Yüksek Lisans Tezi olarak sunduğum **'Theoretical Development of Asset Pricing Models and Their Empirical Results: A Critical Examination of Factor Based Models in the Context of Meta Analysis Approach'** adlı çalışmanın, tarafımdan, bilimsel ahlak ve geleneklere aykırı düsecek bir yardıma başvurmaksızın yazıldığını ve yararlandığım eserlerin bibliyografyada gösterilenlerden oluştuğunu, bunlara atıf yapılarak yararlanılmış olduğunu belirtir ve bunu onurumla doğrularım.

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ABSTRACT

Master Thesis

THEORETICAL DEVELOPMENT OF ASSET PRICING MODELS AND THEIR EMPIRICAL RESULTS: A CRITICAL EXAMINATION OF FACTOR BASED MODELS IN THE CONTEXT OF META ANALYSIS APPROACH

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The power of any models either theoretical model or econometrical model comes from its prediction accuracy. A theoretical model such as Sharpe-Lintner Capital Asset Pricing Model (CAPM) is constructed on a set of assumptions whether these are consistent with the realism or not, and the predictions made in the context of these assumptions. Deriving mathematically the equilibrium representation of the models is carried out through manipulating these assumptions. The purposes of the study are (i) to give an extensive review on theoretical development of asset pricing models by emphasizing the main themes of asset pricing, Markowitz Mean-Variance Algorithm and S-L CAPM in the line with giving rather simple explanations about the static and dynamic models (ii) to present empirical investigations of the models through a systematic based selection criterion so called Meta Analysis and (iii) to investigate Sharpe-Lintner CAPM on manufacturing industry empirically . Results coming out from empirical investigation of S-L CAPM do confirm that there is a linear relationship between risk and return whereas the parameter tests are not satisfactory to conclude that the model parameters are robust. This is mainly due to the weakness of econometric specification for the Model. Therefore, based on the results reported here, one may not reject the model; instead one may reject the proxy inefficiency for market portfolio.

Keywords: 1) Asset Pricing 2) Meta Analysis 3) Financial Modeling 4) Risk Measurement 5) Econometric inference

ÖZET

Yüksek Lisans Tezi

VARLIK FİYATLAMA MODELLEMELERİNİN TEORİK GELİŞİMİ VE AMPİRİK SONUÇLARI : META-ANALİZ YAKLAŞIMI ÇERÇEVESİNDE FAKTÖR TEMELLİ MODELLERİN ELEŞTİREL ANALİZİ

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Herhangi bir theorik ya da ekonometrik modelin gücü tahmin tutarlılığından gelir. Sharpe-Lintner FVFM (Finansal Varlık Fiyatlama Modeli) gibi theorik bir model gerçeklikle tutarlı olsun ya da olmasın belli varsayımlar üzerine kurulur ve bu varsayımlar çercevesinde tahminler yapar. Modellerin denge durumundaki konumunun matematiksel olarak çıkarımı bu varsayımların manipülasyonuyla gerçekleştirilir. Bu çalışmanın amaçları (i) varlık fiyatlama modellerinin temel temaları, Markowitz Ortalama-Varyans Algoritması ve Sharpe-Lintner FVFM'sine vurgu yapıp, static ve dinamik modeler hakkında nispeten daha basit açıklamalar yaparak varlık fiyatlama modellerinin tarihi gelişimi üzerine derin bir tarama vermek, (ii) Meta Analizi olarak bilinen sistematik yöntemle modellerin ampirik araştırmalarını sunmak, ve (iii) Sharpe-Lintner FVFM'yi imalat sanayi firmaları üzerinde ampirik olarak araştırmaktır. Sharpe-Lintner FVFM üzerine yapılan ampirik araştırmadan gelen sonuçlar risk ile getiri arasındaki doğrusal ilişkinin olduğunu teyit etmelerine rağmen parametre testleri parametrelerinin doğruluğunu teyit etmede yetersiz kaldı. Bu, temel olarak modelin ekonometrik spesifikasyonunun zayıflığından kaynaklanır. Bundan dolayı, bu sonuçlar çercevesinde modeli reddedemekle beraber piyasa portföyünün temsilcisinin etkinsizliği reddedilebilir.

Anahtar kelimeler: 1) Varlık Fiyatlama 2) Meta Analizi 3) Finansal Modelleme 4)Risk Ölçümü 5) Ekonometrik Çıkarsama

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CHAPTER I: INTRODUCTION

1.6 Purpose of the Study

Friedman (1953) states that the relevant question to ask about the "assumptions" of a theory is not whether they are descriptively "realistic," for they never are, but whether they are sufficiently good approximations for the purpose in hand. And this question can be answered only by seeing whether the theory works, which means if it yields sufficiently accurate predictions. The purposes of the study as it is inspired by Friedman statement are (i) to give an extensive theoretical and empirical review of the models developed in the field of asset pricing, and (ii) to empirically investigate Sharpe-Lintner CAPM on manufacturing industry.

We implicitly also wanted to make a ground to study the dynamic of Turkish Capital Markets through more advanced models and contribute literature by shedding lights on the main pitfalls of the existed theories.

1.7 Scope of the Study

We extensively analyze the field of asset pricing whereas the analysis is limited with the neoclassical approach. Despite the fact that we only mention the differences between neoclassical and behavioral models, we did not cover the behavioral counterparts in addition with option pricing models.

1.8 Significance of the Study

The originality of the study is that it is the first complete treatment on asset pricing models developed since 1960s. In addition with giving an extensive review on theoretical models and their empirical investigations, it is aimed to make a ground in examining the complete literature and advancing the field by more developed models and econometric specifications.

1.9 Limitations

The most important limitation is the time constraint which limits us to analyze the complete literature on asset pricing. Therefore, we exclude the behavioral models and option pricing models. On the other hand, the space of the thesis limited us to deal with the simplified presentation for the extensions of S-L CAPM. The availability and quality of data constrained us not to work daily and weekly returns. We had to work on monthly data. Since the main concern is to explore the field of asset pricing in an extensive and systematic way, we did not apply every single econometric specification technique to apply in empirical part of the study.

1.10 Structure of the Study

The thesis consists mainly on three related chapters. Chapters II present extensively the main themes of asset pricing, Markowitz Optimization and S-L CAPM in the line with giving rather simple explanations about the static and dynamic asset pricing models. Chapter III gives the results of systematic approach to review the empirical works in the field of asset pricing. Chapter IV focuses on the testability and applicability of S-L CAPM assumptions and predictions.

Chapter II: THEORETICAL BACKGROUND OF ASSET PRICING

2.5 GENERAL CONCEPTS OF ASSET PRICING

2.1.1. Preliminaries

The primary objective of this thesis is to examine one of the core concepts of finance, asset pricing, for the purpose of explaining asset dynamics which have been extensively analyzed by economists, statistician, econometrician, mathematician and financial scholars. More interestingly asset pricing becomes a starting and also pioneering area for many groundbreaking models and extents new perspectives in several fields. In the simplified term, asset pricing can be defined as a common field of economics, finance, mathematics, statistics, econometrics and even psychology. In order to emphasize why study asset pricing, Cochrane (2005:xiii) underlined that:

> *"Asset pricing theory tries to understand the prices or values of claims to uncertain payments. A low price implies a high rate of return, so one can also think of the theory as explaining why some assets pay higher average returns than others. To value an asset, we have to account for the delay and for the risk of its payments. The effects of time are not too difficult to work out. However, corrections for risk are much more important determinants of many assets' values. For example, over the last 50 years U.S. stocks have given a real return of about 9% on average. Of this, only about 1% is due to interest rates; the remaining 8% is a premium[1] earned for holding risk. Uncertainty or corrections for risk make asset pricing interesting and challenging."*

The challenging point as Cochrane underlined is coming from how to adjust the risk under uncertainty. The way I approach the problem is a little bit naïve way of thinking which can be seen as a common way of financial economists as follows[2]:

I would like to start with the following question: Is price[3] of an asset equal to its value[4]?

$$\boxed{price \ = \ value}$$

---

[1] Mehra and Prescott (1985) was the first to introduce the equity primium puzzle. This is what Cochrane emphasizes.

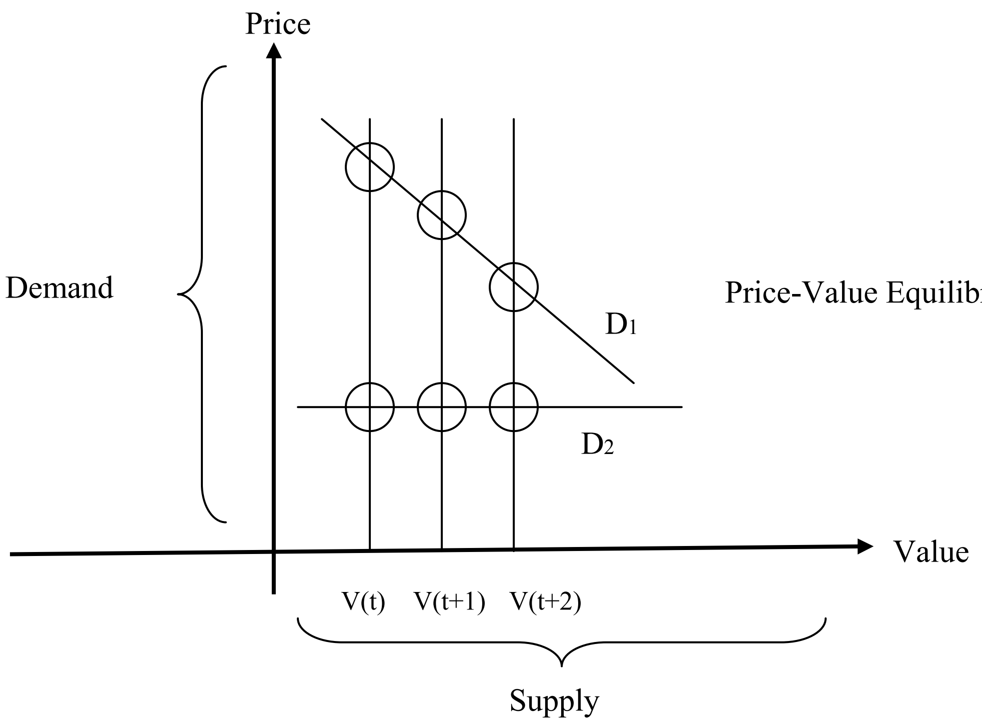
[2] Such way of thinking is just a simplification of complex reality as if how it is done through celebrated model of asset pricing, Capital Asset Pricing Model (CAPM).

[3] By price we mean that the price on which transaction is ended. The ending price can be also defined as market price.

[4] By value we mean that the real value despite the fact that it is hardly quantified. The real value can be also defined as instricting value.

Such a simple question can be easily answered as "No". However, such a simple question can lead us thinking of under which conditions such equality will be held. It is often heard that 'this car is sold under its value' or 'the firm asset is lower than its market price'. It seems that the price and the value are two different concepts. On the one hand, there is an indicator that is price and on the other hand, there is a notion, value, which is quantified through a price. However, the main difference is the factors that affect price and value.

Figure 2.1: Price-Value Relationship in a discrete time (at time t)



Source: the Author

Figure 1[5] describes the price-value relationship whereas it is far away from being realistic representations. The main purpose is to draw a general framework to show how equilibrium exists under the factors that affect price-value equilibrium level. The main factor that affects the price of an asset is its demand in market. If there is

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[5] In case of D_2 , it should be noted that the value at t, t+1, and t+2 are equal. This means that V(t), V(t+1) and V(t+2) are the same line. Since the graph is not drawn in three space geometry, it seems to be contradicted with the proposition we made. In similar manner, in case of D_1 , the value at t, t+1, and t+2 are not equal and the graph is correctly speficied the proposition.

no demand for a particular asset, it does not make any sense to price it. It is implicitly assumed that such asset can be marketable. On the other spectrum, the main factor that affects the value of the asset is its supply side. A car producing firm does not sell all of its products on the same price. "Why?" Since the qualifications of cars are different, their prices are quoted on different levels. It is not intended to say that the demand and the supply do not affect each other and price-value equilibrium. This is a general framework in the sense that the price-value equilibrium is nothing more than a theoretical discussion. However, it is important to underline the fact that the value of the asset is constant at certain time, t. What makes a value of the asset different for all people is its desirability so called its demand. *This implies that if we hold the demand constant between the two periods, the price of the asset will not be changed unless the value of the asset is changed.* It is necessary to describe what kind of process there should be for price and value.

Figure 2.2a: Price-Value process at continuous time

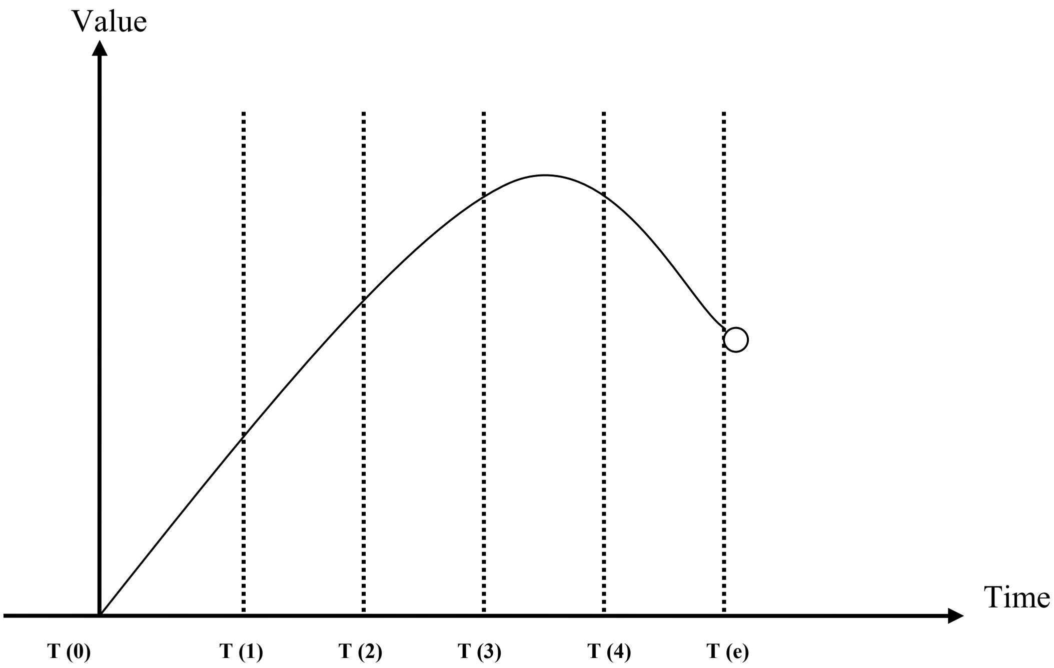
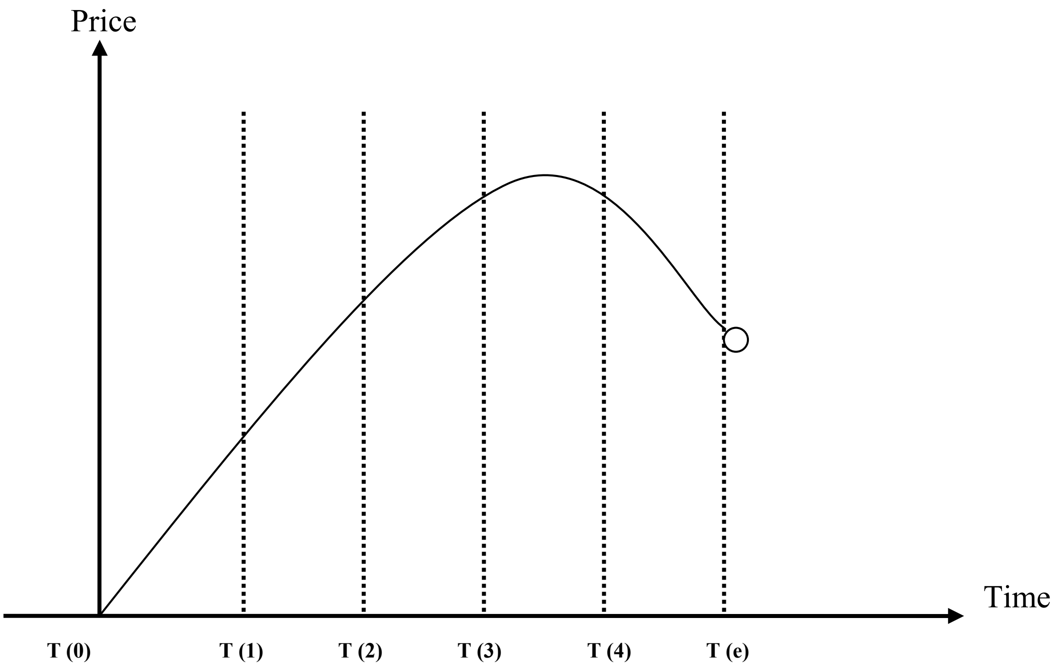


Figure 2.2b: Price-Value process at continuous time



Source: The Author

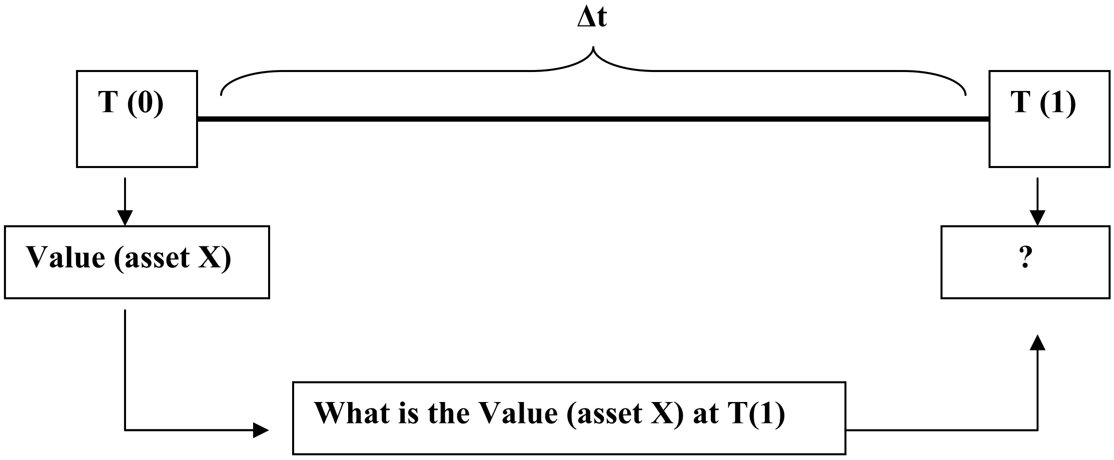
In Figures 2.2a and 2.2b, a representative value process is depicted. As it is seen that this representativeness looks like a product life cycle (or equivalently life cycle of the firm). It can not be extended for all products due to the fact that some products such as consol, a financial product paying fixed cash payments developed and maintained by Bank of England. Consols have simply no maturity. However, in Figures 2a, and 2b, there is an ending time, T (e), for the product. The important inference coming out from Figures 2a and 2b is that at equilibrium, the (ending) price and the (real) value for the asset is the same. In other words, at time t (1), the value of the asset is a vertical line implying that there is a constant value for the asset. The level of its price is determined by its demand at time t (1) and corresponding point represent the equilibrium price-value point. However, it is simply assumed that the demand for the asset depending upon the value of the asset may change so that the level of price increase or decrease. At the ending period, since there is no value for the asset at all, it should not be expected to be priced indicating by empty circle in Figures 2a and 2b. The most difficult part in described framework is how to define the exact price and value process for different assets such as financial assets or nonfinancial assets or even for human capital[6].

Economists usually make specified assumptions to clarify the situation in which their predictions will be held. Let us start with a general case to emphasize how a value of asset can be changed in one period model.

Assumption 1: There is only one period but two dates where transaction takes place.
Assumption 2: There is zero interest rate.
Assumption 3: There is zero inflation.
Assumption 4: There is zero risk.
Assumption 5: For rest of the factors that may affect the transaction is constant at two dates (ceteris paribus). This assumption is required for the existence of price-value equilibrium. As it is noted earlier, if we hold the demand constant between the two periods, the price of the asset will not be changed unless the value of the asset is changed.

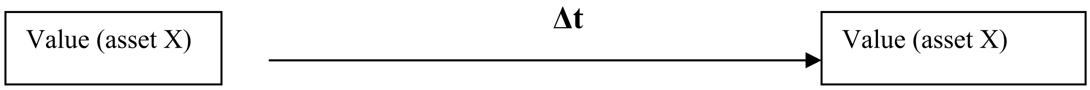
Figures 2.3 up to 2.7 shows how a value of asset can be changed under these assumptions and in lack of assumptions 2, 3 and 4 above.

Figure 2.3: Valuation of an asset



[6] That is why we will keep ourselves to work out on financial assets and explained the asset pricing theories developed on them.

Figure 2.4: Valuation of an asset under the assumptions 1 to 5



$$Value\ (asset\ X)_{T_0} = Value\ (asset\ X)_{T_1} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.1.)$$

Under the assumptions 1 to 5, it is clear that we are certainly dealing with a sure value due to the fact that we fixed every factor that may affect the value of an asset in one way or another in next period. This is the starting point to illustrate from certain value to uncertain. Despite the fact that valuation under uncertainty is the main theme of asset pricing, in this section we will just present it in a simplified manner.

Relaxing assumption 2: There is a constant interest rate that can be earned in the market (later we will define this rate as risk free).

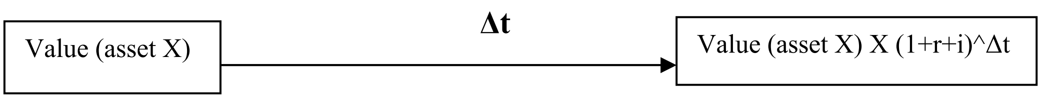
Figure 2.5: Valuation of an asset under the assumptions 1, 3, 4 and 5

$$Value(asset\ A)_{T_0} = Value(asset\ A)_{T_1} \div (1 + r_c)^{\Delta t} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.2)$$

Introducing a constant interest rate lead us to discount the next period value to the present, as it is well documented in financial text books as present value calculation usually used to evaluate the required rate of project. How this rate to be determined is the subject of the models that are explained in the following sections.

Relaxing assumption 2 and 3: There is a constant interest rate denoted as r_c that can be earned in the market and an inflation rate, denoted as i (inflation is usually assumed that it is adjusted in risk free rate or in risk premium whereas it is necessary to demonstrate how it takes place in valuation).

Figure 2.6: Valuation of an asset under the assumptions 1, 4 and 5



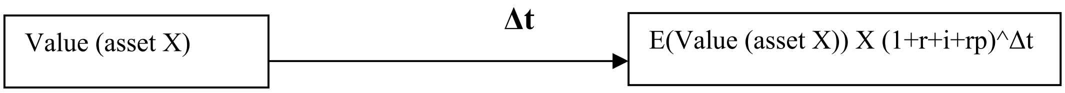
$$Value(asset\ X)_{T_0} = Value(asset\ X)_{T_1} \div (1 + r_c + i)^{\Delta t} \quad \text{……………………..(2.3)}$$

The value of a Turkish Lira today is not equal to the value of a Turkish Lira tomorrow if there is an inflation and equivalently opportunity cost. The impact of inflation results on nominal returns and we usually deduct the impact and gain the real return. Therefore, the inflation rate may be added to constant rate to discount the next period value to the present.

Relaxing assumption 2, 3, and 4: There is a constant interest rate denoted as r_c that can be earned in the market, an inflation rate, denoted as i and the risk that gives a premium denoted as r_p (risk premium is a rate that is required for investors to take the risk. Otherwise, why investors invest if there is a certain rate that can be earned without taking any risk). Since there is an uncertainty, we will expect what will be the value of asset X at time T(1).

The fundamental relation between risk and return is assumed to be linear at least at theoretical point of view. In addition, it is also assumed that investors should be compensated for bearing the risk. This is called premium for bearing the risk. The way we assumed that the rate for bearing risk is a certain rate on the contrary to adjusting it for investors' behaviors or market structure. This is overly simplified the problem whereas it is useful to demonstrate it and compare the result with what Capital Asset Pricing Model (CAPM) suggests.

Figure 2.7: Valuation of an asset under the assumptions 1 and 5



$$Value\,(asset\ X\,)_{T_0} = E(Value\,(asset\ X\,))_{T_1} \div \left(1 + r_c + i + r_p\right)^{\Delta t} \text{ ....(2.4)}$$

If we rearrange the expression (2.4) as $V(asset\ X\,)_{T_0} = \frac{E\left(V\left(asset\ X\,\right)\right)_{T_1}}{\left(1 + r_c + i + r_p\right)^{\Delta t}}$ and since this is one period model, Δt is set to 1 and we assume that inflation is inherit in risk premium or in constant interest rate in addition with to define constant interest rate as risk free and risk premium as $\beta \times excess\,market\,return$ we would have a celebrated model of asset pricing that is Sharpe-Lintner Capital Asset Pricing Model[7]. CAPM states that expected return (μ_X) of an asset is equal to risk free rate (r_f) plus asset's risk premium ($\beta_X\left(\mu_m - r_f\right)$). ($\mu_m$ is denoted hypothetical market portfolio return which consists of all assets)

$$\mu_X = r_f + \beta_X\left(\mu_m - r_f\right) \text{..(2.5)}$$

Let us rearrange the CAPM in terms of returns:

$$\mu_X = r_f + \beta_X\left(\mu_m - r_f\right) \quad \longrightarrow \quad \mu_X = \frac{E\left(P_{X1}\right) - P_{X0}}{P_{X0}} \quad \text{and } \lambda = \mu_m - r_f$$

Then after the relevant adjustment we will have the following equation:

$$P_{X0} = \frac{E\left(P_{X1}\right)}{\lambda\beta_X + r_f + 1} \text{ ....(2.6)}$$

As it is seen that expressions (2.4) and (2.6) are quite similar even though their theoretical backgrounds are not identical. The difference in both equations is what constitutes denominator in discount factor and the way we approach the equilibrium.

[7] The derivation of CAPM will be rigorously explained in this chapter.

2.1.2. Asset Pricing

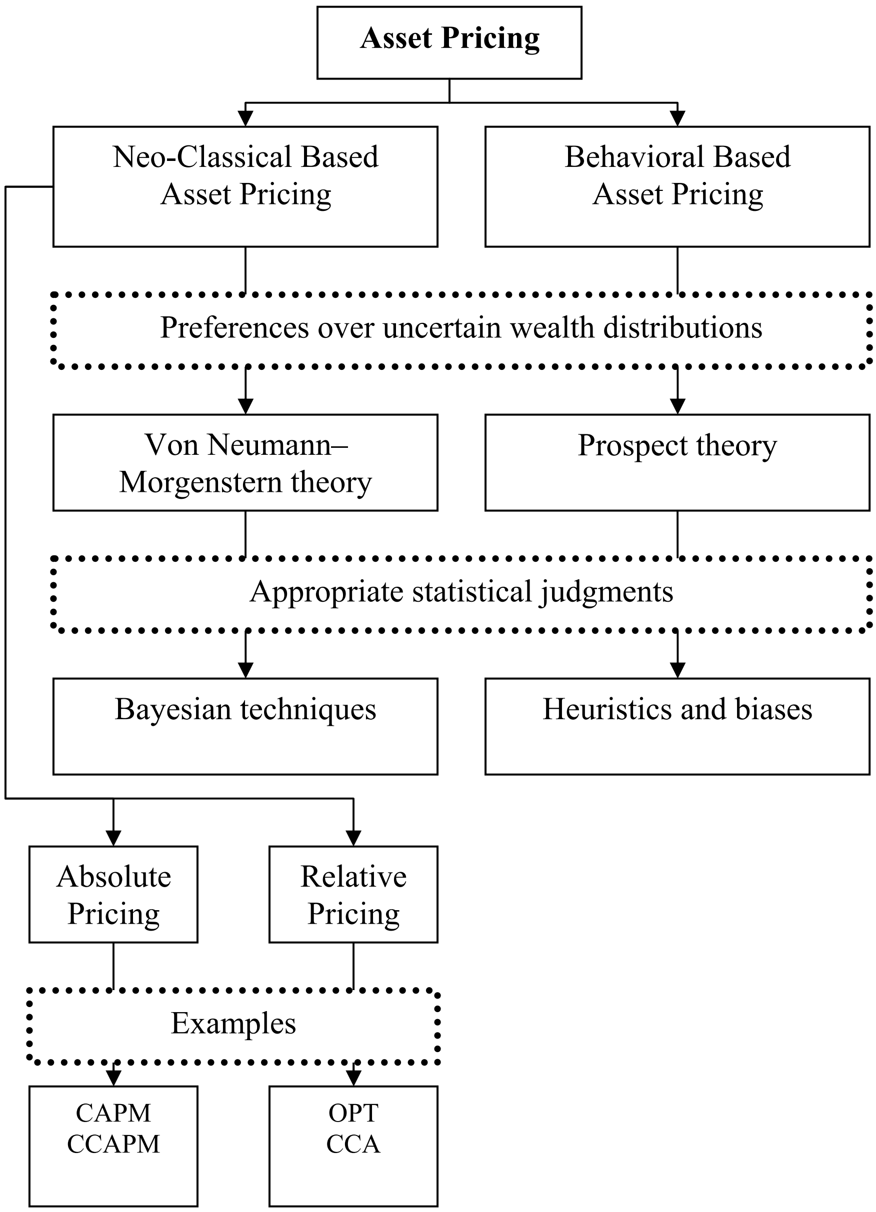
In order to simplify the concept of asset pricing, it needs to give a snapshot of the literature and a brief overview of perspectives in the field in addition with to describe what it is meant by an asset. The assets, financial or nonfinancial, will be defined as generating risky future pay offs distributed over time. Pricing of an asset can be seen as the present value of the pay offs or cash flows discounted for risk and time lags. However, the difficulties coming from discounting process is to determine the relevant factors to affect the pay offs. It is highly important in decision making process at the firm level and also the macro level. To navigate the market signals and infer their impacts on the pay offs are the main task of asset pricing and required to implement the strategic implications. When we consider "asset" pricing we often have in mind stock prices. However, asset pricing in general also applies to other financial assets, for instance, bonds and derivatives, to non-financial assets such as gold, real estate, and oil, and to collectibles like art, coins, baseball cards, etc. Models that are developed in the field of asset pricing shares the positive versus normative tension present in the rest of economics. When we consider a model[8] by which we predict the future, we usually rely on the underlining assumptions behind it. If the underlining assumptions are true after evaluation process of normative tests, their predictions should be true which can be examined through positives tests. However, what we do is in fact not more than putting everything in one simplified settings.

In most cases, the underlining assumptions of given model do not pass the normative tests. Even if it is so, we can not hold the impacts of factors affecting the pay offs constant between two periods. On the other hand, there is another possibility that the way we describe the world should work is not overly simplified but the world is wrong that some assets are mispriced and the models need improvements. Cochrane (2005) states that this latter use of asset pricing theory accounts for much of its popularity and practical application. Also, and perhaps most importantly, the prices of many assets or claims to uncertain cash flows are not observed, such as potential

[8] A model consists of a set of assumptions, mathematical development of the model through manipulations of these assumptions and a set of predictions (Bodie, Kane and Marcus, 2008:309).

public or private investment projects, new financial securities, buyout prospects, and complex derivatives. We can apply the theory to establish what the prices of these claims *should* be as well; the answers are important guides to public and private decisions. Asset pricing theory all stems from one simple concept: *price equals expected discounted payoff*. The rest is elaboration, special cases, and a closet full of tricks that make the central equation useful for one or another application.

Figure 2.8: Stems of Asset Pricing Perspectives



Source: The Author

Figure 8 outlines the theoretical development and the root of asset pricing in short. The main distinction starts with the notion that how individual preferences over the distribution of uncertain wealth are taken place. Financial economists have different views on this ground which can be classified as neoclassical based[9] and behavioral based[10]. The rational notion behind this paradigm shift is coming from the way individuals make their decisions. Individuals, in a simplified manner, make observations, process the data coming out from these observations and come to point in concluding the results. As Shefrin (2005) pointed out that in finance, these judgments and decisions pertain to the composition of individual portfolios, the range of securities offered in the market, the character of earnings forecasts, and the manner in which securities are priced through time. In building a framework for the study of financial markets, academics face a fundamental choice. They need to choose a set of assumptions about the judgments, preferences, and decisions of participants in financial markets. In the neoclassical framework, financial decision-makers possess von Neumann–Morgenstern preferences over uncertain wealth distributions, and use Bayesian techniques to make appropriate statistical judgments from the data at their disposal. On the other spectrum, Behavioral finance is the study of how psychological phenomena impact financial behavior. Behavioralizing asset pricing theory means tracing the implications of behavioral assumptions for equilibrium prices. Psychologists working in the area of behavioral decision making have produced much evidence that people do not behave as if they have von Neumann–Morgenstern preferences, and do not form judgments in accordance with Bayesian principles. Rather, they systematically behave in a manner different from both. Notably, behavioral psychologists have advanced theories that address the causes and effects associated with these systematic departures. The behavioral counterpart to von Neumann–Morgenstern theory is known as prospect theory. The behavioral counterpart to Bayesian theory is known as “heuristics and biases.”

[9] Interested readers should consult Cochrane (2005) for the neoclassical based models whereas Contingent Claim Analysis (CCA) is not extended to macro level in this book. For useful explanations for CCA applied in macro level see Gray, Merton and Bodie (2007) for theoretical explanations and also Keller, Kunzel and Souto (2007) for an application made on Turkey.

[10] Interested readers should consult Shefrin (2005) for the behavioral based models. In the scope of the present thesis we will not explain the bevarioral models.

In the scope of the thesis, we will explain the models that are classified in the framework of neoclassical finance[11]. In neoclassical finance, the models can be grouped into absolute and relative asset pricing models. We mean by absolute pricing that each asset is priced by reference to its exposure to fundamental sources of macroeconomic risk. The consumption-based and general equilibrium models are the purest examples of this approach. The absolute approach is most common in academic settings, in which we use asset pricing theory positively to give an economic explanation for why prices are what they are, or in order to predict how prices might change if policy or economic structure changed. In relative pricing, a less ambitious question is answered. We ask what we can learn about an asset's value given the prices of some other assets. We do not ask where the prices of the other assets came from, and we use as little information about fundamental risk factors as possible. Black—Scholes (1973) option pricing is the classic example of this approach and its extension Contingent Claim Analysis (CCA) developed for crediting a country's default risk. Notwithstanding, there is no solid line between absolute and relative asset pricing models at least in application[12]. The problem is how much relative and how much absolute model may explain asset pricing fundamentals.

More importantly the source of factors that affect the risk premium may also play a role to classify the models such as the models based on macro economic or firm specific factors depending upon the underlying assumptions behind. However, there is a clear argument to classify the models on theoretical ground that generalizing the findings from an empirical investigation is much reasonable than doing that by data mining. Table 1 reports the main development of Capital Asset Pricing Models which were explained in the scope of the thesis. Starting from Markowitz mean-

[11] The reason for this limitation is about giving as much intiutive background of central theories as possible while being informed about the full literature written on asset pricing. We simply cannot explain every single models developed in the field of asset pricing in a master thesis.
[12] Cochrane (2005) explains that asset pricing problems are solved by judiciously choosing how much absolute and how much relative pricing one will do, depending on the assets in question and the purpose of the calculation. Almost no problems are solved by the pure extremes. For example, the CAPM and its successor factor models are paradigms of the absolute approach. Yet in applications, they price assets "relative" to the market or other risk factors, without answering what determines the market or factor risk premia and betas. The latter are treated as free parameters. On the other end of the spectrum, even the most practical financial engineering questions usually involve assumptions beyond pure lack of arbitrage, assumptions about equilibrium "market prices of risk."

variance algorithm, we will explain the models into two main categories as static and dynamic models.

Table 2.1: Theoretical Development of CAPM

Theoretical Development of CAPM		
	Model	Originator(s)
	Markowitz Mean-Variance Algorithm	Markowitz (1952;1959)
	Sharpe-Lintner CAPM	Sharpe (1964), Lintner (1965), Mossin (1966)
Static Models	Black Zero-beta CAPM	Black (1972)
	The CAPM with Non-Marketable Human Capital	Mayers (1972)
	The CAPM with Multiple Consumption Goods	Breeden (1979)
	International CAPM	Solnik (1974), Adler and Dumas (1983)
	Arbitrage Pricing Theory	Ross (1976)
	The Fame-French Three Factor Model	Fama and French (1993)
	Partial Variance Approach Model	Hogan and Warren (1974) and Bawa and Lindenberg (1977) Harlow and Rao (1989)
	The Three Moment CAPM	Rubinstein (1973a), Kraus and Litzenberger (1976)
	The Four Moment CAPM	Fang and Lai (1997), Dittmar[13] (1999)
Dynamic Models	The Intertemporal CAPM	Merton (1973)
	The Consumption CAPM	Breeden (1979)
	Production Based CAPM	Lucas (1978), Brock (1979)
	Investment-Based CAPM	Cochrane (1991)
	Liquidity Based CAPM	Acharya and Pedersen (2005)
	Conditional CAPM	Jagannathan and Wang (1996)

Source: The Author

The main reasons behind the classification[14] and formation of the model exhibited in Table 2.1 are historical development of the advances in asset pricing and theoretical extensions which are built on Sharpe-Lintner CAPM. To divide the models into framework of static and dynamic structure is useful on the theoretical ground to demonstrate how to generalize the model from discrete time process to continuous. The models exhibited in Table 2.1 are just a model in one way or another to give a simplified description of complex reality and are not free of incorrect justifications.

[13] This is Dittmar working paper whereas article form is published in 2002.

[14] Cochrane (2005) induced every asset pricing model into a consumption based asset pricing framework and explain the dynamics of asset pricing model from different order.

Even tough a model that is not an exact description of reality, it is still useful and in most cases better than a simple average of sample return.

2.1.3. Efficiency

A well-known story written by Malkeil (2003: 60) to illustrate what is meant by efficiency as follows: A finance professor and a student who come across a $100 bill lying on the ground. As the student stops to pick it up, the professor says, "Don't bother-if it were really a $100 bill, it wouldn't be there." The term efficiency has several meanings in economics and finance whereas *the informational efficiency* will be mentioned and evaluated among others[15] in the scope of the thesis and explained its role in the context of asset pricing. The term informational efficiency is referred to condition in which prices fully reflect all relevant information in well functioning capital markets. It will be useful to start with why information efficiency plays an important role for asset pricing. Bailey (2005: 58) emphasizes the role of efficiency by underlining its implication to predict stock returns as follows:

> The extent to which asset prices in the future can be predicted on the basis of currently available information is a matter of great significance to practical investors as well as academic model builders. For academic researchers, the objectives are to obtain an understanding of the determination of prices and to find ways of assessing the efficiency of asset markets. For investors, the objective is to exploit their knowledge to obtain the best rates of return from their portfolios of assets.

The implication of informationally efficient market is that there is no way out to make profit using the information set that is already known. In other words, it is useless to predict the stock returns with the previous data. This sounds interesting and divides financial scholars and practitioners into two groups. On the one hand,

[15] Bailey (2005:23) pointed out these terms simply as follows: **Allocative Efficiency** refers to the basic concept in economics known as Pareto efficiency. Briefly, a Pareto efficient allocation is such that any reallocation of resources that makes one or more individuals better off results in at least one individual being made worse off. **Operational efficiency** mainly concerns the industrial organization of capital markets. That is, the study of operational efficiency examines whether the services supplied by financial organizations (e.g. brokers, dealers, banks and other financial intermediaries) are provided according to the usual criteria of industrial efficiency (for example, such that price equals marginal cost for the services rendered). **Portfolio efficiency** is a narrower concept than the others. An efficient portfolio is one such that the variance of the return on the portfolio is as small as possible for any given level of expected return.

there is a strong view in supporting ***the efficient market hypothesis***[16] starting with the collection work of Fama (1970). On the other hand, there are certain pitfalls so called anomalies which can be seen as a pattern in stock returns. The debate among scholars is coming from how to define the efficient markets. As the term market efficiency is defined as prices fully reflect relevant information. Such description is not clear to state the notion of reflection. This definition implies that prices do not ignore information whereas there is a problem about how accurate the information can be reflected. The main source of confusion[17] is that the supporter of market efficiency and behavioral finance have focused and described the different definitions for efficiency. Supporters of efficient market theory have tended to focus on definitions based on the absence of arbitrage whereas supporters of behavioral finance have tended to define market efficiency in terms of objectively correct prices, rather than the absence of arbitrage profits.

It should be noted once again that the information set which is reference to the investors to exploit profit opportunities is required for market efficiency. Fama (1970: 383) defines market efficiency in general as follows: "A market in which prices 'fully reflect' available information is called 'efficient'." In such a market, clearly, no easy profit opportunities remain. To utilize the information in an efficient market, Fama distinguishes three forms by what type of information is assumed to be available. *Weak form efficiency* takes the available information to be just historical prices; *semi-strong form efficiency* takes the information set to be any information that is publicly available; *strong form efficiency* concerns an even larger information set, namely the information available to any group of investors. Fama proposes the "efficient market hypothesis" according to which it should not be possible to devise trading rules, using available (depending on which of the three definitions is used:

[16] 'The mathematical expactation of the speculator is zero' is the main idea of **Bachelier's** thesis written in 1900 in France. It was the first time to show that stock prices follow a random walk 69 years before Fama and 5 years before Einstein's discovery of the motion of electrons (browian motion as a stochastic process is used here). The story of risk is extensively well written in the book of Bernstein (1996).

[17] Shefrin (2005) clarifies this point by giving the following example: An example of the confusion can be found in a side-by-side debate conducted on the pages of *The Wall Street Journal* on December 28, 2000. The Journal published two opinion pieces: "Are Markets Efficient?: Yes, Even if They Make Errors" by Burton G. Malkiel, and "No, Arbitrage Is Inherently Risky" by Andrei Shleifer. A key difficulty with that debate was that the two authors did not subscribe to a shared definition of market efficiency. Shleifer focused on the mispricing of particular securities, whereas Malkiel focused on the absence of abnormal profits being earned by those he took to be informed investors.

past price, public, or private) information, that allow systematic profits to be made over and above transaction costs and a proper compensation for risk.

Slightly more formally Jensen (1978: 96) defines: “A market is efficient with respect to information set, Θ_n, if it is impossible to make profits on the basis of information set, Θ_n.” Fama’s (1970) survey of the literature concludes that, on the whole, markets are efficient under all three of the information assumptions. In an update of his market efficiency survey, Fama (1991: 1575) admits that the strong form of market efficiency requires that information and trading costs – the costs of getting prices to reflect the information, be always zero. He agrees with Jensen (1978) that an economically more sensible version of the efficiency hypothesis says that prices reflect information to the point where the marginal benefits of acting on information (the profits to be made) do not exceed the marginal costs.

More recently, Fama (1998) adds an additional argument in favor of market efficiency. He points out that market efficiency seem to be rejected in the literature. However, there seems to be a systematic pattern in the rejections[18]. For instance, some studies find that prices overreact to public information; the rest find that prices underreact to public information. Fama argues that if anomalies split randomly between overreaction and underreaction, they are consistent with market efficiency. The general definition of efficient markets, in principle, accounts for the fact that information may be costly to obtain (or that transactions may be costly). Thus, if private information could have been used to generate abnormal profits this is not in itself evidence against market efficiency: most investors might have chosen rationally in advance not to become informed to avoid the information cost. This is

[18]Fama (1998:284) states that ‘If one accepts their stated conclusions, many of the recent studies on long term returns suggest market ineffciency, specically, long-term underreaction or overreaction to information. It is time, however, to ask whether this literature, viewed as a whole, suggests that efficiency should be discarded. My answer is a solid no, for two reasons. First, an efficient market generates categories of events that individually suggest that prices over-react to information. But in an efficient market, apparent underreaction will be about as frequent as overreaction. If anomalies split randomly between underreaction and overreaction, they are consistent with market efficiency. We shall see that a roughly even split between apparent overreaction and underreaction is a good description of the menu of existing anomalies. Second, and more important, if the long-term return anomalies are so large they cannot be attributed to chance, then an even split between over- and underreaction is a pyrrhic victory for market efficiency. We shall find, however, that the long-term return anomalies are sensitive to methodology. They tend to become marginal or disappear when exposed to di¤erent models for expected (normal) returns or when di¤erent statistical approaches are used to measure them. Thus, even viewed one-by-one, most long-term return anomalies can reasonably be attributed to chance.’

where Grossman and Stiglitz Paradox comes in. Grossman and Stiglitz (1980) note a problem with the definition of market efficiency in this context. If information is costly to obtain and if prices always fully reflect all relevant information, then no investor has an incentive to become informed. One might just observe market prices and effectively glean all relevant information without incurring the cost. But, clearly then nobody will spend the resources to become informed, and prices cannot reflect information that nobody possesses.

Besides the anomalies that are examples of contradiction to the informationally efficient market, there are two important approaches developed to explain why anomalies are taken place in the market. Black (1986) introduce the concept of noise trading which are done by those of irrational investors and Daniel and Titman (1997) argue that the market tend to be efficient through 'adaptive efficiency'.

It is useful to decompose the empirical investigations of market efficiency in more formal demonstrations and well specified models. One of the well-known models of asset prices is the Martingale[19] Model; the model is defined as follows:

$$E\left[P_{n+1} \middle| \Theta_n\right] = P_n \qquad \left| \begin{array}{ll} P_{n,n+1} & \text{Price at time } n \text{ and } n+1 \\ \Theta_n & \text{Information set at time } n \end{array} \right. \qquad \ldots\ldots.(2.7)$$

Let us define information set, Θ_n as comprising all the past prices of given asset:

$$\Theta_n = \{P_n, P_{n-1}, P_{n-2}, P_{n-3}, \ldots\ldots.\}$$

Sometimes Θ_n is assumed to contain additional information whereas the two crucial features of the information set are:

- **a)** It contains only things that are known at date n
- **b)** It contains, at least, all current and past prices of the asset

[19] The word "Martingale" has long had associated with gambling. Martingale refers to the strategy by which the looser can recoup what has been lost. Suppose you lose 1 LIRA in a game, you put 1 more lira to recoup your loss. Suppose you lose your second lira then you put 2 LIRA an so on. In each time you risk what you have lost. However, nowadays, Martingale has very different meaning. In mathematics the term is used to describe a form of stochastic process that is similar to fair game.

Expression (2.7) imply that the asset prices follow a stochastic process and conditioning on the information set at time n, the expected price for time n+1 is equal to price at time n. From (2.7) we may derive a fair game representation as follows:

$$E\left[P_{n+1} - P_n \middle| \Theta_n\right] = 0 \qquad (2.8)$$

Assumptions that lie behind expression (2.7) and (2.8) are (i) investors believe that holding the asset is just playing a fair game and (ii) they have access to information set. The martingale hypothesis that expected rate of return on asset equals to zero can be shown as follows:

$$\frac{E\left[P_{n+1} - P_n \middle| \Theta_n\right]}{P_n} = 0 \qquad (2.9)$$

Expression (2.9) reflects zero-yield expected return from investing in stocks whereas it is usually assumed that there should be a non zero expected return in the following form:

$$E\left[P_{n+1} \middle| \Theta_n\right] = (1+\mu)P_n \qquad \left|\mu \text{ is a constant}\right. \qquad (2.10)$$

Expression (2.10) is somehow more general form relative to the others and differed depending upon how constant μ is defined. If $\mu > 0$, the expression (2.10) is known as submartingale; If $\mu < 0$, it is known as supermartingale. However, typically it is assumed that as least $\mu \geq -1$ for asset with limited liability. If we rearrange (2.10) in the following form:

$$\mu = \frac{E\left[P_{n+1} \middle| \Theta_n\right] - P_n}{P_n} \qquad (2.11)$$

μ can be seen as the expected rate of return from holding the asset, conditional upon the information set Θ_n. It is important to recognize that μ or $r_{n+1} = (P_{n+1} - P_n)/P_n$ is assumed to be random that is r_{n+1} may take different values, each value being assigned a probability[20].

Given that P_n is an element of Θ_n so that P_n is non-random with respect to Θ_n:

$$E[r_{n+1}|\Theta_n] = \frac{E[P_{n+1}|\Theta_n] - P_n}{P_n} = \mu \quad \text{.................................(2.12)}$$

The force of martingale hypothesis is the assumption that μ is constant, in particular that μ does not vary with any elements of Θ_n. This implies that using the fundamental identity in probability (the law of iterated expectation) that the unconditional expectation of r_{n+1} equals to conditional expectation and both equal to μ.

$$E[E[r_{n+1}|\Theta_n]] = E[r_{n+1}] = \mu \quad \text{...(2.13)}$$

The expected rate of return conditional on information available at date n equals to the unconditional expectation of the rate of return. Thus, information available at date n is no value in predicting $r_{n+1}, r_{n+2}, r_{n+3}, \ldots, r_{n+k}$. In more precise form we may rearrange (2.13) as follows:

$$r_{n+1} = \mu + \varepsilon_{n+1} \qquad |E(\varepsilon_{n+1}|\Theta_n) = 0 \quad \text{........................(2.14)}$$

The martingale model places only mild restrictions on the process governing asset price changes such as assuming that the rate of return at point of time provides no information about the rate of return at forthcoming date or uncorrelated with any function of the return at any later point of time. In most cases, deviation from

[20] Bailey (2005) highlights the point that the theory is silent about how the probabilities are assigned to the value Pn and hence r_{n+1}. Bailey's reflection is important because the probabilities might be interpreted as reflecting the 'true' underlying mechanism. However, If this seems puzzling, the probabilities could be interpreted as expressing degrees of belief about asset prices held by investors.

martingale model is following the way of restricting the probability distributions of stochastic[21] processes.

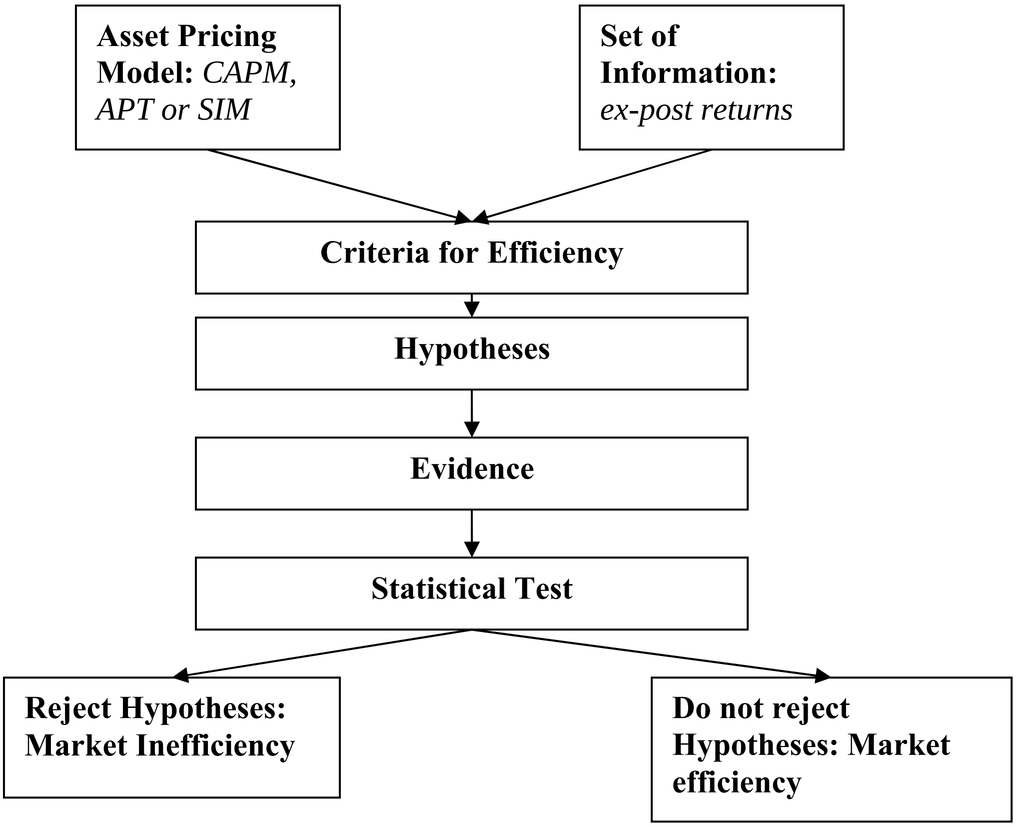
As a result of putting addition restrictions, a set of random walk models are taken place in which they differ among one another according to the assumptions made about ε_n or equivalently about r_n or P_n. Two common restrictions are (i) that the ε_{n+k} are statistically independent of one another for all $k \neq 0$ and (ii) the ε_{n+k} are statistically independent and identically distributed for all $k \neq 0$. It can be shown that (i) implies but it is not implied by, the martingale hypothesis hence (i) is a genuine restriction on the martingale hypothesis. It is obvious that (ii) presents yet another restriction because by itself (i) does not require the identical distribution. Such restrictions play an important role in empirical test on asset prices whereas for some set of data the random walk models[22] might be rejected while the martingale is not.

The most important point established so far is that statements about whether asset markets are efficient or not, invariably rely on the criteria chosen to characterize efficiency. The point is that markets may be judged as efficient according to one set of criteria but inefficient according to another. The criteria for efficiency come from selected asset pricing models in order to measure the return so called 'normal' return and the information set which contains relevant elements assumed to be reflected in asset prices. Fama (1991) clarify this point simply as underlying the importance of joint test in which market efficiency and model accuracy can be tested. Bailey (2005: 67) illustrates this methodology as follows:

[21] The term 'stochastic' comes from the Greek word "stochos" which means a target or bull's eye. If you have ever thrown darts on a dart board with the aim of hitting the bull's eye, how often did you hit the bull's eye? Out of a hundred darts you may be lucky to hit the bull's eye only a few times; at other times the darts will be spread randomly around the bull's eye (Gujarati, 2003:796).

[22] One of the classifications of random walk models can be found in Campbell et al. (1997) with its empirical contents. It is also useful to start with Fama (1970) to adopt martingale models in expected returns equilibrium.

Figure 2.9: A method for appraising asset market efficiency



Source: Bailey (2005:67) Italics are written for representative examples.

Empirical evidence regarding efficient market in general, strong form, semi-strong form and weak form efficiency in particular are mixed and well-documented in literature[23]. As it is mentioned above the common obstacle in testing market efficiency is the joint test of efficiency in the line with its underlying asset pricing model. There is no consensus among academician whether the markets are efficient or not whereas there is a strong view among practitioner that there is always an arbitrage opportunity even if it is limited due to market frictions. As Malkeil (2003) points out well that If any $100 bills are lying around the stock exchanges of the world, they will not be there for long.

[23] The ways empirical methodologies conducted are not covered in depth analysis in the scope of the present thesis whereas their results and classification of the methodologies are partially explained in the third chapter. Interested readers may consult for event study methodology to Mackinlay (1997) and for a standard econometric framework to Campbell et al. (1997).

2.1.4. Arbitrage

The following story from Varian (1987: 55) is an illustration of arbitrage which can be defined as arranging a transaction involving no cash outlay that results in a sure profit.

> An economics professor and a Yankee farmer were waiting for a bus in New Hampshire. To pass the time, the farmer suggested that they play a game. *"What kind of game would you like to play?"* responded the professor. *"Well,"* said the farmer, *"how about this: I'Il ask a question, and if you can't answer my question, you give me a dollar. Then you ask me a question and if I can't answer your question, I'll give you a dollar." "That sounds attractive,"* said the professor, *"but I do have to warn you of something: I'm not just an ordinary person. I'm a professor of economics." "Oh,"* replied the farmer, *"In that case we should change the rules. Tell you what: if you can't answer my question you still give me a dollar, but if I can't answer yours, I only have to give you fifty cents." "Yes,"* said the professor, *"that sounds like a fair arrangement." "Okay,"* said the farmer, *"Here's my question: what goes up the hill on seven legs and down the hill on three legs?"* The professor pondered this riddle for a while and finally replied. *"Gosh, I don't know ... what does go up the hill on seven legs and down the hill on three legs?" "Well,"* said the farmer, *"I don't know either. But if you give me your dollar, I'll give you my fifty cents!"*

The term arbitrage can be interpreted as the class of investment strategies designed to profit from discrepancies among asset prices, while incurring low risks. In more precise sense, a narrower definition is needed for implementing the absence of arbitrage opportunities for asset prices. That is why it is assumed that there is zero risk. Arbitrage principle as a generalization of law of one price required such narrow definition. If the same two assets have two different prices, there is immediate arbitrage opportunity in selling a higher price and buying at lower. However, it may be difficult to exploit it or even if it is exploited, there might be some regularity (market frictions) constraints in the market.

Bailey (2005) asserts that arbitrage plays a central role in financial markets and in theories of asset prices. Arbitrage strategies are – roughly speaking – patterns of trades motivated by the prospect of profiting from discrepancies between the prices of different assets but without bearing any price risk. This quest for profit has an important influence on market prices, for, in a precise sense, observed market prices reflect the *absence of arbitrage opportunities* (sometimes referred to as the *arbitrage* *principle*). If arbitrage opportunities are *not* absent, then investors could design strategies that yield unlimited profits with certainty and with zero initial capital outlays. Their attempts to exploit arbitrage opportunities are predicted to affect market prices (even though the actions of each investor are, in isolation, assumed not to influence prices): the prices of assets in excess demand rise; those in excess supply fall. The ensuing price changes eradicate potential arbitrage profits. In its simplest form, arbitrage implies *the law of one price*: the same asset exchanges for exactly one price in any given location and at any given instant of time. More generally, arbitrage *links* the prices of different assets. Arbitrage reasoning lies at the heart of several important contributions to financial theory. In particular, both the famous Black–Merton–Scholes theory of options prices and the Modigliani–Miller theorems in corporate finance are founded on the absence of arbitrage opportunities. The arbitrage principle also plays a role in asset price determination when combined with other assumptions. For example, arbitrage pricing theory is a consequence of marrying the arbitrage principle with factor models of asset prices.

To clarify how arbitrage is playing important role for asset prices, it will be useful to give relevant terminology and its formal demonstrations[24]:

i) The portfolio requires zero initial outlay: $P_1X_1 + P_2X_2 + ... + P_nX_n = \sum P_iX_i = 0$ with not all $X_i = 0$ for i = 1,2,..,n.

ii) Risk free: $V_{S1}X_1 + V_{S2}X_2 + ... + V_{Sn}X_n = \sum V_{Si}X_i \geq 0$ for every state S_i = 1,2,..,n.

Where X_i denotes the quantity of asset i, P_i is the price of asset i, and V_{Si} is the pay off of asset i in state S.

[24] It is not intended to give a rigorus representations for the concept in details instead it is aimed to give a good descriptions of one of the key concepts, arbitrage principle, in the line with linear pricing representation. This part mainly adopted from Bailey (2005:chapter 7). However, more complete treatment can be found in Duffie (2001).

Let X donated the portfolio as whole that is the vector with elements of $X_{1,2,\ldots\ldots,n}$:

$$V(X,S) \equiv V_{S1}X_1 + V_{S2}X_2 + \ldots + V_{Sn}X_n = \sum V_{Si}X_i$$

Hence, if X is an arbitrage portfolio, it involves zero initial outlay and $V(X,S) \geq 0$ for every state S. Arbitrage opportunity is defined as a set of asset prices such that an arbitrage portfolio exists and $V(X,S) > 0$ for at least one S. In other words, there is a strictly positive payoff occurs in one or more states and a loss in no state. The amount of payoff from an arbitrage opportunity is defined as arbitrage portfolio. Absence of arbitrage opportunity is hold under the following conditions:

i) For every arbitrage portfolio, $V(X,S) = 0$ in every states.

ii) No arbitrage portfolio exists. That is for every portfolio requiring initial outlay, $V(X,S) \geq 0$ for states and $V(X,S) < 0$ for some states.

Arbitrage principle is known as lucking of arbitrage opportunities. A set of asset prices and allocation of asset holdings across investors such that the demand to hold assets is no greater than the supply constitute the market equilibrium. The role of the arbitrage principle in the context of asset prices can be demonstrated in three propositions those provide different sets of necessary and sufficient conditions for the absence of arbitrage opportunities.

Proposition*[25] *I: *The arbitrage principle holds in frictionless asset markets if, and only if, there exists an investor who prefers more wealth to less and for whom an optimal portfolio can be constructed.*

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25 Bailey (2005:170) give an intiutive explanation 'To grasp why proposition I holds, suppose that the arbitrage principle fails in the sense that there exists a portfolio that (a) requires zero initial outlay and (b) yields a non-negative payoff in every state, with a positive payoff in at least one state. Now identify an investor who prefers more wealth to less in each state. The investor must be willing to hold the portfolio in question: it costs nothing, is risk-free and yields a positive payoff in at least one state. But – here is the crucial point – the investor would seek to magnify this portfolio (keeping the asset proportions the same) to an unbounded extent (because more wealth is preferred to less). Formally, the investor has no optimal portfolio. (Infinite wealth, a fantasy that dreams are made on, is just that: a fantasy.) Hence, by a contradiction, the existence of an investor who prefers more wealth to less, and for whom an optimal portfolio can be found, must imply that the arbitrage principle holds true: arbitrage opportunities are absent. The converse namely that the arbitrage principle implies the existence of an investor satisfying the stated conditions is also true.'

The arbitrage principle has two further implications that, although rather abstract, are useful in applications. One of these is the existence of *state prices*. So far, prices have been associated with assets, but it is also possible to make sense of prices that are associated with individual states of the world. Once the existence of state prices has been established, the *risk-neutral valuation relationship* provides a convenient way of expressing any asset price in the absence of arbitrage opportunities.

A state price, q_S, is defined as the price of an asset that has a payoff of one unit of wealth in state S and zero in every other state. In most circumstances these state prices (if they exist) are implicit, in the sense that they are not the prices of any actual assets but, instead, can be inferred from the payoffs of assets that are traded. It is conceivable, of course, that securities that have a unit payoff in one state and zero in all others are observed in practice, but the importance of state prices is not dependent on whether they are, or are not.

Proposition[26] II: *The arbitrage principle is equivalent to the existence of positive state prices,* $q_1, q_2, ..., q_n$ *such that*

$$P_i = q_1 V_{S1} + q_2 V_{S2} + ... + q_n V_{Sn} \qquad \text{i=1,2,…,n}$$

This result is often called the *linear pricing rule*. In words: in the absence of arbitrage opportunities the price of each asset must be equal to the sum of its payoff in each state multiplied by a state price corresponding to that state. The linear pricing rule is equivalence: if arbitrage opportunities are absent, state prices exist; if state prices exist, arbitrage opportunities are absent. Therefore, if the arbitrage principle holds, it implies that every asset price can be written as a weighted average of its payoffs, the weights being the state prices. An immediate implication of the linear pricing rule is the *risk-neutral valuation relationship*[27] stated as follows:

[26] Bailey (2005:174) asserts that Proposition II makes no claim about the *uniqueness* of state prices. If they exist at all, then there may be many sets of them. State prices are unique if asset markets are complete if there sufficiently many assets exist so that, for every state, it is possible to construct an Arrow security – an asset with a unit payoff in the state in question and a zero payoff in all other states. Construction of an Arrow security involves choosing a portfolio of assets in such a way as to yield the required payoff.

[27] Also known as the 'existence of martingale probabilities', or the 'existence of an equivalent martingale measure' or the 'martingale valuation relationship'.

Proposition III: *The linear pricing rule is equivalent to the existence of :*

i) A risk free rate of return, r_f, with associated discount factor, $\lambda = 1/(1+r_f)$ and

ii) Probabilities $\psi_1, \psi_2, \ldots, \psi_n$ one for each state, such that

$$P_i = \lambda E[V_i] \qquad i=1,2,\ldots,n$$

Where V_i denotes the list of payoffs, one for each state, for asset i, and a random variable. The expectation of payoffs is weighted in a given state with its probability. This is shown as follows:

$$E[V_i] = \psi_1 V_1 + \psi_2 V_2 + \ldots + \psi_n V_n$$

The probabilities mentioned in above expression are purely artificial. It is necessary for the proposition and not need to compensate any investors' beliefs.

2.1.5. Risk and Uncertainty

"If you cannot measure it....your knowledge is of a meager and unsatisfactory kind." This is a quotation by Lord Kelvin chiseled in stone on the social science building at Chicago. It is true that measurement is inevitable feature of contemporary social sciences but how accurate we can measure. Knight sarcastically interpreted the quotation above to mean *"Oh, well, If you cannot measure, measure anyhow."* Knight[28] (1921: 209) was the first to distinguish between risk and uncertainty:

> Uncertainty must be taken in a sense radically distinct from the familiar notion of risk, from which it has never been properly separated. [...] It will appear that a measurable uncertainty or risk proper [...] is so far different from an immeasurable one that is not in effect an uncertainty at all.

[28] Frank Knight (1885–1962), in his classic *Risk, Uncertainty and Profit* (1921:226) reasoned why risk and uncertainty should be differed :"[Any given] instance....is so entirely unique that there are no others or not a sufficient number to make it possible to tabulate enough like it to form a basis for any inference of value about any real probability in the case we are interested in." (cited in Bernstein (1996:219)).

He applies the notion of risk to those unknown events for which 'objective probabilities' can be assigned. Uncertainty, on the other hand, Knight applies to events for which such probabilities cannot be assigned, or for which it would not make sense to assign them. Keynes takes a similar view (1937: 213–14):

> By 'uncertain' knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty; [...] The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention. [...] About these matters, there is no scientific basis on which to form any calculable probability whatever. We simply do not know.

It should be figured out that both Knight and Keynes were objectivists[29]. They emphasized that risk and uncertainty are different concepts whereas they were not successfully giving an operational definition of risk. Knight (1921: 226) prefers his own terminology to clarify what is meant by risk and uncertainty as follows:

> To preserve the distinction...between the measurable uncertainty and an immeasurable one we may use the term 'risk' to designate the former and the term 'uncertainty' for the latter.

Despite the fact that this distinction continues to be a debate among economists, it is clear and common manner to use risk and uncertainty interchangeably as one term due to its usefulness in finance. Even Markowitz did not define the term risk explicitly but suggested a metric how to measure it in his groundbreaking paper 'portfolio selection' in 1952. Markowitz (1952: 77) proposes the following rule:

> That the investor does (or should) consider expected return a desirable thing variance of return an undesirable thing.

So far the distinction between uncertainty and risk was emphasized. This is the part in which how to model uncertainty and to explain the existed attempts in literature. It

[29] To comprehend risk we should look at two streams flowing through the 20th century. One is subjective probability. The other one is operationalism. Holton (2004) reviewed the literature and concluded that according to objective interpretations, probabilities are real. We may discover them by logic or estimate them through statistical analysis. According to subjective interpretations that probabilities are human beliefs. They are not intrinsic to nature. Individuals specify them to characterize their own uncertainty.

is clear and universally acknowledged that uncertainty is pervasive in economic decision making process as it is the case in everyday life. In simplified term, the way neoclassical finance follows in explaining economic decision making process date back to von Neumann and Morgenstern's Expected Utility Hypothesis (EUH)[30] which is the first formal incorporation of risk and uncertainty into economic theory in 1944. In addition with EUH[31], as a more general case, State-preference approach is simply discussed and Mean Variance approach as a more special case is introduced. These models for one reason or another have been under attack by behavioral counterparts for the reason that these models are not explaining what is really going on in real life. They are normative theories meaning that they do show how an investor act rather they imply how should an investor act.

Indeed, financial economists typically model investment as a problem of constrained optimization under uncertainty. There are three elements to such a problem: optimization, uncertainty and constraints. Investors try to optimize some objective function in a situation characterized by uncertainty and subject to the restrictions imposed on them. In brief, investment is seen by financial economists as an attempt by investors to invest as good as possible, given their expectations, objectives and restrictions. To implement this general approach three fundamental concepts are used: a utility function to describe the investor's objectives, a probability distribution to describe the investor's subjective expectations about the possible future returns and a portfolio possibility set to describe the possibilities and restrictions faced by investor.

Following Bailey (2005: 85), we will simply mention State-preference Approach in the line with more special cases, Expected Utility Hypothesis and Mean Variance

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[30] The book of van Neumann and Morgenstern, Theory of Games and Economic Behavior, was published in 1953 in which Expected Utility function is described. However, it is out of scope of the thesis to give formal proof of this utility function. The behavioral counterparts of EUH are not cover in the present thesis.

[31]Bailey (2005:83) gave the simple reason why we should infer these three approaches: "The expected utility hypothesis can be interpreted as a special case of the state preference model (though such an interpretation is not mandatory). Similarly, the mean-variance model can be interpreted as a special case of the EUH. Thus, the three approaches form a hierarchy, with state-preference being the most general and mean-variance the least. The reason why all three deserve consideration is simple: more general models are applicable to a broader range of phenomena but make fewer definite predictions; more special models apply more narrowly but make more definite (and, hence, testable) predictions."

Model. However, Mean Variance Model will be discussed in details in the following section.

State-preference approach

Framework comprises three basic ingredients:

- *States of the world*, denoted by the set $S = \{s_1, s_2, ..., s_n\}$ where each s_i is interpreted as a label for the description of some contingency that could occur. It is assumed that exactly one state will occur, though decision makers do not know, at the outset, which one.

- *Actions*, which describe all relevant aspects of the decisions that are made prior to the state of the world being revealed.

- *Consequences*, which express the outcomes of an action corresponding to each state of the world.

More generally, the consequence in any one state (given the decision maker's action) could be represented as a 'bundle of goods' (a vector), the elements of which depend on the realized state and the individual's action.

Thus, if c denotes a consequence and a denotes an action, then the three components of the theory are related by a function of s_i and a such that

$$c = f(s_i, a)$$

Formally, the function $f(.,.)$ maps states and actions into the space of consequences. In the state-preference model, each individual is assumed to possess preferences defined over consequences, or (with little loss of generality) the individual has a utility function the value of which serves to rank all the possible consequences.

Formally, the utility function can be expressed as

$$U = U(f(s_1, a), f(s_2, a), ..., f(s_n, a))$$

where the function $U(.,.)$ is allowed to differ across individuals.

To make the portfolio decision more definite, denote terminal wealth as W_k , where the subscript i denotes the state. The investor's utility function is defined over the consequences, $W_i, i = 1,2,...,n$

$$\text{Ш} = U(W_1, W_2, ..., W_n)$$

This follows:

$$W_i = f(s_i, a)$$

The wealth constraint states that the investor's outlay on assets equals initial wealth:

$$P_1X_1 + P_2X_2 + ... + P_nX_n = A$$

Where A is initial wealth and X_i denotes the number of units of each asset in the portfolio, so that P_iX_i is the amount of wealth devoted to asset $i = 1,2,...,n$. The portfolio is linked to terminal wealth via the payoffs of each asset in each state of the world:

$$W_s = V_{s1}X_1 + V_{s2}X_2 + ... + V_{sn}X_n \qquad s = 1,2,...,k$$

which is the sum of the payoff of each asset multiplied by the chosen amount of the asset.

As a result each investor chooses X_i to maximize

$$\text{Ш} = U(W_1, W_2, ..., W_n)$$

Subject to

$$P_1X_1 + P_2X_2 + ... + P_nX_n = A$$

Where

$$W_s = V_{s1}X_1 + V_{s2}X_2 + ... + V_{sn}X_n \qquad s = 1,2,...,k$$

The result is a portfolio decision in which the amount of each asset held depends on asset prices, initial wealth and preferences.

The state-preference framework is useful as an abstract tool for understanding the fundamentals of decision making under uncertainty, but it is more special than it might at first appear. For example, the set of states, S, is given exogenously; it cannot be affected by the actions of any of the investors. Also, it might seem implausible to assume that investors are capable of ordering *every* possible consequence of their actions across what may be a vast number of states. Consequently, the state-preference model is not as widely applicable as it might at first seem.

Expected Utility Hypothesis

Assumptions:

- Irrelevance of common consequences: The first assumption is that the decision maker orders the actions independently of the common consequences for states not in the event.

- Preferences are independent of beliefs: The second assumption asserts that preferences over consequences for the given state are independent of the state in which they occur. Less formally, the decision maker cares only about the consequence, not the label of, or index of (say, a subscript 'k'), the state in which it is received.

- Beliefs are independent of consequences: The third assumption asserts (again, somewhat imprecisely) that the decision maker's degree of belief about whether a state will occur is independent of the consequences in the state.

Together with the assumption of a complete ordering of actions and some purely technical assumptions, the three conditions imply that: (a) the decision maker acts as if a probability (a real number between zero and unity) is assigned to each state; (b) there exists a function – the von Neumann–Morgenstern utility function – that is dependent only on the outcomes; and (c) the decision maker orders the actions according to the expected value of the von Neumann–Morgenstern utility function.

Formally, using the notation of the state-preference approach, the EUH implies that

$$
\begin{aligned}
\text{П} &= U\left(W_{1,} W_2, \ldots, W_n\right) \\
&= \psi_1 U\left(W_1\right) + \psi_2 U\left(W_2\right) + \ldots . + \psi_n U\left(W_n\right)
\end{aligned}
$$

where ψ_i is the probability that the individual investor assigns to state s_i. The function $U(.)$ is the von Neumann–Morgenstern utility function. Notice that the $U(.)$ is the same for all states, though the value of its argument, W_i, generally differs across states. Both the probabilities and the von Neumann–Morgenstern utility function are allowed to differ across investors.

It is assumed, however, that $U'(W) > 0$ for all relevant levels of W – i.e. investors prefer more wealth to less.

It should be noted that the expected value of the von Neumann-Morgenstern utility function is known as expected utility hypothesis. In more general form EUH can be stated as follows:

$$E[U(W)] = \psi_1 U\left(W_1\right) + \psi_2 U\left(W_2\right) + \ldots + \psi_n U\left(W_n\right)$$

Chronology of Risk[32]:

- 1954 French Mathematicians Blaise Pascal and Pierre de Fermat analyze game of chance, providing for the first time a formal and mathematical basis for the theory of probability.

- 1662 English merchant John Graunt publishes tables of births and deaths in London using innovative sampling methods. He estimates the population of London by technique of statistical inference.

- 1687 Edvard Lloyd opens a coffee house in Tower Street, In 1696 he launches Lloyd's List, giving information on aspects of shipping from a network of European correspondents.

- 1696 English mathematician and astronomer Edmund Halley shows how life tables can be used to price life insurance at different ages.

- 1713 Swiss mathematician Jacob Bernoulli's 'Law of Large Numbers' is published post humously, showing how probabilities and statistical inference can be identified from limited information.

- 1733 French mathematician Abraham de Moivre proposes the normal distribution, the pattern in which a series of variables distribute themselves around an average, from which he also drives the concept of standard deviation.

- 1738 Jacob Bernoulli's nephew Daniel introduces the idea of utility: decisions relating to risk involve not only calculations of probability but also the value of the consequences to the risk taker.

- 1885 English scientist Francis Galton discovers regression to the mean, the tendency of extremes to the return to normal or average.

- 1944 In Theory of Games and Economic Behavior, US academics John von Neumann and Oscar Morgenstern apply the theory of games of strategy (in contrast to games of chance) to decision making in business and investing.

- 1952 US economist Harry Markowitz demonstrates mathematically that risk and expected return are directly related but that investors can reduce the variance of return on their investments by diversification without loss of expected return.

- 1970 US academic Fisher Black and Myron Scholes publish a mathematical model for calculating the value of an option.

[32] Peter L. Bernstein, 'The enlightining Strugle Against Uncertainty", Financial Times, 25 April 2000. (cited in Levy and Post (2005).

2.6 MARKOWITZ MEAN-VARIANCE ALGORITHM

Harry Markowitz, when he was a graduate student in Chicago University, developed a linear programming framework for stock selection. The model that was developed is known as Mean-Variance Algorithm (hereafter MVA). It was the first attempt to show a highly quantitative approach in investment. Markowitz (1952; 1959) shows that at a given level of risk how to maximize expected return and at given level of expected return how to minimize risk. Modeling investment under uncertainty is a typical problem of constraint optimization. The Expected Utility Hypothesis shows the theoretical relationship between the elements of such issue. In case of stock selection, the portfolio possibility set, the probability distribution of asset returns implying the investors' subjective expectations about future and the investors' utility function implying the investors' objectives are determined. In general, Expected Utility Hypothesis is not applicable in practice due to the imprecise of the utility function. The MVA is one of the popular approximations to the expected utility framework.

In the MVA, investors care only about the mean and variance of their portfolio. The expected utility of mean variance investors can be written as a function of mean and variance only. It is assumed that investors prefer a high return and low risk, expected utility is assumed to be an increasing function of the mean and a decreasing function of variance. At first glance, two basic features of this justification are emerged:

- The return distribution can be approximated by a normal distribution[33]
- The utility function can be approximated by a quadratic function

Even though we do not know the precise shape of indifference curves, the curve on which the investors are indifferent to be better off, MVA gives some general properties: all investors prefer more return to less return and they are risk averse. In more compact form:

[33] Normal distribution is one of the form of eleptical distribution meaning that the distribution which can be expressed by their mean and variance alone.

$$E(R_X) \geq E(R_Y) \text{ and } \sigma_X^2 < \sigma_Y^2 \quad \text{OR} \quad E(R_X) > E(R_Y) \text{ and } \sigma_X^2 \leq \sigma_Y^2 \quad ...(2.15)$$

The expression (2.15) asserts that if investment X dominates investment Y, then all risk averse investors will prefer X to Y. This is called mean variance efficient investment. Calculating mean variance efficient frontier is equivalent to solve the following optimization problem: find the portfolio weights $w_1, w_2, ..., w_n$ that minimize the portfolio variance:

$$\text{var}_P = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \operatorname{cov}(r_i, r_j) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2.16)$$

Subject to the constraints

$$E(R_P) = \sum_{i=1}^{n} w_i E(r_i) = \mu \qquad \text{(a given expected return)}$$

And

$$\sum_{i=1}^{n} w_i = 1 \qquad \text{(fully invested portfolio)}$$

In more compact form[34], we may illustrate how to solve such problem even as follows: Suppose first that an investor has to choose a portfolio formed of N risky assets. The investor's choice is embodied in an N-vector $w = \{w_i\}$ of weights where each weight i represents the percentage of the i-th asset held in the portfolio. Suppose assets' returns are jointly normally distributed with an N-vector of expected returns $\mu = \{\mu_i\}$ and an N×N variance-covariance matrix $\sum = \{\sigma_{ij}\}$. Under these assumptions, the return of a portfolio X with weights $w_X = \{w_i\}_X$ is a random variable, which is the sum of normally distributed random variables. Therefore, it is a normally distributed random variable with the following mean and variance:

$$\mu_X = w_X{}' \mu$$
$$\sigma_X^2 = w_X{}' \Sigma w_X$$

[34] Focardi and Fabozzi (2004:476) contributed a guide for take tour with mathematics in finance. Interesting readers may consult to their book to study quantitative finance. We slightly modified matrix notation representation of MVA from their book.

If there are two assets with weights $w_X{}' = \{w_1, w_2\}$ then the portfolio expected return is

$$\mu_X = w_{X1}\mu_1 + w_{X2}\mu_2$$

And its variance is

$$\sigma_X^2 = \begin{bmatrix} w_{X1} & w_{X2} \end{bmatrix} \begin{bmatrix} \sigma_{11} & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{bmatrix} \begin{bmatrix} w_{X1} \\ w_{X2} \end{bmatrix}$$
$$= w_{X1}^2\sigma_1^2 + w_{X2}^2\sigma_2^2 + 2w_{X1}w_{X2}\sigma_{12}$$

By choosing the portfolio's weights, an investor chooses among the available mean-variance pairs. Following Markowitz, the investor's problem is a constrained minimization problem in the sense that the investor must seek

$$\min(\sigma_X^2) = \min(w_X{}' \Sigma w_X)$$

$$\mu_X = w_X{}' \mu$$

$$w_X{}' \iota = 1, \qquad \iota = [1,1,...,1]$$

This is a constrained optimization problem which can be solved with the method of Lagrange multipliers. In this case, the Lagrangian is

$$L = w_X{}' \Sigma w_X + \lambda_1(\mu_X - w_X{}' \mu) + \lambda_2(1 - w_X{}' \iota) \text{...................} (2.17)$$

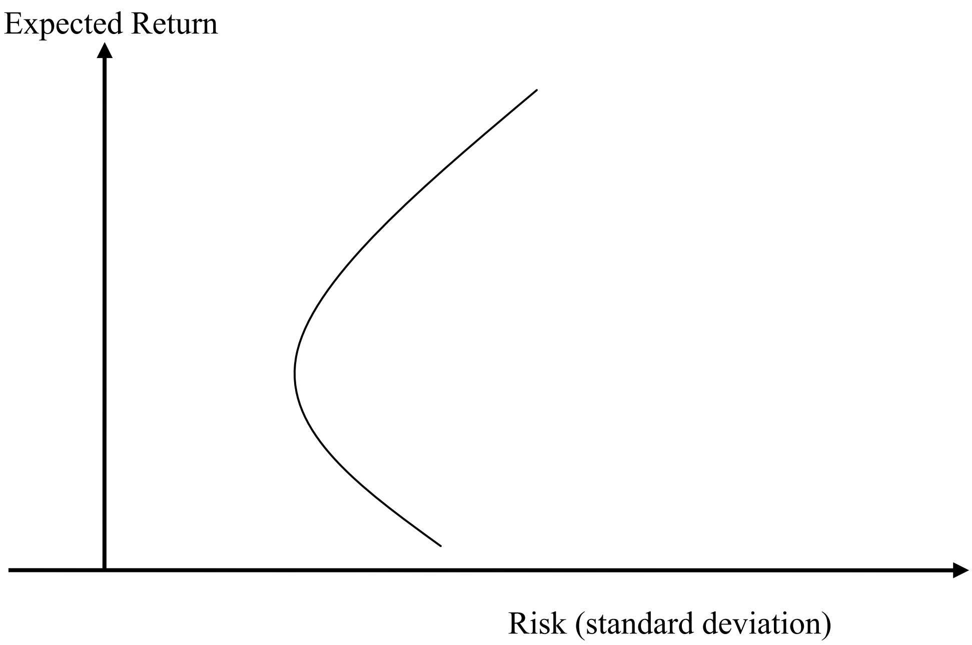
The original optimization problem becomes the problem of unconstrained maximization of the Lagrangian. To solve this problem, it is sufficient to set to zero the partial derivatives of the Lagrangian. Solving yields

$$w_X = A + B\mu_X \text{ ....} (2.18)$$

where **A** and **B** are two vectors which are functions of μ and Σ .Consider the mean-variance plane, that is, a two-dimensional Cartesian plane whose coordinates are mean and variance. In this plane, each portfolio is represented by a point.

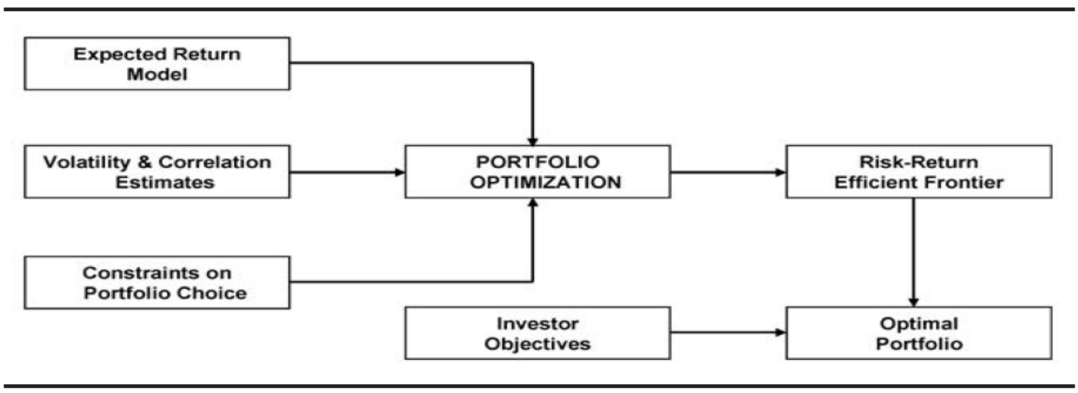
Consider now the set of all efficient portfolios with all possible efficient mean-variance pairs. This set is what we referred to the efficient frontier.

Figure 2.10: A representative Mean Variance Efficient Frontier



Modern Portfolio Theory (MPT) is overall perspective of MVA in addition with a broader set of assumptions. Following figure describe a representative path for this purpose.

Figure 2.11: MPT Investment Process



Source: Exhibit 2 in Frank J. Fabozzi, Francis Gupta, and Harry M. Markowitz (2002: 8).

2.7 SHARPE-LINTNER CAPM

The MVA generally applies to any portfolio of risky assets. This is, however, a normative approach which provides a prescription for constructing an optimal portfolio of risky assets. Constructing an optimal portfolio of stocks, variances, covariances and expected returns of the stocks should be known in advance so that we can find the minimum risk at a given level of expected return. A collection of optimum portfolios constitute the efficient frontier whereas we have not built an equilibrium price for a singular stock in which investors behave optimally to maximize their expectations. First step to reach such equilibrium starts with an introduction of risk free rate so called separation property[35]. Depending upon separation property, investing in stocks can be seen as two independent tasks. On the one hand, there is a selection of risky asset in which we may use MVA and on the other hand, there is a certain rate that can be earned in market without bearing any risk so called risk free rate. The efficient combination of these tasks will emerge Capital Market Line. Sharpe (1964) and Lintner (1965) independently figure out that a market price for individual security can be derived. This derivation is come to be known as Capital Asset Pricing Model[36] (hereafter CAPM).

CAPM is the most popular model of the determination of expected returns on securities and other financial assets. It is considered to be an "asset pricing" model since, for a given exogenous expected payoff, the asset price can be backed out once the expected return is determined. Additionally, the expected return derived within the CAPM or any other asset pricing model may be used to discount future cash flows. These discounted cash flows then are added to determine an asset's price. So, even though the focus is on expected return, we will continue to refer to the CAPM as an asset pricing model. Capital Market Line in addition with CAPM will be

[35] James Tobin (1958) was the first to introduce the seperation property.

[36] Jan Mossin (1966) shows Sharpe and Lintner derivation in more concrete framework however Treynor can be seen as originator of such way of perspective for investing. In his unpublished manuscript, the similar version of CAPM was derived and this is also cited by Sharpe (1964) in his graoudbreaking paper.

derived[37] in somehow similar manner as it is done by Copeland and Weston (1988: 194).

Assumptions:

- Investors are risk averse individuals who maximize the expected utility of their end of period wealth.
    - Technically, this is assumption imply quadratic and non-station utility. In case of non-quadratic preferences, asset returns should be assumed as multi-variate elliptically distributed. We will assume in following proof, that asset return is normally distributed.
- Investors have homogeneous expectations (beliefs) about asset returns.
    - All investors perceive identical opportunity sets implying that everyone have the same information at the same time.
- Asset returns are distributed by the normal distribution[38].
- There exists a risk free rate and investors may borrow or lend unlimited amounts of this asset at a constant rate.
- The model is one period model.
- There is definite number of assets and their quantities are fixed with one period world.
- All assets are perfectly divisible and priced in a perfectly competitive market.
- Asset markets are frictionless and information is costless and simultaneously available to all investors.
    - Borrowing rate is equal to lending rate.
- There are no market imperfections such as taxes, regulations or restrictions on short selling.

Based on these assumptions we will drive CAPM which is also known as Sharpe-Lintner CAPM (hereafter S-L CAPM). Drooping one of the above assumptions leads a different model whereas we will still keep defining any of such expansions as CAPM based model.

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[37] The reason we follow Copeland and Weston (1988:194) is that they explicitly show how to derive CAPM based on MVA. See also footnotes of Sharpe (1964). For introductory treatment, consult to Bodie et.al.(2008:chapter 9), Levy and Post (2005:chapter 10), Bailey (2005: chapter 6); for more advance treatment consult Cochrane (2005:chapter 9), Jones (2008:chapter 4), Campbell et.al.(1997:chapter 5).

[38] The assumption of Normality of returns can be dropped in more general S-L CAPM derivation.

The derivation of S-L CAPM starts by assuming that all assets are stochastic and follow a normal distribution. This distribution is described completely by its two parameters: mean value[39] (μ) and variance[40] (σ^2). In hypothetical world of S-L CAPM all that investor's bother is the value of the normal distribution. In the real world asset return are not normally distributed and investors do find other measure of location and dispersion relevant. However, the assumption may be seen as a reasonable approximation and it is needed in order to simplify matters.

As a result the mean and the variance of returns of an asset X is defined as:

$$\mu_X = E[R_X] = \sum_{i=1}^{n} P_i R_{Xi} \quad \text{.........(2.19)}$$

$$\sigma^2 = VAR[R_{Xi}] = COV[R_{Xi}, R_{Xi}] = E\left[(R_{Xi} - E[R_X])^2\right]$$
$$= \sum_{i=1}^{n} P_i (R_{Xi} - E[R_X])^2 \quad \text{.........(2.20)}$$

The covariance, $COV[R_{Xi}, R_{Yi}]$, and the correlation coefficient, $r_{R_X R_Y}$, between two assets' returns X and Y are:

$$COV[R_X, R_Y] = E[(R_{Xi} - E[R_X])(R_{Yi} - E[R_Y])]$$
$$= \sum P_i (R_{Xi} - E[R_X])(R_{Yi} - E[R_Y]) \quad \text{.........(2.21)}$$

$$r_{R_X R_Y} = \frac{COV[R_X, R_Y]}{\sqrt{VAR[R_X]VAR[R_Y]}} = \frac{COV[R_X, R_Y]}{\sigma_{R_X} \sigma_{R_Y}} \quad \text{.........(2.22)}$$

Where P_i is the probability of random event X_i, and n is the total number of events. The square root of variance defined as the standard deviation which is a more

39 The mean value is a measure of location among many such as median and mode.

40 Variance is a measure of dispersion among many such as range, semiinterquartle, semivariance, mean absolute deviation.

relevant measure than variance. Consider a portfolio of two risky assets, X and Y with w% in asset X and (1-w)% in asset Y. They are both normally distributed. The return on this portfolio[41] is:

$$\mu_P = E[P_R] = E[wR_{Xi} + (1-w)R_{Yi}] = E[wR_{Xi}] + E[(1-w)R_{Yi}]$$

$$= wE[R_X] + (1-w)E[R_Y] \quad \text{...(2.23)}$$

And the variance on this portfolio is:

$$\sigma_P^2 = VAR[R_P] = E\left[\left(R_P - E[R_P]\right)^2\right] = E\left[\left(\{wR_{Xi} + (1-w)R_{Yi}\} - \{E[wR_{Xi} + (1-w)R_{Yi}]\}\right)^2\right]$$

$$= E\left[\left(\{wR_{Xi} + (1-w)R_{Yi}\} - \{wE[R_X] + (1-w)E[R_Y]\}\right)^2\right]$$

$$= E\left[\left(\{wR_{Xi} - wE[R_X]\} + \{(1-w)R_{Yi} - (1-w)E[R_Y]\}\right)^2\right]$$

$$= E\left[\left(w\{R_{Xi} - E[R_X]\} + (1-w)\{R_{Yi} - E[R_Y]\}\right)^2\right]$$

$$= E\left[w^2\{R_{Xi} - E[R_X]\}^2 + (1-w)^2\{R_{Yi} - E[R_Y]\}^2 + 2w(1-w)\{R_{Xi} - E[R_X]\}\{R_{Yi} - E[R_Y]\}\right]$$

$$= w^2E\left[\{R_{Xi} - E[R_X]\}^2\right] + (1-w)^2E\left[\{R_{Yi} - E[R_Y]\}^2\right] + 2w(1-w)E\left[\{R_{Xi} - E[R_X]\}\{R_{Yi} - E[R_Y]\}\right]$$

$$= w^2VAR[R_{Xi}] + (1-w)^2VAR[R_{Yi}] + 2w(1-w)COV[R_{Xi}, R_{Yi}]$$

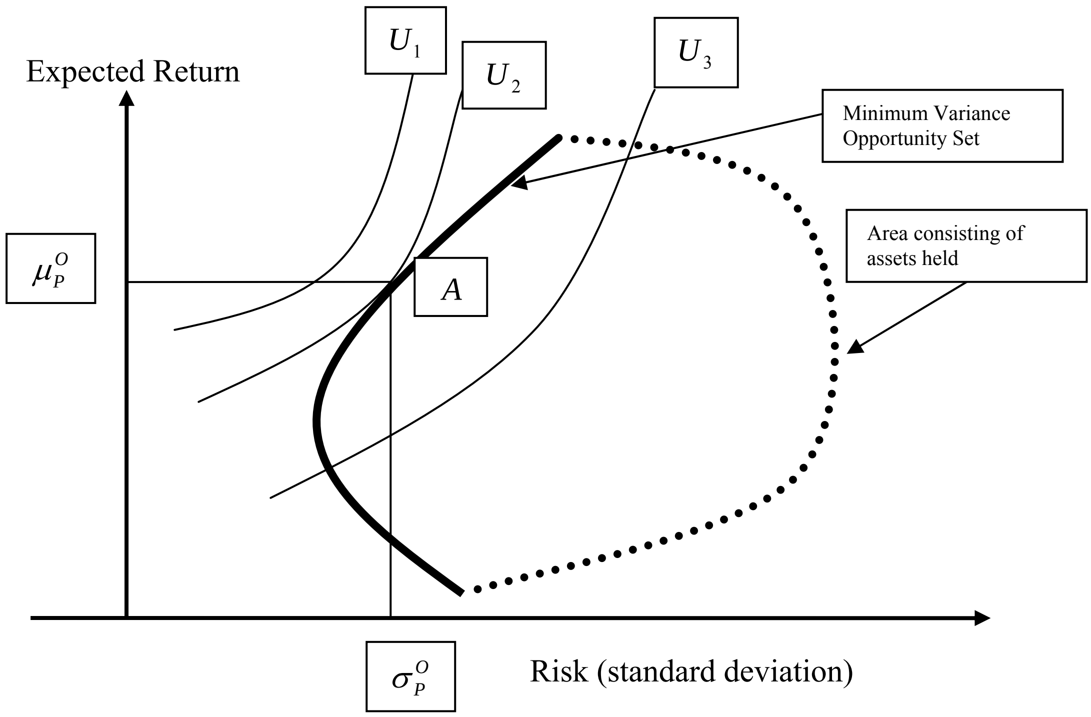
$$= w^2VAR[R_{Xi}] + (1-w)^2VAR[R_{Yi}] + 2w(1-w)r_{R_{Xi}R_{Yi}}\sigma_{R_{Xi}}\sigma_{R_{Yi}} \quad \text{..............................(2.24)}$$

[41] Property 1: $E[X + c] = E[X] + c$; property 2: $E[cX] = cE[X]$;
property 3: $VAR[X + c] = VAR[X]$; property 4: $VAR[cX] = c^2VAR[X]$
where c is a constant and X is a random variable.

Expressions (2.19) – (2.24) show how expected return and portfolio variance are calculated. It is obviously seen that variance of portfolio is not weight average of assets held as it is the case of calculating expected returns. This is where diversification takes place. Correlation coefficient, however, plays important role here. It is true, in general, that $VAR[R_P] < wVAR[R_{Xi}] + (1-w)VAR[R_{Yi}]$ if $-1 < r_{R_{Xi}R_{Yi}} < 1$. In order words, the variance of portfolio is less than the simple average of variance of the assets held in the portfolio if these assets are not perfectly correlated.

Clarifying argument, suppose that correlation coefficient is zero and let variance of returns of X be equal to variance of returns of Y in addition with setting equally weighted portfolio which becomes $VAR[P_P] < VAR[R_{Xi}]$. To see perfect hedge, set $r_{R_{Xi}R_{Yi}} = 0$ then expression $VAR[R_P] < wVAR[R_{Xi}] + (1-w)VAR[R_{Yi}]$ becomes $\{0 = VAR[R_P]\}$. The diversification property implies that the minimum variance opportunity set will be convex, and this is necessary condition for the existence of unique and efficient portfolio equilibrium.

Figure 2.12: Optimum portfolio choice among risky assets for risk averse investors



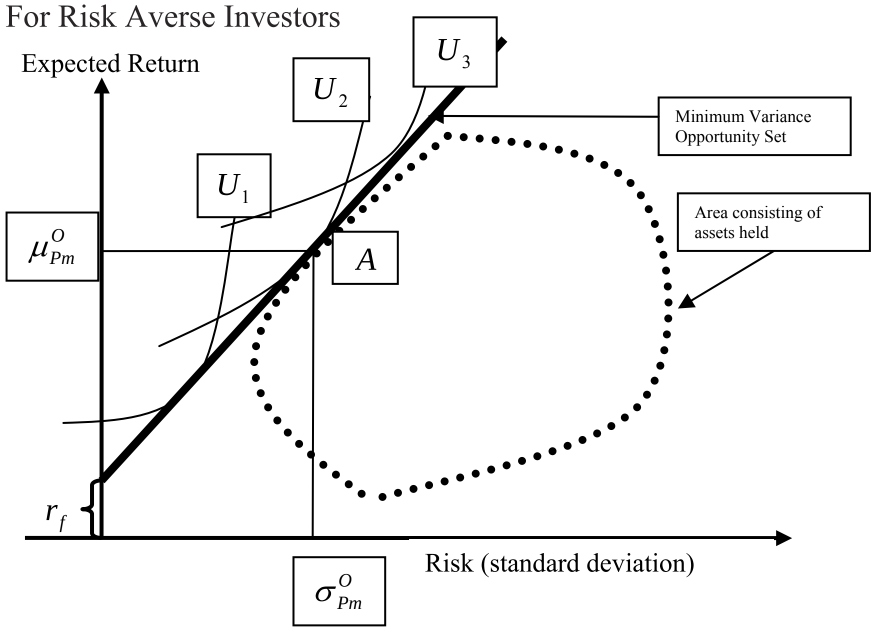
The minimum variance opportunity set is the locus of mean and variance combinations offered by portfolios of risky assets that yield the minimum variance for a given return. Figure 6 illustrates the interaction among utility function and minimum variance frontier.

The next assumption is that investors are risk averse and maximize the expected utility. They perceive variance as a bad and mean as a good. This is also illustrated in figure 6 where three risk averse indifference curves are drawn. Now, the first proposition can be made:

Proposition I: *An individual investor will maximize expected utility of his end of period wealth where his subjective marginal rate of substitution between risk and return represented by his indifference curves is equal to the objective marginal rate of transformation offered by the minimum variance opportunity set:* $MRS(\sigma_P \mu_P) = MRT(\sigma_P \mu_P)$

Let us assume that there exists a risk free rate in addition with many risk asset and investors may borrow or lend unlimited amounts of this asset at risk free rate, r_f, Furthermore, capital markets are assumed to be frictionless. In this case the minimum variance opportunity set which usually defined as Capital Market Line (hereafter CML) will be linear.

Figure 2.13: Optimum Portfolio Choice Among Risky Assets and Risk Free Asset For Risk Averse Investors



The reason for this dramatic change is simple. With the existence of risk free asset the mean and the variance for a portfolio consisting of the risk free asset and portfolio m will be:

$$\mu_P = wE[R_{Pm}] + (1-w)r_f \quad \text{……………………………………………………….(2.25)}$$

$$\begin{aligned}\sigma_P &= \sqrt{w^2 VAR[R_{Pm}] + (1-w)^2 VAR[r_f] + 2w(1-w)COV[R_{Pm}, r_f]} \\ &= w\sigma_{R_{Pm}}\end{aligned} \quad \text{………………(2.26)}$$

Expression (2.3.7) and (2.3.8) show that the minimum variance opportunity set will be linear in the (μ, σ) space and consists of with some fraction w of portfolio m and $(1-w)$ of risk free asset. The equation for CML can be derived in two ways:

First alternative: taking the derivative of (2.25) and (2.26) with respect to w yields:

$\frac{d\mu_P}{dw} = E[R_{Pm}] - r_f$ and $\frac{d\sigma_P}{dw} = \sigma_{R_{Pm}}$

Therefore, the slope of the line is:

$$\frac{d\mu_P / dw}{d\sigma_P / dw} = \frac{E[R_{Pm}] - r_f}{\sigma_{R_{Pm}}}$$

And since the intercept with the mean axle is $(\sigma, \mu) = (0, r_f)$, the equation for CML

$$\mu_P - r_f = \frac{E[R_{Pm}] - rf}{\sigma_{R_{Pm}}} \sigma_P \quad \text{……………………………………………………..(2.27a)}$$

***Second alternative*:** in determinant form write down two given points $\{(0, r_f), (\sigma_{R_{Pm}}, \mu_{R_{Pm}})\}$ in space (μ, σ) as follows:

$$\begin{vmatrix} \sigma_P & \mu_P \\ 0 & r_f \\ \sigma_{R_{Pm}} & \mu_{R_{Pm}} \\ \sigma_P & \mu_P \end{vmatrix} = \left| \sigma_P r_f + 0\mu_{R_{Pm}} + \sigma_{R_{pM}} \mu_P - \mu_P 0 - r_f \sigma_{R_{Pm}} - \mu_{R_{Pm}} \sigma_P \right|$$

$$\Rightarrow \sigma_P r_f + \sigma_{R_{Pm}} \mu_P = r_f \sigma_{R_{Pm}} + \mu_{R_{Pm}} \sigma_P$$

$$\Rightarrow \sigma_{R_{Pm}} \mu_P = r_f \sigma_{R_{Pm}} + \mu_{R_{Pm}} \sigma_P - \sigma_P r_f$$

divede each term by $\sigma_{R_{Pm}}$

$$\Rightarrow \mu_P = r_f + \frac{\sigma_P \left(\mu_{R_{Pm}} - r_f \right)}{\sigma_{R_{Pm}}} \quad \text{...}(2.27b)$$

CML as it is derived in two different forms can be also called the Capital Portfolio Pricing Model (CPPM) since it prices efficient portfolios. To show this let us assume that all investors have homogeneous beliefs about the expected distribution of returns offered by all assets. Also, capital markets are frictionless and information is costless and simultaneously available to all investors. Furthermore, there are no market imperfections. Taken together this implies that all investors calculate the same equation for the capital line and that the borrowing rate equals the lending rate. Within broad degrees of risk aversion each investor will maximize their utility by holding some combination of the risk free asset and portfolio m. This is known as two-fund separation property. Assume further that all assets are perfectly divisible and priced in a perfectly competitive market. Furthermore, there is a definite number of assets and their quantities are fixed with one period. Then the portfolio m turns out to be the market portfolio of all risky assets. The reason is that equilibrium requires all prices to be adjusted so that the excess demand for any asset is zero. That is, each asset is equally attractive to investors. Theoretically, the reduction of variance from diversification increases as the number of risky assets included in the portfolio m rise. Therefore, all assets will be hold in the portfolio m in accordance to their market value weight.

Proposition 2: *with all the above assumptions, the CML in (2.27a,b) shows the relation between mean and variance of portfolio that are efficiently priced and perfectly diversified.*

The CML can be called CPPM since it prices efficient portfolios. The question should be answered is how to price the individual asset. This explains the role of S-L CAPM. Within the assumptions made so far, with a little help of calculus and manipulation we can derive S-L CAPM as follows:

Suppose there is a portfolio, P_K, which consists of $w\%$ in risky asset X and $(1-w)\%$ in the market portfolio M from the CPPM. The mean and variance of this portfolio's returns are by definition:

$$E[P_K] = wE[R_X] + (1-w)E[R_M] \quad \text{...(2.28)}$$

$$VAR[P_K] = w^2 VAR[R_{Xi}] + (1-w)VAR[R_M] + 2w(1-w)COV[R_{Xi}, R_M]$$

$$\sigma_{P_K} = \sqrt{w^2 VAR[R_{Xi}] + (1-w)^2 VAR[R_M] + 2wCOV[R_{Xi}, R_M] - 2w^2 COV[R_{Xi}, R_M]} \quad \text{....(2.29)}$$

taking the derivative of (3.3.10) *and* (3.3.11) *with respect to w yields*

$$dE[P_K]/dw = E[R_X] - E[R_M] \quad \text{...(2.30)}$$

$$\begin{aligned} d\sigma_{P_K}/dw &= 0{,}5\left\{w^2 VAR[R_{Xi}] + (1-w)^2 VAR[R_M] + 2wCOV[R_{Xi}, R_M] - 2w^2 COV[R_{Xi}, R_M]\right\}^{-0,5} \\ &\quad * \left\{2wVAR[R_{Xi}] - 2(1-w)VAR[R_M] + 2COV[R_{Xi}, R_M] - 4wCOV[R_{Xi}, R_M]\right\} \text{..(2.31)} \end{aligned}$$

The basic insight that the Nobel laureate William Sharpe (1963; 1964) provided was that in CPPM equilibrium the market portfolio M already contains the risky asset X. If the risky asset X is added to the market portfolio M in any positive quantity it creates an excess demand for asset X by wX. Therefore, equations (2.30) and (2.31) must be evaluated at $w = 0$ for the equations to describe an equilibrium portfolio.

$$\left.\frac{dE[P_K]}{dw}\right|_{w=0} = E[R_X] - E[R_M] \quad \ldots\ldots (2.32)$$

$$\left.\frac{d\sigma_{P_K}}{dw}\right|_{w=0} = 0{,}5\{VAR[R_M]\}^{-0,5} * \{-2VAR[R_M] + 2COV[R_{Xi}, R_M]\}$$

$$= \frac{(COV[R_{Xi}, R_M] - VAR[R_M])}{VAR[R_M]^{0,5}}$$

$$= \frac{(COV[R_{Xi}, R_M] - VAR[R_M])}{\sigma_{R_{Pm}}} \quad \ldots\ldots (2.33)$$

The slope at equilibrium portfolio at point M (w=0) becomes

$$\left.\frac{dE[P_K]/dw}{d\sigma_{P_K}/dw}\right|_{w=0} = \frac{E[R_X] - E[R_M]}{[(COV[R_{Xi}, R_M] - VAR[R_M])/\sigma_{R_{Pm}}]} \quad \ldots\ldots (2.34)$$

Finally to note that this slope must be equal to the slope of the CML in the expressions (2.27a,b) since the CML is tangent to the market portfolio M. Hence,

$$\frac{E[R_{Pm}] - r_f}{\sigma_{R_{Pm}}} = \frac{E[R_X] - E[R_M]}{[(COV[R_{Xi}, R_M] - VAR[R_M])/\sigma_{R_{Pm}}]} \quad \ldots\ldots (2.35)$$

If we rearranged the expression (2.35) in terms of Expected return of X, we get S-L CAPM[42] as follows:

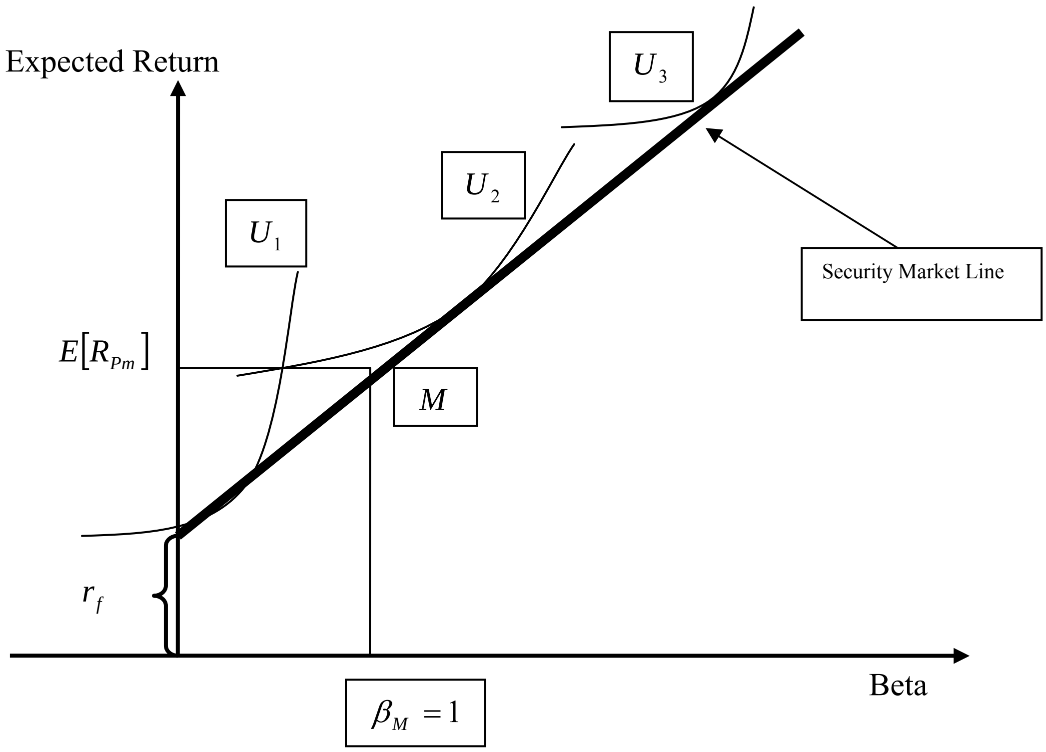
$$E[R_X] = r_f + \left[\frac{COV[R_{Xi}, R_M]}{VAR[R_M]}\right][E[R_M] - r_f] \quad \ldots\ldots (2.36)$$

[42] Expression (2.36) is also known as Security Market Line (SML).

Where

$$\frac{COV[R_{Xi}, R_M]}{VAR[R_M]} = \beta_X$$

Figure 2.14: Security Market Line



S-L CAPM and CPPM are almost identical. Even tough they are both linear and have the same measure for the price of risk also known as risk premium, $(E\lfloor R_{Pm} - r_f \rfloor)$, they quantify the risk differently. On the one hand, S-L CAPM measures the quantity of risk by its normalized covariance which is known as beta, on the other hand, CPPM measure the quantity of risk by normalized standard deviation. The reason to this difference is that investors only want to pay risk premium for undiversifiable risk that is the risk that can not be eliminated by diversified portfolio. In still other words, this is the risk that affect all stocks held in market portfolio. The other difference as it is mentioned above is that CPPM price efficient portfolios while S-H CAPM price individual asset. This should be seen confusing that a portfolio can not have a beta. A portfolio beta is simply weight average of assets held in it. Therefore, part of variance that co-varies with a perfect diversified portfolio is relevant to pay for. To make this point more concrete, let us assume that we have an equally weight portfolio Z, of N risky assets:

$$VAR[Z] = \sum_{i=1}^{N} \sum_{j=1}^{N} \frac{1}{N}\frac{1}{N}\sigma_{ij}$$

$$VAR[Z] = \left(\frac{1}{N}\right)^2 \sum_{i=1}^{N} \sum_{j=1}^{N} \sigma_{ij}$$

$$VAR[Z] = \left(\frac{1}{N}\right)^2 \sum_{i=1}^{N} \sigma_{ii} + \left(\frac{1}{N}\right)^2 \sum_{i=1}^{N} \sum_{j=1}^{N|j\neq i} \sigma_{ij}$$

As an approximation we may assume the individual variance and covariance terms that they approximately have their mean values.

Hence:

$$VAR[Z] = \left(\frac{1}{N}\right)^2 \sum_{i=1}^{N} E[\sigma_{ii}] + \left(\frac{1}{N}\right)^2 \sum_{i=1}^{N} \sum_{j=1}^{N|j\neq i} E[\sigma_{ij}]$$

$$VAR[Z] = \left(\frac{1}{N}\right)^2 N\, E[\sigma_{ii}] + \left(\frac{1}{N}\right)^2 (N^2 - N) E[\sigma_{ij}]$$

$$VAR[Z] = \left(\frac{1}{N}\right) E[\sigma_{ii}] + \left(\frac{N-1}{N}\right) E[\sigma_{ij}]$$

Take the limit to infinity (assume we have such a huge portfolio)

$$\lim_{N\to\infty} VAR[Z] = E[\sigma_{ij}]$$

This indicates the power of diversification implying that as the portfolio becomes more diversified by letting the number of risky assets in the portfolio rise, the covariance term becomes relatively more important. Mathematically, as it is shown, it is the only relevant part of pricing for risk.

The role of S-L CAPM in practice:

- ***In the Application of Cost of Capital***

The Capital budgeting decisions and the appropriate rate of the cost of capital are two vital main applications in corporate finance. Capital budgeting decision is related to decide how a project profitable among others in which the projects future pay offs are discounted at the most appropriate cost of capital; or, in economic terms, the opportunity cost of the capital necessary to finance the project. The opportunity cost accounts for time preference as measured by the risk free interest rate and risk. This is where S-L CAPM takes place. The CAPM implies that relevant risk is systematic risk that can be measured based on the (estimated) beta of the project and the anticipated market excess return. In more concrete application in USA, government fixes the price of a particular service provided by a utility by using the S-L CAPM to determine the "fair" return for the systematic risk of the utility's activities and thus obtaining the required return.

- ***In the Application of Portfolio Return Evaluation***

The main underpinning rational behind the S-L CAPM required return is that it is more appropriate rate than the simple average sample returns. Mutual funds performance and any other managed funds are evaluated with respect to S-L CAPM. The reason is that high level of systematic risk in the portfolio implies high average return. Thus, to evaluate fund performance, a risk correction must be made. Typically, the fund's "alpha" based on the market model (one of the form of S-L CAPM in empirical tests) is calculated and funds with higher alphas are considered to perform better.

- ***In the application of Event Studies***

Many empirical studies in finance use "event study methodology" to evaluate the impact of a particular event in terms of theoretical return such as the one produced by S-L CAPM. The main logic behind event studies is that how a particular event produce abnormal return in relative to some benchmark rate. In many studies, to account for leakage of information, the cumulative abnormal returns (CARs) over a period stretching from a few days before until a few days after the event are computed; it can then be checked whether the CARs are statistically significantly positive. In these cases the CAPM is not necessary. However, if the event window is substantially more than a few days, excess returns may occur purely due to high beta risk. To adjust for risk and to be able to distinguish abnormal returns from merely excess returns, it is necessary to employ an asset pricing model which is, in practice, usually the CAPM.

2.8 STATIC ASSET PRICING MODELS

Despite its limitations, the CAPM is still the most popular asset pricing model. There is a variety of other asset pricing models that deserves attention as well. Many of these are variations of the S-L CAPM. Here we will discuss only these models[43] that are static in nature as is the S-L CAPM.

2.4.10. Black Zero-beta CAPM

One of the debatable assumptions of the S-L CAPM is the hypothesis that a risk-free asset exists. In spite of the existence of, say U.S. T-Bills with any desired short maturity, one could easily argue that no truly risk free asset exists. First, there is inflation risk. One might of course hold an indexed security but available maturities for such securities are limited and inflation corrections may not be appropriate for the individual investor. For instance, the overall CPI may not be very relevant for a retiree living in Alaska. Second, there is reinvestment risk. A short maturity is not riskless for someone saving for retirement as the available interest rate upon maturity is not known. On the other hand, a longer maturity is risky if there is a chance that liquidity is needed ahead of retirement, since selling a long-term bond before maturity may involve a substantial capital loss. Third, the issuer, say the U.S. government, may default in the case of a major natural disaster or war. In addition,

[43] The primary concern here is not to show how to derive these models, instead it is aimed to give the rationale decisions behind the deviations from S-L CAPM.

the “risk free” rate and the market return may not even be independent. Inflation, for instance, might affect both rates in the same direction. We thus drop the 10th assumption of the S-L CAPM and examine the resulting asset pricing model. This was first accomplished by Black (1972) and the resulting model is called the “zero-beta” CAPM to reflect the fact that, in this model, the role of the risk free asset is taken by a portfolio that is uncorrelated with the market and which thus has zero beta.

Black pointed out that among the S-L CAPM assumptions, the one that has been felt to be the most restrictive was existence of risk free rate on which investors might borrow and lend unlimited amount. Lintner has shown that removing assumption that all investors have the same opinions about the possibilities of various end-of-period values for all assets does not change the structure of capital asset prices in any significant way, and assumptions “(i) The common probability distribution describing the possible returns on the available assets is joint normal (or joint stable) with a single characteristic exponent and (ii) Investors choose portfolios that maximize their expected end-of-period utility of wealth, and all investors are risk averse. (Every investor's utility function on end-of-period wealth increases at a decreasing rate as his wealth increases)” are generally regarded as acceptable approximations to reality. However, assumption that an investor may take a long or short position of any size in any asset, including the riskless asset (Any investor may borrow or lend any amount he wants at the riskless rate of interest), is not a very good approximation for many investors, and one feels that the model would be changed substantially if this assumption were dropped. Black (1972) shows that the equivalent relation between expected return and risk on the security X can be reformulated from S-L CAPM:

$$E[R_X] = r_f + \left[\frac{COV[R_{Xi}, R_M]}{VAR[R_M]}\right]\left[E[R_M] - r_f\right] \quad \text{..........} (2.37)$$

Where

$$\frac{COV[R_{Xi}, R_M]}{VAR[R_M]} = \beta_X$$

To

$$E[R_X] = E[R_Z] + \left[\frac{COV[R_{Xi}, R_M]}{VAR[R_M]}\right][E[R_M] - E[R_Z]] \quad \text{..} (2.38)$$

Following Black (1972), the expression (2.38) is known as Zero Beta CAPM. Contrary to S-L CAPM, the difference is that risk free rate is replaced by return of portfolio Z which is uncorrelated with market portfolio. Portfolio Z technically can be called as companion[44] portfolio for market portfolio since it is uncorrelated. As Black explained that the model in expression (2.38) can explain why average estimates of alpha values are positive for low beta securities and negative for high beta securities contrary to the prediction of S-L CAPM.

2.4.11. The CAPM with Non-Marketable Human Capital

Are all assets marketable? If this is not so, what would be the effect of the existence of nonmarketable[45] assets in asset pricing framework? This question is answered by Mayers (1972: 1973) in presenting a single period mean variance model of asset pricing under conditions of uncertainty for marketable and nonmarketable assets. Mayers' Model implies the same linear form of the risk expected return relationship as do S-L CAPM. The results of introducing nonmarketable assets in the model can be evaluated in two respects: (1) the measure of the firm's systematic risk and the risk of the market portfolio include the risk attributable to the existence of nonmarketable assets. (2) Investors hold portfolios of risky marketable assets that vary widely in composition. This implies that each investor holds a portfolio of marketable assets that solves his personal and possibly unique portfolios to be held. S-L CAPM implies that where all assets are marketable the portfolios held by investors are identical and consists of an investment in every outstanding security.

Mayers derives the equilibrium expected return-beta relationship in the following expression:

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[44] This is a tecnical property of efficient frontier. See Merton (1972) and Roll (1977) for details.
[45] Two important assets classes that are not traded are human capital and privately held businesses.

$$E[R_X] = r_f + \left[\frac{P_M COV[R_{Xi}, R_M] + P_H COV[R_{Xi}, R_M]}{P_M VAR[R_M] + P_H COV[R_M, R_H]} \right] [E[R_M] - r_f] \quad \text{.................................}(2.39)$$

Where:

P_M : total value of all marketable assets
P_H : total value of all nonmarketable assets
R_H : one period rate of return on nonmarketable assets
All other terms are defined as before.

As we underlined that individuals no longer holds identical risk portfolios due to the fact that they have different types and quantities of nonmarketable assets. However, expression (2.39) indicates that nevertheless asset pricing is still independent of individual preferences. Even tough unsystematic risk of the nonmarketable assets will affect individual preferences on portfolio choices; it is only the systematic, economy-wide, component of non marketable asset returns that matters. Asset pricing is still affected by covariance risk but it is now an asset's covariance with the market as well as its covariance with the systematic non-market asset return that matters.

Mayers Model[46] is not empirically examined in details in literature for the fact that Beta of the model is no longer the Ordinary Least Square Regression Beta. Therefore, an instrumental variable regression with true market value serving as instrument for the market would provide exactly the right beta coefficient.

2.4.12. The CAPM with Multiple Consumption Goods

In the S-L CAPM, only one consumption good is considered. As all end-of-period wealth is spent on this consumption good, the covariance with the marginal utility of consumption becomes covariance with wealth and the market return on wealth. In general, however, utility, even in a one-period model, will depend on the

[46] Fama and Schwert (1977) emprically test the model. Emprically modified version of the Model and its test can be found in Jagannnathan and Wang (1996).

consumption of various consumption goods. We consider here the consequences of dropping assumption that the investor's utility function includes overall consumption as its only argument. There is no direct utility of diversifying or holding particular securities. The composition of overall consumption is irrelevant. The expression (2.40)[47] depicts the expected return on asset X with market portfolio returns and portfolio P which can be seen as a perfectly correlated portfolio with a composition of multiple consumption goods:

$$E[R_X] = r_f + \beta_{XM}\lfloor E[R_M] - r_f \rfloor + \beta_{XP}\lfloor E\lfloor R_P - r_f \rfloor\rfloor \quad \text{...}(2.40)$$

Where:

$$\beta_{XM} = \frac{VAR[R_P]COV[R_{Xi}, R_M] - COV[R_M, R_P]COV[R_{Xi}, R_P]}{VAR[R_P]VAR[R_M] - (COV[R_M, R_P])^2}$$

$$\beta_{XP} = \frac{VAR[R_P]COV[R_{Xi}, R_P] - COV[R_M, R_P]COV[R_{Xi}, R_M]}{VAR[R_P]VAR[R_M] - (COV[R_M, R_P])^2}$$

It should be noted that the betas are the coefficient of multi-variate regression of the excess return of market portfolio and portfolio p as explanatory variables. The intuition of expression (2.40) is that the investors care about the risk of their wealth. However, they separately also care about what they can do with their wealth.

2.4.13. International CAPM

Several authors have developed international versions of the CAPM. Among these, we could mention Solnik's model (1974), which is called the International Asset Pricing Model (IAPM). This model was established by following a similar framework to that used to obtain the continuous time version of the CAPM in the national case. The reference portfolio is now the worldwide market portfolio. The most widely used index in the United States, as an approximation of this portfolio, is the Morgan Stanley Capital Index (MSCI) Europe, Asia and Far East (EAFE). This is

[47] Derivation of expression (2.40) can be found in Balvers (2001). As Balvers underlined that such case is overlooked in the literature whereas the dinamic version of the model can be found in Breeden (1979, section 7).

an index that is weighted according to the stock market capitalizations of each country. It covers more than 2000 companies from 21 countries. This model uses a risk-free rate from the country of asset *i* and an average worldwide risk-free rate, obtained by making up a portfolio of risk-free assets from different countries in the world. The weightings used are again the same as those used for the worldwide market portfolio. Solnik establishes the following relationship[48]:

$$E[R_X] = r_{fX} + \left[\frac{COV[R_{Xi}, R_{WM}]}{VAR[R_{WM}]}\right][E[R_{WM}] - r_{fW}] \quad (2.41)$$

Where

$$\frac{COV[R_{Xi}, R_{WM}]}{VAR[R_{WM}]} = \beta_X$$

β_X denotes the international systematic risk of security *i*, i.e. calculated in relation to the worldwide market portfolio;

r_{fX} denotes the rate of the risk-free asset in the country of security *i*;
r_{fW} denotes the rate of the average worldwide risk-free asset; and
R_{WM} denotes the return on the worldwide market portfolio.

All the rates of return are expressed in the currency of the asset *i* country.

2.4.14. Arbitrage Pricing Theory

Despite the fact that arbitrage alone goes far to pin down asset prices, the mechanism arbitrage implies is not enough in order to obtain definite predictions. It is necessary to employ the arbitrage principle in a framework that imposes additional conditions on the observable pattern of prices. Factor models postulate that asset prices – or, equivalently, rates of return – are linear functions of a small number of variables, the so-called 'factors'. Ross[49] (1976) introduced The Arbitrage Pricing Theory (hereafter APT) showing how to approximate equilibrium rate of returns using arbitrage

[48] See equation 16 in Solnik (1974).
[49] This part is my distillation from Bailey (2005, chapter 8), for more advanced treatment see original paper of Ross (1976).

portfolios in the framework of factor models. Factor models of asset prices postulate that rates of return can be expressed as linear functions of a small number of factors. The simplest *single*-factor model and two-factor model[50] are written as

$$R_{Xi} = \beta_0 + \beta_i F_1 + \varepsilon_i \quad \text{.....................} (2.41)$$

$$R_{Xi} = \beta_{i0} + \beta_{i1} F_1 + \beta_{i2} F_2 + \varepsilon_i \quad \text{.....................} (2.42)$$

where R_{Xi} is the rate of return on asset or portfolio i. F_1 and F_2 denote the factor's value[51], β_{i0}, β_{i1} and β_{i2} are parameters and ε_i denotes an unobserved random error. The rate of return on asset i, R_{Xi}, could be replaced by the excess return, $R_{Xi} - r_f$, over a risk-free rate, r_f , without affecting the analysis in any substantive way. The slope parameter, β_{i1} and β_{i2}, are sometimes referred to as the 'factor loading'. Assumptions that is brought with expression (2.41) are (i) the expected value of the random error conditional upon the value of factor is zero and depicts as $E[\varepsilon_i | F_1] = 0$, (ii) expected value of error term is zero and depicts as $E[\varepsilon_i] = 0$ and (iii) error term is uncorrelated with the other error terms and depicts as $E[\varepsilon_i | \varepsilon_j] = 0$ and (iv) the number of factors should be less than the number of assets or portfolios.

Let us assume that all asset returns are determined according to expression (2.41), then an approximate absence of arbitrage opportunities implies links among rates of return which is the main feature of APT. The absence of arbitrage opportunities implies in a precise sense approximate given the presence of the error in the factor model. Then the risk among rates of return allows calculation of a risk premium associated with the factor.

In formal demonstration, the APT can be constructed on the following conditions:

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[50] The factor model expressed by (2.41-2.42) is approximate in the presence of the error term, ε_i . The role of ε_i is to allow unexplained forces to affect the rate of return. In exact factor models the error is identically zero.

[51] The factor can be observed in principle such as some index returns or GDP growth but can be also exploited through factor analysis.

Condition 1: Arbitrage portfolio requires zero initial outlay and depicted as follows[52]:

$$Y_1 + Y_2 + ... + Y_n = 0$$

Condition 2: The elimination of systematic risk

$$\beta_{X1}Y_1 + \beta_{X2}Y_2 + ... + \beta_{Xn}Y_n = 0$$

The elimination systematic risk involves choosing a portfolio such that whatever the value of the factor, its effect on the portfolio returns is zero.

Condition 3: Unsystematic risk eliminated approximately[53]

$$\varepsilon_1 Y_1 + \varepsilon_2 Y_2 + ... + \varepsilon_n Y_n \approx 0$$

It follows from conditions 1 to 3:

$$R_{X1}Y_1 + R_{X2}Y_2 + ... + R_{Xn}Y_n \approx \beta_{X1}Y_1 + \beta_{X2}Y_2 + ... + \beta_{Xn}Y_n$$

From now on – with the sacrifice of precision – the approximation is replaced by an exact equality. If the return on the constructed portfolio is not zero, there is an opportunity for arbitrage profit.

Condition 4: In market equilibrium, the zero return on the arbitrage portfolio requires;

$$\beta_{X1}Y_1 + \beta_{X2}Y_2 + ... + \beta_{Xn}Y = 0$$

The four APT conditions collectively imply that assets' rates of return are linked in a particular way in any market equilibrium – otherwise, arbitrage opportunities would

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52 Remember we explain this condition under the title 'Arbitrage' in page 22 whereas for simplicity we denote Y_1 for referring $P_1 X_1$ here.

53 The condition that $E[\varepsilon_i] = 0$ implies that the expected value of the unsystematic return is zero. This can be understood as stating that 'on average' the unsystematic return is zero. But this is not enough to eliminate risk, because it implies merely that positive values in some states are balanced by negative values in others. The arbitrage principle requires that the unsystematic return is zero in every state. Such a stringent requirement cannot be satisfied without error in an approximate factor model. If unsystematic risk cannot be completely eliminated, resort must be made to approximate elimination. This is achieved by choosing a well-diversified portfolio. Under certain conditions – conditions needed to apply the law of large numbers in probability theory – it can be shown that, if the number of assets, n, is large in a precise sense, then the portfolio can be chosen so that the unsystematic return is arbitrarily close to zero for every possible realization of the errors. This implies the third condition.

exist. Such opportunities would not provide entirely risk-free profits in the presence of the random errors. However, condition 3 ensures that the risk can be made arbitrarily small. By applying APT conditions 1, 2 and 4 to an exact factor model, the APT predicts:

$$E[R_X] = \lambda_0 + \lambda_1 \beta_{X1} \qquad X = 1,2,....,n \quad ....(2.43)$$

where the values of λ_0 and λ_1 are the same for every asset. Expression (2.43) holds as a strict equality only for an exact single-factor model. If risk free asset is present, its return, r_f, equals λ_0. Alternatively if the factor model is constructed to explain excess returns, $R_X - r_f$ then $\lambda_0 = 0$. When $\lambda_0 = r_f$, the APT predicts:

$$E[R_X] = r_f + \lambda_1 \beta_{X1} \qquad X = 1,2,....,n \quad ....(2.44)$$

The weight λ_1 is interpreted as the risk premium associated with the factor – that is, the risk premium corresponds to the source of the systematic risk. In similar vein, if there are multifactor specification:

$$E[R_X] = r_f + \lambda_1 \beta_{X1} + \lambda_2 \beta_{X2} + ... + \lambda_K \beta_{XK} \qquad X = 1,2,....,n \quad ....(2.45)$$

2.4.15. The Fame-French Three Factor Model

Fama and French (1992; 1993; 1996) have carried out several empirical studies to identify the fundamental factors those explain average asset returns, as a complement to the market beta. They highlighted two important factors that characterize a company's risk: the book-to-market ratio and the company's size measured by its market capitalization. Fama and French (1993) therefore propose a three-factor model, which argues that many of the CAPM average-return anomalies are related, and they are captured by the three-factor model in Fama and French (1993). The model says that the expected return on a portfolio in excess of the risk-free rate [E(Ri) – Rf] is explained by the sensitivity of its return to three factors: (i) the excess return on a broad market portfolio (RM- Rf); (ii) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB, small minus big); and (iii) the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks (HML, high minus low). Specifically, the expected excess return on portfolio i is:

$$E[R_X] = r_f + \beta_{X1}\lfloor E\lfloor R_M - r_f \rfloor\rfloor + \beta_{X2}[E[SMB]] + \beta_{X3}[E[HML]] \quad \text{............................(2.46)}$$

Where betas are estimated from the following regression:

$$R_{Xt} - r_{ft} = \alpha_i + \beta_{X1}\lfloor R_{Mt} - r_{ft} \rfloor + \beta_{X2}[SMB_t] + \beta_{X3}[HML_t] + \varepsilon_i \quad \text{............................(2.47)}$$

Fama and French assume that the financial markets are indeed efficient but the market factor does not explain all the risks on its own. They concluded that a three factor model does describe the assets return whereas they specify that the selection of the factors is not unique. In addition to the factors that are contained in three factors model they postulate additional factors that also have explanatory power.

2.4.16. Partial Variance Approach Model

Lower partial moment is a measure of portfolio risk that depends on only those portfolio returns that fall below some target level of returns. The idea is that the variance of above average returns realization is irrelevant for the consideration of risk. As such, only the variance below a particular threshold is calculated. The threshold is typically set equal to the risk free return. It is defined and measured as follows:

$$LPM_h(R_P) = \int_{-\infty}^{h} (R_{Pi} - h)^2 f_P(R)dR \quad \text{...(2.48)}$$

Where h is the target level and $f_P(R)$ represents the probability density function of returns for portfolio P.

Hogan and Warren (1974) and Bawa and Lindenberg (1977) independently developed a mean-lower partial moment capital asset pricing model (EL-CAPM). The equilibrium pricing relationship of this model is formulated as:

$$E[R_X] = r_f + \frac{CLPM_{r_f}(R_M, R_X)}{LPM_{r_f}(R_M)}\left[E[R_M] - r_f\right] \quad \text{...2.49}$$

Where

$E[R_X]$ is the equilibrium expected rate of return on asset i;

$E[R_M]$ is the equilibrium expected rate of return on the market portfolio;

$LPM_{r_f}(R_M)$ is the lower partial moment of returns below risk free rate on the market portfolio;

$CLPM_{r_f}(R_M, R_X)$ is the co-lower partial moment below risk free rate on the market portfolio with returns on security X.

$$f(R_{M,}R_X) = \int_{-\infty}^{\infty}\int_{-\infty}^{r_f}(R_M - r_f)(R_X - r_f)\,df(R_X, R_M)$$

$f(R_M, R_X)$ is joint probability density function of returns on asset X and on the market portfolio.

In deriving expression (2.49), the target rate in all cases was set equal to the risk free rate. Systematic risk indicator beta is measured by CLPM/LPM on the contrary to COV/VAR in S-L CAPM. The authors suggest that the replacement of this change should be employed when there are distinct and significant differences between the two measurements.

Harlow and Rao (1989) generalize Hogan and Warren (1974) and Bawa and Lindenberg (1977) and attempt for nth order lower partial moment and show in general that in this scenario a one-beta CAPM obtains, where however the beta cannot be estimated by standard regression methods. They instead estimate beta by (among other changes) separating the market return variable into two separate variables: one for when the market return is above the threshold (this variable is zero whenever market return is *below* the threshold) and one for when the market return is below the threshold (this variable is zero whenever market return is *above* the threshold). The coefficient on the variable for when the market return is below the threshold becomes the appropriate beta.

The security market line in mean-lower partial moment framework is constructed in Harlow and Rao (1989) as follows:

$$E[R_X] = r_f + \beta_X^{MLPM_n^{(\tau)}} \left[E[R_M] - r_f \right] \qquad (2.50)$$

Where

$$\beta_X^{MLPM_n^{(\tau)}} = \frac{\int_{-\infty}^{\tau} \int_{-\infty}^{\infty} (\tau - R_M)^{n-1} (r_f - R_X) \, df(R_X, R_M)}{\int_{-\infty}^{\infty} (\tau - R_M)^{n-1} (r_f - R_M) \, df(R_M)}$$

2.4.17. The Three Moment CAPM

By restricting investor preferences, Rubinstein [1973a] and Kraus and Litzenberger [1976] extended the traditional Sharpe-Lintner mean-variance capital asset pricing model to incorporate the effects of skewness on equilibrium expected rates of return. Rubinstein [1973a] considered the case when all investors have separable cubic utility functions; the development in Kraus and Litzenberger [1976] was based on the assumptions that all investors have HARA utility functions with identical cautiousness and that terms of the fourth and higher orders in the expansion of individual utility can be ignored in deriving equilibrium valuation relations. Since we know that the mean-variance CAPM can be derived from assumptions about the joint distribution of rates of return as well as from assumptions about the preferences of investors, it is natural to inquire whether an equilibrium model incorporating skewness can be developed from assumptions about return distributions.

Further insights into the relationships between the three moment capital asset pricing model and the traditional form of the capital asset pricing model can be gained by specifying the form of characteristic lines for securities. While linear characteristic lines are consistent with the traditional form of the capital asset pricing model, quadratic characteristic lines for securities are consistent with the three moment capital asset pricing model. These can be expressed as follows[54]:

$$R_{Xi} - r_f = c_{0i} + c_{1i}\left(R_{Mi} - r_f\right) + c_{2i}\left(R_M - \overline{R}_M\right)^2 + \varepsilon_i \quad \text{...(2.51)}$$

where the error term, ε_i, is assumed to be homoscedastic, independent of the excess rate of return on the market portfolio, $R_M - r_f$, independent of the squared deviation of the excess rate of return on the market portfolio from its expected value, $(R_M - \overline{R}_M)^2$, and to have an expected value of zero. Taking expected values in (2.51) and subtracting, to express the quadratic market model in deviation form, then multiplying both sides by $R_M - \overline{R}_M$, taking expected values and dividing through by $\sigma^2_{R_M}$ yields an expression for the beta of the ith risk asset:

$$\beta_X = c_{1i} + c_{2i}\frac{(R_M - \overline{R}_M)^3}{\sigma^2_{R_M}}$$

Similarly, multiplying both sides of the deviation form of the quadratic market model by $(R_M - \overline{R}_M)^2$, taking expected values and dividing through by $(R_M - \overline{R}_M)^3$, yields en expression for the gamma of the ith risk asset:

$$\gamma_X = c_{1i} + c_{2i}\left\{\frac{\left(K^4_M - \left(\sigma^2_{R_M}\right)^2\right)}{\left(R_M - \overline{R}_M\right)^3}\right\}$$

where

$$K^4_M = E\left[\left(R_M - \overline{R}_M\right)^4\right]$$

The forth central moment of the rate of return on market portfolio

[54] See equation 6 in Kraus and Litzenberger [1976]

2.4.18. The Four Moment CAPM

Empirical and theoretical attacks on S-L CAPM which is based on the MVA have given impetus to the investigation of moments of higher order than the variance of returns. Fang and Lai (1997) incorporated the effect of kurtosis into the asset pricing model. A four moment CAPM is derived in which systematic kurtosis in addition to systematic variance and systematic skewness, contributes to the risk premium of an asset. Fang and Lai (1997) derived security market line as follows:

$$E[R_X]-r_f=\varphi_1 COV(R_{M,}R_X)+\varphi_2 COV(R_M^2,R_X)+\varphi_3 COV(R_M^3,R) \quad \text{..............(2.52)}$$

Where $R_M^2\left(R_M^3\right)$ is the square (cube) of the standardized market portfolio return R_M ; $\varphi_{1,}\varphi_2,\varphi_3$ are the market prices of systematic variance, systematic skewness and systematic kurtosis respectively. Expression (2.52) is the four moment CAPM which shows that in the presence of kurtosis, the expected excess rate of return is related not only to the systematic variance and systematic skewness but also to the systematic kurtosis. The higher the systematic variance and systematic kurtosis, the higher the expected return. The higher the systematic kurtosis, the lower the expected return.

2.5. DYNAMIC ASSET PRICING MODELS

Dynamic Asset Pricing Models are deserved to be explained in more advanced treatment and needed to be derived with their fundamental and technical properties. However, the main concern here is to give a brief overview of these models in a simplified manner. We will cover the well-known version of dynamic asset pricing models which are Merton’s (1973) The Intertemporal CAPM, Bredeen’s (1979) The Consumption CAPM, Lucas’s (1978) Production Based CAPM , Cochrane’s (1996) Investment-Based CAPM, Acharya and Pedersen’s (2005) Liquidity Based CAPM and Jaganathan and Wang’s (1996) Conditional CAPM. The common property of these models mentioned in this section is that they are dynamic and derived in one way or another on the intuition of S-L CAPM.

2.5.1. The Intertemporal CAPM

S-L CAPM is built on MVA and one period, static, model in addition with assuming constant risk free rate. The two main criticisms to the S-L CAPM are that investors are not able to follow MVA for technical difficulties and luck of intertemporal ability of investment decisions. Merton[55] (1973) derived a continuous time version of the CAPM which is literally known as ICAPM in relaxing these two assumptions and assumed that risk free rate follows a stochastic process and investment decisions are intertemporally made. In other words, it is assumed that a state variable, for example the risk-free interest rate, evolves randomly over time. In this case, Merton shows that investors hold portfolios that result from three funds: the risk-free asset, the market portfolio and a third portfolio, chosen in such a way that its return is perfectly negatively correlated with the return on the risk-free asset. The two-fund separation model is replaced with a three-fund separation model. This third fund allows hedging against the risk of an unanticipated change in the future value of the risk-free rate. This implies that investors do take investment opportunities into account as well.

The expected return of an asset X at equilibrium is depicted by ICAPM as follows[56]:

$$E(R_X)-r_f=\lambda_{1X}\left(E(R_M)-r_f\right)+\lambda_{2X}\left(E(R_{NF})-r\right) \quad (2.53)$$

where

$$\lambda_{1X}=\frac{\beta_{X,M}-\beta_{X,NF}\beta_{NF,M}}{1-(\rho_{NF,M})^2} \qquad AND \qquad \lambda_{2X}=\frac{\beta_{X,NF}-\beta_{X,M}\beta_{NF,M}}{1-(\rho_{NF,M})^2}$$

$$\beta_{X,Y}=\frac{COV[R_X,R_Y]}{VAR[R_Y]} \qquad AND \qquad \rho_{NF,M}=\frac{COV[R_{NF},R_M]}{\sqrt{VAR[R_{NF}]}\sqrt{VAR[R_M]}}$$

$E(R_{NF})$ denotes the expected rate of return of a portfolio that has perfect negative correlation with the risk-free asset r_f . All the rates of return are used in this model

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[55] For formal derivation of ICAPM, despite its advanced treatment, Merton's (1973) original paper is main source; for discreate version see Balvers's (2001); for summary of the model at graduate level see Jones's (2008) and at introductory treatment see Amenc and Le Sourd (2003).

[56] See equation 34 in Merton (1973).

are continuous rates. If the risk-free rate is not stochastic, or if it is not correlated with the market risk, then the third fund disappears, $\beta_{X,NF} = \beta_{NF,M} = 0$.. We then come back to the standard formulation of the CAPM, except that the rates of return are instantaneous and the distribution of returns is lognormal instead of being normal.

There are a number of special cases where the pricing equation in (2.53) can be simplified. When the returns on the market portfolio and security NF are uncorrelated $(\rho_{NF,M} = 0)$ the pricing equation in (2.53) collapses to a multi-beta model as follows:

$$E(R_X) - r_f = \frac{COV[R_X, R_M]}{VAR[R_M]}(E(R_M) - r_f) + \frac{COV[R_X, R_{NF}]}{VAR[R_{NF}]}(E(R_{NF}) - r) \text{.............(2.54)}$$

Referring to expression (2.53) in equilibrium, Merton states that investors are compensated in terms of expected return, for bearing market (systematic) risk, and for bearing the risk of unfavorable (from the point of view of the aggregate) shifts in the investment opportunity set; and it is a natural generalization of the security market line of the classical capital asset pricing model. Note that if a security has no market risk (i.e., $\beta_{X,M} = 0 = \rho_{X,M}$), its expected return will not be equal to the riskless rate as forecast by the usual model.

2.5.2. The Consumption CAPM

S-L CAPM assumes that the expected utility of investors can be constructed in terms of the mean and the variance of their investment portfolio. In practice, derived satisfaction is not directly linked to investment; instead it is linked from current and future consumption of goods and services. It is true that an investment portfolio is a possible source of financing future consumption in way that investors derive utility indirectly from the return on their investment portfolios. Breeden (1979) derives a single beta asset pricing model in multi-good, continuous-time model with uncertain consumption goods prices and uncertain investment opportunities, literally known as Consumption CAPM (hereafter CCAPM). In CCAPM, the equity premium is proportional to a single beta, which is the covariance with consumption (usually replaced with consumption growth per capita in empirical tests) rather than to the market portfolio. The expected return and risk relationship is formulated in CCAPM as follows[57]:

$$E(R_X) - r_f = \beta_{X,C}\left(E(R_C) - r_f\right) \qquad (2.55)$$

Where

$E[R_C]$ is return obtained by creating a mimicking portfolio with stochastic return

$$\beta_{X,C} = \frac{COV[R_X, R_C]}{VAR[R_C]}$$

2.5.3. Production Based CAPM

Production Based CAPM is a relatively more special case of dynamic models which turns to give more empirically testable predictions. The Merton ICAPM model and Breeden CCAPM are rather general treatment of dynamic models. In case of ICAPM, proxies for changes in investment opportunities are too broad and CCAPM provides a factor model with aggregate consumption as the only factor which is very difficult to observe. Lucas (1978) examined the stochastic behavior of equilibrium asset prices in a one-good, pure exchange economy with identical consumers. The single good in this economy is (costlessly) produced in a number of different productive units; an asset is a claim to all or part of the output of one of these units. Productivity in each unit fluctuates stochastically through time, so that equilibrium asset prices will fluctuate as well. Lucas's objective was to understand the relationship between these exogenously determined productivity changes and market

[57] See equation 21 in Bredeen (1979).

determined movements in asset prices and usually used to explain the equity premium puzzle[58].

Deriving an asset pricing equation for each asset analogously to the derivation of the CCAPM, one may obtain the following risk return relationship[59]:.

$$E\left[R_{t+1}^{X}\right]-r_t^f = \beta_{Xy}(E\left[R_{t+1}^{y}\right]-r_t^f)\text{..(2.56)}$$

where

$$\beta_{iy} = Cov_t(r_{t+1}^{y}, r_{t+1}^{i})/Var_t(r_{t+1}^{y})$$

Here r_{t+1}^{y} may represent either the return on an asset perfectly correlated with aggregate production or the growth rate of aggregate production itself. The other variant of Production Based CAPM is that of Brock's (1979) Model which is needed to be explained in more advance treatment and omitted here.

2.5.4. Investment-Based CAPM

Cochrane (1991) proposed a different perspective on asset pricing by exploiting the link between returns on physical investment and the returns on the equity asset that lays claim on the returns from physical investment. We will follow Cochrane's (1996) term *Investment-Based Asset Pricing* for the model described in his paper written in 1991. Cochrane (1991) describes a production-based asset pricing model which is analogous to the standard consumption-based model, but it uses producers and production functions in the place of consumers and utility functions. The production-based model is used to explain two links between stock returns and economic fluctuations that have been the focus of much recent empirical research in finance. These are: 1) a number of variables forecast stock returns, including the term premium, the default premium, lagged returns, dividend-price ratios, and investment; and 2) many of the same variables, and stock returns in particular, forecast measures

58 Mehra and Prescott use the Lucas Model to explain the theoretical discussion behind the puzzle. (cited in Constantinides, G.M., Harris, M., and Stulz, R.M (2003, chapter 14))

59 Balvers (2001) derives the expression (3.8.3.1) based on the equation 6 in Lucas (1978).

of economic activity such as investment and GNP growth. The consumption based model ties asset returns to marginal rates of substitution which are inferred from consumption data (or state variables presumed to drive consumption) through a utility function. It is derived from the consumer's first order conditions for optimal intertemporal consumption demand. Its testable content is a restriction on the joint stochastic process of consumption and return. This restriction can be interpreted in two ways. If we fix or model the return process and make predictions about consumption behavior, it is a theory of consumption, as in the permanent income hypotheses. If we fix or model the consumption process and make predictions about returns, it is the consumption-based asset pricing model. For example, the consumption based asset pricing model might say "expected returns are high because consumption growth is high".

The logic of the investment-based model is exactly analogous. It ties asset returns to marginal rates of transformation, which are inferred from data on investment (and, potentially, output and other production variables) through a production function. It is derived from the producer's first order conditions for optimal intertemporal investment demand. Its testable content is a restriction on the joint stochastic process of investment (and/or other production variables) and asset returns. This restriction can also be interpreted in two ways. If we fix the return process, it is a version of the Q theory of investment. If we fix the investment process, it is an investment-based asset pricing model. For example, the investment-based asset pricing model can make statements like "expected returns are high because (a function of) investment growth is high".

As mentioned above Cochrane derived the expected return and investment relationship in a non standard asset pricing equation with functional form as follows:

$$R^I\left(s^{t+1}\right)=\left(f_k(t+1)+\frac{g_k(t+1)}{g_I(t+1)}\right)g_I(t) \quad \text{.........(2.57)}$$

Where
R^I is the investment return from state s^t to state s^{t+1}

f (.) is production function

g (.) is function for adjustment costs to investment

The notation (t) means 'evaluated with respect to the appropriate arguments at time t in state s^t' and subscript denote partial derivatives.

Cochrane (1991) obtained equation[60] (2.57) in the specific context of a complete markets economy. It can be interpreted as the physical investment return of a firm. It is obtained from a within-firm type of arbitrage: invest in the current period and then withdraw enough investment in the next period to keep the capital stock for future periods equal to what it would have been without the current period investment; the net payoff per unit extra investment in the current period is the investment return.

2.5.5. Liquidity Based CAPM

Acharya and Pedersen (2005) present a simple theoretical model that helps to explain how asset prices are affected by liquidity risk and commonality in liquidity. The model provides a unified theoretical framework that can explain the empirical findings by pricing market liquidity, average liquidity, and liquidity that comoves with returns and predicting future returns. In the liquidity based CAPM, the expected return of a security is increasing in its expected illiquidity and its ''net beta,'' which is proportional to the covariance of its return, r^i; net of its exogenous illiquidity costs, c^i, with the market portfolio's net return $r^M - c^M$. The net beta can be decomposed into the standard market beta and three betas representing different forms of liquidity risk. These liquidity risks are associated with: (i) commonality in liquidity with the market liquidity, $COV\left[c^i, c^M\right]$; (ii) return sensitivity to market liquidity, $COV\left[r^i, c^M\right]$; and, (iii) liquidity sensitivity to market returns, $COV\left[c^i, r^M\right]$.

[60] See equation 12 in Cochrane (1991) in addition with some specific functional form given for operational purposes in emprical tests.

The unconditional result of expected return and risk relationship is constructed as follows[61]:

$$E\left(R_t^X - r_t^f\right) = E\left(c_t^X\right) + \lambda\beta^{1X} + \lambda\beta^{2X} - \lambda\beta^{3X} - \lambda\beta^{4X} \quad \text{.......................................(2.58)}$$

where

$$\beta^{1X} = \frac{COV\left[R_t^X, R_t^M - E_{t-1}\left(R_t^M\right)\right]}{VAR\left[R_t^M - E_{t-1}\left(R_t^M\right) - \left(c_t^M - E_{t-1}\left(c_t^M\right)\right)\right]}$$

$$\beta^{2X} = \frac{COV\left[c_t^X - E_{t-1}\left(c_t^X\right), c_t^M - E_{t-1}\left(c_t^M\right)\right]}{VAR\left[R_t^M - E_{t-1}\left(R_t^M\right) - \left(c_t^M - E_{t-1}\left(c_t^M\right)\right)\right]}$$

$$\beta^{3X} = \frac{COV\left[R_t^X, c_t^M - E_{t-1}\left(c_t^M\right)\right]}{VAR\left[R_t^M - E_{t-1}\left(R_t^M\right) - \left(c_t^M - E_{t-1}\left(c_t^M\right)\right)\right]}$$

$$\beta^{4X} = \frac{COV\left[c_t^X - E_{t-1}\left(c_t^X\right), R_t^M - E_{t-1}\left(R_t^M\right)\right]}{VAR\left[R_t^M - E_{t-1}\left(R_t^M\right) - \left(c_t^M - E_{t-1}\left(c_t^M\right)\right)\right]}$$

$$\lambda = E(\lambda_t) = E\left(R_t^M - c_t^M - r^f\right)$$

2.5.6. Conditional CAPM

One of the assumptions of S-L CAPM is that the behavior of investors is estimated for one period. This is why it is necessary to make certain assumption that the betas of assets remain constant through the time in empirical examination of the CAPM. Jagannathan and Wang (1996) propose a model that includes this assumption for the reason that the relative risk of a firm's cash flow is likely to vary over the business cycle. During a recession, for example, financial leverage of firms in relatively poor shape may increase sharply relative to other firms, causing their stock betas to rise. Also, to the extent that the business cycle is induced by technology or taste shocks, the relative share of different sectors in the economy fluctuates, inducing fluctuations in the betas of firms in these sectors. Hence, betas and expected returns will in general depend on the nature of the information available at any given point in time and vary over time. In this study, therefore, we assume that the conditional version of

[61] See equation 8 for the conditional version of expression (3.8.5.1) and equation 12 for unconditional version, the one explained here, in Acharya and Pedersen (2005).

the CAPM holds, i.e., the expected return on an asset based on the information available at any given point in time is linear in its conditional beta. They formulate so called Conditional CAPM in the following form:

$$E\left[R_{Xt}\middle|\Theta_{t-1}\right] = \lambda_{0t-1} + \lambda_{1t-1}\beta_{Xt-1} \quad \text{...(2.59)}$$

where β_{Xt-1} is the conditional beta of asset i and in each period t,

$$\beta_{Xt-1} = \frac{COV\left[R_{Xt}, R_{Mt}\middle|\Theta_{t-1}\right]}{VAR\left[R_{Mt}\middle|\Theta_{t-1}\right]}$$

λ_{0t-1} is the conditional expected return on a 'zero-beta' portfolio,
λ_{1t-1} is the conditional market risk premium.

The subscript t indicates the relevant time period. R_{Xt} denotes the gross return on asset X in period t and in similar manner, R_{Mt} is the gross return on the aggregate wealth portfolio of all assets in the economy in period t. Explaining cross sectional variations in the unconditional expected return on different asset, take the unconditional expectation of both sides of expression (2.59):

$$E\left[R_{Xt}\right] = \lambda_0 + \lambda_1\overline{\beta}_X + COV\left[\lambda_{1t-1}, \beta_{Xt-1}\right] \text{..(2.60)}$$

where

$\lambda_0 = E\left[\lambda_{0t-1}\right]$ **,** $\lambda_1 = E\left[\lambda_{1t-1}\right]$ **and** $\overline{\beta}_X = E\left[\beta_{Xt-1}\right]$

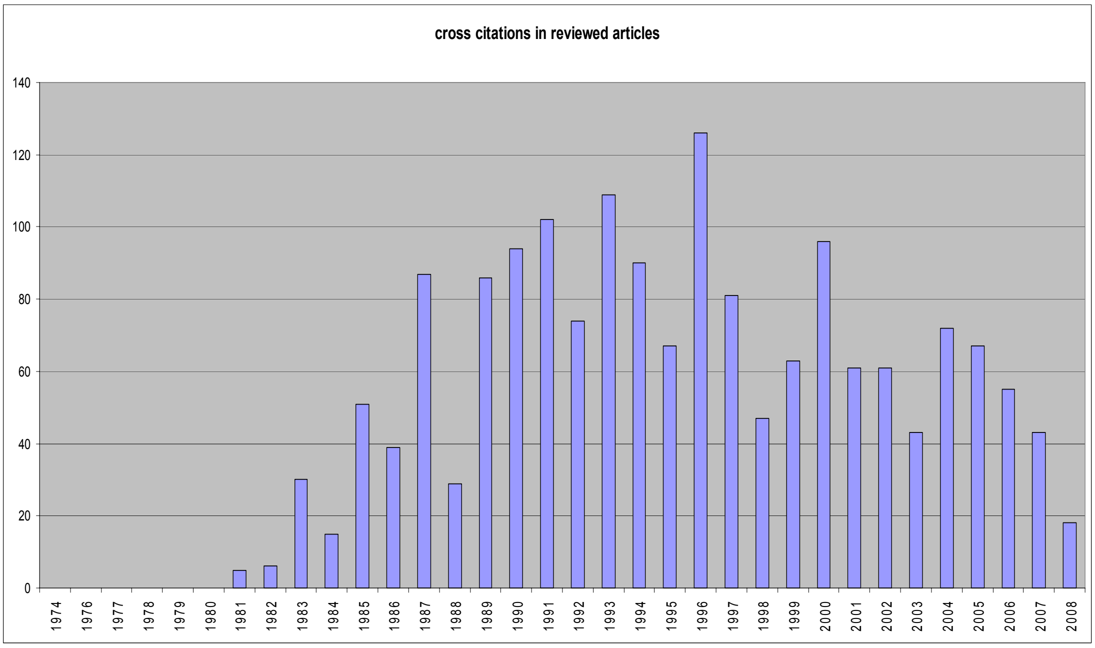
Here, λ_1 -lamdal is the expected market risk premium, and β_X is the expected beta. If the covariance between the conditional beta of asset X and the conditional market risk premium is zero (or a linear function of the expected beta) for every arbitrarily chosen asset X, then expression (2.59) resembles the static CAPM, i.e., the expected return is a linear function of the expected beta. However, in general, the conditional risk premium on the market and conditional betas are correlated. During bad economic times when the expected market risk premium is relatively high, firms on the "fringe" and more leveraged firms are more likely to face financial difficulties and thus have higher conditional betas. If the uncertainty associated with future growth opportunities is the cause for the higher beta of firms on the "fringe," then their conditional betas will be relatively low during bad economic times, resulting in natural perverse market timing. This is because during bad times the uncertainty as well as the value of future growth opportunities is reduced, and this effect may more than the effect of increased leverage.

CHAPTER III: EMPIRICAL RESEARCH LITERATURE ON ASSET PRICING

3.1 Meta Analysis Framework of Empirical Research

This chapter is a complemented part to chapter II in which an extensive theoretical review made on asset pricing models. The empirical research conducted on asset pricing literature is presented here on systematic based selection criteria so called Meta Analysis (hereafter MA). In fact, MA is a technique usually used in Medical Research for the purpose of combining small samples' evidence and interpreting the results on more robust estimates. However, we applied MA in different context here. At the first stage, we selected the most appropriate journals through ISI WEB of Knowledge database and sorted articles based on the field such as economics, finance and the total number of citations and impact factors of the journals. In doing this, we reached 43 journals and around 2000 articles (see table 3.1 for details). The first elimination criterion we employed is that an article should contain an empirical investigation of asset pricing models. This elimination reduced the number of articles to 416. At this stage we explore one of the main concerns for the field of asset pricing that how much attention is paid to asset pricing models in literature. The question is partially answered by showing the numbers of inter-citations among the 416 articles. Graph 3.1 shows the total number of citations made by the articles to themselves on annual basis. For example, there are more than 120 citations made by the articles to the other articles in the pool in 1996. The most interesting conclusion coming out from the inter-citation statistics is that there is a decreasing trend on asset pricing models. However, the results have two important constraints: (i) these articles do contain at least an empirical investigation employed on asset pricing models. There are many theoretical articles left not to be taken into account for this question. Even in this analysis we exclude about 1600 articles. (ii) the results are limited to 43 highly cited journals. However, there are a considerable amount of journals published in field of finance and economics.

Graph 3.1: Cross citations in reviewed articles



The second elimination criterion is that an article should primarily investigate an asset pricing model and their assumptions or predictions. This elimination criterion reduced the number of articles to 136 that are deserved to be reviewed for chapter III.

The main purpose of the review process can be classified as follows:

- To explore the process of asset pricing literature
- To examine the results of empirical examination made on asset pricing models
- To demonstrate the links between asset pricing with the other disciplines such as economics, econometrics, mathematics, statistics, psychology.
- To document the estimation techniques employed in the articles
- To document the main problems developed in the field and their empirical findings.

Table 3.1: Reviewed Journals and the Relevant Statistics

Sorted by total citations[62]												
				Search for 'CAPM'			Serach for 'CAPM test'			Search for 'Capital Asset Pricing Models' (CAPM)		
	Journal Name	Data Interval	Database	Full Text	Abstract	Title	Full Text	Abstract	Title	Full Text	Abstract	Title
1	JOURNAL OF FINANCE	1946-2004	jstor	477	43	14	345	7	1	1049	9	0
2	JOURNAL OF FINANCIAL ECONOMICS	1974-2008	sciencedirect	191	34		174	13		616	48	
3	JOURNAL OF MONETARY ECONOMICS	1975-2008	sciencedirect	23	3		19	2		5	0	
4	REVIEW OF FINANCIAL STUDIES	1988-2004	Jstor	98	6	1	82	1	0	257	4	0
5	JOURNAL OF ACCOUNTING RESEARCH	1963-2002	Jstor	32	0	0	29	0	0	136	0	0
6	JOURNAL OF ACCOUNTING & ECONOMICS	1979-2008	sciencedirect	36	2		34	0		176	1	
7	ACCOUNTING REVIEW	1926-2002	Jstor	29	2	0	28	1	0	173	1	0
8	JOURNAL OF BANKING & FINANCE	1977-2008	sciencedirect	183	26		160	7		769	29	
9	JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS	1966-2003	Jstor	189	14	5	131	0	0	409	5	1
10	JOURNAL OF MONEY CREDIT AND BANKING	1969-2004	Jstor	24	0	0	13	0	0	171	0	0
11	ACCOUNTING ORGANIZATIONS AND SOCIETY	1976-2008	sciencedirect	10	0		8	0		102	0	
12	JOURNAL OF INDUSTRIAL ECONOMICS	1952-2002	Jstor	10	1	0	8	0	0	38	0	0
13	JOURNAL OF RISK AND UNCERTAINTY	1988-2008	Ebsco host	5	0		0	0		9	0	
14	JOURNAL OF INTERNATIONAL MONEY AND FINANCE	1982-2008	sciencedirect	60	13		53	5		233	9	
15	MATHEMATICAL FINANCE	1997-2008	Ebsco host	16	3		0	0		16	3	
	Total			1383	147	20	1084	36	1	4159	109	1

62 The first 15 finance journal based on total citations classified by ISI Web of Knowledge.

Table 3.1: Reviewed Journals and the Relevant Statistics (cont.)

	Sorted by impact factor[63] (2006)			**Search for 'CAPM'**			**Serach for 'CAPM test'**			**Search for 'Capital Asset Pricing Models' (CAPM)**		
	Journal Name	Data Interval	Database	Full Text	Abstract	Title	Full Text	Abstract	Title	Full Text	Abstract	Title
1	JOURNAL OF ACCOUNTING & ECONOMICS	1979-2008	sciencedirect	36	2		34	0		176	1	
2	JOURNAL OF FINANCE	1946-2004	jstor	477	43	14	345	7	1	1049	9	0
3	REVIEW OF ACCOUNTING STUDIES	1996-2008	springerlink	13	0		12	0		82	0	
4	JOURNAL OF FINANCIAL ECONOMICS	1974-2008	sciencedirect	191	34		174	13		616	48	
5	JOURNAL OF ACCOUNTING RESEARCH	1963-2002	jstor	32	0	0	29	0	0	136	0	0
6	ACCOUNTING REVIEW	1926-2002	jstor	37	2	0	28	1	0	173	1	0
7	REVIEW OF FINANCIAL STUDIES	1988-2004	jstor	107	6	1	84	1	0	268	4	0
8	JOURNAL OF MONETARY ECONOMICS	1975-2008	sciencedirect	23	3		19	2		5	0	
9	JOURNAL OF CORPORATE FINANCE	1994-2008	sciencedirect	11	0		9	0		69	0	
10	ACCOUNTING ORGANIZATIONS AND SOCIETY	1976-2008	sciencedirect	10	0		8	0		102	0	
11	FINANCIAL MANAGEMENT	1973-2007	proquest	65	34		0	0		76	47	
12	FINANCE AND STOCHASTICS	1997-2008	ebsco host	3	1		0	0		0	0	
13	WORLD BANK ECONOMIC REVIEW	1998-2008	abi/inform	0	0		0	0		0	0	
14	JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS	1966-2003	jstor	189	14	5	131	0	0	409	5	1
15	JOURNAL OF FINANCIAL INTERMEDIATION	1990-2008	sciencedirect	3	0		2	0		46	0	
16	JOURNAL OF MONEY CREDIT AND BANKING	1969-2004	jstor	29	0	0	14	0	0	171	0	0
17	JOURNAL OF INDUSTRIAL ECONOMICS	1952-2002	jstor	10	1	0	8	0	0	38	0	0
18	MATHEMATICAL FINANCE	1997-2008	ebsco host	16	3		0	0		16	3	
19	AUDITING-A JOURNAL OF PRACTICE & THEORY	1995-2008	na	0	0		0	0		0	0	
20	JOURNAL OF FINANCIAL MARKETS	1998-2008	sciencedirect	14	1		12	0		33	0	
21	QUANTITATIVE FINANCE	2001-2008	informaworld	9	3		7	0		20	0	
22	JOURNAL OF RISK AND UNCERTAINTY	1988-2008	ebsco host	5	0		0	0		9	0	
23	JOURNAL OF INTERNATIONAL MONEY AND FINANCE	1982-2008	sciencedirect	60	13		53	5		233	9	
24	CONTEMPORARY ACCOUNTING RESEARCH	1984-2007	ebsco host	30	5		0	0		29	0	
25	JOURNAL OF BANKING & FINANCE	1977-2008	sciencedirect	183	26		160	7		769	29	
	Total			1553	191	20	1129	36	1	4525	156	1

63 The first 15 finance journal based on total impact factor classified by ISI Web of Knowledge. As it is seen that the first 15 finance journal based on total citations are included when we sorted articles based on impact factor for 25 finance journal. This ensures the quality of the journals.

Table 3.1: Reviewed Journals and the Relevant Statistics (cont.)

Sorted by impact factor [64] (2006)				Search for 'CAPM'			Serach for 'CAPM test'			Search for 'Capital Asset Pricing Models' (CAPM)		
	Journal Name	Date Interval	Database	Full Text	Abstract	Title	Full Text	Abstract	Title	Full Text	Abstract	Title
1	AMERICAN ECONOMIC REVIEW	1911-2005	jstor	56	1	0	37	0	0	248	0	0
2	ECONOMETRICA	1933-2005	jstor	27	3	0	15	0	0	113	1	0
3	JOURNAL OF POLITICAL ECONOMY	1892-2006	jstor	27	4	0	23	0	0	143	0	0
4	QUARTERLY JOURNAL OF ECONOMICS	1886-2002	jstor	10	0	0	7	0	0	91	0	0
5	JOURNAL OF FINANCIAL ECONOMICS	1974-2008	sciencedirect	191	34		174	13		616	48	
6	JOURNAL OF ECONOMETRICS	1973-2008	sciencedirect	36	5		32	1		73	4	
7	REVIEW OF ECONOMIC STUDIES	1933-2004	jstor	15	4	1	9	1	0	90	1	0
8	REVIEW OF ECONOMICS AND STATISTICS	1919-2002	jstor	35	5	0	32	1	0	92	1	0
9	ECONOMIC JOURNAL	1891-2002	jstor	24	1	0	21	0	0	102	0	0
10	JOURNAL OF ECONOMIC THEORY	1969-2002	sciencedirect	12	4		4	0		78	7	
11	JOURNAL OF ECONOMIC PERSPECTIVES	1987-2005	jstor	6	0	0	4	0	0	75	0	0
12	JOURNAL OF MONETARY ECONOMICS	1975-2008	sciencedirect	23	3		19	2		5	0	
13	WORLD DEVELOPMENT	1973-2008	sciencedirect	3	0		1	0		263	1	
14	JOURNAL OF ECONOMIC LITERATURE	1969-2005	jstor	11	0	0	9	0	0	87	0	0
15	ECOLOGICAL ECONOMICS	1989-2008	sciencedirect	5	0		4	0		78	0	
16	JOURNAL OF PUBLIC ECONOMICS	1978-2008	sciencedirect	9	0		5	0		104	2	
17	AMERICAN JOURNAL OF AGRICULTURAL ECONOMICS	1965-2008	ebsco host	19	6		1	0		25	8	
18	EUROPEAN ECONOMIC REVIEW	1969-2008	sciencedirect	32	2		19	0		157	6	
19	RAND JOURNAL OF ECONOMICS	1984-2005	jstor	15	1	0	10	0	0	91	1	0
20	ECONOMICS LETTERS	1978-2008	sciencedirect	36	8		25	4		78	11	
	Total			592	81	1	451	22	0	2609	91	0

64 The first 20 economics journal based on total citations classified by ISI Web of Knowledge.

3.2 Article Screen Panel

	REFERENCES	REVIEW OF THE INTRODUCTION		SAMPLE AND DATA
NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
1	B. H. Solnik (1974)	To determine the International market structure of asset prices.	Can a single world index model give a realistic description of the international structure of asset prices?	The American data was taken from the Standard and Poor's I.S.L. tape of NYSE securities. European data was generously provided by Eurofinance, a prominent European investment research firm. The data base consists of daily prices and dividend data for 234 common stocks of eight European countries and 65 American stocks. The time period covered is from March 1966 to April 1971.
2	Donald R. Lessard (1974)	To better understand the importance of international diversification relative to domestic diversification and to improve the specification of the stochastic process generating returns.	Will it result in greater gains than the ordinary "pure diversification" gains arising from increasing the universe of available securities within a single country? What is the impact of the existence national factors in returns generating process?	Capital International S.A. and published in their monthly publication, Perspective. 16 national market indices and 30 international industry indices. January, 1959-October,1973
3	Gerald A. Pogue and Bruno H. Solnik (1974)	to present the results of some initial tests of the market model for a broad cross-section of the European common stocks	How market model performs on European common stocks returns?	The data base consists of daily prices and dividend data for 229 common stock of seven European countries. The time period covered is from March 1966 to March 1971. In addition, a sample of 65 American stocks was used for comparison purposes. The American data covered the same period and were taken from the Standard and Poor's I.S.L. tape of New York Exchange securities.
4	R. Richardson Pettit and and Randolph Westerfield (1974)	To examines the validity of two widely used methods, CAPM and Market Model, for forming conditional predicted portfolio returns.	Can CAPM explain the structure of conditional predicted portfolio returns?	The data used were taken from an up-dated version of the CRSP tapes. all securities listed on the New York Stock Exchange. Monthly investment relatives during the period January 1926 through June 1968.
5	Bruno H. Solnik (1977)	Attempt to give a fair representation of the various international asset pricing models, stressing their real economic conclusions.	It is very unlikely that an empirical mean-variance analysis will ever be able to discriminate between the various views of the world.	End of month stock prices, Exchange rates and inflation rates for seven countries were used. The period covered is march 1966-April 1974 and the countries are; Belgium, France, Germany, Netherlands, Switzerland, United Kingdom and the United States of America, Stock prices come from Eurofinance; Exchange rates, short term Money rate and inflation indices from the International Monetary Fund. For each country the efficient set was computed independently.
6	Joseph E. Finnerty (1976)	By testing the entire population of insiders, this study evaluates the performance of the "average" insider in terms of market efficiency	Do the insiders earn more than the market on average?	The data are from the S.E.C.'s Official Summary of Stock Transactions for NYSE firms. The data file contains identification of the company and the individual insider, date of the transaction, number of shares traded, end of the month holding of the insider, buy or sell code, and closing price on the day of the trade. The time period for this study runs from January, 1969 to December, 1972
7	Paul A. Griffin (1976)	This study assesses the joint and individual effects of published earnings-per-share numbers and analysts forecasts of earnings per-share on security returns,	The first hypothesis states that there is no difference in the association between each informational variable and security returns. Hypothesis two states that there is no difference in the joint effects of information which is unambiguous for the assessment of security returns and the joint effect of information which is ambiguous	One hundred and sixty-two firms were selected from those listed on the New York Stock Exchange, Each met the following criteria; Earnings-per-share data are available on the annual industrial Compustat tape for December 31 fiscal years 1953-1973, and dividends –per-share data are available on the quarterly industrial Compustat tape for 1967-1974Monthly security return data are available for January 1962-May 1974 on the CRSP tapes obtained from the University of Chicago. The forecast of earnings-per-share made by at least one analyst firm is available from Standard and Poor's Earnings Forecaster as of the announcement date of earnings-per-share for each year 1967-1973. At least one change in dividends-per-share occurred during 1968-1973.
8	Avner Arbel, Richard Kolodny, Josef Lakonishok (1977)	To focus on the role of default risk in capital markets	What is the relationship between default risk and return on equity	all companies on the CRSP tape for which continuous data were available for the period 1965-1973. Bond ratings for unsecured debt, as published in Moody's Bond Survey, were used t o group firms on the basis of default risk . Ratings of unsecured debt were selected in order to provide a better approximation of default risk by eliminating the effects of specific collateral on ratings .

	REFERENCES	REVIEW OF THE INTRODUCTION		SAMPLE AND DATA
NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
9	Chang F. Lee (1977)	To employ the transformation technique developed by Box and Cox to determine the true functional form for testing the risk-return relation and to examine the possible impact of the skewness effect on capital asset pricing.	How possible factors affecting the second-pass regression results in capital asset pricing?	Monthly data of the 30 Dow Jones stocks during January 1965- December 1972 are employed.
10	David Levhari and Haim Levy (1977)	To illustrate that the assumed horizon plays a crucial role in empirical testing.	How deviation from the "true" horizon causes a systematic bias in the regression coefficient?	The monthly rates of return for a sample of 101 stocks traded on the New York Stock Exchange were calculated for the period 1948-68. Fisher arithmetic index is used as a proxy to the market portfolio. The rates of return on Treasury bills as well as on Government bonds were taken from various issues of the Federal Reserve deviation between the and Bulletin. The sample of shares was taken from the return file of the CRSP tapes.
11	Menachem Brenner and Seymour Smidth (1977)	To suggest a specific model of non-stationarity that employs a rather simple approach.	Are betas stationary?	The populations studied consisted of 762 New York Stock Exchange (NYSE) stocks for which data were available on the CRSP tapes for 120 consecutive months ending in June 1968.
12	Michael A. GOLDBERG, Ashok VORA (1977)	To determine whether CAPM is useful in practice.	Is CAPM predictive power of practical use in evaluating the returns to equity of public utility?	Utility returns for the period January 1936 through June 1972. The data (obtained from the CRSP tapes) includes monthly percentage returns for all securities traded on the New York Stock Exchange over this period. For the risk-free rate of interest treasury bills were used when available and banker's acceptances otherwise.
13	William P. Lloyd and Richard A. Shick (1977)	To report the results of an empirical test of Stone's model.	Is Stone's Two-Index Model of returns valid to explain cross-sectional excess returns?	A sample of 60 banks was taken from the Quarterly Bank Compustat tape for the period from 1969 to 1972. Monthly rates of return were calculated without dividends. As an additional test of the two-index model and as a standard of comparison, monthly rates of return were similarly computed (i.e., without dividends) for the 30 stocks in the Dow Jones Industrial Average over the same period. The rate of return on the New York Stock Exchange Composite Index was used for the equity index returns for the bond index Solomon Brothers' '' Total Performance Index for the High-Grade Long-Term Corporate Bond Market'' is used.
14	Irwin Friend, Randolph Westerfield, Michael Granito (1978)	To test CAPM	Can direct test decrease the gab between theory and evidence?	Data were computed using the Standard & Poor 500 Composite Index and return relatives taken from a Rodney L. White Center data tape containing monthly returns on all NYSE firms. There were 46 such stocks in 1974, 34 in 1976 and 48 in 1977. The long-run expected growth rates reported for these stocks almost invariably referred to five year periods.
15	Michael A. Goldberg and Ashok Vora (1978)	This study utilizes spectral analysis to investigate returns	This methodology offers increased generality over OLS when economic phenomena are studied over time	The data base includes monthly percentage returns for all common stocks listed on the New York Stock Exchange during t h e period January 1926 through June 1972. For the risk -free rate of interest , treasury bills were used when available and banker's acceptances at all other times.
16	Robert R. GRAUER (1978)	To test CAPM in the form of the power linear risk tolerance.	(i) linearity, (ii) a positive expected return-risk tradeoff, and (iii) the joint hypothesis that there are no restrictions on riskless borrowing or lending and the composition of the market portfolio is consistent with the specific tastes under consideration.	The monthly data used in the tests were taken from a merged University of Chicago Center for Research in Security Prices (CRSP) and Compustat data base. The monthly returns on the market portfolio were taken to be Fisher's Arithmetic Performance Index. The proxy for the riskfree rate was the one month rate on U.S. Treasury Bills subsequent to 1941 and the monthly rate on Bankers' Acceptances prior to 1941. For each year until January 1966 so that 6 sets of monthly returns on 20 portfolios were created for the 456 month period from January 1934 to December 1971.

	REFERENCES	REVIEW OF THE INTRODUCTION		SAMPLE AND DATA
NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
17	Benjamin Bachrach and Dan Galai (1979)	To find out whether there are specific and distinct characteristics pertaining to groups of securities that. are in certain price ranges with special emphasis on how they affect the empirical tests of the capital asset pricing model.	is the economic rationale for the existence of specific characteristics for groups of securities in "low" and "high" price ranges?	The major body of data for this paper consists of end-of-month prices and percentage returns of all common stocks registered on the NYSE from 1/1926 to 6/1968. The data were collected by the Center for Research in Security Prices (CRSP) a t the University of Chicago.
18	David J. Fowler, C. Harvey Rorke, Vijay M. Jog (1979)	To investigate the effects of trading frequency on the residual behaviour of CAPM (in the form of Market Model) in the TSE.	How residual behavior exists?	Monthly closing prices, dividends and returns were drawn from the Lava1 file for the period June 1965 to June 1976.
19	Jerome B. Baesel and Garry R. Stein (1979)	To investigate the profitability of insider trading	Do insiders earn more than uniformed investors?	The data used i n t h e analysis were simulated trades i n the common stock of any of 111 large, TSE listed industrial firms. The period of the study was January 1968 to December 1972.
20	Stewart L. Brown,Autocorrelation (1979)	test of the CAPM in the context of market efficiency	are the market imperfection(autocorrelation)associated with misspecification of the CAPM?	All firms with complete data on the CRSP tapes for the 1955-73 period, for the two subperiods 1955-64 and 1965-73, and for the immediately preceding five-year period (labeled the prior period) were included in the sample. an equally weighted market index is used for market portfolio proxy The 30-day treasury bill rate was used as a proxy for the riskless rate
21	James Schallheim and Robin Demagistris (1980)	To test CAPM(zero-beta CAPM) with a more efficient econometric procedure for estimating the models parameters.	Is Fama-Macbeth procedure efficient than Random Coefficient Regression?	Betas are computed for each security using seven years of monthly returns, the N securities are ranked by betas in ascending order and divided into 20 nonoverlapping portfolios. The period January 1935 through December 1974,FM used the period January 1935 through June 1968 7 years(formation period) 5 years(estimation period estimation period extends into test period with updating) 4 years(test period)
22	Elton Scott and Stewart Brown (1980)	To demonstrate that concurrent autocorrelated residuals and intertemporal correlations between market returns and residuals can lead to biased, unstable, OLS estimates of betas.	Are betas stable?	using the Quarterly Compustat tapes for four overlapping two year periods from 1967-1971. Monthly excess returns6 were regressed on the excess return of the monthly Fisher Arithmetic Index, an equally-weighted-average of the returns on all stocks listed on the New York Stock Exchange (about 1,800 firms). The thirty-day treasury bill rate was used as a proxy for the riskless rate of return and only firms with fiscal years ending on December 31 were included in the sample
23	Haim Levy (1980)	To examine empirically t h e CAPM and t h e one-parameter performance index with d a t a taken from the Israeli market	How CAPM performs with the data taken from Israel market?	The empirical study covered 104 stocks which are listed on the Israeli stock exchange since 1965 and f o u r representative bond groups.
24	Irwin Friend and Randolph Westerfield (1980)	TO test CAPM and Three Moment CAPM	How CAPM and Three Moment CAPM performs?	The first sample of 891 individual bonds as obtained from a data tape compiled by the Rodney L. White Center containing quarterly rates of return from the fourth quarter of 1968 through the third quarter of 1973 for every corporate bond listed on the NYSE. The second sample of 86 individual bonds covering the period from the first quarter of 1964 through the third quarter of 1968 consisted of a 10% sample of 891 bonds covered in the subsequent period.

	REFERENCES	REVIEW OF THE INTRODUCTION		SAMPLE AND DATA
NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
25	Pao L. Cheng and Robert R. Grauer (1980)	To test CAPM	How CAPM perform under the different tests?	The data for this study are monthly values of equity (the monthly closing price times the number of shares outstanding) for firms traded on the New York Stock Exchange during the period January 1926 through December 1977. The data are from the Center for Research in Security Prices (CRSP) of the University of Chicago.
26	Peter j.Barry (1980)	To estimate risk premiums required to hold farm real estate in a well-diversified market portfolio	How CAPM performs on the farm real estate firms	Risk premiums on farm real estate are estimated by regressing a time series of excess annual rates of return on farm real estate against excess annual rates of return of a market portfolio. The 1950 through 1977 period is free of dominating events like World War I1 and the Great Depression. The risk-free asset is investment in nine- to twelvemonth U.S. government securities with average annual yields obtained from the *Federal Reserve, Bulletin.* weighted by their outstanding market values in each year. The stock index is the widely known Standard and Poors 500, a value-weighted average of 500 stocks, mostly traded on the New York stock exchange. Annual rates of return are measured as the sum of the annual dividend rate on the Standard and Poors (SPP) index, plus the annual percentage change in value of the index.
27	Richard Roll and Stephen A. Ross (1980)	To test APT	How APT performs?	Source: Center for Research in Security Prices Graduate School of Business University of Chicago Daily Returns File Selection Criterion: By alphabetical order into groups of 30 individual securities from those listed on the New York or American Exchanges on both 3 July 1962 and 31 December 1972. The (alphabetically) last 24 such securities were not used since complete groups of 30 were required. Basic data unit: Return adjusted for all capital changes and including dividends, Maximum Sample Size per Security: 2619 daily returns: Number of Selected Securities: 1260, (42 groups of 30 each)
28	Robert C. MERTON (1980)	To estimate the expected return on the market	How the three models developed in the paper estimate the expected return on the market	Market return and interest rate data from 1926 to 1978 are used to estimate the Reward-to-Risk Ratio for each of the three models. The monthly returns (including dividends) on the New York Stock Exchange Index are used for the market return series. This index is a value weighted portfolio of all stocks on the New York Stock Exchange. The U.S. Treasury Bill Index presented in Ibbotson and Sinquefield (1979) is used for the riskless interest rate series. The monthly interest rate from this index is not the yield, but the one-month holding period returns on the shortest maturity bill with at least a thirty-day maturity.
29	Tom W. Miller and Nicholas Gressis (1980)	To presents new procedures for examining risk – return relationships in the presence of nonstationarity so that more precise estimates of alpha and beta can be obtained.	How to dealing with risk-return relationship in the presence of nonstationarity?	28 different no-load mutual funds. time series of weekly observations were used. Standard and poor's composite index was used to calculate the continues one-week rate of return for the market portfolio. Dividends were omitted from market and mutual fund returns.
30	Daniel W. COLLINS and Michael S. ROZEF (1981)	To examine the economic reasons for the observed negative abnormal common stock performance of firms whose reported earnings and stockholders' equity were negatively affected by the proposed elimination of full cost accounting in the oil and gas industry.	How common stock performance of firms are affected in the fight of modified investor theory, contracting cost theory and estimation risk theory.	The initial sample consisted of the 113 firms, selection criteria reduced the sample size to 57 firms. The financial statement data necessary to compute exploration expenditures, total capitalization, debt/equity structure and percentage effects of SFAS No. 19 were taken from the annual stockholder reports, 10-K's, 10- Q's or prospectus filings with the SEC for fiscal years 1977 and 1978. The amount of debt raised publicly vs. privately was obtained from Moody's Industrial, OTC and Bond Manuals. Information concerning the existence of a management compensation scheme and/or covenants on debt agreements tied to reported accounting numbers was obtained from 10-K reports, registration statements, proxy statements filed with the SEC, and from questionnaires sent to the sample firms. Standard and Poors Daily Stock Price Record and CRSP tapes were the primary sources of security price data.

	REFERENCES	REVIEW OF THE INTRODUCTION		SAMPLE AND DATA
NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
31	George S. Oldfield, Jr. and Richard J. Rogalski (1981)	To analyze the response of common stock returns to statistical factors estimated from the weekly returns on a set of U.S. Treasury bills and how to treasury bill factors are estimated and gives statistical results.	How the factors that affect treasury bill influence the common stocks?	All treasury bill data are from the Wall Street Journal weekly during the period January,1964 to December,1979. Weekly common stock data are from the CRSP Daily Returns File which includes individual securities listed on the New York Stock Exchange (NYSE) and the American Stock Exchange (ASE). The weekly returns cover the same period as the Treasury bill data, (i.e. January, 1964 to December, 1979). Intermediate portfolios of the stocks are formed by ordering the NYSE and ASE securities alphabetically into portfolios of thirty securities each.
32	H. L. Brewer (1981)	To focus on the risk-return characteristics of investments in the common stocks of U.S.-based multinational corporations (MNCs) and U.S. national corporations (NATLs).	Is there any difference in the SMLs for MNCs and NATLs?	Monthly percentage returns for 156 months from January 1963 to December 1975 were obtained for a sample of 151 U.S.-based MNCs. For comparison, similar return data were obtained f o r a sample of 137 U.S. NATLs. Monthly returns for individual stocks, as well as a market-value weighted index for the New York Stock Exchange, are from the CRSP monthly file .
33	H. Russell Fogler, Kose John, James Tipton (1981)	To investigate the impact of additional factor for explaining cross sectional asset returns.	If there a multiple factors what might they be?	Monthly returns on 100 common stocks were extracted from the University of Chicago's Center for Research on Security Prices (CRSP) data tape. The period chosen was from January 1, 1959 through December 31, 1977. . The interest data consisted of the two monthly series below from Salomon Brothers' Analytical Record of Yields and Yield Spreads.
34	Marc R. Reinganum (1981)	to investigate empirically whether securities with different estimated betas systematically experience different average rates of return.	Are variations in estimated betas systematically related to variations in average returns?	Stock return data used in this analysis are gathered from the University of Chicago's Center for Research in Security Prices (CRSP) monthly and daily stock return files as of December 1979. The daily file contains the daily stock returns (capital gains plus dividends) of all companies that have traded on the New York Stock Exchange or the American Stock Exchange from July 1962 through December 1979. Unlike the daily file, the monthly file contains information only on NYSE companies; however, the stock return information on the monthly file dates back to January 1926.
35	Marc R. REINGANUM (1981)	To investigate empirical anomalies based on earning's yields and market values	Is CAPM misspecified or market inefficient?	The sample consists of 566 New York Stock Exchange and American Stock Exchange stocks with fiscal year ends in December. The post-announcement price is the closing one on the day the earnings announcement appeared in the *WallStreet Journal.* Data for the historical analysis were gathered from two sources. Corporate annual earnings for the years 1962 through 1975 came from a 1978 version of the Compustat Merged Annual Industrial Tape produced by CRSP. The merged tape includes Compustat's research file, so that firms not currently doing business can nonetheless be analyzed in earlier periods. Stock prices, returns, and common share data are collected from the CRSP daily master and return tapes.
36	Marc R. Reinganum (1981)	investigates empirically whether a parsimonious arbitrage pricing model can account for the differences in average returns between small firms and large firms which are traded on the New York and American Stock Exchanges	Does APT explain the differences in average returns of firms?	The securities selected for analysis in this study are a subset of the stocks contained in the December 1978 version of the University of Chicago's Center for Research in Security Prices daily tape files. The CRSP daily stock return file includes all securities that have traded on the New York and American Stock Exchanges since July of 1962.

	REFERENCES	REVIEW OF THE INTRODUCTION		SAMPLE AND DATA
NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
37	Mark Weinstein (1981)	T6 examine the systematic risk of corporate bonds.	Do hands exhibit systematic risk/to which extent interest rate and default risk explain cross sectional variation of bond's risk?	The data base used for this study consists of monthly holding period returns on a random sample of bonds from June 1962 to July 1974. The holding period returns include accrual of interest and interest payments. The sample is stratified by Moody's rating to ensure that bonds with varying default risk are in the sample
38	Richard Roll (1981)	To explain small firm effect	Do small firms have higher returns even when their measured risk is no greater than that of large firms?	S&P 500 and an equally-weighted index of New York and American listed common stocks for the period July 1962 through December 1977
39	Robert R. Grauer (1981)	To show that the generalized SML tests can not distinguish between the MV model and a much wider variety of power utility LRT models than has previously been entertained.	Do mean variance and Linear Risk Tolerance CAPM distinguishable?	The twenty portfolios consist of New York Stock Exchange common stocks, contained on a merged Compustat and Center for Research in Security Pricing data base, formed into portfolios on the basis of historical beta estimates calculated against an equally weighted market index in formation periods." The proxy for the risk-free rate was the one-month rate on U.S. Treasury Bills subsequent to 1941 and the monthly rate on Banker's Acceptances prior to 1941.
40	Rolf W. BANZ (1981)	To examines the empirical relationship between the return and the total market values of NYSE common stock	Are returns and market value of common stocks related?	The sample includes all common stocks quoted on the NYSE for at least five years between 1926 and 1975. Monthly price and return data and the number of shares outstanding at the end of each month are available in the monthly returns file of the Center for Research in Security Prices (CRSP) of the University of Chicago. Three different market indices are used; this is in response to Roll's (1977) critique of empirical tests of the CAPM. Two of the three are pure common stock indices - the CRSP equally- and valueweighted indices. The third is more comprehensive: a value-weighted combination of the CRSP value-weighted index and return data on corporate and government bonds from Ibbotson and Sinquetield (1977) (henceforth 'market index').5 The weights of the components of this index are derived from information on the total market value of corporate and government bonds in various issues of the *Survey of Current Business* (updated annually) and from the market value of common stocks m the CRSP monthly index file.
41	Son-Nan Chen (1981)	to investigate the relationship between the variability of the beta coefficient and portfolio residual risk, and hence to provide a real picture of the process of portfolio diversification under the condition of beta nonstationarity	Do betas follow stationary process over time?	A sample of 360 firms is drawn from the New York Stock Exchange covering the period from February 1966 through March 1975. The rates of return used in this study are logarithmic holding period returns (continuously compounded re- turns). Both cash and stock dividends and stock splits are adjusted to obtain proper logarithmic holding period returns. The Standard and Poor's stock price index is used to compute the monthly logarithmic return on the market. The yield on the monthly treasury bill is employed as an estimate of the risk-free logarithmic return to generate the appropriate excess returns.
42	Stephen Figlewsk (1981)	To examine the relationship between short interest and realized returns for common stocks.	Do informational effects of restrictions affect the stock returns?	A sample of more than 400 of the stocks included in the standard and poor's 500 index

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NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
43	David H. Downes and Robert Heinkel (1982)	To empirically examine the relation between firm value and two potential actions by entrepreneurs attempting to signal to investors' information about otherwise unobservable firm features.	Are the entrepreneurial ownership retention hypothesis and the dividend signaling hypothesis related to firm value?	The data consist of 449 firms which went public between 1965 and 1969 and for which prospectuses could be obtained. All of the issues were registered with the SEC and underwritten by one or more investment banking firms; no "Regulation A" or "best efforts" underwritings were included
44	Gordon J. Alexander, P. George Benson, Carol E. Eger (1982)	To investigate both theoretically and empirically the appropriateness of describing the systematic risk of mutual funds with a different model of nonstationarity a first order Markov process	Can the systematic risk of mutual funds theoretically be modeled?	The data for this study consist o f the returns for 67 mutual funds over the period January 1965 through December 1973. Prices were adjusted for any splits or stock dividends. The 67 funds were selected from f i v e Wiesenberger classification categories as follows : 9 from the Balanced Fund category, 17 from the Growth and Current Income Fund category, 13 from the Income Fund category, 17 from the Long-term Growth Fund category, and 1 1 from the Maximum Capital Gain Fund category. As a proxy for the market return, both the CRSP value-weighted and equal-weighted indices (with dividends) were used.
45	Kelly Price, Barbara Price, Timothy J. Nantell (1982)	To show theoretically and empirically the difference between variance and lower partial moment of systematic risk.	Are there systematic differences in the two risk measures?	The data are divided on the CRSP monthly tapes into seven nonoverlapping 7-year periods. The sampling periods are listed in Table I. Their length was set at seven years in an effort to balance our concern for a short enough period to maintain stability in the parameters of the distributions and a long enough period to obtain a reasonable proxy for the ex ante distribution. For each sampling period, we identified all the securities on the CRSP monthly tapes for which there are returns available continuously through-out that sampling period and the one following it the time period between 1927 to 1968
46	Marc R. Reinganum (1982)	To investigate Roll's possible explanation of the small firm effect is investigated directly by examining the daily returns of ten portfolios grouped on the basis of firm size.	Is average return of small firm statistically different than big firms?	The securities selected for analysis were a subset of the stocks contained on the December 1978 version of the University of Chicago's Center for Research in Security Prices (CRSP) daily tape files. The number of firms are range from 1457 in 1963 to over 2500 in the mid-1970s.
47	Michael R. Gibbons (1982)	To develop a methodology to test financial models	How a newly developed methodology performed in application.	The estimation uses monthly stock returns as provided by the Center for Research in Security Prices (hereafter, CRSP). The return on the CRSP equally weighted index serves as the return on the market portfolio,
48	Patrick A.Casabona and Ashok Vora (1982)	To demonstrate how the use of risk premiums calculated by the generally accepted method may distort the empirical estimates of the security beta coefficient.	Does the adjusted risk premium perform better than conventional use at risk premium in empirical test of CAPM	The data for the equity securities came from the CRSP tape from January 1926 through June 1972 and included all the stocks trading on the New York Stock Exchange during that period. Fisher's index from the CRSP tape is used as the market index. Thirty-day treasury bills are used as the risk-free asset.
49	Peter E. M. Standish and Swee-Im Ung (1982)	To examine the impact on stock price residuals of fixed asset revaluations by 232 listed British companies in the period 1964-1 973, primarily using a simple CAPM test	Do corporate signaling impact the stock price ?	The file data for the period show 1,528 revaluations in which fixed-asset book values were increased, of which 527 were by companies included in the London Graduate School of Business Studies Share Price Data Base (LSPD).' The LSPD comprises monthly prices and associated trading data for 2,300 companies quoted on the London Stock Exchange from 1955 onwards and contains a cross-reference to the DTI company history file. On average there were about 1,200 companies in both bases for each year in the sample period

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50	Robert C. Klemkosky and Kwang W. Jun (1982)	to investigate the impact of monetary changes on the parametric variables in the Sharpe-Lintner -Black capital asset pricing model (CAPM)	Are there any relationship between monetary changes and CAPM parameters?	The variability of stock market returns is measured by the annual variance o f monthly returns of NYSE stocks f o r t h e period o f 1954-1980. The sample period was selected to coincide with most o f the empirical studies that involve monetary variables for the post-Korean war period. The equally weighted market index with dividend returns included from the CRSP file o f the University o f Chicago is used to compute the annual variance o f market returns.
51	Robert E. WHALEY,Joseph K. CHEUNG (1982)	To test Chicago Board Options Exchange efficiency by examining option price behavior in the weeks surrounding a firm's quarterly earnings announcement.	How earning announcements are anticipated in stock price?	The data employed in this study consisted of price, dividend, and earnings observations for 93 firms whose call options were traded on the CBOE during the 221-week period of September 28, 1973 through December 23, 977. Ninety-two of the firms were listed on the NYSE, and one was listed on the AMEX. (A list of the firms is included in appendix A.) The weekly closing prices of the stocks, options, and Treasury Bills 9 were recorded from various issues of Wall Street Journal, and the quarterly dividend information was taken from Standard and Poor's Stock Reports. Quarterly earnings per share before extraordinary items and the earnings announcement date were compiled from Wall Street Journal Index, and the earnings figures were verified with the information provided in *Moody's Common Stock Manuals. 1°* wherever necessary, adjustments were made for stock-splits and stock dividends. Weekly stock return data were generated from the *Center for Research in Security Price* (CRSP) daily return file, as were the weekly returns of the equal-weighted and the value-weighted NYSE-AMEX market indexes.
52	Robert F. STAMBAUGH (1982)	To investigate the sensitivity of tests of the CAPM to different sets of asset returns.	How CAPM performs when different sets of asset return included in market portfolio?	Construction of a market index requires (i) rates of return on a broad range of assets and (ii) market values by which to weight these returns. Estimates of market values and monthly returns for seven classes of assets are assembled for the period from February 1953 through December 1976. market values for the seven classes of assets: (1) NYSE common stocks, (2) corporate bonds, (3) U.S. Government bonds, (4) Treasury bills, (5) residential real estate (structures), (6) housefurnishings, and (7) automobiles.
53	Bill McDonald (1983)	to derive and test a more generalized form of the CAPM-more general with respect to functional form and also within the context of investment horizons. The second purpose is to investigate nonlinearities, as in [4], and to extend the analysis to a large sample of individual securities.	What is the functional form of CAPM and their effects on empirical evidence?	Monthly returns for all securities appearing on the Center for Research in Security Prices (CRSP) tapes with data avail- able from January 1973 through December 1979 were included in this study's sample. This resulted in a data base of 1,164 securities, each with 84 monthly observations. The value-weighted index of market returns was used for *R,,*. The return on T-bills with one month to maturity was used as the risk-free rate.
54	Colin A. Carter, Gordon C. Rausser, Andrew Schmitz (1983)	To focus original and newer version of the Keynesian theory of normal backwardation and the implications for market efficiency.	Is future market efficient?	Returns in the soybean, corn, wheat, cotton, and cattle futures markets. the results for OLS and GLS are reported. The dependent variables used in the regressions are the first differences of the natural logarithms of weekly average futures prices collected from 1966 through 1976. The independent, variables were obtained from the Commodity Futures Trading Commission (CFTC) reports.

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55	Donald B. KEIM (1983)	To examine by month the empirical relation between abnormal returns and market value of NYSE and AMEX common stock	Are size related anomalies and stock return seasonality persisted and stable over time ?	The data for this study are drawn from the CRSP daily stock files for the seventeen-year period from 1963 to 1979. The sample consists of firms which were listed on the NYSE or AMEX and had returns on the CRSP files during the entire calendar year under consideration. Thus, every year firms enter or leave the sample due to mergers, bankruptcies, delistings and new listings. The number of sample firms in a given year ranges from approximately 1,500 in the mid-1960's to 2,400 in the late 1970's.
56	E. Dimson and P. R. Marsh (1983)	To examine the problems of estimating risk measures and their stability in thin markets.	Are the UK risk measures stable over time ?	sample here consisted of all UK companies for which data were available on the London Share Price Database (LSPD). By including all companies, our sample has a slight bias towards larger (frequently traded) companies. (See Smithers [59,60] for a description of the LSPD). Security returns data were taken from the LSPD monthly returns file. Monthly market returns were calculated from the broadly-based, capitalization weighted Financial Times-Actuaries All-Share Index (FTA).I Five equal length estimation periods of 60 months each were examined, beginning in January 1955 and ending in December 1979
57	Edwin ELTON and Martin GRUBER (1983)	To demonstrate that dividend yield has a large and statistically significant impact return above and beyond that explained by the zero beta form of the CAPM	Does the impact of dividend yield explain the deviations from returns CAPM produced?	the monthly data on dividends, prices and returns for New York Stock Exchange securities available on the University of Chicago's CRSP tape are used the period covered by this study is from January 1927 through December 1976.
58	Lars Peter Hansen and Kenneth J. Singleton (1983)	To study the time series behavior of asset returns and aggregate consumption	How intertemporal relation of asset returns exists?	The monthly, seasonally adjusted real consumption series, dating back to January 1959, were obtained front the CITIBASE data tape. The observations of these series were divided by the monthly estimates of population published by the Bureau of the Census to get per capita values. Return series for two levels of aggregation across common stocks were considered: an average return on all stocks listed on the New York Stock Exchange and returns on individual members of the Dow Jones Industrials. In addition to stock returns, we considered the 1-month return on Treasury bill yields. The stock return data were obtained from the Center for Research in Security Prices (CRSP) tapes, and the Treasury bill data were obtained from Ibbotson and Sinquefield (1979).
59	Lawrence Kryzanowski and Minh Chau To (1983)	to empirically test the second prerequisite assumption that security returns are characterized by an explicit underlying factor structure composed of at least one general or common factor	Is there a common factor affecting stock returns?	B. Data Sources Eleven samples, each consisting of 50 securities, were randomly drawn from those securities that were included on the CRSP (Center for Research on Security Prices) monthly tapes over the 360-month period from January 1948 to December 1977. Each of the eleven samples was further divided into six subsamples. The first three groups of subsamples included all 50 securities and covered the three 120-month periods of January 1948 to December 1957, January 1958 to December 1967, and January 1968 to December 1977, respectively. The fourth and fifth groups of subsamples included all 50 securities, and covered the two 180-month periods of January 1948 to December 1962 and January 1963 to December 1977, respectively. The sixth and final group of subsamples included all 50 securities and covered the entire 360-month period of January 1948 to December 1977.

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60	Nai-Fu Chen (1983)	To estimate the parameters of Ross's arbitrage Pricing Theory (APT)	How APT and CAPM perform?	Source: Center for Research in Security Prices, Graduate School of Business, University of Chicago Daily Returns File Sample period: 1963-78 inclusive. The entire period is divided into four subperiods: I. 1963-66, 11. 1967-70, 111. 1971-74, and IV. 1975-78. Selection criterion: All the securities that do not have missing data during each subperiod." Basic data unit: Return adjusted for all capital changes and including dividends. Number of selected securities: Subperiod: 1.2.3.4 total sample:1.064, 1.522,1.580,1.378
61	Paul SCHULTZ (1983)	To investigate the impact of transaction cost in explaining small firm effect anomaly	Is transaction cost important factor for the anomaly off small firm effect?	The sample of firms I use to form the small firm portfolio is obtained from the Center for Research in Security Prices (CRSP) Daily Master File. The total market value of each stock listed on the NYSE or AMEX is measured for the last trading. The number of stocks in the small firm portfolio of this study varies from 204 to 274 as compared to 71 to 116 in the portfolio used by Stoll and Whaley. Most of the stocks in the small firm portfolio used here are listed on the AMEX and are much smaller than any NYSE stocks. each year during the period 1962-1978.
62	Philip BROWN,Allan W. KLEIDON (1983)	To investigate size related anomalies in stock returns	Do small firms have tended to yield returns than those predicted by traditional CAPM?	Our primary sample consists of the 566 in which a size-related anomaly is reported. The sample is, in turn, a subset of 577 companies. The reason for using this sample is that it has proven informative about the size anomaly. Since all 566 firms were required to have complete quarterly data from June 1967 to December 1975, a survivorship bias is possible.
63	Robert F. STAMBAUGH (1983)	To address a problem that can arise when a broader market index is used to test the CAPM	How the excluded return in indexes for real estate and durables estimated and effect the mean variance theory?	Data for both items (albeit, at times, imperfect) were obtained for seven major asset classes during the period February 1953 through December 1976." (1) NYSE common stocks, (2) corporate bonds, (3) U.S. Government bonds, Treasury bills, (5) residential real estate (structures), (6) housefurnishings, and (7) automobiles. Weights for an index combining these seven assets are displayed in table 1. 5 NYSE common stocks range from 15% of the index's value in 1953 to 34% in 1968 and, on average, account for about one-fourth of the index. Real estate and consumer durables together make up approximately half of the index's market value.

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64	Roger P. Bey (1983)	to use a more powerful statistical test, the cusum of squares of recursive residuals, to determine the stationarity of the market model of individual securities in a specified time period; (2) to provide empirical evidence of the stationarity of the market model for regulated firms; (3) to provide empirical evidence concerning the stationarity of the market model by industry; and (4) to use Quandt's log likelihood ratio for identifying when a secu rity's return-generating process or structure, and, therefore, the market model, changes	Is CAPM in the form of market model stationary over time?	The data bases consisted of both monthly and daily security returns, including both price changes and cash dividends, as listed on the Center for Research in Securities Prices (CRSP) monthly and daily tapes. The CRSP Value Weighted Market Indexes, for monthly and daily returns, were used as proxies for the market portfolios, respectively. The monthly risk-free rate was estimated as the one-month yield on 90-day treasury bills. The Monthly Data Base consisted of the monthly returns for the 453 securities contained in the two-digit SIC industry codes listed in Table 1 with no missing observations for the period January 1960 through December 1979
65	Sanjoy BASU (1983)	To examine The empirical relationship between earnings' yield, firm size and returns on the common stock ol NYSE firms	How is the empirical relationship among earnings' yield firm size and returns of common stocks?	The primary data for this investigation were drawn from two sources. Accounting earnings per share, on a 12-month moving basis, for the years ended December 1962 through 1978 were collected from an annually updated version of the Compustat Prices-Dividends-Earnings (PDE) Tape. The updated version of the PDE tape is analogous to the Merged Annual Industrial Compustat Tape produced by CRSP. Security prices, returns and common share data were obtained from the monthly stock return tile of the CRSP tape. To be included in the sample for a given year T (T= 1963,1964,. . ., 1979), a firm was required to have been listed on the New York Stock Exchange as of January 1 and have traded for at least the first month in that year.
66	Stephen J. Brown and Mark I. Weinstein (1983)	To test asset pricing models with a new approach called the bilinear paradigm	Are the common factor that affect stocks returns constant over time?	Source: Center for Research in Security Prices Graduate School of Business University of Chicago Daily Returns File, Selection Criterion: By alphabetical order into groups of *30* individual securities from those listed on the New York or American Ex-changes on both *3* July *1962* and 31 December *1972.* Basic Data Unit: Return adjusted for all capital changes and including dividends, if any, between adjacent trading days; Maximum Sample Size per Security Number of Selected securities: : *1260, (42* groups of *30* each)
67	D. Chinhyung Cho, Edwin J. Elton, Martin J. Gruber (1984)	To examine the results produced by the Roll and Ross procedure when the return generating process is known.	How zero beta and APT performs?	Daily returns were taken from the Center for Research on Security Prices (CRSP) file for the period January 1, 1973 to September 30, 1980, a total of 1,770 days. This period is more current and slightly shorter than that used by Roll and Ross. Estimates of the daily riskless rate were based on daily quotations on new 90 day certificates of deposit. There were 2,016 securities listed on the New York or American Stock Exchanges on both January 1, 1973 and September 30, 1980. Since one source of betas was the set of fundamental betas generated by Wilshire, we eliminated stocks for which Wilshire did not estimate fundamental betas. There were 247 such stocks. We grouped the remaining stocks into 58 groups of 30 securities each. The grouping was done alphabetically on the basis of ticker symbols.
68	D. Chinhyung Cho (1984)	To test the Arbitrage Pricing Theory(APT)by estimating the factor loadings that are consistent between two industry groups ofr securities through inter-battery factor analysis	Is APT valid model?	Stocks that are listed on the New York or American Stock Exchanges on both July 3, 1962 and December 31, 1972 using the 1982 version of the CRSP Daily Returns file. In total, there were 1286 stocks and 2619 trading days to be considered

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69	Dorothy H. Bower, Richard S. Bower, Dennis E. Logue (1984)	To presents some new evidence that Arbitrage Pricing Theory may lead to different and better estimates of expected return than the Capital Asset Pricing Model, particularly in the case of utility stock returns	Which model is better to estimate the expected returns APT or CAPM?	all companies in these two groups (electricts and gas distribution) traded continuously on the New York and American Stock Exchanges from *1971* through *1979,* using monthly returns data and the CRSP value-weighted index
70	Phoebus J. Dhrymes, Irwin Friend, N. Bulent Gultekin (1984)	To reexamine the evidence presented by RR and point out major pitfalls involved in the empirical methodology employed for testing APT by them and others who have followed their lead.	Are the numbers of factor increasing as the numbers of securities increase in testing APT through factor analysis?	Source: Center for Research in Security Prices, Graduate School of Business, University of Chicago, Daily Stock Returns Files, Selection Criteria:" By alphabetical order of *42* groups with the size of *30* individual securities listed on the New York and American Stock Exchanges Maximum Sample Size Per Security *2619* daily returns, Minimum Sample Size per security: *2509* daily returns: Number of Selected Securities: *1260,* Time Period: July *3, 1962* to December *31, 1972*
71	Thomas B. Hazuka (1984)	To examine the relationship between commodity consumption betas and realized commodity futures contract risk premiums.	Is there a linear relationship between risk premiums and consumption beta?	The commodities were classified according to storage characteristics: nonstorable (live cattle, live hogs, eggs, iced broilers, pork bellies), seasonal storable (wheat, corn, oats, soybeans, soy meal, soy oil, cocoa, sugar), and nonseasonal storable (copper, silver). Only futures contracts with one month to expiration were utilized
72	Phoebus J. Dhrymes, Irwin Friend, Mustafa N. Gultekin, N. Bulent Gultekin (1985)	To provide new tests of the arbitrage pricing theory (APT).	Can the ability of risk measures from one period to another explain returns?	The data in this paper consist of daily stock returns from the CRSP tapes for the July 3, 1962 to December 31, 1981 period. Securities with more than 100 missing observations are deleted. This resulted in 900 New York and American Stock Exchange stocks, providing a sample size (number of observations) ranging from 4793 to 4893 daily returns per security. We rank these securities alphabetically to form groups of 30, 60, and 90 securities each.
73	Christine E. AMSLER and Peter SCHMIDT (1985)	To provide Monte Carlo evidence on the accuracy of the WLR, LM and CSR tests.	How artificial returns work in context of CAPM test?	Random returns (Monte Carlo experiment) with the given parameter value
74	David P. Brown and Michael R. Gibbons (1985)	To investigate utility based asset pricing model with and without assuming a distribution for security returns	Which estimation method, parametric or non-parametric is better?	The empirical results in this section are based on monthly data from 1926- 1981. Two proxies for the market portfolio are examined-the value-weighted and equal-weighted indexes of the New York Stock Exchange from the Center for Research in Security Prices (CRSP) at the University of Chicago. Interest rates are needed to form the "excess returns" on these market proxies. Prior to 1953, monthly returns15 on U.S. treasury bills are from Ibbotson and Sinquefield 1221. From 1953-1981, yields on 30-day (approximately) bills are from the CRSP Government Bond File.
75	Giovanni Barone-Adesi (1985)	To investigate The quadratic form of the covariance-co-skewness model by Kraus and Litzenberger and arbitrage pricing theory for market equilibrium with skewed security returns.	How arbitrage equilibrium with skewed asset returns existed?	The NYSE equally-weighted index was chosen as the market index and a series of monthly Treasury Bill Rates7 was chosen as the riskless rate. The parameters of the quadratic market model are estimated for each security in the monthly CRSP file. Sixty observations are used for this estimation,* which is repeated for each nonoverlapping five-year subperiod from January 1926 to December 1970

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76	James S. Ang and David R. Peterson (1985)	To investigate the relationship between return and yield in the context of ex ante data from The Value Investment Survey and by examining the role of dividends as a proxy for risk.	How is the role of yield (dividend)in explaining stock returns?	Value Line regularly reviews each company four times a year, proceeding through four cycles of thirteen issues. For this study, data from the fourth cycle (chronologically corresponding to the fourth quarter) for each of the years 1973 through 1983 are employed.
77	Jay SHANKEN (1985)	To propose a cross sectional test,(CSRT) of the CAPM is developed and to explore its connection to be Hotelling T^2 test of multivariate statistical analysis.	How zero beta CAPM performs?	all securities on the CRSP monthly return tape with complete data for the subperiod are ranked on the basis of total value of all shares outstanding at the end of the month preceding the subperiod, and (ii) the securities are grouped into twenty equally-weighted portfolios. Each portfolio contains approximately the same number of securities. The portfolios are ranked from one to twenty, portfolio one containing the smallest firms and portfolio twenty the largest. The three subperiods, each of length *T* = 74 (months), are February 1953 to March 1959, April 1959 to May 1965, and June 1965 to July 1971.27 Real returns are computed using the consumer price index.
78	Joseph YAGIL (1985)	To estimate the intrinsic value of index-linked bonds, using the CAPM, and tests whether the market for index bonds is efficient.	Is Index-Linked bond efficient in the content of CAPM?	Finally, the bond's beta coefficient was obtained by regressing the monthly holding period real return on the bond against the corresponding return on the market index (using, each at a time, the bond index and the bond and stock index), for a time period of 36 months preceding December 1981 the month for which the bond intrinsic value is estimated. The sample consists of 50 randomly selected Israeli bonds, out of which 30 are government and 20 are corporate bonds.
79	K. C. CHAN, N.CHEN and D.A. HSIEH (1985)	To investigate the firm size effect for the period 1958 to 1977 in the framework of a multi-factor pricing models.	Is there a firm size effect in the context of multifactor models?	The availability of macroeconomic data limits our investigation to the time period 1953-1977. We divide these twenty-five years into twenty overlapping intervals, each consisting of six years. The first interval is January 1953 to December 1958, the second is January 1954 to December 1959, and so on, and the last one is January 1972 to December 1977. *EWNY* = Equally weighted NYSE stock index. *IPISA* = Growth rate of industrial production from month r to I + 1 (seasonally adjusted). *UITB* = Unanticipated inflation, defined as *CPI* - expected inflation, *DE1* = Change in expected inflation. *UTS* = Difference in return of long-term government bond portfolio and the one-month T-Bill , *BUSF* = Growth rate of the Net Business Formation series from r to r + 1. The data, obtained from the Bureau of Economics Analysis, were seasonally adjusted. *PREM* =Difference in return of 'under BAA' (rated by Moody) bond portfolio and long-term government bond portfolio. The government bond data were taken from Ibbotson and Sinquetield (1982). The non-convertible bond data were obtained from R.G. Ibbotson & Co., Chicago
80	Michael J. Best and Robert R. Grauer (1985)	To show that the set of expected return vectors, for which an observed portfolio is mean variance (MV) efficient, is a two-parameter family. We identify ten ways to specify the time series behavior of the two parameters;	How is the relation between MV based CAPM and observed market value weights?	Two data bases. The first cover the 1935-1979 period. It is patterned after Fama MacBeth to provide a comparison with previous studies of the CAPM. The second provides robustness by extending the data to include five major asset categories: common stock, corporate securities, real estate, U.S. government securities, and municipal bonds. This data base, covering the 1947-1978 period, was compiled by Ibbotson and Fall (IF)
81	Michael R. GIBBONS,Wayne FERSON (1985)	To test financial models perfoms when risk is not canstant	How financial models perform when risk premium is relaxed to be changing?	daily returns on common stocks for 196221980. the CRSP value-weighted index, 1962-1980. Number of observations is 4595.

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82	N. Bulent Gultekin and Richard J. Rogalsk (1985)	To examine the factor structure of U.S. Treasury security returns and tests the Arbitrage Pricing Theory (APT)	How is the bond's risk evaluated in context of APT and CAPM in addition with the interest rate?	All data are from the CRSP U.S. Government Bond File. We use return data all securities in the CRSP file except securities with special tax or call provisions for the 20-year period 1960-1979.
83	Ravi Jagannathan (1985)	Toxtend the two-period Grauer-Litzenberger futures pricing model to a dynamic environment and test it using methods that do not require explicitly specifying the stochastic processes for futures prices and the quantities consumed.	Can future prices be modeled by consumption based intertemporal model?	Estimates were obtained using monthly, seasonally adjusted, nondurables + services consumption series from the CITIBASE data tape. The observations on consumption were divided by the monthly estimates of population published by the Bureau of Census to get per capita consumption values. The monthly nominally risk-free return data were obtained from Ibbotson and Singuefield [15]. Futures prices were obtained from the Center for the Study of Futures Prices, Columbia University. Spot prices were obtained from the Wall Street Journal. Nominal returns were converted to real returns using the implicit price deflator corresponding to the consumption measure we use.
84	Steve SWIDLER (1985)	uses non-parametric statistical methods to test the relation between estimation risk and security returns	How is the role of analysist' forecasts taken place in the context of CAPM?	The empirical work includes data on 851 firms. We calculate security returns from the S& P *Stock Guide,* and the return variable equals the actual return from December 31, 1982 to December 31, 1983. The analysis assumes that the risk free rate of interest equals 8.62%, the appropriate Treasury Bill rate. The market rate of return is calculated from the S&P 500 *Index* and equals 17.27%.
85	Richard J. Sweeney and Arthur D. Warga (1986)	To address the issue of whether firms are required to pay an *ex ante* premium to investors for bearing the risk of interest-rate changes	Are the firms required to pay investors *ex ante* for bearing this risk of interest-rate changes?	Three measures of changes in "the" interest rate were used. The first measure was an index of yields on U.S. government bonds with twenty years to maturity; the second measure was three-month U.S. T-bill rates (FYGTZO and FYGM3, respectively, from the NBER Database). A third measure arose because one problem with using a particular index is that some of its movements may be idiosyncratic to that index, rather than due to changes in the overall level of rates. CRSP value-weighted return, the change in the interest rate, equally weighted portfolios formed from all two-digit SIC code industries for the period 1960-1979, using monthly CRSP data.
86	Bob Korkie (1986)	To develop some propositions regarding market line deviations and discusses abnormal security performance and index inefficiency.	Is size anomaly related to a sample inefficient index?	The monthly effective returns from all firms on the monthly CRSP tape, without missing observations in a time block, were obtained, and the beginning of time block market values were observed. This resulted in 329,490, 677, 979, 917, and 1034 stocks per respective period. Returns from the CRSP value-weighted index were also obtained for each period. Excess returns were formed by subtracting the Ibbotson and Sinquefield [8] one-month Treasury bill returns from the stock and index returns.

	REFERENCES	REVIEW OF THE INTRODUCTION		SAMPLE AND DATA
NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
87	Elroy DIMSON and Paul MARSH (1986)	To focus on event study methodology in the presence of the size effect, using an original study of newspaper recommendations as a cautionary tale.	How size effect is analyzed with event study methodology?	Sample covers stock recommendations published in regular features in the national press from 1975 to 1982. These fall into two groups. New Year Tips appear in late December/early .January, and consist exclusively of purchase recommendations. Portfolio Tips, on the other hand, appear throughout the year in journals which run paper portfolios, and include advice on sales as well as purchases. In total, 862 recommendations are identified from eleven publications which give regular, unambiguous buying or selling recommendations. The sources, and the percentage of total recommendations from each, were the Economist (6%) and Investors Chronicle (IS%), which are financial journals; the Sunday Telegraph (6%), Observer (6%) Sunday Times (4%) and Sunday Express (2%), which are all Sunday papers; the Daily Telegraph newspaper (12%); the IC Newsletter (7%) and the Fleet Street Letter (3%) the two leading stock market letters; and finally three investment magazines, namely Financial Weekly (2%), Mr. Bearbull (a pseudonym for regular staff reporters writing in the Investors Chronicle) (34%) and Money Observer (2%).
88	N. Gregory Mankiw and Matthew D. Shapiro (1986)	TO examine whether the consumption CAPM provides an empirically more useful framework for understanding cross-sectional stock returns.	How CCAPM and CAPM performs ?	The cross-section of stocks, which is from the CRSP tape, includes all those companies listed on the New York Stock Exchange continuously during our sample period; they number 464. We use quarterly data from 1959 to 1982 to calculate the return and covariances for each stock. The return is from the beginning of the quarter to the beginning of the following quarter. The market return we use is the return (capital gain plus dividends) on the Standard and Poor composite. The consumption measure is real consumer expenditure per capita on non-durables and services during the first month of the quarter. We use the comparable consumer expenditure deflator to compute real returns for all the stocks and for the market index. The National Income Accounts data are seasonally adjusted
89	Philippe Jorion and Eduardo Schwartz (1986)	To examine the issue of integration versus segmentation of the Canadian equity market relative to a global North American market.	How Canadian stock market integrated with NYSE?	Monthly rates of return on Canadian stocks were taken from the Laval Securities tape1' for the period from January, 1963 to December, 1982. The Canadian market index return, R,, was computed as the value-weighted average of returns for all included stocks.12 Canadian interlisted securities were identified from the Toronto Stock Exchange Monthly Review. In the Laval subsample, we found 23 stocks traded on the NYSE and 75 stocks on the AMEX, for a total of 98 interlisted stocks.
90	Robert H. Litzenberger and Ehud I. Ronn (1986)	To develop and tests a nonlinear utility-based econometric model of the temporal behavior of aggregate stock price movements based on a constant relative risk aversion utility function and an observable information set consisting of aggregate consumption, aggregate dividends, and past stock prices.	How utility based model performs?	The data used in this study cover the period 1926 through 1982. Consumption is measured as total annual per capita real consumption expenditures on nondurable~ and services. Real annual dividends, Bt, were calculated as total nominal dividends on the NYSE value-weighted index divided by the average monthly value of the personal consumption expenditures (PCE) deflator for the appropriate year. Finally, the annual average real price level, Ft, was estimated as the average of that year's month-end NYSE value-weighted index (appropriately standardized) divided by the average PCE deflator.
91	Seha M. Tinic and Richard R. West (1986).	To test S-L CAPM	How S-L CAPM performs?	Monthly returns of NYSE common stocks from CRSP database in the period of 1935-1982 equally and value weighted indexes

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NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
92	Thomas H. McInish and Robert A. Wood (1986)	To the effectiveness of techniques proposed by: Scholes-Williams; Dimson; Fowler, Rorke, and Jog; and Cohen, Hawawini, Maier, Schwartz, and Whitcomb to control for bias in beta estimates from thin trading and price adjustment delays.	What is the extent of bias in beta estimates due to thin trading and price adjustment delays? (2) How effective are the techniques proposed by Scholes-Williams, Dimson, FRJ, and CHMSW in controlling for this bias	Data for 958 firms listed on the NYSE. A tape was obtained which contains the price of every trade on the exchange from September 1, 1971-February 28, 1972. Prices were adjusted for dividends and changes in capitalization. The proxy for thin trading used is the average time in minutes from last trade to market close.
93	Bill McDonald (1987)	To extend a recent study by Malatesta [14] on measuring abnormal performance using joint generalized least squares	How to deal with the abnormal returns when systems method is used in addition with event study?	Samples of this study are taken from both the CRSP daily and monthly data files. Due to data availability at the time of the study, the daily samples contain event dates from 1964 to 1984, the monthly samples contain event dates from 1961 to 1985. The estimation period for the monthly tests includes 80 months (as in Malatesta) with the event included in the final month. The estimation period for the daily sample includes 245 days (similar to Brown and Warner) with the event falling on the final day.
94	A. Craig MacKINLAY (1987)	To analyze whether such multivariate tests can distinguish between the CAPM and other pricing models.	How to distinguish CAPM from other asset pricing model through multivariate tests?	The 30-year period from January 1954 to December 1983 inclusive is divided into six five-year periods. For each period, we compute the mean and the Standard deviation of the excess return on the CRSP equal weighted index.
95	Albert Corhay, Gabriel Hawawini, Pierre Michel (1987)	To report evidence of seasonality in the Fama and MacBeth estimate of the CAPM-based risk premium in four stock exchanges: the NYSE and the London, Paris, and Brussels exchanges.	How seasonality differs among stock exchanges?	Data source : <u>CRSP tape(US)</u> <u>London stock price(UK)</u> <u>collected by authors(france)</u> <u>collected(belgium)</u> Data begin on : January 1969 January 1969 January 1969 January 1969 Data end on: December 1982 December 1983 December 1983 December 1983 Number of common stocks 782 527 112 170 Market index: equally weighted (from the CRSP tape) equally weighted(using the 527 stocks) equally weighted(using the 112 stocks) >>>equally weighted(using the 170 stocks)
96	D. Chinhyung Cho and William M. Taylor (1987)	To investigate the month-by-month stability of (a) daily returns and correlation coefficients of stock returns, (b) correlation and covariance matrices, (c) number of return-generating factors, and (d) the APT pricing relationship.	Do returns and correlation coefficients differ across calendar months and groups? Do correlation matrices and covariance matrices differ across calendar months and groups? Does the number of return-generating factors differ across calendar months and groups? Do pricing relationships differ across calendar months and groups?	The data used in this study are daily stock returns on the New York or American Stock Exchanges obtained from the 1984 version of the CRSP Daily Returns File. We sample from those companies listed on the file from January 2,1973, to December 30, 1983. The condition of being listed on the first and last trading days of this period and having not more than fifteen missing observations determined the eligible firms in our samples.
97	Daniel W. COLLINS,S.P. KOTHARI,Judy Dawson RAYBURN (1987)	To explore the information content of prices with respect to earnings by focusing on firm size and its relation to the predictive accuracy of price based earnings forecasts.	Is there a broader and richer information set available about the activities of larger firms vis-à-vis smaller firms? Are there greater numbers of traders and professional analysts expending resources on information activities with respect to large vs .small firms?	A sample of COMPUSTAT-CRSP firms with a December 31 fiscal year end a minimum of six prior years of earnings data for each year from 1968-1980.total sample sizes during this time frame ranged from 630 firms in 1968 to 1051 firms in 1980.

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NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
98	Jay SHANKEN (1987)	To develop a Bayesian test of portfolio efficiency~ and derives a computationally convenient posterior-odds ratio.	How efficiency of given portfolio is tested through Bayesian approach ?	CPRS value weighted index over the period 1926-1982 using 12 industry portfolios.
99	Jay SHANKEN (1987)	To test CAPM with different proxy for market portfolio	How CAPM performs when different proxy for market portfolio is used ?	The tests are carried out over five subperiods of equal length from February 1953 through November 1983. January returns have been deleted from the tests in light of much puzzling evidence which indicates that the return generating process may differ in January from that in the rest of the year." As a result, each test period contains T = 68 months of data. Securities with complete data on the CRSP monthly return file, for a given subperiod, are stratified into N = 20 equalweighted portfolios based on the market value of equity at the beginning of each subperiod. Returns on these portfolios constitute the vector *R.* Excess returns are computed using the monthly T-bill return series constructed by Ibbotson and Sinquefield.
100	Kenneth R. FRENCH,G. William SCHWERT,Robert F. STAMBAUGH (1987)	To examine the relation between stock returns and stock market volatility.	Is the expected market risk premium positively related to risk as measured by the volatility at the stock market?	daily values of the Standard and Poor's (S&P) composite portfolio to estimate the monthly standard deviation of stock market returns from January 1928 through December 1984.
101	Robert N. FREEMAN (1987)	To investigate the timing and magnitude of the relation between security returns and accounting earnings for large versus small NYSE firms.	Do the abnormal security returns related to accounting earnings occur (begin and end) earlier for large firms than for small firms (timing hypothesis),? Is the magnitude of those abnormal returns is inversely related to firm size(magnitude hypothesis).?	The sample is drawn from December 31 fiscal-year-end firms on both the 1982 Compustat annual industrial file and the 1983 Center for Research in Security Prices (CRSP) monthly returns file.' Earnings information is derived from accounting data on the COMPUSTAT tape. Abnormal returns are obtained from CRSP. All December 31 firms with data available on both files in a sample year (1966-1982) are candidates for the final sample. The final sample includes 2263 firm-year observations, which is one-quarter of the December 31 firms with data available on both COMPUSTAT and CRSP.
102	Wayne E. Ferson, Shmuel Kandel, Robert F. Stambaugh (1987)	To present new tests of financial valuation models in which expected returns are allowed to vary over time.	How tests of asset pricing with time-varying expected risk premiums and market betas perform?	Weekly returns on common stocks for the twenty year period 1963 through 1982 are used .Weekly excess returns for each stock are compounding the total daily returns reported by CRSP over a calendar week and subtracting the return on a one-week U.S Treasury bill.
103	Tim Bollerslev, Robert F. Engle, Jeffrey M. Wooldridg (1988)	To estimate a multivariate generalized autoregressive conditional heteroscedastic process for returns to bills, bonds and stocks where the expected return is proportional to the conditional covariance of each return with that of a fully diversified or market portfolio.	Do all investors choose mean-variance efficient portfolios with one period horizon although they need not have identical utility functions? Do all investors have the same subjective expectations on the means variances and covariance's of returns? Is the market fully efficient in that there are no transaction costs, indivisibilities taxes or constraints on borrowing or lending at a risk-free rate?	The data are quarterly percentage returns from the first quarter of 1959 through the second quarter of 1984,for a total of 102 observations. The return on 3 month Treasury bills is taken to represent the risk-free return .Two data sets have been analyzed for these three returns series. Standard and Poor's 500 equity series was used with Citibase interest rates. New York Stock Exchange value weighted equity returns are used with Salomon Brothers bill and bond yields.

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104	Yoram Kroll, Haim Levy (1988)	*to test experimentally basic assumptions underking the separation theorem and the capital asset pricing model.*	What are the effects of the correlations between the risky assets on investment portfolios? Is separation theorem valid? What are the effects at magnitude of reward on investors behavior and the magnitude at individual differences;?	Thirty male and female under-graduate students from the University of Haifa participated in Experiment 1. All the subjects were volunteers who agreed to participate in a 3-session, computer-controlled portfolio selection experiment with monetary reward contingent on performance. Only subjects who satisfied the following two criteria were recruited. First, the subjects had completed at least a 1-year long course in statistics.
105	Edwin Burmeister and Marjorie B. McElroy (1988)	To investigate an APT (or multifactor) model in which there are both measured macroeconomic factors and other nonobserved factors	How APT and CAPM perform?	Monthly data and assume that the riskless rate, A;, is measured by the 30-day Treasury-bill rate that is known at the beginning of each month. total monthly returns, in excess of the 30-day Treasury-bill rate, for seventy randomly selected stocks from the CRSP data file for the time period 1972.01 to 1982.12 (132 months). R1 = the total monthly return on a portfolio of 20-year corporate bonds; R2 = the total monthly return on a portfolio of 20-year government bonds; R3 = the total monthly return on the S&P 500 index.
106	Gregory CONNOR,Robert A.KORAJCZYK (1988)	To use an asymptotic principal components technique to estimate the pervasive factor influencing asset returns and to test the restrictions imposed by static and intertemporal equilibrium versions of the arbitrage pricing theory(APT) on a multivariate regression model.	How APT and CAPM perform?	The factors and risk premiums using monthly stock returns in four nonnverlapping five-year subperiods are estimated 1964-1968,1969-1973,1974-1978,and 1979-1983.The choice of five-year intervals makes our results comparable to earlier work such as Black.Jensen,and Scholes and Gibbons. The factors by applying asymptotic principal components to the entire sample of New York Stock Exchange(NYSE) and American Stock Exchange(AMEX;) firms with no missing observations over the five-year subperiod are estimated the numbers of firms available are 1.487,1.720,1.734, and 1.745,respectively,and the number of time periods is 60 for each subperiod. The riskless return is assumed to be equal to the return on Treasury bills taken from Ibbotson Asscociates.
107	K. C. Chan and Nai-Fu Chen (1988)	To make assumptions that take into account recent empirical evidence on the movements of the expected returns and betas3 and obtain a linear relation between the unconditional expected returns and the unconditional betas.	How CAPM performs?	We gather return and firm-size data from the CRSP monthly file for the period 1949 to 1983. During each year, firms on the NYSE that have existed for at least the five previous years and that have price information on December of the previous year are chosen and ranked according to the market value of equity as of that December. The firms are then put into one of twenty portfolios arranged in order of increasing size, each containing (to within one) the same number of securities. the equally weighted NYSE market index (EWNY) as the market proxy.
108	Jeffrey Jaffe, Donald B. Keim, Randolph Westerfield (1989)	To re-examines the relation between the size and E/P effects with (a) a substantially longer sample period, 1951-1986, (b) data that have no significant survivor biases, (c) both portfolio and seemingly unrelated regression (SUR) tests, and (d) an emphasis on the important differences between January and other months.	What is the relation at earnings yields, market value (size) with stock returns?	Data collection and portfolio selection procedures used here are chosen to minimize these biases. Data on returns, price, and shares outstanding are taken from the University of Chicago Center for Research in Security Prices (CRSP) monthly stock return and master files for the 1951-1962 period and from the CRSP daily return and master files for the 1963-1986 period. Use of the daily tapes over the latter period permits inclusion of AMEX firms, thereby substantially increasing the number of sample firms. During this latter period, daily stock returns are linked together within the month to compute a monthly return. Earnings per share are obtained from the Compustat PST files (currently active firms) and the complementary Research file (firms that "disappeared") for the 1967-1986 period and from the "Backdata" versions of these two files for the 1950-1966 period.

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109	Robert A. Korajczyk and Claude J. Viallet (1989)	*To investigate several asset pricing models in an international setting*	How asset pricing models perform in international settings?	Monthly stock returns data for four countries spanning 15 years from January 1969 through December 1983. Our sample includes three major markets: the New York and American Stock Exchanges, the Tokyo Stock Exchange, and the London Stock Exchange. For these three countries our sample includes all assets traded on the exchanges. The Paris Bourse is added in order to introduce a country with severe foreign exchange controls. The four markets represented nearly 65 percent of the world equity market capitalization at the end of 1983. Returns from France, Japan, and the United Kingdom, adjusted for dividends and stock splits, are transformed into dollar returns using end-of-month exchange rates from the Data Resources Incorporated data file. Excess returns were computed using the short-term U.S. Treasury-bill r e t ~ r n . ~We perform our tests on both nominal and real returns. Nominal dollar returns are converted into real returns using inflation calculated at the percentage change in the U.S. consumer price index. The Treasury-bill returns and inflation series are from Ibbotson Associates (1985)
110	Puneet HANDA, S.P. KOTHARI,, Charles WASLEY (1989)	To document beta sensitivity to the return interval.	How the return interval affects betas?	The sample includes all stocks listed on the Center for Research in Security Prices (CRSP) monthly tape [i.e., New York Stock Exchange (NF'SE) firms for at least one year during 1926-1982. For 19641982 we expanded that: sample by adding American Stock Exchange (A EX) securities. The inclusion of these typically smaller firms enables us to perform a severe test of the size effect, which previous evidence suggests is pronounced among smaller firms. Market value and return data the NYSE firms are from the CRSP monthly tape and data for the A X firms are from the (compustat PDF, rape. daily and weekly returns are from the CRSP daily tape.
111	W. V. Harlow and Ramesh K. S. Rao (1989)	To develop a new asset pricing model that generalizes earlier results in the downside risk literature and to test empirically using a multivariate approach.	How MLPM performs?	Historical monthly security returns from CRSP DATABASE are used for the period 1931 to 1980. CRSP equally weighted Index is used. Securities were selected on the basis that no returns were missing during the five year test period or the preceding five year portfolio formation period. The total number of securities used ranged from 981 for the 1976-1980 period to 322 for the 1931-1935 period.
112	James N. Bodurtha, Jr. and Nelson C. Mark (1991)	To draw on Engle's autoregressive conditionally heteroskedastic modeling strategy to formulate a conditional CAPM with time-varying risk and expected returns	How CAPM (conditional) performs?	We take monthly observations on total equity returns for firms listed on NYSE and monthly Treasury bill yields. The estimation period covers 1926-1985. In addition, the GMM tests on orthogonality conditions not used in estimation (the omitted variables tests) exploit data on both the excess yield and the default premium of low-grade corporate bonds over Treasury bonds and the dividend yield on the CRSP NYSE value-weighted index in excess of the Treasury bill return. The sources for this data are the CRSP tapes for the equity return and dividend series, Fama's U.S. Government issue file for the Treasury bill time series, and Ibbotson Associates for the corporate and Treasury bond series.
113	John H. Cochrane (1991)	To develop and test production-based asset pricing model.	How investment-based CAPM performs?	Data are quarterly, 1947:l-1987:4. Annual returns are overlapping quarterly observations. All returns are expressed as percentages. Autocorrelations are calculated from single regression slope coefficients. Stock returns are the CRSP value weighted portfolio deflated by the CPI; the investment return is constructed from gross fixed investment data.

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NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
114	Kai-Jiaw Tan (1991)	To reexamine the empirical evidence of the three-moment capital asset pricing model on 43 randomly selected mutual funds from 1970-1986.	How three moment CAPM performs?	The sample used in this study consisted of 43 randomly selected mutual funds whose quarterly prices, cash dividends, and capital gains were reported in Wiesenberger (1970-1986) from March 1970 to December 1986. The sample data have been adjusted for stock dividends and stock splits so that the adjusted data represent consistent schedules over the entire period.
115	Lilian Ng (1991)	To test of the CAPM with time-varying covariances by a multivariate GARCH approach	How conditional CAPM performs?	Study uses monthly realized returns on all common stocks traded in the New York Stock Exchange during the period January 1926 through December 1987. Data were obtained from the Center for Research in Security Prices (CRSP) at the University of Chicago. Two methods of constructing portfolios are adopted. The first grouping technique ranks assets according to their market betas and divides them into ten groups. Using the first 5 years of monthly data (January 1926-December 1930), the beta coefficient of each security is estimated using a market model regression with the CRSP value-weighted index as a proxy for the market portfolio. Next, securities are ranked on the basis of their estimated beta coefficients and then grouped into ten value-weighted portfolios. The entire procedure is then repeated after dropping the first year of data and moving forward until the last year of data (1987) is reached. For this approach, only stocks with a complete set of returns on the CRSP monthly return file for the 5-year estimation period and for the 1 year after the estimation period are included in the portfolios.
116	Shigeyuki Hamori (1991)	To analyze the C-CAPM for the Japanese assets market	How C-CAPM performs?	The sample period for the estimation is January 1980 through December 1988. Japanese monthly data on the growth rate of real consumption, the real rate of return for Tokyo stocks, long-term government bonds, long-term corporate bonds, and short-term real interest rates are used. For the Japanese stock indices, TOPIX and NIKKEI 225 are often used. However, these indices do not take into consideration the dividends revenue. In this paper, Hamao's data set, which considers both dividend and appreciation as return, is used in order to avoid this problem.
117	Andreas Sauer,Austin Murphy (1992)	To test CCAPM and CAPM for Germany	How CCAPM and CAPM perform?	the complete data set of 249 stocks are first put randomly into 60 groups, with each group consisting of 2 to 3 continuously-traded stocks and 2 to 3 stocks not continuously traded. Next, a portfolio with the maximum correlation (MCP) with real consumption is estimated using quarterly data on these 60 groups.
118	Eugene F. Fama and Kenneth R. French (1992)	To investigate the cross section of expected stock returns	What is the relation of size and book-to-market equity with stock returns?	We use all nonfinancial firms in the intersection of (a) the NYSE, AMEX, and NASDAQ return files from the Center for Research in Security Prices (CRSP) and (b) the merged COMPUSTAT annual industrial files of income-statement and balance-sheet data, also maintained by CRSP. The COMPUSTAT data are for 1962-1989. The 1962 start date reflects the fact that book value of common equity (COMPUSTAT item 60), is not generally available prior to 1962.

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119	Eugene F. Fama and Kenneth R. French (1993)	To identify five common risk factors in the returns on stock and bonds	What are the relevant factors that affect stock and bond returns?	One common risk in bond returns arises from unexpected changes in interest rates. Our proxy for this factor, *TERM,* is the difference between the monthly long-term government bond return (from Ibbotson Associates) and the one month Treasury bill rate measured at the end of the previous month (from the Center for Research in Security Prices, CRSP). For corporate bonds. Shifts in economic conditions that change the likelihood of default give rise to another common factor in returns. Our proxy for this default factor, DEF, is the difference between the return on a market portfolio of long-term corporate bonds (the Composite portfolio on the corporate bond module of Ibbotson Associates) and the long-term government bond return. In June of each year t from 1963 to 1991, all NYSE stocks on CRSP are ranked on size (price times shares). The median NYSE size is then used to split NYSE, Amex. and (after 1972) NASDAQ stocks into two groups. small and big (S and B). Most Amex and NASDAQ stocks are smaller than the NYSE median, so the small group contains a disproportionate number of stocks 13,616 out of 4,797 in 1991). Despite its large number of stocks, the small group contains far less than half (about 8% in 1991) of the combined value of the two size groups.
120	Guofu Zhou (1993)	To investigate asset pricing tests under alternative distributions	How asset pricing tests perform under alternative distributions?	the returns on twelve industry portfolios formed by The industry groups are: petroleum, finance/real estate, consumer durables, basic industries, food/ tobacco, construction, capital goods, transportation, utilities, textiles/ trade, services, and leisure. The portfolio returns are value weighted. The benchmark portfolio return is the value-weighted New York Stock Exchange return available from CRSP at the University of Chicago. All returns are in excess of the 30-day Treasury bill rate available from Ibbotson Associates. The monthly data span February 1926 to January 1986.
121	Jianping Mei (1993)	To develop a semiautoregression (SAR) approach to estimate factors of the arbitrage pricing theory (APT) that has the advantage of providing a simple asymptotic variance-covariance matrix for the factor estimates, which makes it easy to adjust for measurement errors.	How APT and CAPM perform?	The data are obtained from the December 1989 version of the Center for Research in Security Prices (CRSP) monthly return file. Each data set includes all New York Stock Exchange (NYSE) securities with no missing information on returns during the five-year period. The numbers of securities available are 1105, 1276, 1210, and 1089, respectively. The riskless return is assumed to be equal to the return on the thirty-day treasury bill.
122	Su-Jane Chen,Bradford D. Jordan (1993)	To investigate the ability of two models based on the Arbitrage Pricing Theory (APT) to predict portfolio returns over the period 1971-1986.	How APT performs?	The initial sample includes all firms on the CRSP daily tape with no more than 100 missing returns for the period of January 1971 through December 1986. The daily tape is used initially to gain access to securities listed on both the New York and American Stock Exchanges. However, monthly returns are then calculated and used in all subsequent analyses because most macroeconomic data are only available (at best) on a monthly basis.
123	Wayne E. Ferson a and Campbell R. Harvey (1994)	To empirically examines multifactor asset pricing models for the returns and expected returns on eighteen national equity markets.	How multifactor model performs?	Monthly data provided by Morgan Stanley Capital International. The countries include sixteen OECD countries plus Singapore/Malaysia and Hong Kong. The country returns are value-weighted indices formed from a list of 1476 (as of December, 1989) companies. The firms represent about 65% of the market capitalization of the countries' stock markets, with some attempt to stratify the sample by industry groups, so that each industry is represented in proportion to its national weight (see Schmidt, 1990). The stocks are generally those for which the total market value outstanding is large. Total monthly returns are measured for 197&1989 as the capital change component of a country index plus the dividend yield, as provided by MSC14

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NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
124	Glenn N. Pettengill, Sridhar Sundaram, Ike Mathur (1995)	To investigate the conditional relation between beta and returns	How CAPM performs?	The sample period for this study extends from January 1926 through December 1990. Monthly returns for the securities included in the sample and the CRSP equally-weighted index4 (as a proxy for the market index) were obtained from the CRSP monthly databases. The three-month Treasury bill rates (a proxy for the risk-free rate) for the period 1936 through 1990 were collected from the Federal Reserve Bulletin.
125	John H. Cochrane (1996)	To examine a factor pricing model for stock returns	How investment-based CAPM performs?	All asset return data are taken from CRSP. National Income and Product Accounts data and yield data are taken from Citibase. The two investment returns are based on Citibase series GINQ and GIRQ. The stock return series are based on CRSP series EWRETD and VWRETD and the size decile return series DECRETI ... DECRET10. The default premium is based on Citibase series FYBAAC-FYAAAC. Quarterly data are obtained by using the last month of the quarter. The dividend/price ratio is based on CRSP EWRETD and EWRETX, the equally weighted portfolio returns with and without dividends.
126	John Y. Campbell (1996)	To use an equilibrium multifactor model to interpret the cross-sectional pattern of postwar U.S stock and bon returns.	How the multifactor model performs?	This paper uses two separate data sets. The first data set is monthly and runs from January 1952 through December 1990, giving 468 observations. The second data set, an update of that used in Campbell and Schiller (1988) is annual and runs from 1871 through 1990,giving 120 observations.
127	Ravi Jagannathan and Zhenyu Wang (1996)	To investigate the conditional CAPM and the cross section of expected returns	How conditional CAPM performs?	The returns to stocks of nonfinancial firms listed in NYSE and AMEX (1962-90) covered by CRSP alone. We create 100 portfolios of NYSE and AMEX stocks as in Fama and French (1992). For every calendar year, starting in 1963, we first sort firms into size deciles based on their market value at the end of June. For each size decile, we estimate the beta of each firm, using 24 to 60 months of past-return data and the CRSP value-weighted index as the market index proxy. Following Fama and French (1992), we denote this beta as the "pre-ranking" beta estimate, or "pre-beta" for short. We then sort firms within each size decile into beta deciles based on their pre-betas. This gives us 100 portfolios, and we compute the return on each of these portfolios for the next 12 calendar months by equally weighting the returns on stocks in the portfolio. We repeat this procedure for each calendar year. This gives a time series of monthly returns (July 1963-December 1990, i.e., 330 observations) for each of the 100 portfolios.
128	A.D. Clare, R. Priestley, S.H. Thomas (1998)	To investigate the beta efficiency in explaining cross sectional returns.	How CAPM performs?	The data in this paper is obtained from two sources: month-end, dividend adjusted stock return data on 100 9 stocks quoted on the London Stock Exchange between January 1980 and December 1993 are taken from the London Share Price Database (LSPD) tapes; while the accounting data on book value (BE), earnings (E), asset value (A) and equity market values (ME) were obtained from Datastream International.
129	,Andy Naranjo, M. Nimalendran, Mike Ryngaert (1998)	To document that risk-adjusted NYSE stock returns increase in dividend yield during the period from 1963 to 1994.	Do stocks with higher anticipated dividend yields earn higher risk-adjusted returns?	data are for NYSE firms during the period July 1963 to December 1994 (378 months). The returns and yields are in percentage term. The average stock market values are in billions of dollars and are calculated as the simple monthly average of the market capitalizations in each respective portfolio from July 1963 to December 1994

	REFERENCES	REVIEW OF THE INTRODUCTION		SAMPLE AND DATA
NO	AUTHOR(date)	OBJECTIVE(S)	RESEARCH QUESTIONS	DATA-DATABASE- TIME PERIOD
130	Louis K. C. Chan, Jason Karceski, Josef Lakonishok (1998)	To use a common data set to evaluate the performance of various proposed factors in capturing return comovements.	How common factor affect stock returns?	USA Data: the returns on all domestic companies listed on the New York and American stock exchanges, as found on the CRSP files. We only consider common equity issues, so closed-end funds, investment trusts, and units are excluded. The factor returns data extend from January 1968 to December 1993. Accounting data for these issues are extracted from the Annual Compustat files. JAPAN Data: Data on returns and accounting items are taken from the PACAP Japanese database from the Pacific-Basin Capital Markets Research Center at the University of Rhode Island. Our sample period is May 1976 to December 1994. UK Data: Data on returns and accounting items are from a proprietary database on U.K. stocks constructed by ABP and Robeco. Sample period is May 1973 to December 1994.
131	K. Geert Rouwenhorst (1999)	To investigate Local Return Factors and Turnover in Emerging Stock Markets.	Are similar return factors present around the world?	As of April 1997 the Emerging Markets Database of the IFC contains data on more than 2200 firms from 31 emerging markets, but not all are included in the sample. Eleven countries are excluded because of insufficient return histories, which leave 1705 firms in the 20 countries that the IFC tracks for at least seven years. For some firms monthly closing prices and dividends are available dating back to 1975. Starting at various points during the 1980s the IFC expanded its reporting to include monthly time series for price-to-book ratios, price-earnings ratios, market capitalization, trading volume, and the number of days per month that a stock is traded. These countries are Argentina, Brazil, Chile, Colombia, Greece, Indonesia, India, Jordan, Korea, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Portugal, Taiwan, Thailand, Turkey, Venezuela, Zimbabwe.
132	Martin Lettau and Sydney Ludvigson (2001)	To explore the ability of conditional versions of the CAPM and the consumption CAPM-jointly the (C)CAPM-to explain the cross section of average stock returns.	How CAPM and CCAPM performs?	data on returns consist of 25 portfolios formed according to the same criteria as those used in Fama and French (1992, 1993). These data are value-weighted returns for the intersections of five size portfolios and five book-to-market equity (BE/ME) portfolios on the New York Stock Exchange, the American Stock Exchange, and NASDAQ stocks in Compustat.
133	Robert F. Dittmar (2002)	To investigate nonlinear pricing kernels in which the risk factor is endogenously determined and preferences restrict the definition of the pricing kernel.	How four moment CAPM performs?	the returns on 20 industry-sorted portfolios, where the industry definitions follow the two-digit SIC codes. The data used to compute the industry portfolio returns, value-weighted index return, dividend yield, yield spread, and risk-free return are obtained from CRSP. The data used to compute the labor return series is obtained from the NIPA data available on Datastream. Labor income at time t is computed as the per capita difference between total personal income and dividend income. The data cover the period July 31, 1963, through December 31, 1995, totaling 390 observations.
134	Kevin Q. Wang (2003)	To present a new test of conditional versions of the Sharpe-Lintner CAPM, the Jagannathan and Wang(1996) extension of the CAPM and the Fama and French (1993) three factor model.	How S-L CAPM, conditional CAPM and three factor model performs?	monthly observations from January 1947 to December 1995 for portfolio returns and conditioning variables defined below. The returns are arithmetic nominal rates of return in excess of the one-month Treasury bill rate, measured in percent (multiplied by 100).
135	Keith Vorkink (2003)	To compare and contrast some existing ordinary least squares (OLS) and generalized method of moments (GMM) based tests of asset pricing models with a new more general tests	How different estimations techniques affect tests' results?	Our dataset consists of CRSP monthly returns from July 1963 through December 1995. Firms traded on the NYSE, NASDAQ, and AMEX are included in the sample. To compare OLS, GMM, and HLV estimations and asset pricing tests, we sort returns into two sets of portfolios: firm size and previous performance (momentum).
136	Viral V. Acharya, Lasse Heje Pedersen (2005)	To present a simple theoretical model that helps explain how asset prices are affected by liquidity risk and commonality in liquidity.	How Liquidity Based CAPM performs?	Daily return and volume data from CRSP from July 1st, 1962 until December 31st, 1999 for all common shares listed on NYSE and AMEX. Book-to-market data based on the COMPUSTAT measure of book value

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
1	CAPM and International Asset Pricing Model	Risk premium of world market (for IAPM) and national Premium (for CAPM)	Risk Premium of constructed portfolios	OLS
2	CAPM and IAPM (in the form of market model)	Market Value Weighted Index, Equally Weighted Index and Principal Component Psedo Index	Returns of market and industry index	OLS
3	CAPM	the market risk premium	the risk premium on security	OLS
4	CAPM	Fisher's Combination Investment Performance Index	Risk premium of constructed portfolios and returns of constructed portfolio	OLS
5	International Asset Pricing Model	Excess (value weighted) international market portfolio	Excess portfolio return	OLS
6	CAPM	Excess return of market portfolio	Excess return of portfolio	OLS
7	CAPM	Excess return of market portfolio(Fisher's Weighted Market Index)	Excess return of portfolio	OLS
8	CAPM	Excess return of market portfolio	Excess return of securities	OLS
9	CAPM	Risk proxy used to measure the risk for security (or portfolio)	Average rates of return on security (or portfolio)	MLE
10	CAPM	The proxy return for market portfolio, residual variance	Security returns (average returns)	OLS
11	CAPM	Excess Market Return	Excess Stock Return	OLS
12	CAPM	The proxy return for market portfolio (betas)	The excess return for utility securities (average returns) , portfolio returns	OLS (Bivariate spectral analysis)
13	Stone's Two- Index Model of Returns	Excess return on market and Bond index	Excess return on security	OLS
14	CAPM	The proxy return for market portfolio (betas)	Security and bond returns	OLS
15	CAPM	Index (proxy for market portfolio)returns	Security (portfolio) returns	OLS and spectral analysis

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
16	CAPM	The proxy for portfolio returns (betas)	Portfolio returns	OLS
17	CAPM	The proxy for portfolio returns (betas)	Portfolio returns	OLS
18	CAPM	The proxy for portfolio returns (betas)	Portfolio returns	OLS
19	CAPM	Proxy for market portfolio returns	Security(portfolio)returns	OLS.
20	CAPM	Proxy return for market portfolio(betas)	Security returns(average portfolio returns)	OLS
21	CAPM (zero beta CAPM)	Market portfolio returns(betas)	Portfolio returns(average return)	OLS and Random(coefficient regression)
22	CAPM	Excess return of market portfolio(changes in the product of the autocorrelation coefficient and the lagged-residual)	Excess return of securities (changes in betas)	OLS and modified OLS
23	CAPM	Betas and residual variance in second pass regression Excess role of return of proxy for market portfolio	Excess rate of return for securities(portfolios) , Average rate of return	OLS
24	CAPM, Three Moment CAPM	Excess return of portfolios consisted from stocks and bonds, co skewness	Excess return securities and bonds (portfolios)	OLS
25	CAPM	Proxy returns for market portfolio (betas)	Portfolio returns(average portfolio return)	OLS and (orcutt regression)
26	CAPM	Excess annual rate of return of market portfolio(proxy)	Excess annual rate of return of farm real estate	OLS and cochrane-Orcutt regression
27	APT	Factor loading (betas)	Security returns	Factor analysis and OLS
28	Three models(unspecified) to estimate expected return on market	Variance,standard deviation.constant rate of excess return.	Excess return of market value weighted index.	OLS

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
29	CAPM	Excess return of market	Excess return of mutual funds	OLS
30	CAPM (CAR)	aCAR= cumulative abnormal residual; TOTCAP=company size; TOTSEE= percentage effect of SFAS No. 19 on total stockholders' equity; EXPLOR= capital expenditures as a percentage of revenues; DEMK T= BV of debt/MV of equity, PUBDT= whether firm has public debt in capital structure, CONTRCS =whether firm has debt covenants or management compensation plan defined in terms of reported accounting numbers. And security total return	Cumulative (weekly) abnormal return, market total return.	OLS
31	APT	Statistical factors(factor loadings,betas)	Excess return of portfolios	Factor analysis, OLS
32	CAPM (in the form of market model)	Market portfolio retrurn(betas)	Security and portfolio returns (average returns)	OLS
33	Multi factor model	Excess return on the three month U.S treasury bond in period	Excess returns of stocks	OLS
34	CAPM	Poxy return for market portfolio	Portfolio retunrs	OLS+ Scholes williams and Dimson estimates
35	CAPM	Proxy returns for market portfolio E/P (firm standarized unexpected earnings)	Portfolio returns	OLS,
36	APT	Statistical factors	Market value portfolio return	Factor analysis
37	CAPM (in the form of market model)	Some index returns	Bonds returns	OLS,
38	CAPM	Index returns	Portfolio returns	OLS, autocorrelation regression + Dimson beta estimater
39	CAPM(in the form of market model based on MV and LRT	Proxy return for market portfolio	Portfolio return	OLS
40	CAPM (with size variable)	Index returns (betas)	Portfolio returns(average returns)	OLS and GLS
41	CAPM	The proxy return for market portfolio	The security return	Optimal Bayesian estimater, OLS

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
42	CAPM	Proxy returns for market portfolio	Portfolio returns	OLS
43	Leland and Pyle model	The total market value of equity after initial offer	OLS,WLS	OLS
44	CAPM	Mutual fund returns	Value weighted and equal weighted indexes	Regression,Markov process ,Lamotte-Mcwhorter
45	CAPM and lower partial CAPM	The proxy return for market portfolio	Teh return of securities	OLS
46	CAPM	The proxy return for market portfolio(betas) (value-weighted index)	Portfolio returns (average returns)	OLS and Dimson beta
47	CAPM	Proxy return for market portfolio	Security and portfolio returns	OLS
48	CAPM	Proxy return for market portfolio(adjusted risk premium)	Portfolio return	OLS
49	CAPM	Proxy return for market portfolio	Security returns	OLS
50	CAPM	The proxy return for market portfolio(betas)	Security return (average portfolio return)	OLS
51	CAPM	Proxy return for market portfolio	Portfolio return	OLS
52	CAPM	Proxy return for market portfolio	Portfolio return	OLS and MLE
53	CAPM (functional form)	Proxy return for market portfolio	Security returns	MLE
54	CAPM	Proxy returns for market portfolio	Commodity returns(future controls)	OLS, GLS
55	CAPM	Proxy returns for market portfolio	Portfolio returns	OLS, scholes williams beta, dimson beta
56	CAPM	Proxy returns for market portfolio	Security returns	OLS, Adjusted betas

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
57	Zero beta CAPM	The proxy return for market portfolio(betas)	Portfolio return (average return)	OLS
58	CAPM (general equilibrium asset pricing model)	Model parameters		MLE
59	APT	Factor loadings	Portfolio returns	Factor analysis (rao's factor analysis alpha factor analysis)
60	CAPM and APT	Facto loadings(betas)	Average returns of securities	Factor analsis, OLS
61	CAPM	Proxy returns for market portfolio	Excess return after transaction costs for the holding period	Dimson beta
62	CAPM	Proxy returns for market portfolio(Size)	Security returns	OLS,SURM
63	CAPM	Proxy returns for market portfolio	Security returns	MLE
64	CAPM	The proxy return for market portfolio	Security returns	OLS
65	CAPM	proxy return for market portfolio	Portfolio return	OLS ,Dimson beta
66	APT	Factor loadings	Portfolio return	Factor analysis (Jöreskog algorithm) OLS,GLS
67	Zero-beta CAPM,APT	The proxy return for market portfolio(stimulated data with actual data)	Security return (stimulated data with actual data)	Factor analysis ,GLS
68	APT	The proxy return for market portfolio	Security returns(group of security returns)	GLS, factor analysis (inter-battery)
69	APT and CAPM	The proxy return for market portfolio	The security returns, portfolio returns(average returns)	OLS (Theil measure)
70	APT	The factor analysis	Security returns (group of securities)	Factor analysis

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
71	C-CAPM	Rate of change at spot price	Consumption beta	OLS
72	APT	Factor analysis	Security returns (group of securities)	Factor analysis (GLS)
73	CAPM	The proxy return for market portfolio	Security returns	Monte Carlo experiment
74	Utility based asset pricing models	Model parameters		Method of moment and parametric estimation
75	Three moment CAPM	Proxy return for market portfolio (betas)	Security (portfolio)returns (average returns)	OLS (likelihood ratio)
76	CAPM(after tax adjusted)	Proxy return for market portfolio, dividend yield(betas)	Security returns(average return)portfolio returns	Maximum likelihood
77	Zero-beta CAPM	Proxy return for market portfolio (betas)	portfolio returns (average returns	OLS,GLS
78	CAPM	Proxy return for market portfolio	Bond return	OLS
79	Multi-factor pricing models (CAPM)	EWNY , IPISA, UITB, DE1, UTS, BUSF, PREM(betas)	Stock returns (average returns)	OLS
80	CAPM	Proxy return for market portfolio (betas)	Security returns, portfolio returns(average returns)	Mean variance optimization
81	CAPM ,multi factors	Proxy return for market portfolio (betas)	Security returns (average returns) portfolio returns	OLS
82	APT, CAPM	Proxy return for market portfolio (betas)(statistical factors)	Bond's portfolio returns(average returns)	OLS + factor analysis +seemingly unrelated regression + GLS +
83	CCAPM	C-CAPM model parameters		GMM
84	CAPM	Proxy return for market portfolio (betas)	Portfolio returns, security returns(average returns)	OLS
85	APT and CAPM	The market return and changes in the yield on long term government bonds	Security returns	MLE

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
86	CAPM (zero beta CAPM)	Portfolio(index)returns	Portfolio returns	MLE
87	CAPM	Index returns(abnormal returns)+size factor	Security returns	Event study +OLS
88	CAPM and CCAPM	The proxy return for market portfolio (Consumption betas)	Average security (portfolio)returns	OLS + GLS
89	CAPM (ınternational APM)	The proxy return for market portfolio (Consumption betas)	Security (portfolio)returns (average returns)	MLE
90	Utility based model	Utility model parameters		OLS, MLE, method of moments
91	S-L CAPM	Proxy return for market portfolio (betas)	Security (portfolio)returns (average returns	OLS
92	CAPM	Proxy return for market portfolio(different betas)	The security (portfolio)returns (average returns)	Linear programming model to estimate betas
93	CAPM	Proxy return for market portfolio (betas)	Security returns	OLS+GLS+IGLS(hera6ted GLS)
94	CAPM (specific alternatives)	Proxy return for market portfolio (betas)	The security (portfolio)returns (average returns)	Multivariate tests
95	CAPM	Proxy return for market portfolio (betas	The security (portfolio)returns (average returns)	OLS
96	APT	Factor loadings	Portfolio returns	Factor analysis (maximum likelihood) + modified GLS
97	CAPM	Price-based factors (logs)+size	Cumulative average returns +price based factors	OLS (random walk model valuation modell + RWM with drift)
98	(market efficiency)MPT	CPRS value weighted index		Bayesian approach test for efficiency
99	CAPM	The proxy return for market portfolio (betas)	Portfolio returns (average return);	OLS+MLE

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
100	CAPM (ARIMA,ARCH,GARCH specifications)	Volatility, stock returns(logs),index returns	Stock returns, portfolio returns	OLS+WLS+modified WLS
101	CAPM	The proxy return for market portfolio (betas);	Security return (average return)"	OLS
102	CAPM	The proxy return for market portfolio (betas);	Security (portfolio)returns (average returns)	Maximum likelihood methods
103	CAPM (GARC-M ,econometric model)	The proxy return for market portfolio (betas, residuals)	Security (portfolio)returns)average returns percentage returns)	(GARCH-M) maximum likelihood estimation
104	CAPM +MPT			Mean-variance mathematics + ANOVA
105	CAPM and APT	The proxy return for market portfolio (betas)	The security returns (average returns)	Iterated nonlinear weighted least squares, iterated nonlinear seemingly unrelated regressions and iterated nonlinear three stage least squares.
106	APT and CAPM	Factor loadings ,the proxy returns for market portfolio	Portfolio returns (average returns)	Asymptotic principal component (factor analysis)+OLS
107	CAPM	The proxy return for market portfolio (betas) +size	The portfolio returns (average returns)	OLS(modified OLS)+ SURR
108	CAPM	The proxy return for market portfolio +size +earnings yield	Security (portfolio) returns (average returns)	SURR+OLS
109	CAPM and APT	The proxy returns for market portfolio(betas)	Security returns (average returns)	OLS +factor analysis (asymptotic principal components technique)
110	CAPM	The proxy returns for market portfolio(betas) + size	Portfolio returns (average returns)	OLS+GLS
111	MPLM CAPM	The proxy returns for market portfolio(betas)	Portfolio returns	OLS+SURR procedure
112	Conditional CAPM	The proxy return for market portfolio (betas)+residuals(logs)	Portfolio return (average return)	GMM (Garch specification)

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
113	Investment-based CAPM	Investment returns,investment growth,GNP growth	Stock return	OLS
114	Three moment CAPM	The proxy return for market portfolio (higher moment of returns (betas)	Mutual fund's returns (average returns	OLS
115	Conditional CAPM	The proxy return for market portfolio (betas)	Portfolio returns	GMM (GARCH specification)
116	C-CAPM	Model parameters Growth rate of real consumption., Real rate of return for stocks in the Tokyo stock exchange (first section), Real rate of return for long-term government bonds, Real rate of return for long-term corporate bonds, Short-term real interest rates.		GMM
117	CCAPM and CAPM	The proxy return for market portfolios and consumption (betas)	Portfolio returns (average returns)	GLS
118	CAPM	The proxy return for market portfolio +size + book to market equity(betas)	Portfolio return (average return)	OLS
119	CAPM +three factor model	The proxy return for market portfolio +the size + book-to market+ form structure(betas)	The portfolio return (average return)	OLS
120	CAPM	Proxy return for market portfolio (betas)	The portfolio (industry;) return (average return)	MLE
121	CAPM, APT	The proxy return for market portfolio +betas(factor loadings)	Portfolio returns(average returns)	GLS(3 SLS)+ (Semiautoregressive system)+factor analysis
122	APT	1-the unexpected change in the term structure; 2. the unexpected change in risk premiums; 3. the change in expected inflation, 4. the unexpected inflation rate; 5. the unexpected change in the growth rate in industrial production.+ the proxy return for market portfolio +factor loadings	Portfolio returns(average returns)	"factor analysis + GLS
123	Multifactor model	World excess return, change in Eurodollar-treasury yield, log change in G-10 foreign exchange rate, unexpected G-7 inflation, change in long term G-7 expected inflation, change in price of oil, change in G-7 industrial production G-7 real interest rate	Country's return	(SUR) GMM

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
124	CAPM	The proxy return for market portfolio (betas)	The portfolio returns(average returns)	OLS
125	Investment based CAPM	the factors are MP (growth in industrial production), DEI (change in inflation forecast), UI (inflation forecast residual), UPR (return on corporate bonds minus return on 10-year government bonds), and UTS (return on 10-year government bonds minus return on bills). All but MP are based on bond returns (the inflation forecasts are based on Treasury-bill returns).+the proxy return for market portfolio +(betas)	Portfolio returns(average return)	GMM (iterated GMM)+GLS
126	Multifactor models	Real value-weighted stock index return Real labor income growth rate Dividend yield on value-weighted index Relative bill rate (bill rate less 1-year moving average) file Long-short government bond yield spread		GMM (VAR specification)
127	Conditional CAPM	The proxy return for market portfolio +CRR factors+(betas)	The portfolio return (average return)	OLS+GMM
128	CAPM	The proxy return for market portfolio, The natural log of the ratio of book value of common equity to market value of equity, The natural log of the ratio of total book assets to market value of equity, The natural log of the market value of equity, E/P,	Security return (average return)	NLSUR (Non-linear Seemingly Unrelated Regression)
129	Three factor Model (dividend yield adjusted)	Fama-French Factors, dividend yield, size	Portfolio returns (average returns)	OLS, SUR

	THEORETICAL MODEL	VARIABLES		ESTIMATION TECHNIQUE
		INDEPENDENTS	DEPENDENT	
130	Factor Models	Fundamental Factors (the ratio of book value to market value of common equity, the ratio of cash flow (earnings plus depreciation) to market value of equity, the ratio of dividends to market value of equity, the ratio of earnings to market value of equity), Technical Factors (stock's past rate of return), Macroeconomic Factors (the growth rate of monthly industrial production, the difference between the monthly return on a high-yield bond index and the return on long term government bonds, the real interest rate (the return on one-month Treasury bills less the relative change in the monthly CPI, the difference between the return on long-term government bonds and the one-month Treasury bill return, the difference between the yield on long-term government bonds and the yield on Treasury bills, the change in monthly expected inflation. We fit a time-series model (an integrated first order moving average process) to monthly relative changes in the CPI, the forecasts from the model serve as measured expected inflation), Statistical Factors (factor loadings),Market Factor (the proxy return for market portfolio)	The portfolio returns.	OLS, Factor Analysis
131	Three factor Model	Fama-French Factors	The portfolio returns (average returns)	OLS
132	CAPM, CCAPM, Three Factor Model, Conditional CAPM-CCAPM.	Fama-French factors, the betas, Consumption wealth ratio,	Average portfolio returns	OLS, GMM
133	Four moment CAPM, Three factor model.	Pricing kernel, Fama-French factors, moments of returns	Moments of aggregate wealth (average returns)	Hansen Jagannathan estimator (modified GMM)
134	S-L CAPM –conditional CAPM ,three factor model	The pricing model stochastic discounts factor, fama and french factors, the excess return on the value-weighted portfolio of NYSE common stocks, the excess return on the value-weighted portfolio of the Nth size decile NYSE stocks, the dividend yield (in percent) on the NYSE value-weighted index, Baa-rated corporate bond yield minus that of the Aaa.rated bond, Aaa-rated corporate bond yield minus the 1-month T-bill yield, the excess return on the NYSE equally-weighted index, Aaa-rated corporate bond yield minus the 1-month T-bill yield.	Portfolio returns(average returns)	OLS+WLS+GMM+BHV+ (Bansal,hsiesh,viswonathan) approach
135	CAPM	The proxy return for market portfolio and its moments	Portfolio returns (average returns)	OLS+GMM+HLV
136	Liquidity Based CAPM	Liquidity Indicators	Portfolio returns	GMM

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
1	Stock prices are strongly affected by domestic factors. Prices do depend on international events both indirectly by the foreign influence on the general domestic market behavior and selectively among stocks; some stocks might be more sensitive to international factors because of their multinational characteristics, import-export pattern, foreign competition, etc. An international market structure of price behavior appears to exist. Market structure implies that securities are priced according to their international systematic risk but confirms the large dependence on national factors. The domestic β of a security cannot be taken as the true measure of its risk. The true systematic risk of a stock is much smaller than the domestically-non-diversifiable-risk. However, because of the large dependence on national factors, the domestic beta of a stock will still give, in many cases, useful information on the relative risks of securities in a country.	The conclusions are tentative in nature because of the short time period used and the relatively small sample of stocks available. Further research is needed to examine more carefully the pricing structure. Industrial factors might be more important than geographical influences in explaining on which basis the market evaluates security prices.
2	Only a small proportion of the variance of national portfolios is common in an international context which gives rise to considerable risk reduction through international dimension. The industry dimension is much less important than the national dimension in defining groups of securities that share common return elements and, therefore, are a less important part of diversification strategy. Given the importance of national risk factors and the preponderant position of U.S. securities in the world portfolio, a multi-factor market model is called for and that the world factor should be estimated to minimize the impact of national risk factors.	The existence of important national risk factors can be used to derive some simplified rules for portfolio selection. This, however, is one area that requires examination of the structure of returns on individual securities, one area that requires examination of the structure of returns on individual securities,
3	The estimated betas are lowest for daily returns, highest for monthly returns. This effect most likely result from lags in the adjustment of stock prices to changes in market levels. As such, the Effect would be expected to diminish for longer return intervals. The average t statistics for beta confirm the statistical efficiency. The largest t statistics (smallest standard Errors) result from daily calculations. Thus, the daily beta estimates are Most efficient (minimum variance) but biased due to price adjustment lags. The average t values are typically reduced by half between daily and monthly Observations. The average R Square figures show the percentage of variation in Stock returns explained by market movements in the various countries. The numbers display the same general pattern as the beta estimates, rising from a low for daily to a high for monthly return observations. However, as shown below, The spreads between daily and monthly R^2 are larger than for beta. Among the Big Five(united States plus four largest European countries) the United States has the lowest average R^2 Cross-sectional comparisons are complicated by two factors , differing sample sizes and dispersion of subperiod parameters. In an efficient market, beta would not be sensitive to the interval size. This, however, was not the case average monthly betas exceeded average daily betas in all eight countries, the ratios ranging from 1.08 for the United States to 3.20 for Belgium. Thus, price adjustment lags appear least significant in the U.S. market. On the whole, the four major European countries had lower ratios than the three smaller countries, indicating a somewhat shorter adjustment period for the larger markets. Under the CAPM assumptions applied to each market, the average alpha values for each country should average to zero and be uncorrelated across time.	On the whole evidence does not show substantial differences between the United States and the four major European markets. Some cases can be made for the three smaller markets being less efficient. Conclusions regarding efficiency must be viewed as tentative in nature. We have dealt with only a five-year period, using preselected security samples. More definitive conclusions must await more extensive and statistically powerful tests.
4	The predictions from the ex post CAPM and MM include a bias towards zero in the estimates of actual asset returns for portfolios of common stocks over successive periods of one month. Thus, high-risk portfolios perform better than expected when the market return is lower than the risk-free return and worse than expected when the market return is higher than risk-free return. The opposite is true for low-risk portfolios. The conditional predictions of the MM and CAPM provide nonstationary, biased estimates of actual returns. The single-factor market model does not properly adjust for market-wide effects in assessing security performance.	NOT STATED
5	The stock market portfolio is efficient among all stocks The stock market portfolio is efficient among all stocks and nominal bills The stock market portfolio is the stock component of the efficient portfolio (stocks and bills)	To summarize international asset pricing seems to be a very fruitful area for theoretical research, not empirical.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
6	Insiders earn above average returns when they buy securities of their respective corporations The results indicate that the securities the insiders were selling fell more than the general market decline of the period. These results for both the buy and sell portfolios bear out the fact that insiders, because probably of their access to privileged information, can outperform the market in their stock selections.	In the short-run insiders are able to identify profitable as well as unprofitable situations in their own companies.
7	The behaviour of the cumulative average residual-per-share, dividends-per-share and forecasts of earnings-per-share on the assessment of expected return is significant. Unique information appears to be conveyed by analysts' forecasts given earnings –per-share. Further, there appears to be unique information contained in dividends that is not contained in earnings –per-share and analysts' forecasts of earnings –per-share. No major differences in the CAR conditional on the variable alone are observed. The finding that CAR conditional on unambiguous information is generally greater than CAR conditional on ambiguous information is consistent with the statement that not only do capital market participants rely on a broad information set, but also that the aggregate capital market appropriately distinguishes between signals which are not contradictory and those which are contradictory.	Unambiguous signals may be associated with relatively homogeneous probability revisions by individuals of expected return. However, the differential response to unambiguous signals may reflect magnitude of forecast error effects due to positive correlation between the variables. given this interpretation, the results then suggest that the capital market is responding appropriately to the sign and magnitude of the forecast errors associated with the three variables. The findings do not appear sensitive to alternative CAR estimation techniques, alternative portfolio grouping schemes and to subperiod analysis.
8	A visual examination of abnormal returns across *individual* rating groups does not indicate any consistent differences. higher abnormal returns are associated with higher default risk portfolios. the average monthly abnormal returns for the three subperiods combined were higher for the "noninvestment" grade portfolios for all three iso-betas	The test results support the usefulness of the capital asset pricing model and suggest that the magnitude of the cost of default when combined with the probability of occurrence i s insignificant a s an independent variable in generating stock returns.
9	As the skewness effect is an additional important factor in explaining the change of rates of return and the change of systematic risk of a security (or portfolio), then the risk-return tradeoff relation becomes a surface instead of a linear line and the linear function form is no longer an appropriate functional form in testing risk-return relation. The functional form, the skewness effect, and the change of market condition are the most important factors in affecting the empirical conclusions in testing the bias of composite performance measure and the risk-return relation.	NOT STATED
10	the investment horizon for which data are collected plays a crucial role and has a great impact on both the regression coefficients and the performance indices.	Deviation from the true horizon also explains the empirical biases in the intercept as well as in the coefficient of the systematic risk, as measured from a cross-section regression.
11	There is very little difference between the two hypotheses; and that the slight difference that does exist tends to favor the hypothesis of constant beta coefficients.	Both market models are incorrect specifications of the true data generating process. If this interpretation is correct the observed instability of beta coefficient estimates for individual securities may be due less to measurement error than had previously been believed, and more to misspecification of market models.

	CONCLUSIONS	
	FINDINGS	**IMPLICATIONS (SUGGESTIONS)**
12	Portfolio returns were independent of time. SIM (Single Index Model) worked well in explaining the returns on the control securities for all regulated firms, electric, and combination gas and electric portfolios, but did not explain the returns on any of the regulated firm portfolios themselves. (i) all the regulated portfolios demonstrated significantly greater instability in their relationships to the market index than their control securities; (ii) that each portfolio's beta was unstable over time and appeared to vary between cycles of security returns of different durations; and (iii) that the regulated portfolios seemed to have lower beta-estimates for cycles in excess of 6 months and higher beta-estimates for cycles less than 6 months.	The regulatory authority has the complex task of determining the fair return on equity capital for public utilities and of setting a price on the utility services to ensure that this return is realized. If it sets this 'fair return' on the basis of what an investor could be earning if he had invested his capital in securities of commensurate risk, then clearly the 'commensurate risk' class for any public utility is the set of all other public utilities of the same genre. We must reject the direct application of the SIM to a portfolio of utility returns. Thus, if regulatory authorities are to use the SIM to determine a utility's cost of equity capital, then they must proceed by constructing control portfolios of unregulated securities, that are believed to be of comparable risk to the utility in question, and determine the cost of equity of these securities.
13	The results are mixed, but generally favor the model. Adding a bond index term for the bank sample only marginally improves the model's explanatory power although the index is more important than the equity index. The lack of importance of the bond index for banks is not surprising upon further consideration, however. Banks and their earnings should be more sensitive to short-term rather than long-term rates, and the index reflects primarily long-term rates. To bond index improves in performance for the 30 Dow Jones firms and contributes to the explanatory power of the model in 80 percent of the cases.	The short time period used here does not allow us to say anything about the relationship between interest rate movements and the stability of beta. Findings must, be interpreted with care, but overall the introduction of interest rate effects into the single-index model looks promising.
14	Findings are inconsistent with Sharpe-Lintner theory if it is appropriate to use for empirical testing the one factor return-generating function relating actual to expected return and our empirical construct for the market portfolio. The differences between the stock and bond return-risk relationships are of particular interest. The expected return-beta models as well as the other regressions point to significantly different relationships for stocks and bonds, with the return-risk relationships for bonds implying a lower zero-beta or risk-free rate of return than the corresponding relationships for stocks. On the basis of this analysis of returns on individual stocks and bonds, and a broader measure of the overall market rate of return, it would not appear that the Sharpe-Lintner model is able to explain the observed data in the period covered, residual standard deviation seems to be at least as important as the beta coefficient in explaining these data, and the return-risk relationship appears to differ as between stocks and bonds.	NOT STATED
15	The study employed a sequential two-step procedure to analyze market and portfolio returns: the first step investigating the real trend movements over time; the second, analyzing through bivariate spectral analysis, the wide-sense stationary components of each stochastic process. the market index and portfolio return processes have the properties of wide-sense stationarity and require no detrending before proceeding to stage 2 and the bivarate spectral analysis. the market "index" does not perfectly explain individual portfolio movements for *all* portfolios and that despite cyclical betas that are fairly stable over time, the true value of beta appears to be different for cycles of differing durations.	NOT STATED

	CONCLUSIONS	
	FINDINGS	**IMPLICATIONS (SUGGESTIONS)**
16	There was a slight indication that the more risk averse models better described security pricing. Any conclusions drawn from the results of the tests should be greeted with a healthy dose of skepticism because the market proxy did not correspond to the true market portfolio.	The majority of researchers argue that the models are empirically identical, citing either the approximate normality of return distributions or a 'compact return' distribution argument to back up their claim that in the stock market all risk averters are approximately MV decision-makers. On the other hand, one might believe that there is an underlying difference between the models and it is only the particular research design (accentuated by a poor market proxy) that has caused the failure to detect a significant difference between the models. Again, this appears to be an area calling for further research.
17	Low price stocks are riskier than high price stocks The group with low prices possesses higher total variability of rates of return as well as higher systematic risk (as measured by the beta coefficient) relative to the higher price groups. If low price stocks involve risks for which investors are not properly compensated, then the market efficiency hypothesis should be rejected. However, this study shows that the price for bearing systematic risk is unrelated to the stock price classification. In the long run, the compensation is the same, on the average, for the two mutually exclusive price groups. Only part of the relatively high average rate of return on the low price stocks can be explained by their relatively high systematic risk.	Price might be a surrogate to a "real" economic factor that can explain the risk-price relationship. But this relationship is not the important one from the investor's point of view. The crucial relationship is the risk-return relationship. For testing the latter relationship, the stationarity of the distribution of the rates of return is required. Careful analysis of the risk-price relationship tends to suggest that low price stocks usually possess a less stationary distribution of rates of return than do the high price stocks.
18	Author found evidence of heteroscedasticity and low R2 and a noticeable dependence of these with frequency of trading in the underlying stock. The choice of a suitable market proxy does not seem to be a major problem, the TSE 300 or a Global arithmetic average return index were found adequate for the market model studies with respect to heteroscedasticity.	It is possible that the detected phenomenon is not true heteroscedasticity but simply a non-stationarity in the distribution of the residuals induced by thin trading. The use of the logarithmic form of the Market Model seems to reduce this effect somewhat.
19	1. Both ordinary insiders and bank directors earned positive premium returns relative to an uninformed trading strategy. This is i n conflict with the classically stated strong form of the efficient market hypothesis. 2. Bank directors earned larger premiums than ordinary insiders. This was particularly true for buy trades which we believe better represent trades relying on information. 3. The premiums did not accrue until several months after the simulated trades. This is subsequent to the normal period for releasing the information to the public. Hence, the results are inconsistent with the classically stated semi-strong form of the efficient market hypothesis.	An implication of these new studies is that information is a productive good and, given free disposal, more information is preferred to less. An implication for trading profits in securities is that investors with more information should have risk-adjusted returns at least as great as investors with less information.
20	First, as other studies that examine autocorrelation have demonstrated, monthly stock return residuals are predominately negatively autocorrelated . Second, there is an association between the level of autocorrelation and the level of beta. Third, there is a weaker association between the level of autocorrelation and average returns in the different subsamples. Fourth, different levels of autocorrelation are associated with statistically different security market lines. Last, the CAPM is the least misspecified in those subsamples where autocorrelation is essentially neutral.	NOT STATED
21	The FM simple averaging method and RCR model provide estimates for the mean value of the market parameters which are close in magnitude over many of the test periods. In this case the simple averaging procedure appears to be sufficient; however the evidence exhibited by the percentage differences suggests that the RCR procedure does make a difference especially over the long periods. the results substantiate the robustness of the FM conclusion in support of the CAPM.	NOT STATED
22	The empirical results demonstrate that changes in estimated betas are significantly associated with changes in the product of the estimates of autocorrelations for residuals and the estimates for intertemporal market-residual covariances	More stable estimates of betas can be obtained by correcting for these econometric problems that could arise from measurement errors in an otherwise efficient market.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
23	The very thin Israeli stock market is characterized by large daily price fluctuations with small turnovers. Therefore, for short horizons, there is no meaningful relationship between return and risk. However, for annual rates of return , the CAPM explains about 40 percent of the variability of the average rates of return; the coefficients of the regression are not far from the observed variables and, in contrast to all other studies, there is no significant relationship between the reward-to-volatility index and the systematic risk .	The inclusion of bonds i n the market port folio and adjustment for inflation have a significant impact on the return - risk relationship .
24	Kraus and Litzenberger concluded that (1) co-skewness in addition to co-variance is required to explain the returns on individual risky assets and that (2) the implied riskless market rate of return is not significantly different from the actual risk-free rate of return. Our analysis provides some but not conclusive evidence in support of the first of these propositions, suggesting that investors may be willing to pay a premium for positive skewness in their portfolios. However, our tests provide no support for the second of their conclusions, so that we conclude that the Kraus-Litzenberger attempt to develop and substantiate a modified form of the Sharpe-Lintner CAPM is not successful.	The inference that co-skewness in addition to co-variance is required to explain individual asset prices is significantly affected by the different market indexes used and other testing and estimation procedures followed. Empirical evidence uniformly suggests that the estimated risk-free rate of return is significantly higher than the actual risk-free rate of return. the contrary finding of Kraus and Litzenberger is most likely a reflection of the particular time period and estimation procedures they used.
25	Author proposed to test the proposition that there should be no systematic effect on either the intercept, or adjusted coefficient of determination, there are predominantly statistically significant trends in the estimated values of the intercept as regressors are added. However. the trends are not of the same sign. The results concerning trends in the adjusted coefficients of determination are clearer. There is a statistically significant increase in the adjusted coefficient of determination as the number of regressors increases. Evidence against the CAPM the resulting evidence is unambiguous, cannot be claimed for the SML tests. The Invariance Law tests we have performed entertained nothing beyond, indeed substantially less than, what the SML tests have assumed.	The Invariance Law re- quires return stationarity, the SML tests re- quire the same assumption. However, neither framework can cope with the possibility that the CAPM may hold for each period while the return distributions are nonstationary.
26	The low beta values imply that investment in farm real estate at national or regional levels contributes little systematic risk to a well-diversified portfolio. The remaining nonsystematic risk that is attributed to unique supply and demand conditions of agriculture largely could be eliminated by effective diversification. Besides the low-systematic risk, positive alpha values imply that farm real estate has offered substantial premiums above those for systematic risk.	For the period, returns data, and market index, investments in farm real estate by well-diversified investors appeared to outperform the market and most individual assets too.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
27	The empirical data support the APT against both an unspecified alternative-a very weak test-and the specific alternative that own variance has an independent explanatory effect on excess returns. But, these tests are only the beginning and should be viewed in that light.	A number of the empirical anomalies in the recent literature could be reexamined in the context of these results. For example, the APT would predict that insofar as price-earnings ratios have explanatory power for excess returns, they must be surrogates for the factor loadings. This provides the basis for an alternative test of the APT. On the longer term agenda, the statistical underpin- nings of our analysis must be shored. Work on the small sample properties of factor analysis is scarce, and for nonnormal distributions, results appear to be nonexistent.
28	First, whether or not one agrees with the specific way in which it was incorporated here, it has been shown that in estimating models of the expected return on the market, the non-negativity restriction on the expected excess return should be explicitly included as part of the specification. Second, because the variance of the market return changes significantly over time, estimators which use realized return time series should be adjusted for heteroscedasticity.	There are at least three directions in which further research along these lines could prove fruitful. First, because the realized return data provide 'noisy' estimates of expected return, it may be possible to improve the model estimates by using additional non-market data. investor holdings, corporate earnings and other accounting data. A second direction is to employ a more sophisticated approach to the nonstationarity of the time series. Such an approach could be used to estimate the length of time over which it is assumed that the Reward-to-Risk Ratio can be treated as essentially constant. The third and most important direction is to develop accurate variance estimation models which take account of the errors in variance estimates.
29	Results indicate the existence of a good deal of nonstationarity in the risk-return relationships.	Changes in the distribution of risk in the economy and/or changes i n the composition of the mutual fund's portfolio have taken place. When there are changes in beta, investors are interested in whether such changes have beneficial or perverse effects on a shareholder's wealth.
30	The FASB's proposal had a measurable negative effect on the equity values of affected firms. The set of variables which was hypothesized to measure the increased contracting costs and/or estimation risk associated with the FASB's proposed elimination of FC accounting was found to explain a significant proportion of the cross-sectional variation in abnormal return performance of our sample firms in the two weeks centered on the Exposure Draft issuance.	Changes and the first to suggest estimation risk as a possible explanation. Two difficulties encountered are that surrogate variables are used for the various economic variables and that the sample size is relatively small (57 firms). Therefore, we are aware that a more complete understanding of the capital market behavior awaits further research in this area.
31	The time series results do not allow us to reject the proposition that stock returns are correlated with returns of special factor portfolios. This implies the APT is correct because several of the special factor portfolios appear to have a significant influence and none of these portfolios represent the market portfolio. It appears that the proposition that the mean of cross section coefficients equals the sample mean portfolio returns cannot be rejected. This implies that the APT gives a correct ex ante return model and Treasury bill returns are a source of information about factors. However, since the hypothesized values are very close to zero this test is rather weak. Overall, the proposition that the market return adds an additional significant dimension to the factor model cannot be rejected with our data. But this does not lead to rejection of our joint proposition that APT is valid and Treasury bills give factor information. It simply means the Treasury bills returns do not appear to contain all the relevant information for stock returns. Thus, we cannot reject the null hypothesis that the average cross section intercept is zero only for the regressions including the zero beta rate	Treasury bill returns provide a source for identifying statistical factors that influence common stock returns.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
32	There seems to be no statistical difference in the risk-adjusted performance of MNC and NATL common stocks. MNCs provide no discernable advantage over nationals with respect to an investor's quest for the risk/return benefits of international portfolio diversification	No difference in the SMLs for MNCs and a joint hypothesis test is involved; the stated hypothesis and the hypothesis that the model is correctly specified. NATLs.
33	The returns from stock groups such as Farrell's stables-cyclical-and-growth were shown to relate to returns in the Government bond market and to corporate bonds with default risk. Further, the returns of bond market variables were found to relate the stock market factors derived from all 100 stocks, although those bonds with default risk show a very weak relationship.	(1) Does the existence of a relationship between ex post factors and ex post return series indicate that there is an ex ante risk/return relationship with the risk space being a function of the three beta coefficients?; (2) What are the economic determinants of the changed expectations which are reflected in the ex post returns of the three financial series used in this study?; (3) Does a multi-beta model with interest rate and bankruptcy variables reduce beta non-stationarity.?; (4) What are the implications of the foregoing for portfolio performance measurement?
34	The evidence indicates that NYSE-AMEX stock portfolios with widely different estimated betas possess statistically indistinguishable average returns. Evidence based on NYSE stock portfolios dating back to 1935 corroborates this result. Of course, this finding should not be construed to mean that all securities possess identical average returns.	Cross-sectional differences in portfolio betas estimated with common market indices are not reliably related to differences in average portfolio returns; that is, the returns of high beta portfolios are not significantly different from the returns of low beta portfolios. Empirical importance for securities traded on the New York and American Stock Exchanges.
35	The evidence in this study strongly suggests that the simple one-period capital asset pricing model is misspecified. The set of factors omitted from the equilibrium pricing mechanism seems to be more closely related to firm size than *E/P* ratios. The misspecification, however, does not appear to be a market inefficiency in the sense that 'abnormal' returns arise because of transaction costs or informational lags. Rather, the source of the misspecification seems to be risk factors that are omitted from the CAPM as is evidenced by the persistence of 'abnormal' returns for at least two years.	One must surely conclude that alternative models of capital market equilibrium ought to be seriously considered and tested. For evidence in this study clearly demonstrates that, at least for portfolios based on firm size or *E/P* ratios, the simple one-period capital asset pricing model is an inadequate empirical representation of capital market equilibrium. Ball,
36	The evidence in this paper indicates that a parsimonious APT fails this test. That is, portfolios of small firms earn on average 20% per year more than portfolios of large firms, even after controlling for APT risk. This result is detected regardless of whether APT risk is measured with a three-, four-, or five-factor model.	The stochastic process generating returns of financial securities may not be linear, Or one may not be able to completely diversify away the idiosyncratic variances. Thus, the factor loadings need not be cross-sectionally related to security expected returns, even if the linear stochastic process assumed is true. While the evidence does not support the APT, the tests do not pinpoint exactly the source of error. Nonetheless, one cannot conclude from the evidence that the arbitrage pricing theory is an adequate model of asset pricing. The difference in average returns obtained by grouping portfolios on the basis of firm size is still not accounted for by empirical representations of capital market equilibrium

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
37	Beta and interest rate risk are positively related. The waters are much muddier when we turn to 6 and default riskat least over the 1969-1972 period (1967-1974 data), a significant relationship in the predicted direction. It is clear that a major reason we find significance is because we include industrial bonds with ratings of Ba and B and below.	The bond market is amenable to the same types of analyses as have been done in recent years on the stock market.
38	Trading infrequency seems to be a powerful cause of bias in risk assessments with short-interval data. Rather horrendous bias is induced in daily data and the bias is still large and significant with returns measured over intervals as long as one month	The mis-assessment of risk has the potential to explain why small firms, low price/earnings ratio firms, and possibly high dividend yield firms display large excess returns (after adjustment for risk). Positive auto-correlation induced in portfolios of such firms because of infrequent trading results in downward biased measures of portfolio risk and corresponding overestimates of "risk adjusted" average returns.
39	At the macro level, the primary results are: (1) judged by the generalized SML tests, the MV and a very wide variety of power utility LRT models are indistinguishable; (2) in a pragmatic but somewhat limited sense, in light of Roll's critique, the results are not affected by the choice of either an equally or value-weighted proxy for the market portfolio. On the other hand, at the micro level, the key result is that, with approximately normal or real world return distributions, the models exhibit different investment policies. With short sales constraints, the mix of risky assets for utility functions with powers greater than zero differs from the mix of risk assets for negative power utility functions and the MV model. Moreover, margin constraints are binding for the more restrictive, but widely studied, isoelastic or constant proportional risk-aversion functions with powers greater than zero. Naturally, the binding margin constraints accentuate any differences in the risky asset mix.	It is widely accepted that in discrete time, if return distributions are normal, all risk averse expected utility decision makers will pick MV efficient portfolios. But technically this is incorrect. And while most people probably accepted the statement as a (perhaps very good) approximation, the results of this paper indicate that, with approximate normality, the mix of risky assets differs. Now, in moving from the micro foundations to the macro implications of a CAPM, we must allow the theorist and the tester considerable license, as many factors, taxes, transactions costs, etc., have been ignored. At the same time, we should be cautious in accepting the results of the micro tests: first, because the generalized SML methodology used to generate the macro results is itself suspect, and second, because the portfolio selection results indicate that the macro theory is not based on firm micro foundations. Perhaps more important, the demonstration of the differences in the risky asset mix should caution us that we may be premature in using the apparent empirical identity of the models at the macro level to infer that the models are essentially identical a t the portfolio selection level
40	The CAPM is misspecified. On average, small NYSE firms have had significantly larger risk adjusted returns than large NYSE firms over a forty year period. This size effect is not linear in the market proportion (or the log of the market proportion) but is most pronounced for the smallest firms in the sample. The effect is also not very stable through time. An analysis of the ten year subperiods show substantial differences in the magnitude of the coefficient of the size factor.	There is no theoretical foundation for such an effect. We do not even know whether the factor is size itself or whether size is just a proxy for one or more true but unknown factors correlated with size
41	the OLS method is not an appropriate method to be used to estimate portfolio residual risk if the beta coefficient is changing over time. The use of the OLS method will overestimate portfolio residual risk and lead to the incorrect conclusion that larger portfolio residual risk is associated with higher variability in beta coefficient.	The pure residual risk is unrelated to variability of the beta coefficient. In addition, the reduction i n the pure rather than the OLS portfolio residual risk represents the process of portfolio diversification in a world with the nonstationarity of beta coefficients.
42	In a financial market where investors have diverse information, an institutional factor which affects the way the market aggregates individual expectations can lead to systematic effects on prices. Restrictions on short sales are particularly important because they have a different impact on investors with unfavorable information than on those with favorable information. The hypothesis that prices of stocks for which there was relatively more adverse information among investors would tend to be too high, received empirical support from our tests.	The possibility that pessimistic investors will attempt to circumvent the constraints on short selling in the stock market by trading in options. By buying puts or writing calls an investor can take an options position that is equivalent to a short sale of the stock. As investors do this, the price of the underlying stock will be influenced and their unfavorable information will be incorporated by this indirect means. This mechanism will be examined in future research.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
43	Results offer strong support for the LP hypothesis. Firms in which entrepreneurs retain high fractional ownership do indeed have higher values, as the theory predicts. On the other hand, the BH dividend signaling hypothesis is rejected by the data. The significant negative role found for dividends suggests that this may be attributable to omitted, not readily observable, variables from the valuation equation	NOT STATED
44	Mutual fund systematic risk theoretically can be modeled as a first - order Markov process when fund managers do not actively engage in timing decisions. Furthermore, the results of the LaMotte-McWhorter and Sunder tests over the time period 1965 t o 1973 indicate that a significant number of mutual funds may have had betas that followed a first - order Markov process. Thus, it can be argued that beta non stationarity is not a sufficient condition for identify in g funds that actively engage in timing decisions.	One possible direction for future research is the development of a statistical procedure to distinguish between a first -order Markov process for beta and switching regressions. Such a procedure would facilitate the classification of managers according to whether they actively engage in timing decisions and, thereby, provide a basis for performance evaluation.
45	Author tested some ex post distributions to see if there was enough skewness of the lognormal form in the market to cause the risk measures to diverge. For six nonoverlapping seven-year selection periods, all continuously available securities were divided into above average risk, average risk, and below average risk samples on the basis of both risk measures being significantly above or below 1.0. The values of the two risk measures for the high risk and low risk samples were then compared for each of six adjacent testing periods. For ten of the twelve samples we rejected the null hypothesis that COV/V = CLPMILPM. For six of the ten significant samples, the relationship between the two risk measures was as hypothesized by our theorem for bivariate lognormal distributions. For the other four, the relationship was the opposite of that hypothesized. It was conjectured that these "anomalous' results were caused by the moderate *negative* skewness that existed in the ex post distributions of returns for the market index. The significance of these four samples depends on how good a proxy their ex post distributions are for the true ex ante distributions.	At any rate, the results do not allow us to rest easy with the assumption that CLPM/LPM = COV/V, and hence that the latter, more familiar, measure can be used as our measure of systematic risk.
46	The test results indicate that precise estimates of betas for small firms may be difficult to obtain. Nonetheless, even the highest point estimate for the beta of the small firm portfolio did not seem to account for its superior performance.	While the OLS estimates seem to understate the betas of small firms, the excess returns not explained by the misestimation could easily exceed twenty percent per year on average. Thus, one can conclude with confidence that the small firm effect is still a significant economic and empirical anomaly.
47	With no additional variable beyond, the substantive content of the CAPM is rejected for the period 1926-1975 with a significance level less than 0.001.	Strict adherence to the CAPM would lead to a structure which is inconsistent with the data, and such misspecitication may yield incorrect inferences about a hypothesis not directly related to the CAPM. The use of a statistical model with a more general parameterization would be a sensible precaution.
48	The use of conventional risk premiums, calculated in the manner suggested by Roll may cause significant bias in the estimates of the parameters of the market model. This is because the risk premiums are customarily calculated by subtracting the yield of a treasury bill, with one month to mature, from the securities returns. This procedure is inadequate for calculating the Pure risk premiums since the riskless asset have shorter duration and therefore cannot neutralize the effect of changes in interest rate on the returns on assets with different degrees of I-R Risk.	Consequently security risk premiums will contain measurement errors that bias estimates of securities beta coefficient.

	CONCLUSIONS	
	FINDINGS	**IMPLICATIONS (SUGGESTIONS)**
49	Results indicate that, on average, there were positive unexpected returns from investment in our sample of British companies which announced revaluations of fixed assets. The unexpected returns were not particularly large, but to gain a full understanding of their significance it was necessary to partition the total sample into subgroups depending on the .occurrence of other signals of major interest to the capital market, notably stock dividends and other subsequent capitalization changes, and changes in earnings or dividends. Once this is done, a different picture emerges. It suggests that revaluations are taken in some instances as a pointer to other favorable signals from a company and to increased future benefits to stockholders.	Having examined the evidence, we are no longer convinced that the system of voluntary fixed asset revaluations, as it operated in Britain in the 1964-1973 period, was clearly disadvantageous to stockholders. Instead, what emerges is a system of considerable interest from a financial strategy viewpoint, in which revaluations are probably seen by management as useful device for influencing capital market expectations about their companies and in which investors view revaluations in a fairly neutral way unless they receive associated favorable signals or have reason to believe that such signals will be shortly forthcoming .
50	The wealth effect and the return variability effect of money are shown to be the two important channels of the monetary impact on the market risk premium for three representative classes of utility functions Having empirically confirmed the positive return variability effect of monetary changes; the hypothetical positive money-market risk premia relationship is tested by cross - correlation analysis. The statistical results support the hypothesis that the market risk premium is positively related to the changes in money supply. As a by-product of the empirical study, supportive evidence for market efficiency is also obtained from the causality test.	The growth of money supply should be stabilized in order not to hamper capital formation in the economy via an increased risk premium.
51	The evidence reported in this study indicates that the CBOE is an efficient market. No profits net of transaction costs can be earned in the option market by trading on the basis of firms' earnings announcements. Market prices appear to reflect fully the information content of the earnings disclosure by the end of the announcement week In fact, the information content of the earnings announcement has its most dramatic impact on option prices during the announcement week. While most of the returns in the pre-announcement weeks are positive, the return in the week of the announcement is dramatically larger and more significant. Finally, the results of the study support the structure of the Foster earnings expectation model. Because the abnormal return of the preannouncement trading strategy is positive and significant, it can be concluded that the model adequately describes the quarterly earnings process.	NOT STATED
52	The various market index portfolios constructed here produce identical inferences about the CAPM. The portfolios include common stocks, corporate bonds, U.S. Government bonds, real estate, and consumer durables. In one portfolio, stocks represent only 10% of the total value. It remains *possible* that alternative market portfolios can reverse inferences about the model. But the results of this sensitivity analysis almost surely indicate that such an occurrence is less likely than Roll's (1977) arguments suggest. Inferences prove to be sensitive to -the set of assets used in the tests. Inferences based on the most inclusive set of assets - common stocks, bonds, and preferred stocks - reject the Sharpe-Lintner version of the CAPM but do not reject the more general Black version. Other sets of assets provide different inferences.	It is important to view this sensitivity in the broader context of testing any asset pricing theory - not only the CAPM. A test of any pricing relation is based on a particular set of assets, and other sets of assets can, in principle, yield different inferences. Sensitivity to construction of the market index could imply that the CAPM is less testable than other models, but no such sensitivity is found in this study
53	1. the fully generalized functional form model does not significantly improve the estimation of the risk-return relationship in comparison to the single transformation model; 2. the nonlinear, single transformation model is the more appropriate specification in a significant number of cases; 3. the direct estimates of the transformation parameter suggest that the ob-served nonlinearities are not wholly attributable to the investment horizon problem; 4. although the nonlinear model is frequently superior in comparison to the traditional model, the resulting impact on the estimate of systematic risk appears inconsequential; and *5.* there is a negative relationship between firm size and the occurrence of a significant CES model. The corresponding impact of firm size on estimates of beta does not indicate any systematic biases that might resolve previous findings of a firm size effect.	For the researcher and the practitioner, the findings of this study support the validity of applying the linear or logarithmic CAPM in estimating systematic risk, versus a methodology that could vastly complicate the estimation process. Although the CAPM is frequently attacked because of the assumptions made in its application, rigorous tests of the linearity assumptions and the related time horizon problem suggest that the traditional model is surprisingly robust.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
54	Empirical models for the three commodities -wheat, corn, and soybeans-reveal significant. and positive systematic risk for a number of futures contracts. In addition, the "nonmarket" rate of' return measure proved to be generally significant. For commodities more closely linked to the general level of economic activity (cotton and live cattle), similar results were obtained. The results for cotton are particularly striking. Not only do net long (short) speculators earn excess returns but the degree of systematic risk is conditioned on whether speculators are net short or net long.	For an efficient portfolio and an application of the CAPM to futures contracts that allows for changing speculative position, our analysis supports the generalized Keynesian theory of normal backwardation.
55	Evidence indicates that daily abnormal return distributions in January have large means relative to the remaining eleven months, and that the relation between abnormal returns and size is always negative and more pronounced in January than in any other month – even in years when, on average, large firms earn larger risk-adjusted returns than small firms. Nearly fifty percent of the average magnitude of the size anomaly over the period 1963-1979 is due to January abnormal returns. Further, more than fifty percent of the January premium is attributable to large abnormal returns during the first week of trading in the year, particularly on the first trading day.	Hypotheses advanced to explain the size effect appear unable to explain the January effect. Several alternative explanations with testable implications are discussed, but the tests are deferred for future research.
56	Thin trading can lead to serious bias in risk measures. Furthermore, since trading frequency is stable over time, this bias will be persistent, and will impart a spurious stability to estimates of beta and other risk measures. This study has analyzed these distortions in estimated stability. Using an extensive sample over 25 years of history, we have shown that thin trading is indeed a serious problem. Fortunately, it is one which can be overcome by using the trade-to-trade method for estimating risk measures which are largely free from thin trading bias. In our empirical study, these risk measures are shown to be as stable in the UK as they are in the USA. Beta estimates are found to be moderately stable for individual shares and extremely stable for portfolios. The quality of these estimates can be improved by extending the estimation period and by making appropriate adjustments for regression bias. Even after such adjustments, however, UK beta estimates still appear to regress at a slow rate to their mean. Finally, estimates of the total and residual risk of shares appear to be at least as stable as those of beta	Research has a number of implications. First, it serves as an example of the importance of making adjustments for thin trading bias in any research study on thin markets. Second, it helps us interpret previous research on stability in such markets. We have already referred to previous work on European markets in this context. Finally, it provides important evidence that risk measures can be applied with the same degree of confidence in the UK as in the USA.
57	Authors found a persistent relationship between dividend yield and excess returns. In particular, except for those stocks which had previously paid zero dividends, the higher the dividend yield the higher the excess return. One group of stocks, those which had previously paid no dividends, had excess returns which were above what we would expect from this relationship. Part of this differential was shown to be due to the effect of low priced stocks but an influence beyond that still seems to exist.	There seems to be persistent patterns in excess returns which are related to dividend yield. Some of these differences may be due to tax effects. Others have not as yet been adequately explained.
58	Maximum likelihood estimation of the free parameters of most of the monthly models yielded point estimates of the coefficients of relative risk aversion that were between zero and two. The test statistics provided little evidence against the models using the value-weighted return on stocks listed on the New York exchange. Ill contrast, the marginal significance levels of the test statistics for the models of individual Dow Jones and Treasury bill returns were essentially zero. We also conducted tests of CRRA-lognormal models using multiple returns that are robust to mismeasurement of consumption and the deflator and accommodate certain types of shocks to preferences. These tests provided substantial evidence against the restrictions as well.	In light of results reported here, authors plan on pursuing models of asset returns with more general specifications of preferences and distribution-free methods of estimation and inference.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
59	Two factor analytic techniques were used to examine the factor structures of security returns. Both techniques yielded surprisingly similar factor structures for various samples of U.S. and Canadian securities for various portfolio sizes and various time periods. For various 50-factor models, a 10-factor structure was deemed necessary by the chi-square test. However, using the more "clinical" tests available with alpha factor analysis, the observation that factors beyond the fifth factor accounted for a very low percentage of the common variance, and the finding that few securities are associated with factors beyond the fifth factor, it seems reasonable to hypothesize that a factor structure of five factors is sufficient from an economic perspective	It appears that both the Rao and alpha factor analytic techniques present at least two procedural biases. First, the larger the sample size in terms of time periods, the simpler is the factor structure in terms of the number of relevant factors, and the relatively more "important" is the first factor. Second, the larger the number of securities in the samples studied, the greater is the number of relevant factors. These two biases might help to explain the smaller number of factors found by authors who used a larger sample size and a smaller number of securities
60	Based on the empirical evidence gathered so far, the APT cannot be rejected in favor of any alternative hypothesis, and the APT performs very well against the CAPM as implemented by the S&P 500, value weighted, and equally weighted indices. Therefore, the APT is a reasonable model for explaining cross-sectional variation in asset returns	In perspective, this study can be regarded as a moderate step toward solving the problem of what determines the expected return of assets. There are two, somewhat equivalent, ways to solve that problem: we can make assumptions and produce a theory that specifies which variables should enter the pricing equation and then test it; or, we can examine assets' realized return and determine empirically to which macro variables (suggested by theories) they correspond. The APT is more in the spirit of the second approach. The computation of the FL in this paper would enable construction of a portfolio corresponding to each of the common factors. Of course, some idiosyncratic term may still remain, but by constructing these large portfolios, each consisting of over a thousand securities, we can obtain time series (with noise) of the behavior of the common factors and can match these against time series behavior of global economic variables such as industrial production, interest rates, and so on. This is probably the most important direction for future research-an economic interpretation of the common factors.
61	The anomalous behavior of small firm returns cannot be explained solely on the basis of differences in transaction costs between small and large firms.	NOT STATED
62	There are three new results here concerning size-related anomalies in stock returns. First, we have shown that the relation between excess returns and firm size can be regarded as linear in the log of size. The transform is important because of skewness in the distribution of firm size. Second, we have shown that the ex ante excess returns attributable to size are not constant through time. Third, we have shown that different estimation methodologies can lead to different conclusions about the size effects.	NOT STATED

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
63	None of the statistics rejects linearity at conventional significance levels, and the statistics and p-values are quite similar across indexes	Estimates of the rental return differ somewhat between indexes, which could reflect either sampling variablity or a violation of one of the assumptions (probably some of both). Nevertheless, the estimates all seem economically plausible, ranging from 1.7% to 5.4~ per year. Separate estimates for real estate and durables could be constructed using estimated betas, but such an exercise must await future studies.
64	An important result of this study is that it demonstrates that the cusum of squares test and the QLLR can be used to test the stationarity of the market model and identify market model structural changes for individual securities over any specified historical time period (assuming, of course, an adequate number of observations exists). The empirical results of this study indicate that the behavior of the market model for individual securities, utilities, and nonutilities varied considerably over time and was dependent on the time period studied. Hence, since stationarity is a critical requirement in the application of the CAPM to rate of return cases for utilities, considerable care must be exercised in selecting both the appropriate time period and the comparable set (if one is used) of nonutilities.	The combination of the cusum of squares test and the QLLR should help regulators to understand the behavior of the market model and should be beneficial to them in the application of the CAPM in regulatory proceedings. In summary, the varying degree of the nonstationarity of the market model over different time periods and length of observation periods makes it mandatory to exercise considerable caution in applying the CAPM in regulatory proceedings
65	The empirical findings reported in this paper indicate that, at least during the 1963-80 time period, the returns on the common stock of NYSE firms appear to have been related to earnings' yield and firm size. In particular, the common stock of high *E/P firms* seem to have earned, on average, higher risk-adjusted returns than the common stock of low *E/P* firms. This *E/P* effect, furthermore, is clearly significant even after experimental control was exercised over differences in firm size, i.e., after the effect of size, as measured by the market value of common stock, was randomized across the high and low *E/P* groups. On the other hand, while the common stock of small NYSE firms appear to have earned considerably higher returns than the common stock of large NYSE firms, the size effect virtually disappears when return are controlled for differences in risk and *E/P* ratios.	Further analysis for possible effects of interaction between *E/P* ratios and market values of common stock suggests that firm size may have an indirect effect on the risk-adjusted returns of NYSE common stocks. Essentially, it appears the strength of the earnings' yield effect seems to vary inversely with firm size. More specifically, the results show that the *E/P* effect is sufficiently weak for larger than average NYSE firms that from a stochastic viewpoint it either is not significant or, at best, is marginally significant. In addition. The empirical findings indicate that the *E/P* anomaly cannot be attributed earnings information effects and, as such, attest to the descriptive validity Ball's hypothesis that the *E/P* anomaly probably implies a misspecification of the equilibrium pricing model rather than capital market efficiency per se.
66	Authors have implemented the test on the basis of the same data used by Roll and Ross, and these data are in apparent conflict with the model at standard levels of statistical significance. However, with very many observations it is possible to reject any hypothesis at one's favorite level of statistical significance. When we adjust the size of the test to take this into account, our results are consistent with the three factors APM. Further, we continue to reject the five and seven factor versions, a fact which actually adds support to the three factor version. By examining variations in the number of factors and by organizing securities according to industrial classifications, we conclude that there are few rather than many economy wide factors that appear to be priced in an APM framework.	The fact that we are able to test a model, the APM, that imposes so very few constraints on the observed data, suggests that the bilinear paradigm may be a useful tool for the examination of more highly structured models of equilibrium asset pricing

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
67	In two simulation experiments, we find that while their procedure has a slight tendency to overstate the number of factors at work in the market, this tendency cannot account for the large number of factors they found in their original article. This is true even though the parameters of the two-factor CAPM were linearly related to other variables and changed over time in response to changes in these variables	NOT STATED
68	Results indicate that there are five or six inter-group common factors that generate daily returns for two groups and that these inter-group common factors do not depend on the size of groups. Also, the APT could not be rejected in the sense that the risk-free rate and the risk premia are the same across groups and that the risk-free rate is different from zero.	Results could have been further improved if we could estimate market wide factor loadings that are common across all groups. We believe that the problem of extracting market wide common factors across all groups can be handled by extending the methodology used in this study to more than two groups. This is left for future research.
69	APT does do better CAPM in explaining and conditionally forecasting return variations through the time and across assets.	Policymakers should not adopt CAPM as a sole standard. Instead they would be wise to give APT greater weight in decisions.
70	The basic methodology of analyzing small groups of securities in order to gather confirmatory or contrary evidence relative to the APT model is seriously flawed.. Analyzing small groups of securities produces results whose meaning is unclear and which cannot possibly be what the investigator wishes to accomplish. Second, because of the indeterminacies of factor analysis, it is not possible to test directly whether a given "factor" is priced, i.e., it is not meaningful to carry out "t-tests" (or other similar tests) of significance on individual risk premia coefficients. We can, however, carry out unambiguously "F-tests" or asymptotic chi-square tests on the significance of the *vector of risk premia.* Thus, the important research issue here is how many factors there are and whether (collectively) they are priced. Third, the basic conclusion of RR that there are three to five factors does not appear to be robust; our results show that how many factors one "discovers" depends on the size of the group of securities one deals with. For example, when dealing with a 15-security group one "discovers" two factors; when dealing with a group of 30 securities, one "discovers" three factors; with a group of 45 securities, four factors; with a group of 60 securities six factors; and with a group of 90 securities nine factors.	Findings have relevance more to the empirical methodology currently in use for testing the APT, rather than to the validity of arbitrage pricing theory models *per se.*
71	Models fit using non-storable commodities had the greatest informational content and models fit using commodities having large inventory levels relative to consumption had the least informational content. The slope coefficients of the linear predictive models were seen to be estimates of commodity futures risk premiums. The linear relationship between these risk premiums and consumption betas implied by the consumption CAPM was empirically investigated. Both the intercept and the slope coefficients were significantly positive, as the theory predicted; however, the magnitude of the intercept was smaller and that of the slope greater than predicted. Finally, the fitted intercepts of the linear predictive models were compared with the theoretical prediction. All but one were positive as would be expected given the theory.	NOT STATED

	CONCLUSIONS	
	FINDINGS	**IMPLICATIONS (SUGGESTIONS)**
72	Test results appear to be extremely sensitive to the number of securities used in the two stages of the tests of the APT model. New tests also indicate that unique risk is fully as important as common risk. While these tests have serious limitations, they are inconsistent with the APT. results reported in this paper show that, again in the 30 security context, whether we use a 10-year time-series sample or a 20-year time-series sample, the proper (joint) test of significance for the risk premia vector rejects its nullity in, at most, 10 of 30 groups. When own (total) or residual standard deviation is introduced as an additional variable, then the hypothesis that the vector of risk premia is null is accepted by the proper (joint) test in 30 of 30 groups, i.e., uniformly for the entire sample. It is difficult to imagine a more complete rejection of the crucial implication of such APT models, using the flawed methodology of splitting the universe of assets into 30 security groups.	NOT STATED
73	The main results of our experiment are clear and easily summarized: 1. The Wald test is unreliable. 2. Shanken's Q^A and Q^* tests are unreliable. 3. The LR test is better than the tests in 1 and 2, but it is still unreliable unless the sample size is very large. Its problem is that it rejects the null hypothesis too often (when it is true). 4. The LM test is considerably better than the tests in 1, 2 and 3. It is reasonably reliable except when *T* is small or K is relatively large, in which case it exhibits a tendency to reject the null hypothesis too seldom. 5. Shanken's CSR test and Jobson and Korkie's LR* test are quite reliable under all circumstances which we consider. 6. There is no basis in our results to prefer the CSR test to the LR* test, or vice versa.	It is important to emphasize the usual disclaimer concerning Monte Carlo results - the results may not hold for parameter values other than those considered. Nevertheless, there is no guarantee that the results may not be different at other parameter points. Only by deriving tests with known finite sample distributions can this difficulty be avoided.
74	The results from the overall period suggest no *statistically* significant departure from log utility. The *economic* distinction between RRA equal to one versus (say) two may not be very important given the behavior of an individual to a timeless gamble. An individual with log utility will pay a half basis point of wealth to avoid a fair coin toss which risks 1% of current wealth. When RRA is two, the individual will pay one basis point of wealth to avoid the same gamble. Under the alternative hypothesis of nonnormality, the parametric estimator is not necessarily consistent, and the difference between the estimates may be nonzero.	Although distributional assumptions can simplify the estimation of utility-based asset pricing models, such an approach may not be robust to departures from the assumed distribution. The suggested nonparametric estimator, although nonlinear, is easy to compute and provides reasonably precise estimates-at least for the data analyzed here
75	The contrasting results of K-L and F-W seem to be due to the poor statistical properties of the original formulation of the covariance-co-skewness model, which lead to the serious econometric problems affecting their tests. The estimation errors of their portfolio parameters, complicated by their collinearity, induce biases in their estimates of risk premiums, which are also subject to large estimation errors. A more powerful test of the empirical relevance of departures of security returns from multivariate normality for security pricing can be designed on the quadratic market model, which describes some of these departures explicitly. Some of the portfolios used in this paper may have heteroskedastic residuals. The lack of a good model to describe residual security returns reduces the efficiency of tests of market equilibrium founded on two-step regressions and it may considerably affect the multivariate tests. On the other hand, these tests are free of the errors-in-variables problems of the multiple regressions used in the B-JS procedure.	Empirical tests try to relate *ex* post returns to *ex ante* expectations. Their results are, therefore, sensitive to the specification of this link. With this caveat, it appears that the arbitrage equilibrium associated with the quadratic market model is not a complete description of empirical security returns, even though this arbitrage model appears to be of some utility in understanding security pricing. Further insights in security pricing will require further research on the security return-generating process and the links between its parameters and other economic variables.
76	Results from the estimation of the after-tax CAPM indicate a general positive and significant relationship between return and yield, although there are years in which the relationship is insignificant. There is also a positive relationship between return and beta and a negative relationship between return and size, both of which are significant. With a size effect included in the model, the average coefficient on yield is 0.566. The grouping procedure gives a negative relationship between coefficients on yield and yield. Thus, a positive relationship is found between return and yield, and a clientele pattern is found which is consistent with earlier studies.	NOT STATED
77	Since the three basic test statistics are exact transformations of one another, there is really just one test. The three alternative test statistics conform to a given ordering in every sample, yet all three have the same asymptotic chi-squared distribution. If this distribution is taken as the reference point for drawing inferences, different conclusions may be reached, depending on which test statistic is employed - a problem previously encountered elsewhere in the econometrics literature. the CRSP equallyweighted index is inefficient, but that the inefficiency is not explained by a firm size-effect from February to December.	This application illustrates the value of the multivariate test as a tool to be used in conjunction with more traditional methods and not necessarily as an alternative to those methods.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
78	The empirical results indicated that the model presented was somewhat successful in identifying incorrectly valued index bonds, implying that this market is not perfectly efficient, at least in the case of the Israeli index bond market. the findings of this empirical study imply that (I) the CAPM can be applied to the standard bond formula in order to estimate intrinsic values of index bonds, and (2) the model can be employed to detect inefficiencies in the market for index bonds.	NOT STATED
79	Among the economic variables included, the measure of the changing risk premium explained a large portion of the size effect.	On the basis of the evidence gathered so far, we concluded that the firm size anomaly is essentially captured by a multi-factor pricing model. The higher average returns of smaller firms are justified by the additional risks borne in an efficient market
80	Authors identify ten ways to specify the time series behavior of the two parameters; the result highlights a number of inconsistencies involved in MV modeling. For each of the cases, it permits the inference of the time series of expected return vectors, as well as all the other Capital Asset Pricing Model (CAPM) variables, compatible with a known covariance matrix and the observed time series of market value weights. The empirical work shows that there are substantial case-to-case differences in the time series of mean vectors and many of them are quite different from the constant mean vector envisioned in tests of the CAPM.	Framework makes it clear that these differences and inconsistencies are the price we pay in attempting to embed a single-period model in a multiperiod framework
81	The evidence suggests that mean stock returns on Monday are not only lower than on other days, but frequently negative. the magnitudes of the coefficients appear to differ across securities in a roughly similar fashion for both of the predetermined variables. The F-test suggests that inadequate dispersion within the sample is not a serious problem and reinforces the acceptance of the single-factor model. the results are consistent with a lack of sensitivity to the specification of the market portfolio and with the hypothesis that the LRT employed in Gibbons's original tests was biased against the null hypothesis in small samples. The methodology was applied to daily stock return data, and a single-factor asset pricing hypothesis could not be rejected in any of four equal subperiods from 1962 to 1980.	Asset pricing models can be estimated and tested without observing the market portfolio or state variables. Avoiding a specification of these is a by-product of relaxing the assumption that risk premiums are constant. While changing risk premiums does require a model for conditional expected returns, a regression model permits standard specification tests and is robust to missing information.
82	Two-stage-factor analytic approach as implied by the formulation of the APT. In the first step, the number of factors, k, is determined, and the elements of the factor loadings matrix, B, are estimated. In the second stage, we estimate risk premia, A,, using the estimated matrix B as independent variables. This is an adaptation of the Fama-MacBeth methodology to a factor-analytic framework. The null hypothesis of no linear relation cannot be rejected for a one-factor model based on the small and insignificant chi-square values of 0.054 and 0.153 for Samples 1 and 2 in Column (11). The opposite conclusion is reached for two or more factors. That is, once the number of factors is increased beyond one, the chi-square values become significant at the 5% level and do not comply with the null hypothesis. These findings for multiple factors are consistent with one of the implications of the APT and suggest two or more "priced" factors in the U.S. Treasury securities market. Intercept tests are not supportive of the Sharpe-Lintner version of the CAPM but are consistent with Black's version. The tests here should be viewed simply as the first empirical attempt to properly measure interest-rate risk for bonds using factor-generating models. Results in terms of the existence of priced risk premia are more favorable to multifactor models than to single-factor models or the CAPM. Also, one-month ahead forecasts using factor-generating models are somewhat better than corresponding naive predictions or predictions using a typical index portfolio. Multi-factor models, however, do not seem to give a complete explanation of the risk-return relation in the U.S. Treasury security market.	Authors find that at least two factors are linearly related to mean bond portfolio returns. We did not, however, uncover a linear relation between mean bond returns and various portfolio proxies. Furthermore, multivariate test results are not supportive of the APT or the Sharpe Lintner and Black versions of the CAPM.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
83	The model was rejected. It is possible that the asymptotic inference theory was not justified in our case due to the small sample size. It is also possible that some of the underlying assumptions were not satisfied. In what follows, we outline how the assumptions could be erroneous. We do so with the hope that it may be useful in linking up our work with other related work in this area and for future research.	The representative agent paradigm will not in general be valid if agents do not possess the same information set. There was a representative agent whose preferences could be represented by a utility function which is time separable and homothetic and that there are no shocks to preferences. Some researchers have pointed out that time separability may not be a reasonable assumption. The representative agent has frictionless access to markets. This is equivalent to assuming that all agents in the economy have frictionless access to financial markets. This may not be true if some agents face liquidity constraints. Authors ignored durable goods consumption, due to the difficulties associated with measuring the service flow from durables. Active rental markets for many durable goods do not exist, possibly due to relatively high transactions costs.
84	Firms neglected by analysts have greater divergence of opinion about the mean forecast. This result implies hat investors require a higher return for relatively neglected securities, and the analysis rigorously tests the relationship between security research concentration, systematic risk, and risk adjusted returns.	Contrary to earlier findings, the statistical results indicate that ex-post systematic risk and the degree of research are inversely related. However, the most neglected firms comprised the lowest beta portfolio, a result that merits further study. Finally, the portfolio analysis consistently indicates that neglected firms earn higher returns, ceteris paribus, and it seems plausible to conclude that investors require higher compensation for the additional estimation risk associated with these securities.
85	Changes in government bond yields clearly affect ex post returns to electric utilities, and that this phenomenon is concentrated to a much larger extent in this particular industry than in NYSE firms as a whole. Evidence of the pricing is provided within the framework of the APT.	The interest rate factor can be thought of as equal to unanticipated changes in expected inflation plus changes in the real rate of interest. This interpretation allows us to consider several mechanisms, in particular regulatory lags, as responsible for the effect. The identification of regulatory lags would indicate that the cause of the interest rate loading is a recognized source of risk in the market, and hence help rationalize the evidence that this factor is priced by market participants. Furthermore, this sensitivity to changes in interest rates seems to be priced, in the sense that ex ante returns incorporate a premium based on the risk of interest-rate changes, with the premium proportional to the stocks sensitivity to these changes
86	Assuming the propriety of mean-variance analysis, this study claims that no economic argument exists to justify the use of Jensen-type market line deviations in identifying return anomalies such as the small firm anomaly. Since market line deviations are meaningless from a performance perspective, then deviations' proxies, in cross-sectional mean return-beta regressions, serve no useful purpose. When returns are grouped by month, a test of Sharpe-Lintner index efficiency was possible in seven months, where *short* positions on both small and/or large firm portfolios were generally required to improve index efficiency. In those months, like January, where the Sharpe-Lintner test was not possible, a test of index efficiency conditional on the maximum likelihood estimate of the zero beta rate, indicated that no significant improvement in the index was possible. The index, therefore, lies on the efficient set hyperbola, the Black version of the asset-pricing model is not rejected, and the small firm anomaly disappears.	The probability is also reasonably large that the January efficient set configuration is a sample outcome in a Sharpe-Lintner asset pricing world, since the test of a positive return on the global minimum portfolio is not rejected.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
87	The most striking feature of our results, as shown graphically in fig. 1, is their very obvious sensitivity to the design of the experiment. Overall performance can appear significantly positive or negative, depending on the choice of index and methodology. Unless tipsters are to be credited (or debited) with a market wide phenomenon, the size effect, performance must be evaluated using a methodology which adjusts for size. On this basis, tipsters exhibit no evidence of stock selection skills. Performance measures can be seriously distorted when (1) the measurement interval is long, (2) event securities differ in size or weighting from the index constituents, and (3) the size effect is large and/or volatile.	research provides insights into the impact of the size effect on event studies, and demonstrates the importance of taking this pervasive phenomenon into account. Two conclusions emerge, one methodological, the other empirical. The methodological conclusion in that longer-term performance measures which ignore the size effect may be of no value to researchers. The empirical conclusion is that published UK stock recommendations may be of no value to anyone.
88	The data we examine in the paper provide no support for the consumption CAPM as compared to the traditional formulation. A stock's market beta contains much more information on its return than does its consumption beta. Since the consumption CAPM appears preferable on theoretical grounds, the empirical superiority of the traditional CAPM is a conundrum. As in all empirical research, however, we examine a joint hypothesis; the apparent rejection of the consumption CAPM is potentially attributable to failure of the one of the many auxiliary assumptions.	it seems possible that the consumption CAPM holds for the minority of consumers that hold stock and that our stock market index is a better proxy for the consumption of the minority than is aggregate consumption.
89	An international CAPM was not a good description of the pricing of Canadian securities for the period from *1968* through *1982.* National factors not present in the global index are an essential component of expected return in Canada. Authors therefore reject the joint hypothesis of integration of the North American equity market combined with the CAPM. There is evidence of segmentation in the pricing of Canadian stocks. Their ability to reject at least one of the competing hypotheses can be traced to the use of the maximum likelihood technique, which is more powerful than the traditional Fama-MacBeth two-pass approach.	The methodology could be extended to more general multifactor asset pricing models, and it would be interesting to see whether purely national factors also lead to rejection of integration.
90	The econometric model gives an estimate of the coefficient of relative risk aversion of 4.22, with an estimated standard error of 0.254. The t-value thus obtained is substantially higher than the t-values for relative risk aversion obtained based on unconditional tests of CRRA models using the method of moments. Over the same holdout period, the utility-based model correctly predicts the direction of aggregate common stock price movements 70% of the time, which compares with a 55% for the risk-neutral model, for the Williams-Gordon-Rubinstein model, for the simple technical model The endogenization of discount rate changes using a utility-based valuation model and observable consumption data results in superior performance com- pared to constant discount rate models.	NOT STATED

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
91	The results do not support the important implications of the CAPM. Results reveal that there are significant nonlinearities in the relationship between the returns and risks of common stocks. In addition, they show that the nonlinearities in the risk-return relationship cannot be attributed solely to the anomalous behavior of stock returns in January or to the so-called small-firm effect. Even when the data for January are excluded from the analysis and firm size is explicitly recognized, the two-parameter asset pricing model is rejectable.	NOT STATED
92	The OLS beta estimates for the five portfolios vary monotonically from 0.744 to 1.494 in the direction expected for thin trading and price adjustment delay bias-portfolios comprising securities traded less frequently than the market proxy have beta estimates less than 1.0 while those with more frequently traded securities have beta estimates greater than 1.0. Thus, evidence is provided that bias due to thin trading and price adjustment delays is substantial for NYSE stocks when daily returns are used Each of the four beta adjustment techniques considered moves the portfolio beta estimates in the direction of reducing the amount of bias. However, the best technique, Dimson betas, reduced the bias by only 29% compared with the spread in OLS beta estimates..	NOT STATED
93	although systems methods have various characteristics that are amenable to event study applications, the promise of these methods is not supported by a variety of empirical tests. The basic conclusions that the simple OLS market model method is sufficient. In this study, there is limited evidence that the extension of the OLS model to systems methods is in many cases statistically significant; however, these gains do not provide superior power over simpler tests in identifying abnormal returns.	Future studies appealing to the characteristics of systems methods in tests of abnormal performance must be careful to show the efficacy of using the more complicated methodology.
94	The results indicate that, with an unspecified alternative hypothesis, an important determinant of the power is the type of deviation present. The tests can have reasonable power if the deviation is random across assets. But if the deviation is the result of missing factors (as is the case in many competing models), the tests are quite weak. There exists an upper bound (depending on the missing factor parameters) on the distance the distribution of the test statistic under the alternative can be from the distribution under the null hypothesis. This distance will be relatively small for reasonable missing factor parameters.	The distribution of the test statistic in an APT world is likely not to be very different from the distribution in a CAPM world making such an interpretation, without further investigation, inappropriate.
95	Equity markets differ widely in terms of size and activity among these countries. The world's largest and most active exchange is the NYSE; one of the world's smallest and least active is the Brussels Stock Exchange. Despite these differences, our empirical evidence reveals a common characteristic across the four stock exchanges: the presence of persistent seasonalities in these markets' risk premia and stock returns. In the United States and Belgium, the relationship between average portfolio returns and their corresponding systematic risk is *significantly positive* only in January. This positive January seasonal is not observed in the United Kingdom. It is replaced by an April seasonal, the only month of the year during which the relationship between average portfolio returns and systematic risk is significantly positive on the London Stock Exchange. In France, the January risk premium is positive and larger than the risk premium during the rest of the year, but it is *not* significantly different from zero. Contrary to the case of the United States, where the relationship between the average portfolio returns and systematic risk is not significantly different from zero the rest of the year, it is, on average, significantly *negative* during the other eleven months of the year in the three European countries in our sample. We have also found that the January *excess* risk premium (the January premium less the premium during the rest of the year) is significantly *larger* in the United States than in the three European countries in our sample. During the rest of the year, however, the European risk premia do not differ significantly from the U.S. risk premium	Although a perfect correspondence between these patterns exists in the United States, it is not the case in the United Kingdom, France, and Belgium. A possible explanation of this phenomenon is presented in the previous section.

	CONCLUSIONS	
	FINDINGS	**IMPLICATIONS (SUGGESTIONS)**
96	The results show that there is a January effect and a small-firm effect in stock returns. Correlation matrices are more stable than covariance matrices, but both types of matrices are not stable across months and across the sample groups. The number of return-generating factors is rather stable most of the time and for most of the sample groups, but there is some significant instability that is related to the average correlation coefficients among stocks. The APT pricing relationship does not seem to be supported by the two-stage process using the maximum-likelihood factor analysis	To the extent that the factor-structure instability is significant, tests of the APT should employ methods that accommodate the observed patterns. We leave the application of alternative methods for future research.
97	Price-based earnings will outperform univariate time series forecasts by a greater margin for larger firms than for smaller firms .size is viewed as a proxy for available information in addition to that which is reflected in the past time series of earnings and for the number of market participants gathering and processing information .Price-based models outperform both the random walk and random walk plus drift models when forecasting the earnings of larger firms. However for small firms we found little difference between the price-based models and these two univariate time series models.	These findings have important methodological implications for studies that attempt to measure the degree of association between accounting earnings and stock returns over annual periods. Specifically, results suggest that for larger firms, simple univariate time series model are inadequate proxies for the market's earnings expectations over one-year forecast horizons. Alternatively, researches may want to consider starting the cumulation of returns prior to the period for which the earnings number is computed to accommodate the fact that price changes tend to anticipate earnings changes, particularly for larger firms.
98	The analysis indicates that significance levels higher than the traditional 0.05 level are recommended for many test situations. in an example from the literature. the classical test fails to reject with p-value 0.082. yet the odds are nearly two to one against efficiency under apparently reasonable assumptions. Procedures for testing approximate efficiency and for aggregating subperiod results are also considered.	Future research might re-examine the efficiency question in the context of a specific investment decision problem. It would also be desirable to extend the present framework to deal with more general asset pricing restrictions, for example, efficiency when a riskless asset is not available. The likelihood perspective could prove useful in event study empirical work as well.
99	Empirical evidence has been presented which suggests that either the Sharpe-Lintner CAPM is invalid or our proxies account for at most two-thirds (rejected at the 0.05 level), or perhaps only one-half (rejected at the 0.10 level), of the variation in the true market return. The results are essentially the same whether we use the CRSP equal-weighted stock index alone, or together with the Ibbotson-Sinquefield long-term U.S. government bond index, in a multivariate proxy.	While discussion has focused on the Sharpe-Lintner model, similar principles clearly apply in the testing of other equilibrium models such as the consumption CAPM and variants thereof.
100	The expected market risk premium (the expected return on a stock portfolio minus the Treasury bill yield) is positively related to the predictable volatility of stock returns. There is also evidence that unexpected stock market returns are negatively related to the unexpected change in the volatility of stock returns. This negative relation provides indirect evidence of a positive relation between expected risk premiums and volatility.	The estimates of volatility and expected risk premiums in this paper suggest that these variables have fluctuated widely over the past sixty years. Although we are unwilling to choose a particular model for the relation between expected risk premiums and predictable movements in volatility, it seems obvious that future work in this area is called for. Other variables that could affect expected risk premiums should be integrated into this analysis, as well as different measures of time-varying risk
101	The security prices of large firms anticipate accounting earnings earlier than the security prices of small firms, and the magnitude of abnormal returns associated with good or bad news from a common class of signals (in the current study, accounting earnings) is inversely related to firm size.	The time series of accounting earnings or security returns differs systematically between large and small firms but the research design does not adequately control for those differences. Future research should introduce different controls in order to refine our understanding of the differential information hypothesis.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
102	Using weekly data on ten portfolios of common stocks formed according to firms equity capitalizations, conditional mean-variance efficiency of a value-weighted stock index is rejected for the overall period,1963 through 1982.The strongest evidence is observed in the 1963 through 1967 subperiod, when a size effect on average returns is most pronounced. Simulation evidence indicates that these results are insensitive to the amount of variation through time in expected risk premiums. A single risk premium model of expected returns is not rejected if the premium is allowed to vary over time and if the risk measures associated with that premium are not constrained to equal market betas.	NOT STATED
103	The conditional covariance matrix of the asset returns is strongly autoregressive. The data clearly reject the assumption that this matrix is constant over time. The expected return or risk premia for the assets are significantly influenced by the conditional second moments of returns. There is also some evidence that the risk premia are better represented by covariances with the implied market than by own variances. However, information in addition to past innovations in asset returns is important in explaining premia and heteroscedasticity. In particular, lagged excess holding yields and innovations in consumption appear to have some explanatory power for the asset returns.	Probably even better econometric models with a richer specification for the risk premia, not necessarily derived directly from any economic theory, can therefore be constructed. Other interesting questions that remain are the sensitivity of the results to the choice of the "market portfolio" and a quarterly one-period horizon. It is possible that wider definitions of the market would allow the model to do better. We leave the answer to all these questions for future research.
104	As predicted by the CAPM, in most cases the subjects diversified their invest- ment capital among the three risky assets. However, on the average the subjects invested considerably more than predicted in the riskiest asset. The population variance-covariance matrix that governs the risky assets had no significant effect on investment behavior. The introduction of a riskless asset did not enhance homogeneity in investment behavior, in contradiction to the Separation Theorem	CAPM should manipulate experimentally (a) the amount of investment capital, (b) the 1ntere5t rate for borrowing and lending, (c) the population variance-covariance matrix governing the behavior of the risky assets, (dl the magnitude of effect that the decisions of each investor have on subsequent returns, (e) the information that each investor has about the investment decisions and reputation of other investors, and (f) the financial knowledge and sophistication of the subjects. It would be useful and instructive to conduct such experiments with individuals who have acquired much experience in selecting portfolios. Although access to such a population of investors is difficult, it is by no means impossible.
105	The January effect is an important determinant of expected returns. The existence of a January effect that is not explained by this set of factors is evident, but, as discussed above, it would be trivial to add a portfolio that exhibits a strong January effect and hence represents a "January factor." Including or excluding a January effect has, however, no appreciable effect on the following results from nested testing: the CAPM restrictions on the APT are rejected; the APT restrictions on the LFM are not rejected.	The implementation of exogeneity tests should have high priority both in our own work and the work of others.
106	The APT performs much better than either implementation of the CAPM in explaining the January-specific mispricing related to firm size. This result is due to seasonality in the estimated risk premiums of the multi-factor model that is not captured by the single-factor CAPM relations, even though the premium in the latter model also exhibits seasonality.- the prediction of an intertemporal version of the APT that there is a factor for which all assets have a sensitivity of unity. This hypothesis is strongly rejected for a five-factor APT.	Extensions of this work can take several directions. Procedures designed to compare nonnested models. Time improvement in the technology may be obtained by investigating recent specifications of the error covariance matrix. Linking the seasonality in estimated factor risk premiums to more undamental economic variables should help us understand the nature of the observed seasonal effects. Empirical results indicate that while neither of our implementations of the APT or CAPM is a perfect model of asset pricing, the APT is consistent with the persistent size-related seasonal effects in asset pricing. Empirically, the model seems to be a reasonable alternative to the CAPM.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
107	Although our results show that the pricing equation cannot be rejected in favor of the alternative pricing equation with the firm-size variable, theoretical reasoning suggests that we should have a multifactor asset-pricing model if risks corresponding to a changing investment opportunity set (e.g., changing expected returns, changing implicit market risk aversion, and changing market risk measures) can be hedged. Empirically, factors that are related to the changing investment opportunity set were shown to have explanatory power on cross-sectional differences in average returns.	Authors are not proposing here that their single-factor equation can provide a complete description of the risk-return tradeoff. The main point of study is that, among the size-ranked portfolios, the proxy log(size) does not have additional explanatory power of the cross-sectional returns after controlling for the unconditional equally weighted market beta.
108	Research finds significant E/P and size effects when estimated across all months during the 1951-1986 period. The findings also indicate a difference between January and the rest of the year; the coefficients on *both* E/P and size are significant in January, but only the E/P coefficient is significant outside of January. Furthermore, the results on E/P are not affected by our technique of ranking first on E/P and then on market value. Controlling for cross-sectional differences in market price attenuates the coefficients on both E/P and size. However, the only change in the above inferences is that the E/P coefficient is no longer significant in January. Finally, we find evidence of consistently high returns in firms of all sizes with negative earnings.	NOT STATED
109	There is some evidence against all of the models, especially in terms of pricing common stock of small-market-value firms. Multifactor models tend to outperform single-index CAPM-type models in both domestic and international forms. The value-weighted CAPM has much larger pricing errors than the APT. The equal-weighted CAPM performs about as well as the APT except in terms of explaining seasonality in asset returns. There is strong evidence that the behavior of the models in the period from January *1969* to January *1974* is different from their behavior after January *1974.* We interpret this evidence as being consistent with a scenario in which some combination of capital control deregulation and the break-down of the fixed exchange rate regime lead to pricing effects that are not well captured by models of either completely segmented or completely integrated markets. Controlling for regime shifts in the level of capital controls, inter- national versions of the CAPM outperform domestic versions while the opposite is true for the APT. The evidence is generally consistent with nontrivial international influences in asset pricing.	NOT STATED
110	Beta changes with the return interval because an asset return's covariance with the market return and the market return's variance may not change *proportionately* as the return interval is varied. The evidence is consistent with the market model betas changing predictably with the return interval. etas of high-risk securities increase with the decrease with the return interval, whereas betas of low-risk securities decrease with the return interval.	The implication is that betas estimated using longer-interval returns lack statistical precision, which should make them less able to explain return variation. The evidence, based on both OLS and GLS estimation procedures, is not consistent with beta changes stemming primarily from increased standard errors. To examine the implications of beta changes for the size-effect tests, results suggest that only annual betas explain return variation incrementally. The coefficient on the firm-size variable is insignificant, which is inconsistent with the size-effect hypothesis. Overall, the results are consistent with the joint hypothesis of CAPM and market efficiency.
111	Using market data, the MLPM model was tested against an unspecified alternative. For the CRSP equally weighted index, the MLPM model could not be rejected for a large set of alternative target rates of returns. In addition, the CAPM as a special case of the model was rejected as a well-specified alternative. Conditional on the assumption that the MLPM model is valid equilibrium pricing relationship, market participants appear to characterize risk as downside deviations below a target that is related to equity marker mean returns rather than the risk-free rate, the target rate that is implicit in the CAPM and explicit in earlier downside risk formulations.	NOT STATED

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
112	Authors detected the presence of a deterministic component in returns and modeled it with a January dummy variable. Based on the test of the orthogonality conditions used in estimation, this model was found to fit the data relatively well. We found strong evidence of time variation in the conditional first and second moments of excess stock returns. The first- and third-order lags in the conditional variance of the market risk premium, as well as in the conditional covariance between the returns of five value-weighted portfolios and the market were found to be significant. These results suggest that monthly and quarterly variability components are priced in equity excess returns. The quarterly component may be evidence of an information effect corresponding to quarterly release of news in corporate and governmental statistical reporting	The implications of the model held up relatively well under hypothesis testing. We temper our conclusions, however, as analyses of the residuals indicated that current and lagged dividend yields contain significant predictive information for the smaller sized firms beyond that contained in our conditional CAPM.
113	investment returns do not explain the component of stock returns forecastable by dividend-price ratios. Dividend-price ratios seem to forecast a long horizon component in stock returns not present in investment returns. This component of stock returns might reflect a long-term movement in productivity, which is assumed to be constant here.	There are several promising directions in which this model can be extended. Alternate forms for technology may improve the fit, and variations in marginal products can be estimated. By not attempting to construct a mimicking portfolio, producers' first order conditions can be estimated and tested by generalized method of moments.
114	The tests of the TMCAPM show that the average return over time on the selected mutual funds tends to deviate from the predictions of the model. They are generally flatter than predicted by TMCAPM, implying that tradeoffs of risks for return are less than predicted.	The lack of a significant relationship between the first three statistical moments on the selected mutual funds does not invalidate the three-moment equilibrium model. There are other investment strategies that guarantee to produce consistent positively skewed return distributions. The portfolio that will work involves investments combining with equities with either options or convertible bonds.
115	Empirical results based on the pooled time series and cross-section of beta-ranked portfolio returns do not reject the conditional mean-variance efficiency of the market proxy portfolio. The findings also indicate that the ratio of expected excess market return to the conditional market variance, or the reward-to-risk ratio, is positively correlated with the level of the conditional market variance. When tests are based on ten size-sorted portfolios, however, the tests reject the model.	The cross-sectional variation in the parameter estimates is perhaps attributed to some incremental effects not explicitly incorporated in the model. Thus, size-sorted portfolios may provide a better proxy for these factors than beta-ranked portfolios.
116	The estimation results of C-CAPM in Japan is totally different from those in the United States. The existing literature, which mainly dealt with the U.S. asset market, shows that C-CAPM cannot fit the movements of the asset return. This fact sometimes causes the doubt on the applicability of dynamic economic model to the economic data. However, this paper shows that these results are not robust and at least in Japan the model is consistent with the movements of asset returns. This is probably caused by the institutional difference between the two countries. In the United States, some factors which are not considered by C-CAPM (eg., monetary factors, tax distortion) may affect the movement of asset returns.	NOT STATED

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
117	This research finds evidence that the CAPM is a better indicator of capital asset pricing in Germany than the CCAPM. However, the tests indicate that deviations from CAPM risk-return relationships may exist at least for monthly data over subintervals. These findings are similar to those found for the U.S. market.	NOT STATED
118	Main result is that for the 1963-1990 period, size and book-to-market equity capture the cross-sectional variation in average stock returns associated with size, E/P, book-to-market equity, and leverage.	It is possible that, by chance, size and book-to-market equity happen to describe the cross-section of average returns in our sample, but they were and are unrelated to expected returns. We put little weight on this possibility, especially for book-to-market equity. First, although BE/ME has long been touted as a measure of the return prospects of stocks, there is no evidence that its explanatory power deteriorates through time.
119	The three stock-market factors are largely uncorrelated with one another and with the two term-structure factors. The regressions that use the proxy return for market portfolio, SMB, HML, TERM and DEF as factors to explain stock and bond returns thus provide a good summary of the separate roles of the five factors in the volatility of returns and in the cross-section of average returns.	Results can be used in any application that requires estimates of expected stock returns. The list includes (a) selecting portfolios, (b) evaluating portfolio performance, (c) measuring abnormal returns in event studies, and (d) estimating the cost of capital.
120	Using monthly industry returns for every consecutive ten-year period from 1926 to 1986, we find strong evidence against the usual multivariate normality assumption. We also test the mean-variance efficiency of the CRSP value-weighted index. Under the usual normality assumption, we reject the efficiency for half of the periods, but the efficiency can no longer be rejected under plausible alternative assumptions on the stock returns. Our results suggest that, if the returns are elliptically distributed, empirical studies that ignore the nonnormality are likely to overreject the theory being tested, but the proposed approach can be used to detect the magnitude of the overrejection.	NOT STATED

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
121	Historical returns can be used to approximate the unobservable factor loadings and factors can be estimated by running a series of semiautoregressions.Authors find that the measurement errors in the extracted factors are small. Using the asymptotic variance-covariance matrix for the factor estimates, Author shows how to take measurement errors into account in the second-state hypothesis testing. Empirical work confirms the result of previous studies that the APT offers a slightly better description of asset returns than the CAPM.	NOT STATED
122	A number of tests are run in this study to compare the performance of two empirical versions of the APT, a factor loading model (FLM) and a macroeconomic variable model (MVM). The viability of the MVM to the FLM is suggested by all three sets of test results. Given the fact that the FLM factors are sample specific, the better performance of the FLM than the MVM in explaining the variation in excess returns across industry groups is expected and confirmed. However, the FLM dominates the MVM by only a small margin. Little is lost in moving from the FLM to the MVM, and the MVM may turn out to be the better mode1 when the two are tested against a holdout sample or against a test period. This finding is very promising because the MVM has several advantages, including economically interpretable factors.	No attempt is made in this study to determine the best set of macroeconomic variables or how to best measure the ones selected, so the possible performance of the MVM is probably understated.
123	Although previous studies do not reject the unconditional mean-variance efficiency of a world equity market portfolio, we find that the world market betas provide a poor explanation of the average returns across countries. Our tests do not reject the hypothesis that the returns are consistent with a four-factor model. The average pricing errors of the multiple-beta model are only 0.2% per month for Japan and 0.1% for Hong Kong, which are much smaller than the errors of a model based on only the world market portfolio. This suggests that when the measures of risk are expanded to include such variables as exchange rates, oil prices and long-term inflationary expectations, then much of the seemingly abnormal average performance of the Japanese and Hong Kong markets may be explained as compensation for global economic risk.	NOT STATED
124	A systematic relation exists between beta and returns for the total sample period and is consistent across subperiods and across months in a year, and a positive tradeoff between beta and average portfolio returns is observed.	Since the concerns regarding the weak correlation between beta and the cross- section of returns appear to be unfounded, the results support the continued use of beta as a measure of market risk.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
125	The simple investment return model performs surprisingly well. The investment return factors significantly price assets, the model is not rejected, and it is able to explain a wide spread in expected returns, including managed portfolio returns formed by multiplying returns with instruments. The model performs about as well as two standard finance models, the CAPM and the Chen, Roll, and Ross factor model. The investment return model performs substantially better than the standard consumption-based model and an ad hoc consumption growth factor model. It is robust; an investment growth model performs about as well.	An adjustment cost (or some wedge between the price of installed and uninstalled capital), currently not included in most real business cycle models, is useful in order to reconcile investment and asset returns.
126	Author has argued that the CAPM, as traditionally implemented in empirical work, is seriously flawed. Most important, it ignores time variation in expected stock returns. In monthly postwar U.S. data, the time variation in returns is large and takes the form of mean reversion, reducing the long-run risk of stock market investment relative to the short-run risk. By neglecting mean reversion, the CAPM over-states the risk of stock market investment and correspondingly under-states the risk aversion coefficient needed to fit the equity premium. Despite these flaws, the CAPM does capture most of the variation in expected excess returns across the assets studied here. At a mechanical level, this result may not be surprising since the market is the first factor in all the multifactor models studied here. Empirically, all the stock portfolios studied here have high average excess returns and large covariances with the stock market, whereas the bond portfolios have low average excess returns and small covariances with the stock market. The insights provided by the intertemporal model do not come without costs. Most obviously, many assumptions and approximations have to be used to derive the theoretical model. There are also some more specific empirical concerns. the implications of the intertemporal model for the conditional moments of asset returns are strongly rejected, although there is only weak evidence against its implications for unconditional moments	The approach suggested in this paper can be developed in a number of directions. The asset pricing model can be embedded in a macroeconomic model that jointly determines the return on human and financial capital.
127	When betas and expected returns are allowed to vary over time by assuming that the CAPM holds period by period, the size effects and the statistical rejections of the model specifications become much weaker. When a proxy for the return on human capital is also included in measuring the return on aggregate wealth, the pricing errors of the model are not significant at conventional levels. More importantly, firm size does not have any additional explanatory power.	The conditional CAPM we study in this article is very different from what is commonly understood as the CAPM, and resembles the multi-factor model of Ross (1976). The model we evaluate has three betas, whereas the standard CAPM has only one beta. We chose this model because (i) the use of a better proxy for the return on the market portfolio results in a two-beta model in place of the classical one-beta model, and (ii) when the CAPM holds in a conditional sense, unconditional expected returns will be linear in the unconditional beta as well as a measure of beta-instability over time. When the CAPM holds conditionally, we need more than the unconditional beta calculated by using the value-weighted stock index to explain the cross-section of unconditional expected returns.
128	In contrast to US findings, when we estimate the CAPM using monthly stock return data from the UK we find a significant and powerful role for beta in explaining expected returns. Our findings indicate no role for the Fama and French variables when the CAPM is estimated using NLSUR with an unconstrained variance-covariance matrix. When we consider the Fama±MacBeth t-statistics we cannot rule out the existence of a price effect in the UK stock market.	Do these results indicate that beta is alive and well? The answer to this question may become clearer with future research into the nature of the correlation between idiosyncratic returns. However, for the moment we believe that our results, at best, could be interpreted as an indication that b is not dead; at worst they could be interpreted as evidence that b should be augmented by other variables as a guide to expected stock returns.

	CONCLUSIONS	
	FINDINGS	**IMPLICATIONS (SUGGESTIONS)**
129	Returns are positively related to that yield. This holds true even after making risk adjustments based on the Fama French factors and macroeconomic risk factors from the asset pricing literature. Using implied tax rates from the bond market, we find that the size of the yield effect appears to be unrelated to the level of the implied tax rate, and hence the potential tax penalty from receiving taxable dividend income. We also examine shocks to the implied tax rate series. To the extent that it is costly for high yield firms to adjust their dividend policy, we would expect that an unanticipated increase in the implied tax rate would lead to worse performance for higher yielding stocks. We find no such result. Consequently, it is difficult to attribute our documented yield effects to tax effects. Further casting doubt on the tax-effect story is the fact that the yield effect does not exist for the largest NYSE stocks and appears to be nonlinear with disproportionately poor returns for zero-yield stocks.	What then are we observing? It appears we are left with the usual suspects: misspecified asset pricing models that result in yields proxying for omitted risk factors and/or some sort of market inefficiency with respect to yields.
130	The performance of these Macroeconomic factors to be quite disappointing. With the exception of the factors related to the default premium and the term premium, the macroeconomic factors do a poor job in explaining return co-variation. In terms of understanding the return covariation across stocks, widely used factors such as industrial production growth and unanticipated inflation do not seem to be more useful than a randomly generated series of numbers. The mean return premiums associated with the macroeconomic factors are also quite low, further suggesting that they are of limited use in structuring efficient port- folios. Possibly, the poor showing of the macroeconomic factors may be due to measurement errors in the estimated sensitivities. in a predictive sense, there is no benefit to adding statistical factors beyond the first two or three principal components. These fundamental factors seem to work well in capturing the covariation in stock returns. The performance of the size factor is especially noteworthy. Its standard deviation is very large (5.1 1 % per month). Two additional fundamental factors, book-to-market and dividend yield, also have relatively large standard deviations of about 3.8% per month. Technical variables (past returns) have generally not been extensively used as the basis for common risk factors. Their inclusion rests mainly on the fact that they generate large spreads in returns. The technical factors also produce sizable standard deviations of around 4%.	Results uncover some important regularities that can help investors to understand better the return patterns on various investment styles.
131	The return factors in emerging markets are qualitatively similar to those in developed markets: Small stocks outperform large stocks, value stocks outperform growth stocks and emerging markets stocks exhibit momentum. There is no evidence that local market betas are associated with average returns. The low correlation between the country return factors suggests that the premiums have a strong local character. Furthermore, global exposures can- not explain the average factor returns of emerging markets. There is little evidence that the correlations between the local factor portfolios have in-creased, which suggests that the factors responsible for the increase of emerging market country correlations are separate from those that drive the differences between expected return within these markets. There is no evidence of a relation between expected returns and turnover in emerging markets. However, beta, size, momentum, and value are positively cross-sectionally correlated with turnover in emerging markets. This suggests that the return premiums do not simply reflect a compensation for illiquidity.	NOT STATED
132	Scaled consumption CAPM does a good job of explaining the celebrated value premium: portfolios with high book-to-market equity ratios also have returns that are more highly correlated with the scaled consumption factors we consider, and vice versa. Furthermore, the scaled consumption model eliminates residual size and book-to-market effects that remain in the CAPM. Taken together, these findings lend support to the view that the value premium is at least partially attributable to the greater nondiversifiable risk of high-booktomarket portfolios, and not simply to elements bearing no relation to risk, such as firm characteristics or sample selection biases. the data suggest that the Fama-French factors are mimicking portfolios for risk factors associated with time variation in risk premia. Once the (C)CAPM is modified to account for such time variation, it performs about as well as the Fama-French model in explaining the cross-sectional variation in average returns. If conditional expected returns to the market portfolio are time-varying, the investor's discount factor will not merely depend unconditionally on consumption growth or the market return, but instead will be a function of these factors conditional on information about future returns. Assets are riskier if their returns are more highly *conditionally* correlated with factors, rather than un-conditionally correlated as in classic versions of the (C)CAPM.	The empirical results we obtain from doing so suggest that a multifactor version of the consumption CAPM can explain a large portion of the cross section of expected stock returns.

	CONCLUSIONS	
	FINDINGS	IMPLICATIONS (SUGGESTIONS)
133	The pricing kernels implied by both a linear single- and a linear multi-factor model appear unable to explain the cross-sectional variation in port- folio returns. However, if we allow for nonlinearity in the pricing kernel, either quadratic or cubic in aggregate wealth, and impose restrictions on agents' preferences, we are able to describe cross-sectional variation in re- turns. One noteworthy feature of the nonlinear pricing kernels is their incorporation of a measure of the return on human capital. The evidence suggests that this linear impact is not sufficient to explain cross-sectional variation in returns. Rather, it is a nonlinear function of the return on human capital that improves the performance of the model. Tests of the model show that incorporating nonlinearity substantially improves upon the pricing kernel's ability to describe the cross section of returns. In particular, when human capital is incorporated into the measure of aggregate wealth, a quadratic and cubic pricing kernel are able to fit the cross section of industry-sorted portfolio returns, whereas a linear pricing kernel and a pricing kernel implied by power utility cannot. the nonlinear pricing kernels are able to price the cross section of returns substantially better than the Fama and French (1993) three-factor model; the quadratic and cubic models are not rejected whereas the Fama-French model is, and the polynomial pricing kernels produce smaller pricing errors.	The results suggest the possibility that fitting the data necessitates a highly nonlinear pricing kernel. However, a polynomial cannot simultaneously provide this high degree of nonlinearity and a globally decreasing functional form. What functional relationship between aggregate wealth and returns can provide both of these conditions? What features of the data necessitate the high degree of nonlinearity? These questions remain important issues to be addressed in future research.
134	The momentum effect does not seem to be a serious anomaly to the nonparametric conditional version of the Fama and French model. According to the model, the winners tend to have conditional expected returns that are significantly higher than the losers. On average, the difference between expected returns on the winners and the losers is about one percent (per month), which can account for a large portion of the observed profits to momentum strategies.	The new methodology allows us to draw inferences in a way that is free from functional form misspecification of beta risk, risk premia, and the stochastic discount factor. The new testing methodology can be applied to examine anomalies. In the evaluation of anomalies, a critical issue is how to measure risk and risk premia.
135	Contrary to the OLS and GMM estimators, the Hodgson, Linton, and Vorkink (2002) estimator fails to reject the linear CAPM on the group of size-sorted portfolios. We find that the OLS-GMM rejection of the CAPM is driven by sensitivity to outliers in the size-sorted data. Outliers in the momentum-sorted dataset, primarily related to January returns, also cause the OLS-estimated mispricing associated with the linear CAPM to be understated. Consequently the puzzle associated with momentum may be larger than previously believed.	NOT STATED
136	The liquidity-adjusted CAPM explains the data better than the standard CAPM, while still exploiting the same degrees of freedom. Further, we find weak evidence that liquidity risk is important over and above the effects of market risk and the level of liquidity. The model has a reasonably good fit for portfolios sorted by liquidity, liquidity variation, and size, but it fails to explain the book-to-market effect.	While the model gives clear predictions that seem to have some bearing in the data, it is obviously simplistic. The model and the empirical results are suggestive of further theoretical and empirical work.

3.3 Concluding Remarks

The primary concern of this part is to give as much empirical evidence on asset pricing as possible while being strict on the quality of the research articles. One may go further to build his/her research based on the findings here. As we explained static and dynamic extensions of S-L CAPM, we provide the empirical investigations conducted on these models. However, for the space limitation we left the issue to classify the findings and re-examine the theoretical development of arguments regarding the asset pricing literature here. One may easily interpret the findings and develop an econometric specification to examine market efficiency, the impact of a factor that affect cross sectional security returns, the differences of advanced testing methodologies etc.

The way we approach the empirical literature on asset pricing is unique in the sense that we were able to cover almost a complete literature to review in a systematical approach whereas the question of ‘How’ (e.g. how factor analysis is employed?) is not answered here for the reason that it is out of scope of the thesis and the place limitation.

CHAPTER IV: EMPIRICAL RESEARCH

4.1 Research Objectives

Research objectives considered in this thesis can be seen as empirical investigation of S-L CAPM. A theoretical model such as S-L CAPM is constructed on a set of assumptions (described extensively in chapter II so that are not repeated here) whether these assumptions are consistent with the realism or not. Deriving mathematically the equilibrium representation of the model is carried out through manipulating these assumptions. However, the power of any models either theoretical model or econometrical model comes from its prediction accuracy. The main confusion here is that how to evaluate the importance of the model. A well specified econometric model can work well with a set of data whereas the same model may not work with the different set of data. For this reason, theoretical rational behind the specification of the model plays a crucial role in predictions. On the other spectrum, a well known theoretical model may not be appropriate due to the changing the structural differences in market. In such cases, models may be needed to be improved (as we described the extensions of S-L CAPM in chapter II).

There is a huge literature written on empirical inquiry of S-L CAPM with various econometric specifications (as we made an extensive empirical literature review in Chapter III) whereas we empirically examine the arguments of S-L CAPM through rather simple econometric techniques since developing an advanced econometric test for the model justification is not the main concern here. However, we cover almost every different empirical investigation and apply for S-L CAPM within data set from Istanbul Stock Exchange (hereafter ISE) for non-financial firms. The quality of data restricted us to work on rather short period (78 monthly observations) and the reason of such limitation explained below. There are many anomalies explored in literature that we can not analyze all of them here. Any generalization of findings should be carefully interpreted since we did not explore the impact of every single anomaly in returns patters contradicting the S-L CAPM such as exploring the small-firm effect or dividend yield differences.

4.2 Research Hypothesis

Research hypotheses are developed for testing the S-L CAPM and summarized here. We worked on both individual securities and portfolio for testing the hypotheses. The hypotheses are categorized as follows:

i) testing expected abnormal returns for securities against theoretical value
ii) testing the systematic risk level for securities for pre-specified values
iii) testing the model parameters for pre-specified values (model fitting)
iv) testing the prediction power of the model
v) testing the linearity of risk and return for individual securities
vi) testing the systematic risk indicators for securities for up and down market conditions
vii) testing the structural changes of systematic risk indicator for two pre-determined sample size
viii) testing the linearity of risk and return for portfolio returns

4.3 Research Methodology and Data

The monthly adjusted returns for manufacturing industry for the period from January 2002 to June 2008 (78 monthly observations) are analyzed for the study. As a proxy for market portfolio, the ISE100 index is used and for risk free rate, Central Bank overnight interest rate is used. We follow Istanbul Stock Exchange classification for manufacturing industry sub group categories to divide all firms into eight subgroups. The relevant statistics are calculated for both individual returns and portfolio returns.

4.3.1 Preliminaries and Limitations

The main limitations for the thesis are the quality of data and the time required to prepare the appropriate data to analyze. Author previous research (Celik, 2007 and Celik et al, 2008) shows that the length of the returns interval may change the results considerable. It is not the same to work with daily data and weekly data as it is not the same to work with monthly data. Based on the author findings (regarding with previous researches and the one here), the time interval affect the results such as betas (higher betas are produced by shorter interval and lower betas by longer) whereas the statistical power of econometrical tests decreases as the time interval increases since the number of observations decreases.

4.3.2 Transformation of Data and Empirical Model

Monthly adjusted returns of common stocks are computed as follow (ISE, 2007: 388-89):

$$G_i = \frac{F_i \times (BDL + BDZ + 1) - R \times BDL + T - F_{i-1}}{F_{i-1}} \quad \ldots\ldots\ldots\ldots(4.1)$$

Where Gi : return of month 'i'; Fi : closing price of month 'i'; BDL : number of stocks bought from using right issues during the month ; BDZ: number of stocks bought from using bonus issues during the month; R : price of pre-emptive rights ; T : dividend distributed per 1000 TL/1 YTL nominal value of one share ; F i-1 : closing price of month 'i-1'

ISE National 100 Index is determined as a proxy of market portfolio and The Central Bank O/N interest rate is determined as a proxy of risk-free rate. ISE National 100 index is the only index that is being computed since the establishment of ISE; and hence, the most appropriate one representing the market portfolio. It is a type of weighted average index and is computed as follow:

$$E_t = \frac{\sum_{i=1}^{n} F_{it} \times N_{it} \times H_{it}}{B_t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4.2)$$

Where E_t : index value at time t ; n : number of stocks in the index (which is 100) ; F_{it} : price of stock i at time t ; N_{it} : total number of issued stocks of I ; H_{it} : ratio of public offering of stock i at time t ; B_t : adjusted base market cap.

[Insert Table 4.1 about here]

Using the market model regression for each asset, the following regression model employed so-called first-pass regression[65]:

$$\mu_{it} - r_f = \alpha_i + \beta_i(\mu_{Mt} - r_f) + \varepsilon_{it}\ , \quad \left| \begin{array}{l} \varepsilon_{it} \approx iid \quad N(0, \delta^2) \\ \text{cov}(\varepsilon_{it}, \mu_{Mt} - r_f) = 0 \ or \\ \varepsilon_{it} \ is \ independent \ of \ \mu_{mt} - r_f \\ t = 1, 2, \ldots\ldots, T \end{array} \right. \qquad \ldots\ldots (4.3)$$

In the first pass-regression, the term μ_{it} is stock i return at time t; r_f is risk free rate; μ_{mt} is index return used as proxy for market portfolio; α_i and β_i are parameters of the model employed and ε_{it} is the error term which has mean zero and constant variance. In addition, error term should be uncorrelated with risk premium. In the CAPM world, the parameters are stable and hypothetically α_i should be equal to zero and beta should not be equal to zero (sign of the beta can be negative or positive depending on market's up and down condition). It is going to be examined time varying model in the forthcoming tests as well.

4.3.3 Testing the expected abnormal return

Expected abnormal return on an asset which is depicted in equation (4.3) as alpha, should hypothetically be zero in equilibrium. The value of alpha leads the conclusion for an asset that positive alphas are seen as a good deal on the contrary of negative alpha. It should be underlined the fact that there should not be any deviation for the value of alpha in equilibrium. To investigate the hypothetic value of alpha against zero can be formulated as the following in the form of two side test[66]:

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[65] In the market model framework, the regression is employed for each asset with Ordinary Least Square algorithm. Throughout this paper E-views, Minitab and Excel as econometric softwares are used to support the required calculations.

[66] Gibbons, Ross and Shanken (1989) developed a methodology to jointly test alphas (GRS Test) whereas it is not employed here.

Null hypothesis[67]: $H_n \ : \alpha = 0$ [expected abnormal return is equal to zero]

Alternative hypothesis: $H_a \ : \alpha \neq 0$ [expected abnormal return is NOT equal to zero]

[Insert Table 4.2 about here]

Testing alpha values against zero is a theoretical concern stating that there should not be any excess abnormal return at equilibrium. If there is such abnormal return, rational investors will exploit it and traded on the stock so that the return of the stock will converge to the equilibrium. However, the econometrical assumption lies behind the coefficient tests is that the residuals should be distributed identical, independent and normally. Jarque-Bera Test (1987) is conducted for normality of residuals and reveals that the residuals are not normally distributed. Under the limitations of non-normally distributed, the power of t-test decreases especially in the small samples. Results of t-tests for alpha values are reported in table 4.2 in addition with t-test for betas and F test for joint hypothesis. Results indicate that alpha values of 11 out of 154 manufacturing are statistically different than the theoretical value of zero at 5 % significant level. The period of return calculation (monthly) and the number of observation (78) may lead these results. The critical question in this context is that how investors adjust the relevant information rationally in a time period. Hence, how long it will take time for a stock to be converged to its fair value. The point here is that how long this time is and in which pattern investors adjust relevant information into price. There is not an existed theory to describe pattern of intrinsic value of a stock in the literature which can be well fit within the realistic framework.

[67] For rejecting null hypothesis, the estimated value of α is required to have a value that is much or less than zero. To determine how big the estimated value of α needs to be rejected, the t-statistic can be employed:

$$t_{\alpha=0} = \frac{\hat{\alpha} - 0}{se(\hat{\alpha})} \quad \left| \begin{array}{l} \hat{\alpha} : estimated \quad alpha \\ se\left(\hat{\alpha}\right) : estimated \quad STANDARD \quad error \end{array} \right.$$

4.3.4 Testing the asset systematic risk level against $\beta = 1$

Beta, systematic risk indicator, measures the undiversifiable risk that is not taken away through diversification and the only relevant risk that should be compensated by investors. The inference coming out from beta is that the higher beta shows greater variability than market portfolio whose beta equals to one. Testing the hypothesis that whether the asset has the same level of systematic risk so that required higher returns, the appropriate null and alternative hypothesis can be formulated as follows[68]:

Null hypothesis[69]: $H_n : \beta = 1$ [Systematic risk of given asset is equal to market portfolio's systematic risk]

Alternative hypothesis: $H_a : \beta \neq 1$ [Systematic risk of given asset is NOT equal to market portfolio's systematic risk]

Testing whether betas are at the same level of risk as the market index against the alternative that the risk is different from the market is not a test to validate CAPM. The reason of conducting such test is of interest to examine the given stocks performance with the proxy of theoretical market portfolio. The implications, however, play important role to describe the stocks' risk characteristics against a well known benchmark. The low betas imply that the variability of observed stock returns are higher than that of benchmark which leads to conclusion that seventy one (71) common stocks produce statistically significant higher and/or lower beta than predetermined value one (1). For practical implication, these stocks which have high betas compensate the high reward for bearing risk on their common stocks or vice versa.

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[68] It should be noted that this test is not testing linerity of beta with average return. In the second pass regression it will be described how to conduct beta-expected return linerity test.

[69] The data cast doubt on this hypothesis if the estimated value of β is much different from one. This hypothesis can be tested using the t-statistic:

$$t_{\beta=1} = \frac{\hat{\beta} - 1}{se(\hat{\beta})} \quad \left| \begin{array}{l} \hat{\beta} : estimated \quad beta \\ se\left(\hat{\beta}\right) : estimated \quad STANDARD \quad error \end{array} \right.$$

Which measures how many estimated standard errors the least squares estimate of β is from one. The null hypothesis is rejected at e.g. the 5%level if $\left| t_{\beta=1} \right| \rangle \; t_{0,025\,T-2}$ (two-side test).

4.3.5 Joint test of alpha $\alpha = 0$ and beta $\beta = 1$

To consider how well a model fit on the given data, it is usually looked how much deviation observed between restricted model and unrestricted model. Therefore, under the joint test of alpha and beta, we assume that restricted model parameters should be equal to zero and one for alpha and beta respectively. For this reason, we hypothesize that both β and α have the same risk characteristics as the market index, as a result the following form of joint test can be conducted:

Null Hypothesis[70]: $H_n \; : \alpha = 0 \quad and \;\; \beta = 1$

If CAPM does not hold (in other words at equilibrium in CAPM world), the asset has different risk characteristic than the market index or both, the null hypothesis can be rejected under the following alternative:

Alternative Hypothesis: $H_a \; : \alpha \neq 0 \quad or \quad \beta \neq 1 \;\; or \;\; \alpha \neq 0 \quad and \quad \beta \neq 1$

As a results of joint test of alpha and beta, we rejected the predetermined value of desirable model parameters (alpha is zero and beta is one) for sixty eight (64) common stocks analyzed here. However, it should not be understood that the fundamental value of beta should be equal to one rather it is of interest to see how different characteristics of a stock has relative to a theoretical frameworks of CAPM. In practical manner, it should not be thought that such test can explain why these stocks' performance deviate from what CAPM assumes rather it is highly reasonable to see the current picture of these stocks within the frameworks of CAPM.

[70]This type of joint hypothesis is easily tested using so-called F-test. The idea behind the F-test is to estimate the model imposing restrictions specified under the null hypothesis and compare the fit of the restricted model to the fit of the model with no restrictions imposed.

4.3.6 Testing prediction power of CAPM

The expected return-beta relationship can be represented through Security Market Line (SML) which depicts a benchmark for the evaluation of investment performance. SML portrays individual asset risk premiums as a function of asset risk. Consider the SML equation for CAPM. The SML implies that there is a simple positive linear relationship between expected returns on any asset and the beta of that asset with the market portfolio. High beta assets have high expected returns and low beta assets have low expected returns. This linear relationship is tested by dividing the sample arbitrary into two equal subsamples despite the fact that there is no economic rationale behind this decision. Fama and MacBeth (1973) and Pettengill et.al. (1995) are two standard test methodologies to test unconditional and conditional linearity between risk and expected return in the literature. However, we will apply a modified approach to test linearity of expected return and beta relationship. The betas from first subsample calculated so-called ex-post beta to forecast expected returns for the second subsample. As a proxy of ex-ante expected returns, the excess average asset returns are calculated. In the second pass regression, ex-post beta are used as explanatory variable while ex-ante excess average asset returns used as dependent variable.

[Insert Table 4.3 about here]

Following regression is employed for second-pass regression:

$$\left(\hat{R}_i\right) = \tau + \phi\left(\hat{\beta}_i\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.4)$$

where;

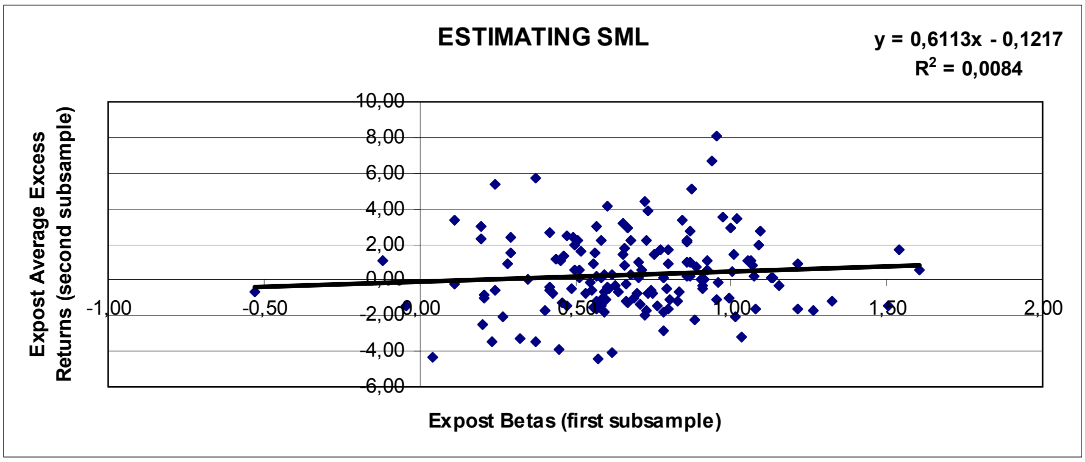
$\left(\hat{R}_i\right)$ is average excess stock i return in the second subsample as an estimate of ex-ante expected return; τ and ϕ are parameter of second pass regression; $\left(\hat{\beta}_i\right)$ is beta for stock i in the first subsample.

Table 4.4: Second-pass Regression (4.4)

	Alpha (Standard error)	t-stat (α) [Prob (t-stat)]	Beta (Standard error)	t-stat (β) [Prob (t-stat)]	F-statistic [Prob(F-statistic)]	R-squared [Adjusted R-squared]	Durbin-Watson stat
Second-pass regression result	-0.121717 (0.403544)	-0.301620 (0.7634)	0.611285 (0.539052)	1.134001 (0.2586)	1.285958 (0.258579)	0.008389 (0.001866)	2.043297

Coefficient of linear relation coming out from the second pass regression (-0,61) is not statistically different than zero and the variation that is explained by betas (0,008%) is not enough indicators to explain cross sectional expected return among asset analyzed in this research. The interesting conclusion is that the difference between R-Square and Adjusted R-Square emphasize that the econometrical model is not well fit to explain the relation between the variables we examined. Results imply that the prediction based on the past data (returns and betas) do not have predictive information for future prospect. In other words, it is easily seen that the coefficient of ex-post beta has no explanatory power on excess average asset returns at all. Second pass regression has no statistical meaning because of the limited number of observations analyzed in this research. Yet it is no guarantee to conclude that it will make sense to increase the number of observations to validate the CAPM. That is why we worked on portfolios returns and reported the results for testing the linear relationship of risk and returns as well.

Graph 4.1: Security Market Line (prediction)



4.3.7 Estimating Security Market Line

Estimating Security Market Line is straightforward. In the previous test we divide the sample into two equal-size subsample. In this case, sample averages of the excess return on each of the assets, $\left(\overset{\mapsto}{R_i - r_f} \right)$, sample estimates of beta coefficients of each of the assets, β_i, sample average of the excess return of the market index, $\left(\overset{\mapsto}{R_M - r_f} \right)$, are calculated from the full sample and following regression is conducted:

$$\left(\overset{\mapsto}{R_i - r_f} \right) = \lambda_0 + \lambda_1 (\beta_i) \quad \text{......(4.5)}$$

Where:

λ_0 *and* λ_1 are coefficients of regressions that should be tested against $\lambda_0 = 0$ *and* $\lambda_1 = \left(\overset{\mapsto}{R_M - r_f} \right)$.

Table 4.5: Second-pass regression (4.5)

	Alpha (Standard error)	t-stat (α) [Prob (t-stat)]	Beta (Standard error)	t-stat (β) [Prob (t-stat)]	F-statistic [Prob(F-statistic)]	R-squared [Adjusted R-squared]	Durbin-Watson
Second-pass regression result	-0.111591 (0.426430)	-0.261687 (0.7939)	0.685423 (0.539109)	1.271401 (0.2055)	1.616461 (0.205528)	0.010523 (0.004013)	1.887551

To test second pass regression (4.5) null hypotheses, we simple employ t-test as follows:

$\lambda_0 = -0.111591$, $\lambda_1 = 0{,}685423$ and $\left(\overset{\mapsto}{R_M - r_f} \right) = -0.28$ and null hypotheses are $\lambda_0 = 0$ *and* $\lambda_1 = \left(\overset{\mapsto}{R_M - r_f} \right)$ t-statistic at 5% significant level for $\lambda_0 = 0$ is $t_{\lambda=0} = \dfrac{\hat{\lambda}_0 - 0}{se(\hat{\lambda}_0)}$ = 0,26 (in absolute term) and similarly, t-statistic at 5% level for $\lambda_1 = \left(\overset{\mapsto}{R_M - r_f} \right)$ is

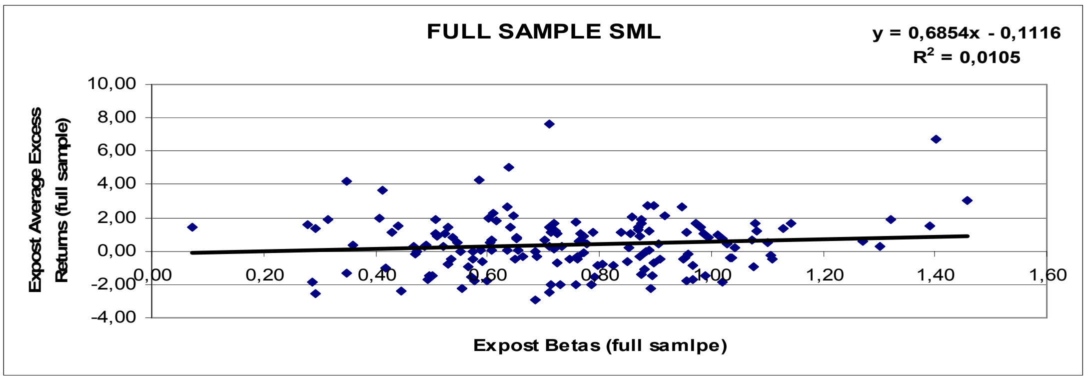
$$t_{\lambda_1 = \left(\overset{\mapsto}{R_M - r_f} \right)} = \frac{\hat{\lambda}_1 - \left(\overset{\mapsto}{R_M - r_f} \right)}{se(\hat{\lambda}_1)} = 1{,}77$$

Table 4.6: Second-pass Regression (4.5) Test Results

	$\lvert t_{CAL} \rvert$	$t_{0,025,T-2}$	**Decision rule: Ho is rejected if**	**inferences**
Second pass regression (2)	**0,26**	**2**	$\lvert t_{CAL} \rvert > t_{0,025,T-2}$	$\lambda_0 = 0$ is not rejected
Second pass regression (2)	**1.77**	**2**	$\lvert t_{CAL} \rvert > t_{0,025,T-2}$	$\lambda_1 = \left(\overset{\mapsto}{R_M} - r_f \right)$ is not rejected

Second pass regression (4.5) results do not support well the linear relationship between average excess return which is used as a proxy for expected excess return and ex-post betas within the estimation period (in theory ex-ante betas are linked with expected return). The main problem here is that the statistical significant of second pass regression (4.5) is not robust. Even though the coefficient tests do not allow us to reject the hypotheses, it is clear that the theoretical values are different from estimated values. The explained variation in excess returns of individual securities is not explained by variation in excess return of index returns (low R square). Despite the fact that the fundamental relation between expected return and beta in upward sloping is confirmed, it is too flat. It is rigorously depicted in graph 2. As it is seen that hypotheses of $\lambda_0 = 0$ and $\lambda_1 = \left(\overset{\mapsto}{R_M} - r_f \right)$ are not rejected at 5% significant level. It is concluded from second pass regression that SML which is upward sloping showing that the more risk is rewarded by more expected return, is supported. However, the data do not support this linearity. There is negative excess return observed in analysis period. The reason behind such results can be partially explained by error in variable problem that is the betas calculated in first pass regression are not free of error that is why they produce such inconsistency with the fundamentals.

Graph 4.2: Security Market Line



4.3.8 Testing structural test of beta

One of the interesting questions taken place in the literature as it is shown above is the structural change of beta over some periods. The reason lies behind this investigation is that beta assumed to hold constant in the CAPM world. However, the characteristics of assets differ time to time, it is logical to expect that beta may change over shorter time period. It should be underlined the fact that CAPM does not propose any certain holding time period (it is single period model) for the investment made. For this reason, the following test methodology employed should not be seen as the one that theory proposed. There are two cases of interest: (1) β may differ over the two subsamples; and (2) both α and β may differ over the subsamples.

4.3.8.1 Testing structural change in β only

If α is the same, but β is different over the two sub-samples then we really have two excess return market model regressions as follows:

$$\mu_{it} - r_f = \alpha + \beta_1\left(\mu_{Mt} - r_f\right) + \varepsilon_{it,} \qquad t = 1,\ldots\ldots,T_H$$
$$\mu_{it} - r_f = \alpha + \beta_2\left(\mu_{Mt} - r_f\right) + \varepsilon_{it,} \qquad t = T_{H+1},\ldots.,T$$

These models share the same intercept α but have different slopes $\beta_1 \neq \beta_2$. We can capture such a model very easily using a "step dummy variable" defined as

$$d^T = 0, \; t \leq T_H$$
$$= 1, \; t > T_H$$

And rewriting the regression model as

$$\mu_{it} - r_f = \alpha + \beta\left(\mu_{Mt} - r_f\right) + d^T\varphi\left(\mu_{Mt} - r_f\right) + \varepsilon_{it} \qquad t = 1,\ldots\ldots\ldots\ldots\ldots,T \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots..(4.6)$$

The model for the first sub-sample when $d^T = 0$ is

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varepsilon_{it} \qquad t = 1,.................,T_B$$

The model for the second subsample when $d^T = 1$ is

$$\begin{aligned} \mu_{it} - r_f &= \alpha + \beta(\mu_{Mt} - r_f) + \varphi d^T(\mu_{Mt} - r_f) + \varepsilon_{it} \qquad t = T_{B+1},.................,T \\ &= \alpha + (\beta + \varphi)(\mu_{Mt} - r_f) + \varepsilon_{it} \end{aligned}$$

It should be noted that the "beta" in the first sample is $\beta_1 = \beta$ and the beta in the second subsample is $\beta_2 = \beta + \varphi$. If $\varphi < 0$, the second subsample beta is smaller than the first sample beta and if $\varphi > 0$, first sample beta is larger than the second subsample beta. We can test the constancy of beta over time by testing whether $\varphi = 0$ in the following formation:

H_n :[71] (beta is constant over time) $\varphi = 0$ versus H_a : (beta is not constant over time) $\varphi \neq 0$

[Insert Table 4.7 about here]

As a conclusion of results depicted in table 4.7, the betas are not stable over the two predetermined period (equal size) for seventeen (17) common stocks analyzed in this research. Allowing beta to be different over the two sample and holding alpha constant imply that there is statistically significant differences in slope of regression equation whereas there is nothing to say about the constant term, alpha, so that it is going to be conducted the following test.

4.3.8.2 Testing structural change in α and β

[71] The test statistic is simply the t-statistic: $t_{\varphi=0} = \dfrac{\hat{\varphi} - 0}{SE(\hat{\varphi})} = \dfrac{\hat{\varphi}}{SE(\hat{\varphi})}$

And we reject the hypothesis $\delta = 0$ at the 5% level if $|t_{\delta=0} = 0| > t_{0.025,T-3}$

At the previous test, the structural differences examined while constant term hold constant. In case of conducting appropriate test where both α and β are allowed to be different over the two subsamples, the following formation can be employed:

$$\mu_{it} - r_f = \alpha_1 + \beta_1(\mu_{Mt} - r_f) + \varepsilon_{it,} \qquad t = 1,......,T_H$$
$$\mu_{it} - r_f = \alpha_2 + \beta_2(\mu_{Mt} - r_f) + \varepsilon_{it,} \qquad t = T_{H+1},....,T$$

The dummy variable specification in this case is

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varphi_1 d^T + \varphi_2 d^T(\mu_{Mt} - r_f) + \varepsilon_{it} \qquad t = 1,............,T \quad ....(4.7)$$

When $d^T = 0$ the model becomes

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varepsilon_{it} \qquad t = 1,.................,T_H$$

So that $\alpha_1 = \alpha$ and $\beta_1 = \beta$,

When $d^T = 1$ the model is

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varphi_1 d^T + \varphi_2 d^T(\mu_{Mt} - r_f) + \varepsilon_{it} \qquad t = T_{H+1},.................,T$$
$$= (\alpha + \varphi_1) + (\beta + \varphi_2)(\mu_{Mt} - r_f) + \varepsilon_{it}$$

So that $\alpha_2 = \alpha + \varphi_1$ and $\beta_2 = \beta + \varphi_2$

The hypothesis of no structural change becomes:

$H_n : \varphi_1 = 0$ and $\varphi_2 = 0$ versus $H_a : \varphi_1 \neq 0$ and $\varphi_2 \neq 0$

The evidence coming out from testing structural differences in both alpha and beta indicates that there is statistically significant shift in both samples for ten (10) common stocks. The underlining reason behind the results reported for the structural changes in equal size samples is that there were not important differences for majority of stocks analyzed in this research. Therefore, results are expected to be in this way.

4.4 Stability of beta over the market cycle

Stability of beta has been taken considerably attention over the market fluctuations as well. An 'up market' condition defined for an asset as positive excess return, $\mu_{Mt} - r_f > 0$, and 'down market' as negative excess return, $\mu_{Mt} - r_f < 0$. The question that leads such investigation is that how an asset's systematic risk changes depending upon market fluctuations. Since systematic risk of an asset is the only relevant risk indicator, it would be an attractive asset to hold in case of having beta greater than one in 'up market' and less than one in 'down market'. Formation regarding to test this question can be done through the following dummy variable specification:

$$\begin{aligned} d_{up}^{T} &= 1,\ \mu_{Mt} - r_f > 0 \\ &= 0,\ \mu_{Mt} - r_f \leq 0 \end{aligned}$$

where, d_{up}^{T} divides the sample into "up market" movements, and "down market" movements. The regression that allows beta to differ depending on the market cycle is then:

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varphi d_{up}^{T}(\mu_{Mt} - r_f) + \varepsilon_{it} \qquad t = 1,\ldots\ldots\ldots\ldots\ldots\ldots, T \quad \ldots\ldots\ldots.(4.8)$$

In the down market, when $d_t^{up} = 0$, the model becomes:

$$\mu_{it} - r_f = \alpha + \beta(\mu_{Mt} - r_f) + \varepsilon_{it}$$

And β captures the down market beta, and in the up market, when, $d_{up}^{T} = 1$, the model is

$$\mu_{it} - r_f = \alpha + \beta\left(\mu_{Mt} - r_f\right) + \varphi\, d_{up}^{T}\left(\mu_{Mt} - r_f\right) + \varepsilon_{it}$$
$$= \alpha + \left(\beta + \varphi\right)\left(\mu_{Mt} - r_f\right) + \varepsilon_{it}$$

So, that $\beta + \varphi$ captures the up market beta. The hypothesis that beta does not vary over the market cycle is

H_n :[72] $\varphi = 0$ Versus H_a : $\varphi \neq 0$

Results indicate that betas do not vary over the market movements except for ten common stocks. In the light of previous studies (Bhardwaj and Brooks (1993), Fabozzi and Francis (1977, 1979)) which analyzed the US stock market, our study shows that manufacturing industry common stocks are not affected the potential impact of up and down market fluctuations. Through such investigation it is shown that there is not statistically significant shift in betas depending upon the fluctuations.

4.5 Testing linearity between risk and return on portfolio returns

The early tests of S-L CAPM were conducted on individual securities' returns and results were not in the favor of the model. For eliminating the potential problem of estimation, research work on portfolio returns rather than individual returns. In this research we show one of the simply way to sort common stocks within the portfolio and measure the risk-return trade off. We divided all manufacturing firm into eight but unequal size portfolios based on the classification of ISE. The various statistics is provided in tables 4.9-4.16 (for details see tables). Table 4.8 reports the statistics we

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[72] This can be tested with simple t-statistic $t_{\varphi=0} = \dfrac{\hat{\varphi}}{SE\left(\hat{\varphi}\right)}$. If the estimated value of φ is found to be statistically greater than zero we might then want to go on to test the hypothesis that the up market beta is greater than one. Since the up market beta is equal to $\beta + \varphi$, this corresponds to testing :

H_n : $\beta + \varphi \leq 1$ versus $\beta + \varphi > 1$, Which can be tested using t-statistic:

$$t_{\beta+\varphi=1} = \frac{\hat{\beta} + \hat{\varphi} - 1}{SE\left(\hat{\beta} + \hat{\varphi}\right)}$$

Since this is a one-side test we will reject the null hypothesis at the 5% level if $t_{\beta+\varphi=1} < -t_{0.05,T-3}$.

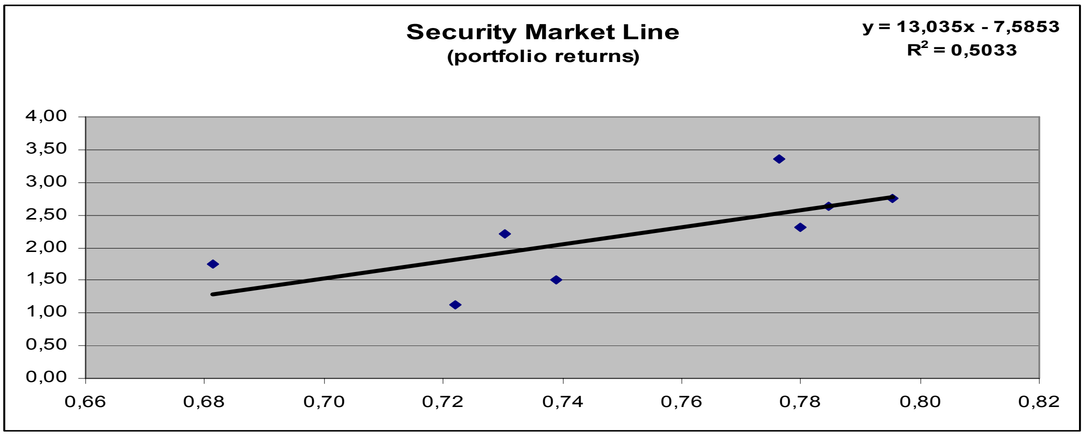
used in cross-sectional regression here and graph 4.3 exhibits a linear positive relationship between ex-post excess return and ex-post betas which is implied in ex-ante form by S-L CAPM.

Table 4.8: portfolio returns statistics of subsectors

	sub sector 1	Sub sector 2	Sub sector 3	Sub sector 4	Sub sector 5	Sub sector 6	Sub sector 7	Sub sector 8
portfolio return (%)	3,35	1,76	2,22	2,75	2,63	2,31	1,12	1,52
portfolio beta	0,78	0,68	0,73	0,80	0,78	0,78	0,72	0,74
portfolio risk (sdv) (%)	10,39	9,17	8,93	10,20	9,08	10,01	10,65	9,36

It is much clearer that the fundamentally true relationship between risk and return is confirmed by the portfolio returns statistics whereas the number of observations is limited to generalize the conclusions.

Graph 4.3: Security Market Line for Portfolio returns



4.6 Empirical Findings

Finance in general, financial economics in particular, just like the other field of sciences, develop its own models by simplifying reality and forming mathematical equations that define the given reality in scientific jargon. In the case of CAPM, we accept the predictions to be true as long as we adopt the relevant assumptions, of which the model is based on, and believe in their validity. A model should not be judged by its simplified assumptions but rather it should be assessed by looking at how accurate its predictions are. Otherwise, there would not be any usefulness of it. However, the model is an elegant one and its testability gives meaningful insight about the structure of the market and the reactions of investors. For these reasons, the usefulness of testing the CAPM may shed considerable lights on stock returns analyzed in this paper. Our study accentuates the theoretical and empirical content of the CAPM by mentioning its extensions and applying several empirical investigations concerning with its validity and predictions on manufacturing industry common stocks in Turkey.

Empirical investigation of S-L CAPM justifications is carried out through developing the hypotheses as (i) testing expected abnormal returns for securities against theoretical value, (ii) testing the systematic risk level for securities for pre-specified values, (iii) testing the model parameters for pre-specified values (model fitting), (iv) testing the prediction power of the model, (v) testing the linearity of risk and return for individual securities, (vi) testing the systematic risk indicators for securities for up and down market conditions, (vii) testing the structural changes of systematic risk indicator for two pre-determined sample size, and (viii) testing the linearity of risk and return for portfolio returns based on extensive survey of literature.

Results do confirm that there is a linear relationship between risk and return whereas the parameter tests are not satisfactory to conclude that the model parameters are robust. This is mainly due to the weakness of econometric specification for the Model. Therefore, based on the results reported here, one may not reject the model instead one may reject the proxy inefficiency for market portfolio or may criticize the limited number of observations analysis conducted on.

4.7 Implication for Further Research

We reported various statistics for this chapter whereas we only mention few here for space limitations. The author strongly suggests that the statistics provided here can be used for starting ground to explore the impact of factors that may affect the variations in stock or portfolio returns other than index’s beta. As previously noted, the impact of the fundamental factors is not examined in addition with the returns interval is not extended to shorter periods. Empirical investigations conducted here limited also with S-L CAPM whereas there are many extensions and none of them is examined here especially the Three Factor Model of Fama and French (1993) or Arbitrage Pricing Theory of Ross (1973) which are empirically examined in literature well. Of course, every study has its own limitations; we will cover the topics mentioned above in near future and also link the findings with the specific factor that characterizes the Turkish Capital Markets such as investors' characteristics or microstructure of the market.

Conclusions

The primary objective of the thesis is to examine one of the core concepts of finance, asset pricing, for the purpose of explaining asset dynamics which have been extensively analyzed by economists, statistician, econometrician, mathematician and financial scholars. More interestingly asset pricing becomes a starting and also pioneering area for many groundbreaking models and extents new perspectives in several fields. We extensively analyzed the field of asset pricing whereas the analysis is limited with the neoclassical approach. Despite the fact that we only mention the differences between neoclassical and behavioral models, we did not cover the behavioral counterparts in addition with option pricing models.

The distinctiveness of the study as a part of general research is that it is the first complete treatment on asset pricing models developed since 1960s. In addition with giving an extensive review on theoretical models and their empirical investigations, it is aimed to make a ground in examining the complete literature and advancing the field by more developed models and econometric specifications. One may easily interpret the findings and develop an econometric specification to examine market efficiency, the impact of a factor that affect cross sectional security returns, the differences of advanced testing methodologies etc.

Results coming out from empirical investigation of S-L CAPM do confirm that there is a linear relationship between risk and return whereas the parameter tests are not satisfactory to conclude that the model parameters are robust. This is mainly due to the weakness of econometric specification for the Model. Therefore, based on the results reported here, one may not reject the model instead one may reject the proxy inefficiency for market portfolio or may criticize the limited number of observations analysis conducted on.

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Appendices:

Table 4.1: Descriptive statistics of stocks' total returns

Firms	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Jarque-Bera Probability	Obs.
ADANA5	3,54	3,16	56,99	-31,78	15,24	0,85	4,76	19,41	0,00	78
ADBGR5	3,49	1,38	46,95	-23,01	12,60	0,95	4,69	21,10	0,00	78
ADEL7	2,67	1,63	30,09	-27,27	12,16	0,21	2,96	0,58	0,75	78
ADNAC5	3,07	0,68	56,90	-30,21	14,40	1,06	5,31	32,14	0,00	78
AEFES2	1,86	1,47	27,55	-21,19	9,62	0,11	2,89	0,20	0,90	78
AFYON5	3,27	0,80	40,35	-25,09	12,03	0,54	3,95	6,73	0,03	78
AKALT8	-0,20	-0,64	39,13	-28,79	12,49	0,26	3,54	1,84	0,40	78
AKCNS5	2,30	1,22	37,75	-28,15	14,03	0,16	2,76	0,52	0,77	78
AKIPD8	1,02	-2,05	63,64	-50,00	17,76	0,52	5,19	19,14	0,00	78
AKSA3	-0,15	0,00	36,84	-30,51	11,08	0,36	4,27	6,93	0,03	78
ALCAR4	1,34	0,26	43,23	-25,53	12,58	0,99	4,88	24,14	0,00	78
ALKA6	2,38	2,11	65,63	-51,58	15,14	0,63	7,61	74,08	0,00	78
ALKIM3	2,69	0,99	55,97	-17,76	12,23	1,17	6,29	52,91	0,00	78
ALTIN8	3,70	0,80	60,23	-27,68	16,52	0,92	4,26	16,20	0,00	78
ALYAG2	0,27	-3,18	79,59	-53,25	20,57	1,20	6,30	54,04	0,00	78
ANACM5	3,49	2,26	33,78	-25,40	11,32	0,22	3,22	0,78	0,68	78
ARCLK4	1,41	0,45	42,22	-24,29	13,42	0,63	3,59	6,36	0,04	78
ARSAN8	1,79	-1,61	98,92	-62,90	20,10	1,45	10,18	194,64	0,00	78
ASLAN5	3,24	1,15	58,42	-35,71	13,99	1,00	6,17	45,80	0,00	78
ASUZU4	2,77	2,07	58,54	-28,57	15,53	0,89	5,23	26,58	0,00	78
AYGAZ3	1,48	2,53	35,44	-25,71	12,34	0,18	2,94	0,45	0,80	78
BAGFS3	4,16	2,90	52,95	-24,57	13,84	0,73	4,66	15,87	0,00	78
BAKAB6	1,34	-0,23	50,00	-39,17	14,32	0,66	4,98	18,46	0,00	78
BANVT2	2,90	0,24	49,09	-31,59	16,03	0,77	3,36	8,24	0,02	78
BERDN8	0,53	-1,46	90,42	-24,03	15,38	2,73	16,67	704,47	0,00	78
BFREN4	9,51	-1,30	389,78	-67,65	63,14	5,36	32,15	3135,47	0,00	78
BISAS8	1,22	-0,98	67,00	-60,91	21,96	0,56	4,55	11,84	0,00	78
BOLUC5	2,63	0,71	61,76	-26,75	14,42	1,61	7,76	107,54	0,00	78
BOSSA8	1,51	-0,56	40,22	-20,99	12,16	0,86	3,90	12,30	0,00	78
BRISA3	1,85	0,79	34,85	-23,26	12,23	0,45	3,50	3,41	0,18	78
BRMEN8	-0,02	-0,56	27,63	-25,30	10,92	0,10	3,72	1,80	0,41	78
BRSAN1	2,55	0,29	35,08	-32,35	11,39	0,40	3,86	4,47	0,11	78
BSHEV4	2,11	0,00	87,50	-22,88	16,59	2,13	10,78	255,52	0,00	78
BSOKE5	2,27	1,82	45,76	-31,25	13,68	0,50	3,61	4,44	0,11	78
BTCIM5	1,92	1,22	40,32	-28,13	11,94	0,75	4,32	12,85	0,00	78
BUCIM5	2,21	0,00	48,42	-15,27	8,92	2,43	12,12	347,15	0,00	78
BURCE1	2,15	0,43	69,23	-40,88	14,78	1,20	8,11	103,73	0,00	78
BYSAN8	0,07	0,00	81,73	-47,09	19,08	1,76	9,87	193,61	0,00	78
CBSBO3	-0,57	-2,07	43,10	-40,91	14,85	0,62	4,42	11,64	0,00	78
CELHA1	3,48	2,12	67,90	-30,57	17,62	1,11	6,11	47,43	0,00	78
CEMTS1	2,94	1,68	33,33	-25,00	12,26	0,17	3,02	0,39	0,82	78

CEYLN8	0,39	0,00	37,72	-31,64	15,24	0,02	2,63	0,46	0,79	78
CIMSA5	2,67	2,69	38,36	-30,65	12,87	-0,02	3,20	0,14	0,93	78
CMBTN5	1,95	0,49	40,48	-27,41	13,08	0,63	3,73	6,93	0,03	78
CMENT5	1,34	0,46	55,36	-49,09	13,65	0,41	7,38	64,71	0,00	78
CYTAS8	2,15	-2,71	91,44	-42,31	21,42	1,29	6,35	57,99	0,00	78

Table 4.1: Descriptive statistics of stocks' total returns (Cont.)

Firms	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Jarque-Bera Probability	Obs.
DARDL2	0,18	-0,41	27,14	-35,94	13,98	-0,12	2,65	0,58	0,75	78
DENCM5	0,42	-0,79	47,17	-28,43	12,91	1,10	5,98	44,61	0,00	78
DENTA6	1,66	0,91	30,32	-34,38	10,43	0,00	4,37	6,14	0,05	78
DERIM8	3,77	0,00	193,33	-51,03	27,71	4,01	29,41	2475,87	0,00	78
DEVA3	5,50	2,05	67,16	-24,11	19,21	1,05	4,12	18,49	0,00	78
DGZTE6	3,36	-1,29	89,58	-32,85	22,46	1,25	5,21	36,35	0,00	78
DITAS4	2,88	0,58	85,80	-31,37	17,61	1,42	8,12	111,31	0,00	78
DMSAS1	2,16	1,38	34,12	-29,34	11,24	0,42	3,99	5,52	0,06	78
DOBUR6	2,46	-3,37	81,58	-32,28	22,33	1,37	5,10	38,75	0,00	78
DOGUB5	1,04	-2,44	93,33	-58,89	20,84	1,37	7,98	104,93	0,00	78
DURDO6	3,00	-1,54	69,44	-61,25	21,52	0,88	4,92	21,93	0,00	78
DYOBY3	-0,40	-2,45	45,24	-27,85	14,71	0,90	4,07	14,30	0,00	78
ECILC3	3,77	2,20	57,63	-24,14	15,44	1,16	5,23	33,76	0,00	78
ECYAP5	1,69	0,00	50,82	-22,83	13,35	0,77	4,16	12,06	0,00	78
EDIP8	2,22	-0,48	43,02	-27,27	12,16	0,77	4,21	12,39	0,00	78
EGEEN4	1,36	-1,02	37,50	-26,15	12,22	0,42	3,07	2,34	0,31	78
EGGUB3	4,53	0,94	49,07	-21,43	13,76	0,93	4,22	16,09	0,00	78
EGPRO3	3,28	1,50	63,38	-34,05	15,10	1,47	7,18	84,91	0,00	78
EGSER5	1,40	-1,46	57,00	-37,41	16,44	0,49	3,78	5,06	0,08	78
EMKEL4	0,35	-3,49	75,00	-27,17	18,70	1,42	5,93	54,16	0,00	78
EMNIS4	3,39	0,00	70,59	-31,98	18,29	1,29	6,13	53,57	0,00	78
EPLAS3	1,17	0,00	104,82	-43,90	20,90	1,87	10,38	222,32	0,00	78
ERBOS1	1,88	1,25	56,40	-28,70	14,75	0,92	5,18	26,44	0,00	78
EREGL1	4,54	5,35	49,55	-29,13	13,86	0,13	3,36	0,65	0,72	78
ERSU2	0,38	-1,31	67,02	-41,03	15,80	1,40	7,57	93,53	0,00	78
ESEMS8	2,53	-3,24	157,81	-43,57	30,03	2,54	12,46	374,76	0,00	78
FENIS1	3,43	0,92	88,17	-30,43	16,88	1,92	10,41	226,53	0,00	78
FMIZP4	6,07	1,80	128,12	-28,46	22,95	2,45	12,41	366,20	0,00	78
FRIGO2	1,39	-0,87	110,85	-45,39	18,65	2,52	16,81	702,98	0,00	78
FROTO4	2,46	1,61	33,93	-25,33	11,28	0,59	3,73	6,23	0,04	78
GEDIZ8	-0,65	-0,49	39,52	-32,81	12,56	0,29	4,02	4,47	0,11	78
GENTS7	1,87	0,60	37,78	-23,29	11,25	0,55	4,00	7,18	0,03	78
GOLDS7	1,43	-1,47	54,84	-30,77	17,55	0,62	3,38	5,39	0,07	78
GOLTS5	3,81	2,20	58,14	-28,74	14,82	0,91	5,28	27,51	0,00	78
GOODY 3	1,11	0,00	30,56	-24,32	12,31	0,42	2,81	2,40	0,30	78
GUBRF3	6,12	3,09	81,49	-30,37	17,61	1,62	7,55	101,33	0,00	78
HEKTS3	2,29	1,28	43,14	-34,25	13,01	0,49	4,13	7,23	0,03	78
HURGZ6	1,58	1,54	37,50	-34,09	14,59	-0,06	3,20	0,18	0,91	78
HZNDR5	3,06	0,00	79,41	-44,03	17,65	1,25	7,36	81,81	0,00	78
IDAS8	2,91	2,43	51,90	-38,41	15,32	0,14	3,93	3,11	0,21	78
IHEVA4	6,91	-0,70	88,75	-25,91	26,03	1,55	4,94	43,24	0,00	78
IPMAT6	2,95	-0,66	61,11	-37,10	18,56	0,67	3,38	6,31	0,04	78
ISAMB6	0,85	-2,82	90,48	-35,06	22,53	1,94	8,19	136,17	0,00	78
IZMDC1	3,29	1,55	62,74	-32,31	16,23	1,03	5,50	33,93	0,00	78
IZOCM5	4,61	0,75	50,18	-26,87	14,58	0,55	3,65	5,33	0,07	78
KAPLM6	2,93	-0,28	108,90	-34,43	21,33	1,96	10,06	212,12	0,00	78
KARSN4	1,36	-0,29	70,06	-29,27	19,47	1,26	5,42	39,67	0,00	78

Table 4.1: Descriptive statistics of stocks' total returns (Cont.)

Firms	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Jarque-Bera Probability	Obs.
KARTN6	2,10	1,03	96,61	-23,56	15,41	3,00	19,60	1012,41	0,00	78
KENT2	1,82	1,00	42,02	-28,75	13,17	0,36	3,29	1,94	0,38	78
KERVT2	3,29	1,26	64,60	-27,31	16,36	1,02	5,64	36,14	0,00	78
KLBMO7	-0,13	-1,82	51,22	-48,72	16,66	0,44	4,24	7,50	0,02	78
KLMSN4	2,57	1,02	76,87	-20,00	13,77	2,02	12,19	327,24	0,00	78
KNFRT2	2,96	-2,44	121,59	-33,49	25,15	3,07	14,13	525,54	0,00	78
KONYA5	3,59	1,41	43,75	-24,12	14,32	0,65	3,13	5,55	0,06	78
KORDS8	0,91	0,26	39,48	-37,36	14,10	0,30	3,93	4,03	0,13	78
KRDMB1	8,53	0,00	352,05	-26,79	48,29	5,50	36,87	4122,42	0,00	78
KRSTL2	2,06	-1,79	104,49	-46,25	23,93	1,80	8,27	132,27	0,00	78
KRTEK8	2,10	-0,45	63,59	-35,48	15,74	0,96	5,13	26,70	0,00	78
KUTPO5	3,78	1,67	72,67	-29,32	16,10	1,85	9,62	186,66	0,00	78
LUKSK8	2,34	0,90	98,79	-26,87	16,74	2,53	16,12	642,54	0,00	78
MAKTK4	0,04	-3,72	59,52	-34,12	17,03	1,08	4,46	22,12	0,00	78
MEGES3	2,76	-3,65	126,36	-54,68	28,08	1,87	8,75	152,89	0,00	78
MEMSA8	4,93	-0,65	480,00	-26,83	56,32	7,83	66,61	13949,44	0,00	78
MERKO2	2,75	0,51	96,83	-28,15	17,91	2,20	11,91	321,07	0,00	78
MNDRS8	0,04	-0,61	54,93	-28,70	14,21	1,31	6,67	66,13	0,00	78
MRDIN5	3,87	1,51	56,82	-18,70	13,29	1,75	7,60	108,84	0,00	78
MRSHL3	1,53	0,00	44,33	-31,25	12,28	0,98	5,30	29,72	0,00	78
MTEKS8	0,28	-2,91	84,51	-43,51	19,27	1,77	9,04	159,42	0,00	78
MUTLU4	3,26	1,80	46,81	-27,03	14,40	0,54	3,42	4,33	0,11	78
NUHCM 5	3,72	2,99	39,71	-20,00	9,59	0,99	5,25	29,05	0,00	78
OKANT8	-1,07	-3,20	61,11	-43,48	14,01	1,24	8,24	109,00	0,00	78
OLMKS6	2,53	3,45	39,23	-22,16	10,79	0,29	4,35	7,02	0,03	78
OTKAR4	3,03	0,80	66,67	-31,93	16,86	1,13	5,23	32,63	0,00	78
PARSN4	4,58	2,09	77,01	-51,95	18,90	0,93	6,15	43,39	0,00	78
PENGD2	0,13	-0,24	64,36	-35,94	16,33	0,87	5,92	37,60	0,00	78
PETKM3	0,35	0,00	50,82	-36,96	14,31	0,23	4,77	10,88	0,00	78
PETUN2	3,53	2,57	46,94	-29,32	14,80	0,47	3,32	3,21	0,20	78
PIMAS3	1,01	0,32	43,28	-44,00	14,03	0,18	4,39	6,72	0,03	78
PINSU2	3,84	-0,69	112,96	-26,62	19,38	2,93	15,68	633,55	0,00	78
PNSUT2	3,11	0,26	48,20	-40,32	15,39	0,40	4,04	5,63	0,06	78
PRKAB4	1,72	-1,01	40,48	-28,00	14,40	0,40	3,16	2,20	0,33	78
PTOFS3	1,35	0,83	83,78	-34,82	15,63	1,73	11,37	266,98	0,00	78
SARKY1	1,89	0,00	29,31	-24,29	10,25	0,42	3,34	2,71	0,26	78
SELGD2	-0,39	-2,28	72,55	-56,28	19,07	1,29	7,77	95,59	0,00	78
SERVE7	2,89	2,32	48,57	-30,73	15,37	0,29	3,23	1,29	0,53	78
SKPLC2	3,99	-2,31	160,00	-47,27	25,49	2,98	19,27	976,26	0,00	78
SKTAS8	2,89	2,07	37,20	-42,34	14,44	0,09	3,48	0,87	0,65	78
SNPAM8	3,00	-0,30	85,71	-33,09	20,55	1,64	7,17	91,28	0,00	78
SODA3	1,53	0,91	42,57	-34,10	12,57	0,08	3,88	2,60	0,27	78
SONME8	1,88	-1,52	54,87	-32,26	17,01	0,86	3,71	11,17	0,00	78
TATKS2	1,76	0,89	34,01	-29,17	12,78	0,41	3,23	2,37	0,31	78
TBORG2	-0,68	-1,34	62,30	-34,97	13,32	1,55	9,65	175,13	0,00	78
TIRE6	3,94	1,59	55,95	-25,88	14,14	1,00	4,81	23,82	0,00	78
TOASO4	2,05	0,87	50,94	-25,51	14,68	0,70	4,81	16,92	0,00	78
TRCAS3	3,19	0,74	59,76	-35,51	16,11	0,68	4,75	15,99	0,00	78

Table 4.1: Descriptive statistics of stocks' total returns (Cont.)

Firms	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Jarque-Bera Probability	Obs.
TRKCM5	1,54	1,96	33,82	-30,00	10,51	-0,02	4,23	4,95	0,08	78
TUDDF4	3,28	1,36	37,93	-59,26	15,40	-0,50	5,61	25,41	0,00	78
TUKAS2	-0,12	-1,09	35,37	-30,34	10,33	0,21	4,33	6,29	0,04	78
TUMTK8	1,06	0,00	124,14	-64,91	22,25	2,25	14,72	511,96	0,00	78
TUPRS3	2,52	2,56	47,11	-25,71	11,77	0,51	4,76	13,35	0,00	78
UNYEC5	2,86	2,09	56,82	-35,06	14,86	1,31	6,46	61,11	0,00	78
USAK5	0,96	-0,60	63,78	-35,56	16,41	0,76	5,03	20,97	0,00	78
UZEL4	0,75	-0,25	39,90	-34,31	14,27	0,45	3,52	3,54	0,17	78
VANET2	1,84	1,75	28,30	-29,32	12,32	0,00	3,04	0,01	1,00	78
VESBE4	0,00	0,00	41,94	-34,48	12,92	0,65	5,07	19,39	0,00	78
VKING6	1,22	-1,11	57,14	-30,89	16,90	0,66	3,92	8,34	0,02	78
YATAS8	2,34	-0,88	58,49	-57,52	18,23	0,47	5,16	18,10	0,00	78
YUNSA8	0,94	-0,94	30,34	-22,05	10,60	0,94	3,99	14,60	0,00	78
ISE100	1,72	3,64	29,74	-23,12	10,29	0,06	3,29	0,32	0,85	78

Table 4.2: Simple Parameter Coefficient tests for the Model

		alpha test			beta test			joint test of alpha and beta		
firms	obs	t cal	t cri. value	decision	t cal	T cri. value	decision	F cal	F cri. value	decision
1BRSAN	78	0,72	2	not reject	3,79	2	reject	7,47	3,15	reject
1BURCE	78	0,78	2	not reject	3,20	2	reject	4,91	3,15	reject
1CELHA	78	0,99	2	not reject	0.12	2	not reject	1,16	3,15	not reject
1CEMTS	78	1,48	2	not reject	1,67	2	not reject	2,14	3,15	not reject
1DMSAS	78	0,92	2	not reject	2,90	2	reject	4,23	3,15	reject
1ERBOS	78	0,55	2	not reject	2,74	2	reject	3,76	3,15	reject
1EREGL	78	2,55	2	reject	0,50	2	not reject	3,27	3,15	reject
1FENIS	78	1,52	2	not reject	1,50	2	not reject	7,96	3,15	reject
1IZMDC	78	1,14	2	not reject	0,88	2	not reject	0,89	3,15	not reject
1KRDMB	78	1,15	2	not reject	0,73	2	not reject	1,15	3,15	not reject
1SARKY	78	0,89	2	not reject	4,33	2	reject	9,38	3,15	reject
2AEFES	78	1,01	2	not reject	5,19	2	reject	13,43	3,15	reject
2ALYAG	78	0,32	2	not reject	1,95	2	not reject	2,11	3,15	not reject
2BANVT	78	0,97	2	not reject	4,95	2	reject	1,40	3,15	not reject
2DARDL	78	1,31	2	not reject	0,05	2	not reject	1,00	3,15	not reject
2ERSU	78	0,28	2	not reject	3,02	2	reject	4,88	3,15	reject
2FRIGO	78	0,05	2	not reject	1,33	2	not reject	0,91	3,15	not reject
2KENT	78	0,70	2	not reject	3,89	2	reject	7,41	3,15	reject
2KERVT	78	1,33	2	not reject	2,77	2	reject	4,14	3,15	reject
2KNFRT	78	0,58	2	not reject	0,79	2	not reject	0,42	3,15	not reject
2KRSTL	78	0,23	2	not reject	0,60	2	not reject	0,19	3,15	not reject
2MERKO	78	0,76	2	not reject	1,26	2	not reject	0,96	3,15	not reject
2PENGD	78	0,41	2	not reject	4,32	2	reject	4,69	3,15	reject
2PETUN	78	1,47	2	not reject	0,25	2	not reject	1,08	3,15	not reject
2PINSU	78	1,43	2	not reject	0,28	2	not reject	4,44	3,15	reject
2PNSUT	78	1,11	2	not reject	0.93	2	not reject	0,90	3,15	not reject
2SELGD	78	0,65	2	not reject	2,22	2	reject	2,92	3,15	not reject
2SKPLC	78	0,88	2	not reject	0,32	2	not reject	0,40	3,15	not reject
2TATKS	78	0,23	2	not reject	1,20	2	not reject	0,70	3,15	not reject
2TBORG	78	0,80	2	not reject	5,07	2	reject	13,28	3,15	reject
2TUKAS	78	1,62	2	not reject	3,62	2	reject	8,73	3,15	reject
2VANET	78	0,56	2	not reject	2,84	2	reject	3,88	3,15	reject
3AKSA	78	1,51	2	not reject	3,01	2	reject	6,49	3,15	reject
3ALKIM	78	1,39	2	not reject	3,85	2	reject	7,54	3,15	reject
3AYGAZ	78	0,19	2	not reject	0,59	2	not reject	0,20	3,15	not reject
3BAGFS	78	2,17	2	reject	2,83	2	reject	5,52	3,15	reject
3BRISA	78	0,35	2	not reject	1,33	2	not reject	0,83	3,15	not reject
3CBSBO	78	0,83	2	not reject	3,51	2	reject	7,21	3,15	reject
3DEVA	78	2,21	2	reject	2,82	2	reject	5,50	3,15	reject
3DYOBY	78	1,46	2	not reject	0,79	2	not reject	1,66	3,15	not reject
3ECILC	78	2,24	2	reject	0,88	2	not reject	1,41	3,15	not reject
3EGGUB	78	2,45	2	reject	2,74	2	reject	5,72	3,15	reject
3EGPRO	78	1,80	2	not reject	5,54	2	reject	15,58	3,15	reject
3EPLAS	78	0,18	2	not reject	0,49	2	not reject	0,16	3,15	not reject

Table 4.2: Simple Parameter Coefficient tests for the Model (cont.)

		alpha test			beta test			joint test of alpha and beta		
firms	obs	t cal	t cri. value	decision	t cal	T cri. value	decision	F cal	F cri.value	decision
3GOODY	78	0,13	2	not reject	2,51	2	reject	3,30	3,15	reject
3GUBRF	78	2,67	2	reject	2,33	2	reject	5,26	3,15	reject
3HEKTS	78	0,69	2	not reject	0,94	2	not reject	0,59	3,15	not reject
3MEGES	78	0,59	2	not reject	1,59	2	not reject	1,32	3,15	not reject
3MRSHL	78	0,32	2	not reject	3,06	2	reject	4,39	3,15	reject
3PETKM	78	1,17	2	not reject	0,09	2	not reject	0,72	3,15	not reject
3PIMAS	78	0,28	2	not reject	1,59	2	not reject	1,41	3,15	not reject
3PTOFS	78	0,27	2	not reject	0,60	2	not reject	0,21	3,15	not reject
3SODA	78	0,02	2	not reject	1,33	2	not reject	0,85	3,15	not reject
3TRCAS	78	0,97	2	not reject	1,03	2	not reject	1,20	3,15	not reject
3TUPRS	78	1,18	2	not reject	2,41	2	reject	3,19	3,15	reject
4ALCAR	78	0,33	2	not reject	0,58	2	not reject	0,26	3,15	not reject
4ARCLK	78	0,39	2	not reject	0,36	2	not reject	0,12	3,15	not reject
4ASUZU	78	0,87	2	not reject	0,92	2	not reject	0,67	3,15	not reject
4BFREN	78	1,14	2	not reject	0,42	2	not reject	0,68	3,15	not reject
4BSHEV	78	0,51	2	not reject	1,75	2	not reject	1,55	3,15	not reject
4DITAS	78	0,80	2	not reject	0,88	2	not reject	0,59	3,15	not reject
4EGEEN	78	0,34	2	not reject	3,87	2	reject	7,34	3,15	reject
4EMKEL	78	0,63	2	not reject	0,61	2	not reject	0,45	3,15	not reject
4EMNIS	78	1,28	2	not reject	2,84	2	reject	4,36	3,15	reject
4FMIZP	78	2,08	2	reject	2,58	2	reject	4,73	3,15	reject
4FROTO	78	1,22	2	not reject	2,64	2	reject	3,77	3,15	reject
4IHEVA	78	1,99	2	not reject	1,29	2	not reject	2,46	3,15	not reject
4KARSN	78	0,30	2	not reject	0,61	2	not reject	0,21	3,15	not reject
4KLMSN	78	1,03	2	not reject	2,61	2	reject	3,53	3,15	reject
4MAKTK	78	0,55	2	not reject	2,26	2	reject	33,03	3,15	reject
4MUTLU	78	1,42	2	not reject	2,10	2	reject	2,78	3,15	not reject
4OTKAR	78	0,91	2	not reject	0,71	2	not reject	0,57	3,15	not reject
4PARSN	78	1,59	2	not reject	0,58	2	not reject	1,31	3,15	not reject
4PRKAB	78	0,28	2	not reject	1,77	2	not reject	1,45	3,15	not reject
4TOASO	78	0,22	2	not reject	0,37	2	not reject	37,40	3,15	reject
4TUDDF	78	1,18	2	not reject	0,15	2	not reject	0,70	3,15	not reject
4UZEL	78	0,61	2	not reject	1,00	2	not reject	0,77	3,15	not reject
4VESBE	78	2,02	2	reject	1,50	2	not reject	2,04	3,15	not reject
5ADANA	78	1,39	2	not reject	0,66	2	not reject	1,38	3,15	not reject
5ADBGR	78	1,94	2	not reject	1,26	2	not reject	2,34	3,15	not reject
5ADNAC	78	1,14	2	not reject	0,79	2	not reject	1,16	3,15	not reject
5AFYON	78	1,85	2	not reject	3,21	2	reject	6,03	3,15	reject
5AKCNS	78	0,49	2	not reject	0,30	2	not reject	0,19	3,15	not reject
5ANACM	78	2,26	2	reject	2,95	2	reject	5,97	3,15	reject
5ASLAN	78	1,53	2	not reject	3,04	2	reject	5,07	3,15	reject
5BOLUC	78	0,76	2	not reject	0,19	2	not reject	0,34	3,15	not reject
5BSOKE	78	0,72	2	not reject	1,86	2	not reject	1,72	3,15	not reject
5BTCIM	78	0,71	2	not reject	3,29	2	reject	5,37	3,15	reject
5BUCIM	78	1,68	2	not reject	7,07	2	reject	25,18	3,15	reject
5CIMSA	78	1,06	2	not reject	0,04	2	not reject	0,57	3,15	not reject
5CMBTN	78	0,56	2	not reject	2,33	2	reject	2,73	3,15	not reject

Table 4.2: Simple Parameter Coefficient tests for the Model (cont.)

		alpha test			beta test			joint test of alpha and beta		
firms	obs	t cal	t cri. value	decision	t cal	T cri. value	decision	F cal	F cri.value	decision
5CMENT	78	0,15	2	not reject	2,69	2	reject	3,51	3,15	reject
5DENCM	78	1,02	2	not reject	1,22	2	not reject	1,51	3,15	not reject
5DOGUB	78	0,16	2	not reject	0,91	2	not reject	0,46	3,15	not reject
5ECYAP	78	0,03	2	not reject	0,41	2	not reject	0,09	3,15	not reject
5EGSER	78	0,05	2	not reject	1,48	2	not reject	1,12	3,15	not reject
5GOLTS	78	0,22	2	not reject	2,65	2	reject	4,44	3,15	reject
5HZNDR	78	0,98	2	not reject	0,39	2	not reject	1,49	3,15	not reject
5IZOCM	78	2,34	2	reject	0,87	2	not reject	2,87	3,15	not reject
5KONYA	78	1,65	2	not reject	1,81	2	not reject	2,58	3,15	not reject
5KUTPO	78	1,77	2	not reject	3,89	2	reject	8,23	3,15	reject
5MRDIN	78	2,08	2	reject	1,28	2	not reject	2,62	3,15	not reject
5NUHCM	78	3,06	2	reject	5,50	2	reject	17,50	3,15	reject
5TRKCM	78	0,27	2	not reject	3,06	2	reject	4,70	3,15	reject
5UNYEC	78	0,91	2	not reject	0,08	2	not reject	0,44	3,15	not reject
5USAK	78	0,47	2	not reject	0,22	2	not reject	0,16	3,15	not reject
6ALKA	78	0,83	2	not reject	2,56	2	reject	3,37	3,15	reject
6BAKAB	78	0,23	2	not reject	2,93	2	reject	4,31	3,15	reject
6DENTA	78	0,79	2	not reject	5,30	2	reject	13,22	3,15	reject
6DGZTE	78	0,49	2	not reject	2,05	2	reject	2,40	3,15	not reject
6DOBUR	78	0,13	2	not reject	1,34	2	not reject	0,96	3,15	not reject
6DURDO	78	0,92	2	not reject	2,43	2	reject	3,10	3,15	not reject
6HURGZ	78	0,31	2	not reject	1,07	2	not reject	0,57	3,15	not reject
6IPMAT	78	0,71	2	not reject	0,25	2	not reject	0,26	3,15	not reject
6ISAMB	78	0,05	2	not reject	2,36	2	reject	2,84	3,15	not reject
6KAPLM	78	0,57	2	not reject	0,06	2	not reject	0,16	3,15	not reject
6KARTN	78	0,74	2	not reject	3,20	2	reject	4,99	3,15	reject
6OLMKS	78	1,42	2	not reject	3,37	2	reject	5,92	3,15	reject
6TIRE	78	1,95	2	not reject	2,55	2	reject	4,45	3,15	reject
6VKING	78	0,15	2	not reject	0,94	2	not reject	0,48	3,15	not reject
7ADEL	78	1,32	2	not reject	3,18	2	reject	5,10	3,15	reject
7GENTS	78	0,70	2	not reject	3,48	2	reject	5,92	3,15	reject
7GOLDS	78	0,22	2	not reject	0,23	2	not reject	0,04	3,15	not reject
7KLBMO	78	0,85	2	not reject	1,47	2	not reject	1,69	3,15	not reject
7SERVE	78	1,20	2	not reject	3,06	2	reject	4,92	3,15	reject
8AKALT	78	1,41	2	not reject	2,03	2	reject	3,61	3,15	reject
8AKIPD	78	0,23	2	not reject	1,02	2	not reject	0,58	3,15	not reject
8ALTIN	78	1,49	2	not reject	2,26	2	reject	3,20	3,15	reject
8ARSAN	78	0,56	2	not reject	3,19	2	reject	5,10	3,15	reject
8BERDN	78	0,05	2	not reject	3,91	2	reject	7,87	3,15	reject
8BISAS	78	0,08	2	not reject	1,74	2	not reject	1,54	3,15	not reject
8BOSSA	78	0,28	2	not reject	2,84	2	reject	4,03	3,15	reject
8BRMEN	78	0,43	2	not reject	6,10	2	reject	19,61	3,15	reject
8BYSAN	78	0,45	2	not reject	2,09	2	reject	2,50	3,15	not reject
8CEYLN	78	0,29	2	not reject	3,12	2	reject	5,21	3,15	reject
8CYTAS	78	0,05	2	not reject	1,62	2	not reject	1,33	3,15	not reject
8DERIM	78	0,54	2	not reject	1,19	2	not reject	9,36	3,15	reject
8EDIP	78	1,07	2	not reject	4,13	2	reject	8,59	3,15	reject

Table 4.2: Simple Parameter Coefficient tests for the Model (cont.)

		alpha test			beta test			joint test of alpha and beta		
firms	obs	t cal	t cri. value	decision	t cal	T cri. value	decision	F cal	F cri.value	decision
8ESEMS	78	0,21	2	not reject	0,23	2	not reject	0,06	3,15	not reject
8GEDIZ	78	1,59	2	not reject	2,55	2	reject	5,32	3,15	reject
8IDAS	78	1,07	2	not reject	1,85	2	not reject	2,01	3,15	not reject
8KORDS	78	0,94	2	not reject	0,79	2	not reject	0,65	3,15	not reject
8KRTEK	78	0,74	2	not reject	3,18	2	reject	5,06	3,15	reject
8LUKSK	78	0,76	2	not reject	2,58	2	reject	3,38	3,15	reject
8MEMSA	78	0,39	2	not reject	0,76	2	not reject	0,42	3,15	not reject
8MNDRS	78	1,36	2	not reject	0,38	2	not reject	1,12	3,15	not reject
8MTEKS	78	0,54	2	not reject	1,07	2	not reject	0,83	3,15	not reject
8OKANT	78	1,61	2	not reject	2,34	2	reject	4,77	3,15	reject
8SKTAS	78	1,28	2	not reject	3,22	2	reject	5,39	3,15	reject
8SNPAM	78	0,80	2	not reject	1,38	2	not reject	1,07	3,15	not reject
8SONME	78	0,21	2	not reject	0,86	2	not reject	0,24	3,15	not reject
8TUMTK	78	0,06	2	not reject	1,96	2	not reject	1,96	3,15	not reject
8YATAS	78	0,57	2	not reject	1,52	2	not reject	1,20	3,15	not reject
8YUNSA	78	0,04	2	not reject	4,45	2	reject	10,00	3,15	reject

Table 4.3: Betas and Average Excess Return

Firms	Ex-post-beta (full sample)	Ex-post-beta (first subsample)	Ex-post-beta (second subsample)	average excess return (full sample)	average excess return (first subsample)	average excess return (second subsample)
1BRSAN	0,61	0,60	0,60	0,70	2,53	-1,13
1BURCE	0,52	0,53	0,48	0,30	1,33	-0,73
1CELHA	1,14	1,09	1,25	1,62	1,30	1,95
1CEMTS	0,84	0,78	0,93	1,09	2,10	0,08
1DMSAS	0,73	0,70	0,78	0,31	1,37	-0,75
1ERBOS	0,59	0,42	0,90	0,03	0,64	-0,58
1EREGL	0,95	1,02	0,83	2,69	1,91	3,47
1FENIS	0,28	0,20	0,44	1,57	0,87	2,28
1IZMDC	0,87	1,21	0,20	1,44	1,96	0,92
1KRDMB	1,40	1,60	0,93	6,68	12,78	0,58
1SARKY	0,61	0,59	0,64	0,04	-0,26	0,34
2AEFES	0,55	0,50	0,66	0,01	-0,55	0,58
2ALYAG	0,57	0,40	0,89	-1,58	-1,41	-1,75
2BANVT	0,77	0,65	0,98	1,04	0,67	1,41
2DARDL	0,97	0,89	1,11	-1,67	-1,14	-2,20
2ERSU	0,50	0,24	0,99	-1,47	-2,40	-0,55
2FRIGO	0,75	0,49	1,24	-0,46	-0,42	-0,50
2KENT	0,47	0,45	0,53	-0,03	-1,17	1,11
2KERVT	0,53	0,51	0,58	1,44	0,65	2,23
2KNFRT	0,79	0,11	2,12	1,11	-1,12	3,34
2KRSTL	0,85	0,69	1,15	0,20	1,43	-1,02
2MERKO	0,77	0,73	0,89	0,90	-2,07	3,87
2PENGD	0,49	0,21	1,05	-1,72	-2,43	-1,00
2PETUN	0,97	0,87	1,19	1,68	0,65	2,71
2PINSU	0,41	0,29	0,63	1,99	1,62	2,35
2PNSUT	0,87	0,67	1,28	1,26	-0,41	2,93
2SELGD	0,56	0,45	0,73	-2,24	-0,55	-3,94
2SKPLC	0,92	0,65	1,41	2,14	1,10	3,18
2TATKS	0,88	0,92	0,81	-0,09	-1,26	1,08
2TBORG	0,29	0,20	0,46	-2,53	-2,54	-2,52
2TUKAS	0,71	0,59	0,94	-1,97	-2,17	-1,78
2VANET	0,69	0,66	0,77	-0,01	-1,82	1,81
3AKSA	0,73	0,72	0,74	-2,01	-2,05	-1,96
3ALKIM	0,54	0,56	0,49	0,84	0,15	1,53
3AYGAZ	0,95	0,92	1,02	-0,37	-1,32	0,58
3BAGFS	0,61	0,72	0,42	2,30	0,22	4,38
3BRISA	0,88	0,95	0,73	0,00	1,11	-1,10
3CBSBO	0,45	0,23	0,83	-2,42	-1,38	-3,47
3DEVA	0,41	0,37	0,52	3,65	1,57	5,72
3DYOBY	0,89	0,75	1,20	-2,25	-3,93	-0,57
3ECILC	0,88	0,87	0,87	1,92	3,63	0,21
3EGGUB	0,63	0,58	0,72	2,68	3,18	2,18
3EGPRO	0,07	-0,12	0,43	1,43	1,75	1,11
3EPLAS	0,90	0,80	1,11	-0,68	-2,32	0,95
3GOODY	0,73	0,75	0,68	-0,74	-0,72	-0,76

Table 4.3: Betas and Average Excess Return (Cont.)

Firms	Ex-post-beta (full sample)	Ex-post-beta (first subsample)	Ex-post-beta (second subsample)	average excess return (full sample)	average excess return (first subsample)	average excess return (second subsample)
3GUBRF	0,58	0,95	-0,01	4,27	0,43	8,11
3HEKTS	0,91	1,07	0,59	0,44	0,09	0,79
3MEGES	0,51	0,20	1,14	0,91	-1,15	2,96
3MRSHL	0,66	0,59	0,79	-0,32	0,33	-0,98
3PETKM	0,99	0,99	0,99	-1,50	-1,99	-1,01
3PIMAS	0,80	0,61	1,17	-0,84	-1,20	-0,48
3PTOFS	0,91	1,06	0,63	-0,50	-2,06	1,07
3SODA	0,87	0,87	0,90	-0,32	-1,66	1,02
3TRCAS	1,13	1,09	1,22	1,34	-0,03	2,71
3TUPRS	0,77	0,86	0,59	0,67	0,31	1,03
4ALCAR	0,95	0,91	1,03	-0,52	-0,75	-0,28
4ARCLK	1,03	1,08	0,92	-0,44	0,78	-1,66
4ASUZU	0,87	0,86	0,88	0,92	1,62	0,23
4BFREN	0,71	0,58	0,82	7,66	16,88	-1,57
4BSHEV	0,71	0,66	0,79	0,26	0,71	-0,20
4DITAS	0,85	0,78	0,95	1,03	3,87	-1,81
4EGEEN	0,54	0,43	0,74	-0,49	-0,24	-0,74
4EMKEL	0,89	0,73	1,21	-1,50	-2,24	-0,76
4EMNIS	0,44	0,50	0,33	1,54	1,09	2,00
4FMIZP	0,35	0,41	0,19	4,22	5,76	2,69
4FROTO	0,76	0,78	0,71	0,61	1,10	0,11
4IHEVA	0,64	0,24	1,40	5,06	4,78	5,34
4KARSN	1,11	0,90	1,51	-0,50	-1,05	0,05
4KLMSN	0,65	0,57	0,85	0,72	-1,54	2,97
4MAKTK	0,60	0,57	0,67	-1,81	-2,46	-1,16
4MUTLU	0,71	0,80	0,54	1,41	1,11	1,72
4OTKAR	0,89	0,86	0,96	1,17	0,20	2,15
4PARSN	0,90	0,73	1,21	2,73	3,29	2,18
4PRKAB	0,77	0,51	1,27	-0,13	-0,85	0,59
4TOASO	1,04	1,05	1,03	0,20	-0,64	1,04
4TUDDF	0,98	1,13	0,67	1,43	2,71	0,15
4UZEL	0,88	0,78	1,04	-1,10	0,64	-2,85
4VESBE	1,02	1,03	0,98	-1,85	-0,52	-3,18
5ADANA	1,08	1,01	1,20	1,68	1,95	1,41
5ADBGR	0,88	0,77	1,07	1,64	1,55	1,72
5ADNAC	1,08	1,15	0,92	1,22	2,78	-0,34
5AFYON	0,64	0,70	0,50	1,42	2,72	0,11
5AKCNS	1,03	0,96	1,15	0,45	1,02	-0,13
5ANACM	0,72	0,79	0,54	1,64	3,73	-0,46
5ASLAN	0,57	0,46	0,77	-0,06	1,18	-1,29
5BOLUC	1,02	1,07	0,91	0,78	1,34	0,22
5BSOKE	0,78	0,71	0,90	0,42	0,27	0,57
5BTCIM	0,64	0,68	0,55	0,07	-0,18	0,32
5BUCIM	0,36	0,29	0,51	0,36	-0,78	1,49
5CIMSA	1,00	0,91	1,14	0,82	1,63	0,01
5CMBTN	0,72	0,66	0,81	0,10	1,43	-1,23
5CMENT	0,65	0,62	0,72	-0,51	-1,30	0,27

Table 4.3: Betas and Average Excess Return (Cont.)

Firms	Ex-post-beta (full sample)	Ex-post-beta (first subsample)	Ex-post-beta (second subsample)	average excess return (full sample)	average excess return (first subsample)	average excess return (second subsample)
5DENCM	0,87	0,80	1,01	-1,43	-1,75	-1,11
5DOGUB	0,81	0,77	0,87	-0,81	-0,14	-1,48
5ECYAP	0,96	1,01	0,88	-0,16	-0,77	0,44
5EGSER	0,76	0,64	1,00	-0,45	-0,22	-0,69
5GOLTS	0,60	0,46	1,33	1,96	2,56	1,37
5HZNDR	0,72	0,55	1,01	1,21	2,98	-0,56
5IZOCM	0,89	0,98	0,73	2,76	1,98	3,53
5KONYA	0,76	0,55	1,12	1,74	3,67	-0,18
5KUTPO	0,32	0,47	0,02	1,93	1,36	2,50
5MRDIN	0,86	0,86	0,86	2,02	1,84	2,20
5NUHCM	0,51	0,49	0,54	1,87	1,32	2,43
5TRKCM	0,76	0,67	0,92	-0,32	0,64	-1,28
5UNYEC	1,01	1,00	1,06	1,01	-0,93	2,94
5USAK	0,97	0,80	1,29	-0,89	-0,16	-1,62
6ALKA	0,61	0,59	0,61	0,53	1,71	-0,66
6BAKAB	0,58	0,42	0,88	-0,51	-0,60	-0,42
6DENTA	0,47	0,35	0,70	-0,19	-0,42	0,04
6DGZTE	1,39	1,33	1,48	1,51	4,22	-1,21
6DOBUR	1,27	1,21	1,35	0,61	2,86	-1,64
6DURDO	0,43	0,27	0,68	1,14	4,35	-2,06
6HURGZ	1,11	1,01	1,26	-0,27	1,52	-2,05
6IPMAT	0,96	0,87	1,18	1,09	-2,92	5,11
6ISAMB	0,42	-0,04	1,29	-1,00	-0,57	-1,42
6KAPLM	0,99	0,83	1,26	1,08	3,31	-1,15
6KARTN	0,49	0,47	0,49	0,25	1,91	-1,41
6OLMKS	0,70	0,75	0,61	0,68	-0,04	1,40
6TIRE	0,65	0,84	0,28	2,09	0,80	3,38
6VKING	0,85	0,71	1,11	-0,63	0,12	-1,38
7ADEL	0,65	0,68	0,61	0,82	-0,60	2,24
7GENTS	0,65	0,57	0,82	0,02	-0,19	0,23
7GOLDS	1,04	0,89	1,33	-0,42	-1,55	0,71
7KLBMO	0,76	0,57	1,13	-1,99	-2,38	-1,59
7SERVE	0,51	0,44	0,64	1,04	0,93	1,15
8AKALT	0,78	0,73	0,89	-2,05	-2,41	-1,69
8AKIPD	0,83	-0,53	0,69	-0,84	-0,97	-0,71
8ALTIN	0,62	0,60	0,67	1,85	-0,44	4,14
8ARSAN	0,29	0,11	0,62	1,39	3,03	-0,26
8BERDN	0,35	0,32	0,36	-1,32	0,67	-3,31
8BISAS	0,59	0,58	0,59	-0,63	0,16	-1,42
8BOSSA	0,69	0,63	0,79	-0,34	-0,40	-0,29
8BRMEN	0,29	0,04	0,72	-1,87	0,58	-4,32
8BYSAN	0,58	0,37	0,94	-1,78	-0,06	-3,51
8CEYLN	0,50	0,58	0,36	-1,46	-3,05	0,13
8CYTAS	1,30	1,26	1,35	0,29	2,34	-1,75
8DERIM	1,32	1,54	0,90	1,92	2,12	1,73
8EDIP	0,49	0,56	0,36	0,37	-0,16	0,90
8ESEMS	1,07	1,50	0,21	0,68	2,78	-1,43

Table 4.3: Betas and Average Excess Return (Cont.)

Firms	Ex-post-beta (full sample)	Ex-post-beta (first subsample)	Ex-post-beta (second subsample)	average excess return (full sample)	average excess return (first subsample)	average excess return (second subsample)
8GEDIZ	0,71	0,56	1,01	-2,50	-3,49	-1,51
8IDAS	0,72	0,70	0,76	1,06	1,08	1,04
8KORDS	1,08	0,91	1,41	-0,94	-1,43	-0,46
8KRTEK	0,47	0,20	0,96	0,25	1,31	-0,81
8LUKSK	0,55	0,28	1,05	0,48	0,05	0,92
8MEMSA	1,46	0,94	2,51	3,08	-0,57	6,72
8MNDRS	0,96	1,13	0,64	-1,82	-3,73	0,10
8MTEKS	0,79	0,60	1,17	-1,57	-2,76	-0,38
8OKANT	0,68	0,62	0,80	-2,92	-1,76	-4,08
8SKTAS	0,52	0,51	0,52	1,04	1,98	0,10
8SNPAM	0,71	0,52	1,09	1,15	0,69	1,61
8SONME	0,89	0,83	0,99	0,03	0,73	-0,67
8TUMTK	0,53	0,57	0,39	-0,79	2,86	-4,45
8YATAS	1,10	0,66	0,83	0,49	0,17	0,81
8YUNSA	0,56	0,59	0,51	-0,91	-0,75	-1,07
ISE100				-0,13	-0,20	-0,05

NOTE: ISE100 Index is used as a proxy for market portfolio so that its beta theoretically is 1. $\text{cov}(R_{ise100}, R_{ise100}) / \text{var}(R_{ise100}) = 1$

Table 4.7: Beta stability tests

		beta stability test			alpha and beta stability test			beta stability over the market cycle		
firms	obs	t cal	t cri. value	decision	F cal	F cri. value	decision	t cal	t cri. value	decision
1BRSAN	78	0,30	2	not reject	1,95	3,15	not reject	0,75	2	not reject
1BURCE	78	0,30	2	not reject	0,38	3,15	not reject	0,80	2	not reject
1CELHA	78	0,53	2	not reject	0,15	3,15	not reject	0,98	2	not reject
1CEMTS	78	0,52	2	not reject	0,95	3,15	not reject	0,73	2	not reject
1DMSAS	78	0,18	2	not reject	0,97	3,15	not reject	0,05	2	not reject
1ERBOS	78	1,44	2	not reject	1,37	3,15	not reject	1,94	2	not reject
1EREGL	78	0,72	2	not reject	0,52	3,15	not reject	0,33	2	not reject
1FENIS	78	0,62	2	not reject	0,19	3,15	not reject	1,57	2	not reject
1IZMDC	78	3,43	2	reject	5,80	3,15	reject	0,13	2	not reject
1KRDMB	78	0,79	2	not reject	0,84	3,15	not reject	0,10	2	not reject
1SARKY	78	0,24	2	not reject	0,03	3,15	not reject	0,01	2	not reject
2AEFES	78	0,95	2	not reject	0,45	3,15	not reject	1,06	2	not reject
2ALYAG	78	1,02	2	not reject	0,58	3,15	not reject	1,10	2	not reject
2BANVT	78	1,01	2	not reject	0,51	3,15	not reject	0,48	2	not reject
2DARDL	78	0,89	2	not reject	0,63	3,15	not reject	0,87	2	not reject
2ERSU	78	2,22	2	reject	2,44	3,15	not reject	0,37	2	not reject
2FRIGO	78	1,88	2	not reject	1,84	3,15	not reject	0,01	2	not reject
2KENT	78	0,33	2	not reject	0,17	3,15	not reject	0,55	2	not reject
2KERVT	78	0,23	2	not reject	0,05	3,15	not reject	0,76	2	not reject
2KNFRT	78	4,00	2	reject	7,93	3,15	reject	0,20	2	not reject
2KRSTL	78	0,78	2	not reject	0,53	3,15	not reject	0,39	2	not reject
2MERKO	78	0,66	2	not reject	1,25	3,15	not reject	0,60	2	not reject
2PENGD	78	2,38	2	reject	2,81	3,15	not reject	0,45	2	not reject
2PETUN	78	1,36	2	not reject	1,07	3,15	not reject	0,40	2	not reject
2PINSU	78	0,74	2	not reject	0,28	3,15	not reject	0,07	2	not reject
2PNSUT	78	2,31	2	reject	2,92	3,15	not reject	0,65	2	not reject
2SELGD	78	0,50	2	not reject	0,68	3,15	not reject	1,98	2	not reject
2SKPLC	78	1,46	2	not reject	1,04	3,15	not reject	0,45	2	not reject
2TATKS	78	0,35	2	not reject	0,63	3,15	not reject	0,42	2	not reject
2TBORG	78	0,81	2	not reject	0,41	3,15	not reject	0,20	2	not reject
2TUKAS	78	2,06	2	reject	2,16	3,15	not reject	0,20	2	not reject
2VANET	78	0,68	2	not reject	1,05	3,15	not reject	0,15	2	not reject
3AKSA	78	0,05	2	not reject	0,02	3,15	not reject	0,36	2	not reject
3ALKIM	78	0,23	2	not reject	0,08	3,15	not reject	0,52	2	not reject
3AYGAZ	78	0,72	2	not reject	0,65	3,15	not reject	0,57	2	not reject
3BAGFS	78	0,82	2	not reject	1,37	3,15	not reject	1,03	2	not reject
3BRISA	78	1,37	2	not reject	1,60	3,15	not reject	0,12	2	not reject
3CBSBO	78	1,67	2	not reject	2,08	3,15	not reject	1,17	2	not reject
3DEVA	78	0,44	2	not reject	0,36	3,15	not reject	0,94	2	not reject
3DYOBY	78	1,88	2	not reject	2,19	3,15	not reject	1,26	2	not reject
3ECILC	78	0,21	2	not reject	0,84	3,15	not reject	0,54	2	not reject
3EGGUB	78	0,38	2	not reject	0,26	3,15	not reject	0,06	2	not reject
3EGPRO	78	1,46	2	not reject	1,34	3,15	not reject	2,42	2	reject
3EPLAS	78	0,80	2	not reject	0,49	3,15	not reject	1,64	2	not reject

Table 4.7: Beta stability tests (cont.)

		beta stability test			alpha and beta stability test			beta stability over the market cycle		
firms	obs	t cal	t cri. value	decision	F cal	F cri. value	decision	t cal	t cri. value	decision
3GOODY	78	0,33	2	not reject	0,07	3,15	not reject	1,15	2	not reject
3GUBRF	78	2,38	2	reject	5,93	3,15	reject	1,56	2	not reject
3HEKTS	78	2,23	2	reject	2,63	3,15	not reject	1,25	2	not reject
3MEGES	78	1,53	2	not reject	1,20	3,15	not reject	1,60	2	not reject
3MRSHL	78	0,73	2	not reject	0,67	3,15	not reject	0,33	2	not reject
3PETKM	78	0,04	2	not reject	0,06	3,15	not reject	0,81	2	not reject
3PIMAS	78	2,16	2	reject	2,33	3,15	not reject	0,61	2	not reject
3PTOFS	78	1,28	2	not reject	1,60	3,15	not reject	1,67	2	not reject
3SODA	78	0,33	2	not reject	0,72	3,15	not reject	2,49	2	reject
3TRCAS	78	0,63	2	not reject	0,68	3,15	not reject	0,44	2	not reject
3TUPRS	78	1,28	2	not reject	0,88	3,15	not reject	0,39	2	not reject
4ALCAR	78	0,67	2	not reject	0,22	3,15	not reject	0,94	2	not reject
4ARCLK	78	1,01	2	not reject	1,27	3,15	not reject	1,56	2	not reject
4ASUZU	78	0,00	2	not reject	0,17	3,15	not reject	0,79	2	not reject
4BFREN	78	0,05	2	not reject	0,89	3,15	not reject	0,21	2	not reject
4BSHEV	78	0,28	2	not reject	0,14	3,15	not reject	0,17	2	not reject
4DITAS	78	0,20	2	not reject	1,62	3,15	not reject	0,37	2	not reject
4EGEEN	78	1,13	2	not reject	0,84	3,15	not reject	0,40	2	not reject
4EMKEL	78	1,28	2	not reject	0,81	3,15	not reject	0,42	2	not reject
4EMNIS	78	0,39	2	not reject	0,08	3,15	not reject	0,28	2	not reject
4FMIZP	78	0,53	2	not reject	0,37	3,15	not reject	0,37	2	not reject
4FROTO	78	0,49	2	not reject	0,35	3,15	not reject	2,81	2	reject
4IHEVA	78	1,98	2	not reject	1,98	3,15	not reject	0,42	2	not reject
4KARSN	78	1,70	2	not reject	1,42	3,15	not reject	0,55	2	not reject
4KLMSN	78	1,21	2	not reject	1,58	3,15	not reject	1,19	2	not reject
4MAKTK	78	0,30	2	not reject	0,06	3,15	not reject	0,97	2	not reject
4MUTLU	78	0,86	2	not reject	0,38	3,15	not reject	1,00	2	not reject
4OTKAR	78	0,36	2	not reject	0,17	3,15	not reject	0,20	2	not reject
4PARSN	78	1,18	2	not reject	0,84	3,15	not reject	0,75	2	not reject
4PRKAB	78	2,83	2	reject	3,96	3,15	reject	0,52	2	not reject
4TOASO	78	0,01	2	not reject	0,24	3,15	not reject	0,43	2	not reject
4TUDDF	78	1,83	2	not reject	1,96	3,15	not reject	0,31	2	not reject
4UZEL	78	0,75	2	not reject	1,65	3,15	not reject	0,66	2	not reject
4VESBE	78	0,57	2	not reject	1,38	3,15	not reject	1,29	2	not reject
5ADANA	78	0,73	2	not reject	0,33	3,15	not reject	1,25	2	not reject
5ADBGR	78	1,44	2	not reject	1,06	3,15	not reject	0,61	2	not reject
5ADNAC	78	1,29	2	not reject	1,76	3,15	not reject	1,23	2	not reject
5AFYON	78	1,06	2	not reject	1,31	3,15	not reject	0,93	2	not reject
5AKCNS	78	0,79	2	not reject	0,58	3,15	not reject	0,03	2	not reject
5ANACM	78	1,61	2	not reject	3,83	3,15	reject	0,49	2	not reject
5ASLAN	78	0,83	2	not reject	1,49	3,15	not reject	1,89	2	not reject
5BOLUC	78	0,79	2	not reject	0,40	3,15	not reject	1,60	2	not reject
5BSOKE	78	0,69	2	not reject	0,24	3,15	not reject	0,94	2	not reject
5BTCIM	78	0,53	2	not reject	0,14	3,15	not reject	0,53	2	not reject

Table 4.7: Beta stability tests (cont.)

		beta stability test			alpha and beta stability test			beta stability over the market cycle		
firms	obs	t cal	t cri. value	decision	F cal	F cri. value	decision	t cal	t cri. value	decision
5BUCIM	78	1,24	2	not reject	0,94	3,15	not reject	0,01	2	not reject
5CIMSA	78	1,10	2	not reject	1,31	3,15	not reject	0,38	2	not reject
5CMBTN	78	0,36	2	not reject	0,96	3,15	not reject	0,66	2	not reject
5CMENT	78	0,44	2	not reject	0,15	3,15	not reject	0,97	2	not reject
5DENCM	78	0,98	2	not reject	0,47	3,15	not reject	0,90	2	not reject
5DOGUB	78	0,18	2	not reject	0,10	3,15	not reject	0,44	2	not reject
5ECYAP	78	0,52	2	not reject	0,30	3,15	not reject	1,13	2	not reject
5EGSER	78	1,00	2	not reject	0,59	3,15	not reject	1,85	2	not reject
5GOLTS	78	1,16	2	not reject	0,96	3,15	not reject	0,13	2	not reject
5HZNDR	78	1,03	2	not reject	1,35	3,15	not reject	2,45	2	reject
5IZOCM	78	0,83	2	not reject	0,54	3,15	not reject	0,33	2	not reject
5KONYA	78	1,79	2	not reject	3,50	3,15	reject	0,11	2	not reject
5KUTPO	78	1,20	2	not reject	0,74	3,15	not reject	0,08	2	not reject
5MRDIN	78	0,03	2	not reject	0,00	3,15	not reject	1,34	2	not reject
5NUHCM	78	0,30	2	not reject	0,06	3,15	not reject	0,06	2	not reject
5TRKCM	78	1,27	2	not reject	2,28	3,15	not reject	1,43	2	not reject
5UNYEC	78	0,49	2	not reject	1,24	3,15	not reject	0,69	2	not reject
5USAK	78	1,50	2	not reject	1,44	3,15	not reject	1,17	2	not reject
6ALKA	78	0,09	2	not reject	0,43	3,15	not reject	1,91	2	not reject
6BAKAB	78	1,48	2	not reject	1,15	3,15	not reject	0,75	2	not reject
6DENTA	78	1,59	2	not reject	1,31	3,15	not reject	1,43	2	not reject
6DGZTE	78	0,17	2	not reject	0,93	3,15	not reject	0,17	2	not reject
6DOBUR	78	0,14	2	not reject	0,60	3,15	not reject	0,56	2	not reject
6DURDO	78	0,59	2	not reject	1,48	3,15	not reject	0,64	2	not reject
6HURGZ	78	0,86	2	not reject	2,24	3,15	not reject	1,08	2	not reject
6IPMAT	78	1,17	2	not reject	2,87	3,15	not reject	0,64	2	not reject
6ISAMB	78	2,58	2	reject	3,59	3,15	reject	0,46	2	not reject
6KAPLM	78	0,79	2	not reject	1,06	3,15	not reject	0,26	2	not reject
6KARTN	78	0,15	2	not reject	0,73	3,15	not reject	0,77	2	not reject
6OLMKS	78	0,67	2	not reject	0,43	3,15	not reject	0,09	2	not reject
6TIRE	78	1,80	2	not reject	2,15	3,15	not reject	0,46	2	not reject
6VKING	78	1,06	2	not reject	0,82	3,15	not reject	2,24	2	reject
7ADEL	78	0,12	2	not reject	0,54	3,15	not reject	1,57	2	not reject
7GENTS	78	1,17	2	not reject	0,71	3,15	not reject	1,41	2	not reject
7GOLDS	78	1,45	2	not reject	1,15	3,15	not reject	2,44	2	reject
7KLBMO	78	1,65	2	not reject	1,36	3,15	not reject	1,27	2	not reject
7SERVE	78	0,57	2	not reject	0,18	3,15	not reject	1,32	2	not reject
8AKALT	78	0,73	2	not reject	0,28	3,15	not reject	0,52	2	not reject
8AKIPD	78	0,54	2	not reject	0,15	3,15	not reject	1,49	2	not reject
8ALTIN	78	0,38	2	not reject	0,69	3,15	not reject	0,49	2	not reject
8ARSAN	78	0,95	2	not reject	0,85	3,15	not reject	1,17	2	not reject
8BERDN	78	0,12	2	not reject	1,01	3,15	not reject	0,81	2	not reject
8BISAS	78	0,07	2	not reject	0,10	3,15	not reject	1,21	2	not reject
8BOSSA	78	0,67	2	not reject	0,26	3,15	not reject	1,61	2	not reject

Table 4.7: Beta stability tests (cont.)

		beta stability test			alpha and beta stability test			beta stability over the market cycle		
firms	obs	t cal	t cri. value	decision	F cal	F cri. value	decision	t cal	t cri. value	decision
8BRMEN	78	2,39	2	reject	7,89	3,15	reject	0,84	2	not reject
8BYSAN	78	1,16	2	not reject	1,38	3,15	not reject	0,34	2	not reject
8CEYLN	78	0,53	2	not reject	0,50	3,15	not reject	2,23	2	reject
8CYTAS	78	0,05	2	not reject	0,54	3,15	not reject	0,35	2	not reject
8DERIM	78	1,11	2	not reject	0,62	3,15	not reject	2,14	2	reject
8EDIP	78	0,71	2	not reject	0,28	3,15	not reject	1,87	2	not reject
8ESEMS	78	2,09	2	reject	2,22	3,15	not reject	1,09	2	not reject
8GEDIZ	78	2,01	2	reject	2,06	3,15	not reject	2,97	2	reject
8IDAS	78	0,15	2	not reject	0,03	3,15	not reject	0,98	2	not reject
8KORDS	78	2,59	2	reject	3,31	3,15	reject	1,39	2	not reject
8KRTEK	78	2,02	2	reject	2,74	3,15	not reject	1,34	2	not reject
8LUKSK	78	2,10	2	reject	2,21	3,15	not reject	1,69	2	not reject
8MEMSA	78	1,32	2	not reject	0,95	3,15	not reject	0,50	2	not reject
8MNDRS	78	1,80	2	not reject	3,52	3,15	reject	0,24	2	not reject
8MTEKS	78	1,45	2	not reject	1,08	3,15	not reject	1,57	2	not reject
8OKANT	78	0,47	2	not reject	0,72	3,15	not reject	0,12	2	not reject
8SKTAS	78	0,09	2	not reject	0,34	3,15	not reject	2,27	2	reject
8SNPAM	78	1,28	2	not reject	0,81	3,15	not reject	1,34	2	not reject
8SONME	78	0,37	2	not reject	0,23	3,15	not reject	1,27	2	not reject
8TUMTK	78	0,61	2	not reject	1,39	3,15	not reject	0,48	2	not reject
8YATAS	78	0,45	2	not reject	0,10	3,15	not reject	1,85	2	not reject
8YUNSA	78	0,46	2	not reject	0,18	3,15	not reject	0,36	2	not reject

Table 4.9: Subsector 1 (Basic Metal Industries)

firms	total risk (%)	beta	sistematic risk (%)	specific risk (%)	weight (%)	cont.to port. Beta	mean return (%)	coefficient of variation	sharpe ratio (%)	skewness	kurtosis	Jarque-Bera	Jarque-Bera (prob)	portfolio return (%)	portfolio beta	portfolio risk (sdv) (%)
BRSAN1	11,39	0,61	6,28	5,11	0,09	0,06	2,55	4,46	-0,02	0,40	3,86	4,47	0,11	3,35	0,78	10,39
BURCE1	14,78	0,52	5,35	9,43	0,09	0,05	2,15	6,87	-0,02	1,20	8,11	103,7	0,00			
CELHA1	17,61	1,14	11,73	5,89	0,09	0,10	3,48	5,07	-0,02	1,11	6,11	47,4	0,00			
CEMTS1	12,26	0,84	8,64	3,62	0,09	0,08	2,94	4,17	-0,02	0,17	3,01	0,38	0,82			
DMSAS1	11,24	0,73	7,51	3,73	0,09	0,07	2,16	5,21	-0,03	0,42	3,99	5,51	0,06			
ERBOS1	14,75	0,59	6,07	8,68	0,09	0,05	1,88	7,85	-0,02	0,91	5,18	26,43	0,00			
EREGL1	13,86	0,95	9,77	4,09	0,09	0,09	4,54	3,05	-0,02	0,13	3,35	0,64	0,72			
FENIS1	16,88	0,28	2,88	14,00	0,09	0,03	3,43	4,93	-0,02	1,92	10,41	226,5	0,00			
IZMDC1	16,23	0,87	8,95	7,28	0,09	0,08	3,29	4,93	-0,02	1,03	5,49	33,9	0,00			
KRDMB1	48,29	1,4	14,40	33,88	0,09	0,13	8,53	5,66	-0,01	5,55	36,87	4121	0,00			
SARKY1	10,25	0,61	6,28	3,98	0,09	0,06	1,89	5,43	-0,03	0,42	3,34	2,71	0,26			

Note: Average risk free rate in the period is calculated as 2%. Please refer to any standard Finance text book for the calculation of the statistics.

Table 4.10: sub sector 2 (Manufacture of Food, Beverage and Tobacco)

firms	total risk (%)	beta	sistematic risk (%)	specific risk (%)	weight (%)	cont.to port. Beta	mean return (%)	coefficient of variation	sharpe ratio (%)	skewness	kurtosis	Jarque-Bera	Jarque-Bera (prob)	portfolio return (%)	portfolio beta	portfolio risk (sdv) (%)
AEFES2	9,62	0,55	5,67	3,95	0,05	0,03	1,86	5,16	-0,03	0,12	2,89	0,20	0,90	1,76	0,68	9,17
ALYAG2	20,57	0,57	5,88	14,68	0,05	0,03	0,27	75,63	-0,01	1,20	6,30	54,04	0,00			
BANVT2	16,03	0,77	7,89	8,14	0,05	0,04	2,90	5,53	-0,02	0,77	3,36	8,24	0,02			
DARDL2	13,98	0,97	9,94	4,04	0,05	0,05	0,18	78,74	-0,02	-0,12	2,65	0,58	0,75			
ERSU2	15,80	0,50	5,10	10,70	0,05	0,02	0,38	41,92	-0,02	1,40	7,57	93,53	0,00			
FRIGO2	18,65	0,75	7,68	10,97	0,05	0,04	1,39	13,41	-0,02	2,52	16,81	702,98	0,00			
KENT2	13,17	0,47	4,89	8,29	0,05	0,02	1,82	7,24	-0,02	0,36	3,29	1,94	0,38			
KERVT2	16,36	0,53	5,44	10,91	0,05	0,03	3,29	4,97	-0,02	1,01	5,64	36,14	0,00			
KNFRT2	25,15	0,79	8,12	17,03	0,05	0,04	2,96	8,50	-0,01	3,07	14,10	525,54	0,00			
KRSTL2	23,93	0,85	8,77	15,16	0,05	0,04	2,06	11,64	-0,01	1,80	8,27	132,27	0,00			
MERKO2	17,91	0,77	7,95	9,95	0,05	0,04	2,75	6,51	-0,02	2,20	11,90	321,07	0,00			
PENGD2	16,33	0,49	5,08	11,25	0,05	0,02	0,13	122,24	-0,02	0,87	5,92	37,60	0,00			
PETUN2	14,80	0,97	10,00	4,80	0,05	0,05	3,53	4,19	-0,02	0,47	3,32	3,21	0,20			
PINSU2	19,38	0,41	4,18	15,20	0,05	0,02	3,84	5,05	-0,01	2,93	15,67	633,55	0,00			
PNSUT2	15,39	0,87	8,96	6,43	0,05	0,04	3,11	4,95	-0,02	0,41	4,04	5,63	0,06			
SELGD2	19,07	0,56	5,72	13,35	0,05	0,03	-0,39	-48,50	-0,01	1,29	7,76	95,59	0,00			
SKPLC2	25,50	0,92	9,43	16,06	0,05	0,04	3,99	6,39	-0,01	2,98	19,27	976,26	0,00			
TATKS2	12,78	0,88	9,06	3,72	0,05	0,04	1,76	7,26	-0,02	0,42	3,23	2,37	0,31			
TBORG2	13,32	0,29	3,01	10,31	0,05	0,01	-0,68	-19,64	-0,02	1,55	9,65	175,13	0,00			
TUKAS2	10,33	0,71	7,34	2,98	0,05	0,03	-0,12	-85,08	-0,03	0,21	4,32	6,29	0,04			
VANET2	12,32	0,69	7,06	5,25	0,05	0,03	1,84	6,68	-0,02	0,00	3,08	0,01	1,00			

Note: Average risk free rate in the period is calculated as 2%. Please refer to any standard Finance text book for the calculation of the statistics.

Table 4.11: Sub Sector 3 (Manufacture Of Chemicals and of Chemical Petroleum, Rubber And Plastic Products)

firms	total risk (%)	beta	sistematic risk (%)	specific risk (%)	weight (%)	cont.to port. Beta	mean return (%)	coefficient of variation	sharpe ratio (%)	skewness	kurtosis	Jarque-Bera	Jarque-Bera (prob)	portfolio return (%)	portfolio beta	portfolio risk (sdv) (%)
AKSA3	11,08	0,73	7,51	3,57	0,04	0,03	-0,16	-71,34	-0,03	0,36	4,27	6,93	0,03	2,22	0,73	8,93
ALKIM3	12,23	0,54	5,56	6,68	0,04	0,02	2,69	4,54	-0,02	1,17	6,29	52,91	0,00			
AYGAZ3	12,34	0,95	9,77	2,56	0,04	0,04	1,48	8,33	-0,02	0,18	2,94	0,45	0,80			
BAGFS3	13,84	0,61	6,28	7,56	0,04	0,03	4,16	3,33	-0,02	0,73	4,66	15,87	0,00			
BRISA3	12,23	0,88	9,05	3,17	0,04	0,04	1,85	6,59	-0,02	0,45	3,5	3,41	0,18			
CBSBO3	14,85	0,45	4,63	10,22	0,04	0,02	-0,57	-25,94	-0,02	0,62	4,42	11,64	0,00			
DEVA3	19,21	0,41	4,22	14,99	0,04	0,02	5,50	3,49	-0,01	1,05	4,12	18,49	0,00			
DYOBY3	14,71	0,89	9,16	5,55	0,04	0,04	-0,40	-36,93	-0,02	0,9	4,07	14,3	0,00			
ECILC3	15,44	0,88	9,05	6,39	0,04	0,04	3,77	4,10	-0,02	1,16	5,23	33,76	0,00			
EGGUB3	13,76	0,63	6,48	7,28	0,04	0,03	4,53	3,04	-0,02	0,93	4,22	16,09	0,00			
EGPRO3	15,10	0,07	0,72	14,38	0,04	0,00	3,28	4,60	-0,02	1,47	7,18	84,91	0,00			
EPLAS3	20,90	0,90	9,26	11,64	0,04	0,04	1,17	17,91	-0,01	1,87	10,38	222,32	0,00			
GOODY3	12,31	0,73	7,51	4,80	0,04	0,03	1,11	11,09	-0,02	0,42	2,81	2,4	0,30			
GUBRF3	17,61	0,58	5,97	11,65	0,04	0,03	6,12	2,88	-0,02	1,62	7,55	101,33	0,00			
HEKTS3	13,01	0,91	9,36	3,65	0,04	0,04	2,29	5,68	-0,02	0,49	4,13	7,23	0,03			
MEGES3	28,08	0,51	5,25	22,83	0,04	0,02	2,76	10,18	-0,01	1,87	8,75	152,89	0,00			
MRSHL3	12,28	0,66	6,79	5,49	0,04	0,03	1,53	8,04	-0,02	0,98	5,3	29,72	0,00			
PETKM3	14,31	0,99	10,18	4,12	0,04	0,04	0,35	41,02	-0,02	0,23	4,77	10,88	0,00			
PIMAS3	14,03	0,80	8,23	5,80	0,04	0,03	1,01	13,84	-0,02	0,18	4,39	6,72	0,03			
PTOFS3	15,63	0,91	9,36	6,27	0,04	0,04	1,35	11,54	-0,02	1,73	11,37	266,98	0,00			
SODA3	12,56	0,87	8,95	3,61	0,04	0,04	1,53	8,21	-0,02	0,08	3,88	2,6	0,27			
TRCAS3	16,11	1,13	11,63	4,48	0,04	0,05	3,19	5,05	-0,02	0,68	4,75	15,99	0,00			
TUPRS3	11,77	0,77	7,92	3,85	0,04	0,03	2,52	4,67	-0,02	0,51	4,76	13,35	0,00			

Note: Average risk free rate in the period is calculated as 2%. Please refer to any standard finance text book for the calculation of the statistics.

Table 4.12: Sub Sector 4 (Manufacture Of Fabricated Metal Products, Machinery and Equipment)

firms	total risk (%)	beta	sistematic risk (%)	specific risk (%)	weight (%)	cont.to port. Beta	mean return (%)	coefficient of variation	sharpe ratio (%)	skewness	kurtosis	Jarque-Bera	Jarque-Bera (prob)	portfolio return (%)	portfolio beta	portfolio risk (sdv) (%)
ALCAR4	12,58	0,95	9,77	2,80	0,04	0,04	1,34	9,42	-0,02	0,99	4,88	24,14	0,00	2,75	0,80	10,20
ARCLK4	13,42	1,03	10,60	2,82	0,04	0,04	1,41	9,50	-0,02	0,63	3,59	6,36	0,04			
ASUZU4	15,53	0,87	8,95	6,58	0,04	0,04	2,77	5,60	-0,02	0,89	5,23	26,58	0,00			
BFREN4	63,14	0,71	7,30	55,84	0,04	0,03	9,51	6,64	0,00	5,36	32,15	3135,47	0,00			
BSHEV4	16,59	0,71	7,30	9,28	0,04	0,03	2,11	7,87	-0,02	2,13	10,78	255,52	0,00			
DITAS4	17,61	0,85	8,74	8,86	0,04	0,04	2,88	6,11	-0,02	1,42	8,12	111,31	0,00			
EGEEN4	12,22	0,54	5,56	6,66	0,04	0,02	1,36	8,99	-0,02	0,42	3,07	2,34	0,31			
EMKEL4	18,70	0,89	9,16	9,55	0,04	0,04	0,35	53,26	-0,02	1,42	5,93	54,16	0,00			
EMNIS4	18,29	0,44	4,53	13,76	0,04	0,02	3,39	5,39	-0,02	1,29	6,13	53,57	0,00			
FMIZP4	22,95	0,35	3,60	19,35	0,04	0,02	6,07	3,78	-0,01	2,45	12,41	366,20	0,00			
FROTO4	11,28	0,76	7,82	3,46	0,04	0,03	2,46	4,59	-0,03	0,59	3,73	6,23	0,04			
IHEVA4	26,03	0,64	6,58	19,44	0,04	0,03	6,91	3,77	-0,01	1,55	4,94	43,24	0,00			
KARSN4	19,47	1,11	11,42	8,05	0,04	0,05	1,36	14,37	-0,01	1,26	5,42	39,67	0,00			
KLMSN4	13,77	0,65	6,69	7,09	0,04	0,03	2,57	5,36	-0,02	2,02	12,19	327,24	0,00			
MAKTK4	17,03	0,60	6,17	10,86	0,04	0,03	0,04	407,54	-0,02	1,08	4,46	22,12	0,00			
MUTLU4	14,40	0,71	7,30	7,09	0,04	0,03	3,26	4,41	-0,02	0,54	3,42	4,33	0,11			
OTKAR4	16,86	0,89	9,16	7,70	0,04	0,04	3,03	5,57	-0,02	1,13	5,23	32,63	0,00			
PARSN4	18,90	0,90	9,26	9,64	0,04	0,04	4,58	4,12	-0,02	0,93	6,15	43,39	0,00			
PRKAB4	14,40	0,77	7,92	6,48	0,04	0,03	1,72	8,38	-0,02	0,40	3,16	2,20	0,33			
TOASO4	14,68	1,04	10,70	3,98	0,04	0,05	2,05	7,16	-0,02	0,70	4,81	16,92	0,00			
TUDDF4	15,40	0,98	10,08	5,32	0,04	0,04	3,28	4,70	-0,02	-0,50	5,61	25,41	0,00			
UZEL4	14,27	0,88	9,05	5,22	0,04	0,04	0,75	19,08	-0,02	0,45	3,52	3,54	0,17			
VESBE4	12,92	1,02	10,49	2,42	0,04	0,04	0,00	10075,01	-0,02	0,65	5,07	19,39	0,00			

Note: Average risk free rate in the period is calculated as 2%. Please refer to any standard Finance text book for the calculation of the statistics.

Table 4.13: Sub Sector 5 (Manufacture of Non-Metallic Mineral Products)

firms	total risk (%)	beta	sistematic risk (%)	specific risk (%)	weight (%)	cont.to port. Beta	mean return (%)	coefficient of variation	sharpe ratio (%)	skewness	kurtosis	Jarque-Bera	Jarque-Bera (prob)	portfolio return (%)	portfolio beta	portfolio risk (sdv) (%)
ADANA5	15,24	1,08	11,11	4,13	0,04	0,04	3,54	4,31	-0,02	0,85	4,76	19,41	0,00	2,63	0,78	9,08
ADBGR5	12,60	0,88	9,05	3,55	0,04	0,03	3,49	3,61	-0,02	0,95	4,69	21,10	0,00			
ADNAC5	14,40	1,08	11,11	3,29	0,04	0,04	3,07	4,69	-0,02	1,06	5,31	32,14	0,00			
AFYON5	12,03	0,64	6,58	5,45	0,04	0,02	3,27	3,68	-0,02	0,54	3,95	6,73	0,03			
AKCNS5	14,03	1,03	10,60	3,43	0,04	0,04	2,30	6,11	-0,02	0,16	2,76	0,52	0,77			
ANACM5	11,32	0,72	7,41	3,91	0,04	0,03	3,49	3,25	-0,03	0,22	3,22	0,78	0,68			
ASLAN5	13,99	0,57	5,86	8,13	0,04	0,02	3,24	4,32	-0,02	1,00	6,17	45,80	0,00			
BOLUC5	14,42	1,02	10,49	3,93	0,04	0,04	2,63	5,48	-0,02	1,61	7,76	107,54	0,00			
BSOKE5	13,68	0,78	8,02	5,66	0,04	0,03	2,27	6,03	-0,02	0,50	3,61	4,44	0,11			
BTCIM5	11,94	0,64	6,58	5,36	0,04	0,02	1,92	6,21	-0,02	0,75	4,32	12,85	0,00			
BUCIM5	8,91	0,36	3,70	5,21	0,04	0,01	2,21	4,03	-0,03	2,43	12,12	347,15	0,00			
CIMSA5	12,87	1,00	10,29	2,58	0,04	0,04	2,67	4,82	-0,02	-0,02	3,20	0,14	0,93			
CMBTN5	13,08	0,72	7,41	5,67	0,04	0,03	1,95	6,71	-0,02	0,63	3,73	6,93	0,03			
CMENT5	13,65	0,65	6,69	6,96	0,04	0,02	1,34	10,18	-0,02	0,41	7,38	64,71	0,00			
DENCM5	12,91	0,87	8,95	3,95	0,04	0,03	0,42	30,68	-0,02	1,10	5,98	44,61	0,00			
DOGUB5	20,84	0,81	8,33	12,51	0,04	0,03	1,04	20,02	-0,01	1,37	7,98	104,93	0,00			
ECYAP5	13,35	0,96	9,88	3,48	0,04	0,03	1,69	7,90	-0,02	0,77	4,16	12,06	0,00			
EGSER5	16,44	0,76	7,82	8,62	0,04	0,03	1,40	11,76	-0,02	0,49	3,78	5,06	0,08			
GOLTS5	14,82	0,60	6,17	8,65	0,04	0,02	3,82	3,89	-0,02	0,91	5,28	27,51	0,00			
HZNDR5	17,65	0,72	7,41	10,24	0,04	0,03	3,06	5,76	-0,02	1,25	7,36	81,81	0,00			
IZOCM5	14,58	0,89	9,16	5,42	0,04	0,03	4,61	3,16	-0,02	0,55	3,65	5,33	0,07			
KONYA5	14,32	0,76	7,82	6,50	0,04	0,03	3,59	3,98	-0,02	0,65	3,13	5,55	0,06			
KUTPO5	16,10	0,32	3,29	12,81	0,04	0,01	3,78	4,26	-0,02	1,85	9,62	186,66	0,00			
MRDIN5	13,29	0,86	8,85	4,44	0,04	0,03	3,87	3,43	-0,02	1,75	7,60	108,84	0,00			
NUHCM5	9,59	0,51	5,25	4,34	0,04	0,02	3,72	2,57	-0,03	0,99	5,25	29,05	0,00			
TRKCM5	10,51	0,76	7,82	2,69	0,04	0,03	1,53	6,85	-0,03	-0,02	4,23	4,95	0,08			
UNYEC5	14,86	1,01	10,39	4,47	0,04	0,04	2,86	5,20	-0,02	1,31	6,46	61,11	0,00			
USAK5	16,41	0,97	9,98	6,43	0,04	0,03	0,96	17,08	-0,02	0,76	5,03	20,97	0,00			

Note: Average risk free rate in the period is calculated as 2%. Please refer to any standard Finance text book for the calculation of the statistics.

Table 4.14: Sub Sector 6 (Manufacture of Paper and Paper Products, Printing and Publishing)

firms	total risk (%)	beta	sistematic risk (%)	specific risk (%)	weight (%)	cont.to port. Beta	mean return (%)	coefficient of variation	sharpe ratio (%)	skewness	kurtosis	Jarque-Bera	Jarque-Bera (prob)	portfolio return (%)	portfolio beta	portfolio risk (sdv) (%)
ALKA6	15,14	0,61	6,28	8,86	0,07	0,04	2,38	6,36	-0,02	0,63	7,61	74,08	0,00	2,31	0,78	10,01
BAKAB6	14,32	0,58	5,97	8,35	0,07	0,04	1,34	10,69	-0,02	0,66	4,98	18,46	0,00			
DENTA6	10,43	0,47	4,84	5,60	0,07	0,03	1,66	6,27	-0,03	0,00	4,37	6,14	0,05			
DGZTE6	22,46	1,39	14,30	8,16	0,07	0,10	3,36	6,68	-0,01	1,25	5,21	36,35	0,00			
DOBUR6	22,33	1,27	13,07	9,27	0,07	0,09	2,46	9,07	-0,01	1,37	5,10	38,75	0,00			
DURDO6	21,52	0,43	4,42	17,10	0,07	0,03	3,00	7,18	-0,01	0,88	4,92	21,93	0,00			
HURGZ6	14,59	1,11	11,42	3,17	0,07	0,08	1,58	9,21	-0,02	-0,06	3,20	0,18	0,91			
IPMAT6	18,56	0,96	9,88	8,69	0,07	0,07	2,95	6,30	-0,02	0,67	3,38	6,31	0,04			
ISAMB6	22,53	0,42	4,32	18,21	0,07	0,03	0,85	26,39	-0,01	1,94	8,19	136,17	0,00			
KAPLM6	21,33	0,99	10,18	11,14	0,07	0,07	2,93	7,27	-0,01	1,96	10,06	212,12	0,00			
KARTN6	15,41	0,49	5,04	10,37	0,07	0,04	2,10	7,34	-0,02	3,00	19,60	1012,41	0,00			
OLMKS6	10,79	0,70	7,20	3,59	0,07	0,05	2,53	4,27	-0,03	0,29	4,35	7,02	0,03			
TIRE6	14,14	0,65	6,69	7,45	0,07	0,05	3,94	3,59	-0,02	1,00	4,81	23,82	0,00			
VKING6	16,90	0,85	8,74	8,16	0,07	0,06	1,22	13,82	-0,02	0,66	3,92	8,34	0,02			

Note: Average risk free rate in the period is calculated as 2%. Please refer to any standard finance text book for the calculation of the statistics.

Table 4.15: Sub Sector 7 (Other Manufacturing Industry)

firms	total risk (%)	beta	sistematic risk (%)	specific risk (%)	weight (%)	cont.to port. Beta	mean return (%)	coefficient of variation	sharpe ratio (%)	skewness	kurtosis	Jarque-Bera	Jarque-Bera (prob)	portfolio return (%)	portfolio beta	portfolio risk (sdv) (%)
GENTS7	9,62	0,65	6,69	2,93	0,20	0,13	1,86	5,16	-0,03	0,21	2,96	0,58	0,75	1,12	0,72	10,65
KLBMO7	20,57	0,65	6,69	13,88	0,20	0,13	0,27	75,63	-0,01	0,55	4,00	7,18	0,03			
ADEL7	16,03	1,04	10,70	5,33	0,20	0,21	2,90	5,53	-0,02	0,62	3,38	5,39	0,07			
GOLDS7	13,98	0,76	7,82	6,16	0,20	0,15	0,18	78,74	-0,02	0,44	4,24	7,50	0,02			
SERVE7	15,80	0,51	5,25	10,55	0,20	0,10	0,38	41,92	-0,02	0,29	3,23	1,29	0,53			

Note: Average risk free rate in the period is calculated as 2%. Please refer to any standard Finance text book for the calculation of the statistics.

Table 4.16: Subsector 8 (Textile, Wearing Apparel and Leather Industries)

firms	total risk (%)	beta	sistematic risk (%)	specific risk (%)	weight (%)	cont.to port. Beta	mean return (%)	coefficient of variation	sharpe ratio (%)	skewness	kurtosis	Jarque-Bera	Jarque-Bera (prob)	portfolio return (%)	portfolio beta	portfolio risk (sdv) (%)
AKALT8	12,49	0,78	8,02	4,47	0,03	0,03	-0,20	-63,48	-0,02	0,26	3,54	1,84	0,40	1,52	0,74	9,36
AKIPD8	17,76	0,83	8,54	9,22	0,03	0,03	1,02	17,49	-0,02	0,52	5,19	19,14	0,00			
ALTIN8	16,52	0,62	6,38	10,15	0,03	0,02	3,70	4,47	-0,02	0,92	4,26	16,20	0,00			
ARSAN8	20,10	0,29	2,98	17,11	0,03	0,01	1,79	11,20	-0,01	1,45	10,18	194,64	0,00			
BERDN8	15,38	0,35	3,60	11,78	0,03	0,01	0,53	28,93	-0,02	2,73	16,67	704,47	0,00			
BISAS8	21,96	0,59	6,07	15,89	0,03	0,02	1,22	17,97	-0,01	0,56	4,55	11,84	0,00			
BOSSA8	12,17	0,69	7,10	5,07	0,03	0,02	1,51	8,07	-0,02	0,86	3,90	12,30	0,00			
BRMEN8	10,91	0,29	2,98	7,93	0,03	0,01	-0,02	-621,41	-0,03	0,10	3,72	1,80	0,41			
BYSAN8	19,08	0,58	5,97	13,12	0,03	0,02	0,07	282,45	-0,01	1,76	9,87	193,61	0,00			
CEYLN8	15,24	0,50	5,14	10,09	0,03	0,02	0,39	38,99	-0,02	0,02	2,63	0,46	0,79			
CYTAS8	21,42	1,30	13,37	8,05	0,03	0,04	2,15	9,98	-0,01	1,29	6,35	57,99	0,00			
DERIM8	27,71	1,32	13,58	14,13	0,03	0,05	3,77	7,35	-0,01	4,01	29,41	2475,87	0,00			
EDIP8	12,16	0,49	5,04	7,12	0,03	0,02	2,22	5,47	-0,02	0,77	4,21	12,39	0,00			
ESEMS8	30,03	1,07	11,01	19,02	0,03	0,04	2,53	11,88	-0,01	2,54	12,46	374,76	0,00			
GEDIZ8	12,56	0,71	7,30	5,26	0,03	0,02	-0,65	-19,35	-0,02	0,29	4,02	4,47	0,11			
IDAS8	15,32	0,72	7,41	7,92	0,03	0,02	2,91	5,26	-0,02	0,14	3,93	3,11	0,21			
KORDS8	14,10	1,08	11,11	2,99	0,03	0,04	0,91	15,53	-0,02	0,30	3,93	4,03	0,13			
KRTEK8	15,74	0,47	4,84	10,91	0,03	0,02	2,10	7,50	-0,02	0,96	5,13	26,70	0,00			
LUKSK8	16,74	0,55	5,66	11,08	0,03	0,02	2,34	7,17	-0,02	2,53	16,12	642,54	0,00			
MEMSA8	56,32	1,46	15,02	41,30	0,03	0,05	4,93	11,43	-0,01	7,83	66,61	13949,44	0,00			
MNDRS8	14,21	0,96	9,88	4,33	0,03	0,03	0,04	404,38	-0,02	1,31	6,67	66,13	0,00			
MTEKS8	19,27	0,79	8,13	11,14	0,03	0,03	0,28	68,66	-0,01	1,77	9,04	159,42	0,00			
OKANT8	14,01	0,68	7,00	7,02	0,03	0,02	-1,07	-13,11	-0,02	1,24	8,24	109,00	0,00			
SKTAS8	14,44	0,52	5,35	9,09	0,03	0,02	2,89	4,99	-0,02	0,09	3,48	0,87	0,65			
SNPAM8	20,55	0,71	7,30	13,24	0,03	0,02	3,00	6,85	-0,01	1,64	7,17	91,28	0,00			
SONME8	17,01	0,89	9,16	7,85	0,03	0,03	1,88	9,04	-0,02	0,86	3,71	11,17	0,00			
TUMTK8	22,25	0,53	5,45	16,80	0,03	0,02	1,06	20,99	-0,01	2,25	14,72	511,96	0,00			
YATAS8	18,23	1,10	11,32	6,92	0,03	0,04	0,94	19,31	-0,02	0,47	5,16	18,10	0,00			
YUNSA8	10,60	0,56	5,76	4,84	0,03	0,02	1,72	6,15	-0,03	0,94	3,99	14,60	0,00			

Note: Average risk free rate in the period is calculated as 2%. Please refer to any standard finance text book for the calculation of the statistics.