



A Review of the Relevance of the Arbitrage Pricing Model in Identifying and Exploiting Mispriced Securities and Enhancing Risk Assessment

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Abstract

Arbitrage pricing model is an important tool in asset pricing and risk assessment, The role of this model is to establish the expected return of a security taking into consideration its sensitivity to multiple macroeconomic factors. This article provides a comprehensive review of the Arbitrage pricing model with emphasize on its relevance in risk enhancement and identifying and exploiting mispriced securities in line with various empirical investigations. The review also highlights the limitations of implementing the model and selection of appropriate macroeconomic factors. The findings suggests that arbitrage pricing model provides a robust framework for identifying mispriced securities and risk assessment of the securities, however, the model does not specify the criteria to be used to select appropriate macroeconomic factors to take into consideration when calculating the expected return of a security, additionally, the multifactor approach of the model makes the model complex and challenging to interpret and implement especially as compared to a simpler model like capital asset pricing model.

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1. Introduction

Corporate finance theories include a wide range of financial concepts and procedures that organizations employ to make choices regarding financing, investments, and dividends decisions. These theories thus guide the firms in the way resources are to be used so that shareholder value can be maximized with the choice of optimal capital structure and funding sources. More specifically, corporate finance deals with one of the most central objectives of the productive entity as a whole: maximizing the firm's value for its investors, given prudent investment decisions and an optimal mix between debt and equity financing (Van Horne and Wachowicz, 2008) ^[11]. Some of the corporate finance theory important to corporation include; the time value of money, capital structure theory and Gordon Growth Model.

While these theories guide how the resources should be allocated, financed or invested, arbitrage pricing theory goes further and in-depth to study the risk and return in the financial markets, thereby assisting finance professionals in assessing and hedging of risk through financial instruments such as futures, swaps, options, etc., this is essential in that it preserves the value of the company and stabilizes cash flows. Arbitrage pricing model, developed as an alternative to capital asset pricing theory, asserts that the factors influencing the return on an asset are numerous other than market risk. This article critically reviews the Arbitrage pricing theory and its applicability in identifying and exploiting mispriced securities and how it improves finance professional's ability to analyze risk.

Objectives

The following are the objectives of this article;

1. To determine the relevance of Arbitrage Pricing model in identifying and exploiting mispriced securities.
2. To establish how arbitrage pricing theory enhance the risk assessment capabilities of finance professionals.

Research Methodology

The study used desktop literature review where several journal articles from credible databases and repositories such as Google Scholar, JSTOR, Emerald Insights, EBSC Host and many more were used.

Literature Review

Arbitrage Pricing Theory, is a theory developed in 1976 by Stephen Ross, it explains the relationship between macroeconomic risk and expected return of the financial asset. Arbitrage involves buying and selling the same security in more than one market, capturing price differences for guaranteed riskless profit from the transaction. Undeniably, the concept of arbitrage forms the very foundation of arbitrage pricing theory: exploit price deviations of the current market price for an asset against its theoretically modeled value. These measures ensure that prices never are away from equilibrium, and hence there are no perpetual opportunities for arbitrage. Arbitrage pricing theory is premised on the assumption that there are few major macroeconomic factors influencing asset returns like GDP, inflation, interest rates, and other industry and company-related factors. This theory seeks to capture how sensitive the returns on an asset are to shifts in specific macroeconomic factors.

Arbitrage pricing model can be applied to analyzing portfolios from the value investing perspective in search of mispriced securities. For an analyst and investor, the APT proposes a multi-factor pricing model for securities based on the correlation between expected return and risks of a financial asset. It assumes that markets are not rather efficient all the time; therefore, once in a while, some assets actually might be mispriced for some time—either over- or undervalued. Over the long term, however, market forces should correct this imbalance and drive pricing back to fair market value. For arbitrageurs, momentarily mispriced stocks represent a nearly riskless opportunity for profit in the short run. APT also gives a very useful model in shareholders' value creation, macroeconomic variables have considerable effects on stock prices (Iqmal and Putra, 2020) [5].

In the study by Iqmal and Putra (2020) [5], the arbitrage pricing model was used to review how macroeconomic factors influence stock prices. The study was based in the Indonesia Stock Exchange. The study suggested that in order to have a return on the stock market acceptable to shareholders, companies have to pay more attention to macroeconomic variables since changes in macroeconomic variables affect the price of stocks. Company policies have to incorporate macroeconomic variables.

Application of Arbitrage Pricing Model

The APT is based on the following assumption

Risk Factors: APT assumes that there are lesser and finite variables than the total number of assets which are existing in the market. These variables affect the return of every asset in the market.

Factor Sensitivity: APT measures sensitivity through risk

factor coefficients. It denotes the amount by which return on the asset changes when there is a change in one unit of the factor. APT assumes that, for any asset in the market, factor loadings are known and constant.

Factor premium: expectations of premium an investor would earn for every unit of each risk factor. Otherwise, it could be understood as the difference between expected return and the risk-free rate. APT assumes that factor premium is known and constant against every risk factor in the market.

Arbitrage: APT assumes there are no arbitrage opportunities available within the security market; an investor can't construct a portfolio of assets with a positive expected return for no risk, or vice versa, have a portfolio with a higher expected return than another portfolio containing the same amount of risk.

One such theory on which APT is built is the 'law of one pricing', which mentions that two assets have to be priced identically if they exhibit identical risk and return characteristics. One can make riskless profit from the mispricing of assets, upon the violation of the law of one price, by buying the underpriced asset and selling the overpriced asset. APT assumes that market efficiency holds, and the exploiting of arbitrage opportunities by the arbitrageurs themselves will very swiftly remove any chance of arbitrage. The APT postulates that there can be a perfect linear relationship between the expected rate of return of an individual security, the risk-free return, and the return of other factors that have risk (Ullah, Naz and Khan, 2012) [10] and (Huberman and Wang, 2005) [4].

The APT expected rate of return formula is expressed as follows (Roll and Ross, 1980) [8];

$$R_i = E(R_i) + \beta_{i1}F_1 + \beta_{i2}F_2 + \dots + \beta_{in}F_{2n} + \varepsilon$$

Where;

R_i is the return of the asset

$E(R_i)$ is the risk-free return

β_{i1} is the sensitivity of the asset to the factor

F_1 is the value of the factor

ε is unsystematic risk component of the asset

If the expected return using the arbitrage pricing formula is higher than the actual return then the asset is undervalued, If the expected return using the arbitrage pricing model is lower than the actual return then the asset is overvalued.

Ullah *et al.* (2012) [10] used three stages in a study of the Pakistani equity market to test the validity of the arbitrage pricing model: first, he performed regression analysis for each company's return separately, using the stock returns as dependent variables and identified macroeconomic factors as independent variables. For each of the macroeconomic components, the regression coefficients (beta) were obtained by regression analysis. In the second step, these betas were utilized to project the values of stock returns for the sample period. In the third step, the similarity between the two sets of values was examined by comparing the projected and actual returns. The findings indicate that there is no discernible difference between the two value sets, supporting the validity of arbitrage pricing theory especially in forecasting future stock.

Asset Pricing Theory VS Capital Asset Pricing Model (CAPM)

The CAPM and APT are essential models in establishing the

expected return of an asset, APT was introduced as an alternative model to Capital Asset Pricing Theory (CAPM). CAPM is based on the assumption that expected return of a security is related to a single risk factor that is the market risk, however, in reality there are a number of factors that could influence the asset return either than market risk, furthermore, CAPM assumes market is efficient with perfect information, which might not be case due to information asymmetry. The CAPM measures that sensitivity of an asset in relation to changes in market factors ignoring other risk factors that could affect the price of an asset, additionally, CAPM assumes that investors have the same preference of asset return, however, investors have different asset return preferences due to diverse risk attitude. APT model was developed in order to address the limitation of CAPM by considering multiple risk factors, no arbitrage principle and the linear relationship between the risk factors and the asset return.

Yadav and Hedge conducted a study involving a comparison of APT with the capital asset pricing theory, by considering some macroeconomic factors which influence the prices of market securities and finding out how APT explains the majority of returns. Yadav simply focused on the core components of revenue, assets, liabilities, and growth potentials in trying to compute the intrinsic value based on the investor's risk tolerance. The results suggest that APT explains a large portion of the share returns of the company. Macroeconomic variables are among the most important inputs that financial analysts should take into consideration while estimating the projected returns since they have a long-term significant impact on the risk of an asset (Yadav and Hegde, 2022) ^[12]. Additionally, sources of risks of the APT model in a given data set explain to the investor why given equities move in a given way.

Similarly, Jugu and Yunisa (2024) ^[6] carried out a comparative analysis of Capital Asset Pricing Model with Arbitrage Pricing Model as efficient decision models in asset pricing to identify which among the two is more appropriate and efficient. The major flaws of CAPM were found to be based on a number of simplifying assumptions that appear to be far from realistic in a real-life situation. On top of that, it is mooted that CAPM is wrong in description of expected returns, and that the market proxies are not mean-variance efficient; hence, a multi-factor model such as APT explains it better (Jugu and Yunisa, 2024) ^[6]. APT better warns of the asset risk and gives a better estimate of the required rate of return than CAPM that uses a beta as the only market risk as reflected by Jugu and Yunisa, 2024 ^[6]. Unlike the APT (Hamao, 1988) ^[3] CAPM beta does not pick up any further additional risk that may have been captured by the macroeconomic factors; APT remains the most promising explanation of relative returns relative to it; hence, it is said to outperform CAPM by nature from giving a description as a whole.

Relevance in identifying and exploiting mispriced securities

Understanding the factors that influence asset values more deeply is made possible by the multi-factor approach. This level of detail can reveal mispricing that a one-factor model like the CAPM could overlook. Multiple factors may have an impact on securities, hence the need of a multiple factor model. APT is especially helpful for sector-specific analysis and mispricing identification because of its flexibility in factor selection. The model is relevant in that it facilitates the

identification of mispriced assets by comparing the expected return estimated by the model with the realized actual returns. If the expected return is higher than the actual return realized from an asset then the security is undervalued, the investors can then exploit this arbitrage opportunity by buying the undervalued asset and selling the overvalued asset.

By considering multiple factors, APT enables investors to diversify their risk exposure more effectively, which is also crucial for identifying mispriced securities without taking on excessive risk. Furthermore, Investors can back test APT models using historical data to validate their efficacy in predicting returns and identifying mispricing. This empirical basis provides confidence in the model's practical application.

APT improves asset pricing by recognizing that assets are sensitive to the different factors to different degrees. In providing some factor loadings, which estimate the sensitivities of an asset's returns to each factor, one can make better predictions of the expected returns of an asset. This would then result in better pricing of securities and a finer understanding of their risk-return profiles. Consequently, APT helps in determining the mispriced assets, hence avoiding the arbitrage opportunities for extra profit.

Enhancement of risk assessment capabilities of finance professionals

By taking into account a variety of risk factors, APT provides a more thorough assessment of the risks associated to a security. Better-informed investment decisions result from this. APT facilitates the distinction between unsystematic (unique to particular securities) and systematic (market-wide) risks, enabling more accurate risk management techniques.

APT model identifies a range of risk factors that help finance professionals have a good idea about where the risks in their portfolios are coming from. Armed with this increased insight, more powerful diversification strategies can be built. It would then be possible for finance professionals to diversify not just across different assets but across a set of risk factors, thereby, avoiding overexposure to any particular source of risk. This multidimensional diversification gives way to more resilient portfolio performance, especially in episodes of turbulence in the markets. Indeed, it is precisely this flexibility that makes the model capable of dynamic changes in terms of the changing economic environment, therefore providing a more robust context for risk management practices.

In risk management, APT is considered as very useful because its ability to isolate and quantify different forms of risks remains unmatched. By considering various identified risk factors, finance professionals can establish hedging strategies using the APT. For instance, if the sensitivity with respect to changes in interest rates is very high for an asset, there will be a hedging instrument relevant to that factor that will apply, which will minimize the existence of that particular risk. Focus of this kind will hence add to the overall value of such risk management strategies.

Advantages of APT

APT is quite flexible as compared to other models. It incorporates a number of factors in order to explain the cross-sectional variation in projected returns for instance, APT can take into account firm-specific characteristics like size, value, or momentum, industry-specific characteristics like oil prices, technological innovation, or customer preferences, or

macroeconomic characteristics like inflation, interest rates, or GDP growth. In contrast to other models that rely on a single component (like CAPM) or a small number of factors, this enables APT to capture additional sources of risk and return. APT does not require assessment of the market portfolio and the market risk premium, which are challenging and difficult to quantify in real-world scenarios. Rather, APT simply needs the factor risk premiums and factor betas to be estimated, which may be accomplished by a variety of techniques like regression, principal component analysis, and factor analysis. Furthermore, APT can take into consideration the correlation and interaction between the elements because it does not make the assumption that the factors are independent. This lessens the possibility of multi-collinearity or omitted variable bias, which can compromise the precision and dependability of other models.

APT is easier to understand in that an asset's expected return and risk can be easily broken down into component factor values. APT, for instance, can demonstrate the proportion of an asset's return and risk that can be attributed to its exposure to the market, industry, or company. This can assist analysts and investors in determining the sources of risk and value in their portfolios and in modifying their factor exposures in accordance with expectations and preferences. By contrasting the real returns of assets with their predicted returns, which are determined by factor betas and risk premiums, essential assist in identifying asset mispricing.

Limitation of APT

APT does not clearly explain how factor risk premium is calculated and how it effects expected returns. APT lets the user determine the components empirically rather than deriving them from any behavioral or economic theory. This indicates that APT is limited to describing the patterns found in the data. Additionally, APT does not outline how to choose the precise number of factors to be employed from an endless pool of possible factors (Ragheb, Sakr and Gebeily, 2016)^[7]. Furthermore, APT could be subjective in that different users of the model may use different factors, methods, or criteria in analysis, making it challenging to compare performance or test validity the APT.

In order to estimate the factor betas and risk premiums for every asset and factor, APT requires a significant quantity of data and calculation. This can be expensive and time-consuming, particularly for dynamic, sizable portfolios with a wide range of components and assets. APT also requires continuous update and observation of the variables and their values as they are subject to change over time as a result of events, developments, and market conditions. This may impact the accuracy and consistency of the model by introducing instability and uncertainty. APT also makes the assumption that all assets have needed returns equal to their expected returns and that there are no arbitrage opportunities in the market.

Conclusion

In summary, Arbitrage pricing theory describes asset returns through a myriad of factors. it incorporates flexibility and all-inclusive risk measures in asset pricing or returns. The model provides a comprehensive framework to understand the risk-return relationship which is essential in understanding financial markets dynamics. It helps discover the mispricing opportunities by contrasting the real market price of an asset with its intrinsic theoretical value. APT also refines the

measuring of risk by breaking down the risk of assets into factor hazards which allows for better portfolios and risk diversification. Naturally, there are also some limitations to APT, such as selecting precisely the factors that determine asset prices making it difficult to identify and quantify the factors. However, APT is a useful resource in understanding the complexity of financial markets for scholars, investors as well finance professionals. Therefore, Arbitrage pricing theory is relevant in identify and exploiting mispriced securities and it enhances the risk assessment capabilities of finance professionals.

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