Pricing Downside Risk in Arbitrage Pricing Theory: A Comparison Across Emerging and Developed Markets

Syed Asim Shah[1] Muhammad Khan[2] Hassan Raza[3]

Abstract

The research study aims to test the new augmented and improved version of the Arbitrage Pricing Theory (APT), termed Downside Risk-based Arbitrage Pricing Theory (DR-APT). The augmented version is based on the inclusion of the security factors downside betas, semi-variance, and semi-covariance risk methods. The inclusion of these new risk factors improves both the theoretical and methodological applications of the model in response to the limitations and restrictions of the conventional factors' models. The mean-variance hypothesis is replaced by the mean-semi-variance hypothesis and the asymmetric behavior of stock returns' distribution empirically suggests the use of an alternative factors' model, based on the downside risk. This comparative study is based on the monthly stock returns of 199 firms listed on the PSX and 1073 firms listed on NYSE. The observed economic, financial and global factors are the explained and stock returns are the explanatory variables for the study period of 1997-2017. The findings of the study indicate that the DR-APT model with pricing restrictions in the form of unconditional linear factors model endows the better performance over the study period. All of the observed pricing factors, except exports for Pakistan and exports along with the exchange rate for the USA are significant for pricing the security returns in the augmented DR-APT model. The findings of all the tests corroborate the DR-APT as a better model to price stock returns in volatile emerging and developed markets conditions compared to the conventional APT model. The outcomes of the study are useful for the investment and fund managers, investors, economists, and company managers for forecasting security returns, cost of capital calculations, risk assessment and firm valuations.

Keywords: Downside risk, Semi-variance, Semi-covariance, Downside beta, Downside risk-based Arbitrage Pricing Theory (DR-APT)

Introduction and Background of the Study

The asset pricing models and theories based on the conventional mean-variance framework posits various limitations and remain debatable in literature. In these models, the factor betas that explained the systematic risk of asset or portfolio is proved to be

[1] Iqra University, Islamabad. E-mail: sashah@numl.edu.pk.
[2] Iqra University, Islamabad.
[3] National University of Modern Languages, Islamabad.

restrictive, deficient and a controversial measure (Estrada 2002, 2005; Grootveld & Hallerbach, 1999). Many empirical studies in the framework of both single Index and factors model, specifically APT alike multifactor asset pricing models reject the hypothesis based on the mean-variance framework, the normality of security returns and application of common factor-betas in pricing the stock returns (Chunhachinda *et al.*, 1997; Prakash *et al.*, 2003; Singleton & Wingender, 1986).

In juxtaposition to the mentioned empirical literature opposing the application of variance and standard deviation to measure the systematic risk of asset return postulate number of drawbacks and limitations (Markowitz, 1959; Tavakoli Baghdadabad *et al.*, 2011). These conventional methods capture both upper and lower tails in calculating the deviation around the average return. As a result, this method of risk is considered to be the deficient measure of risk in asset pricing when the resulting distribution of security or asset returns is asymmetric. The robust empirical literature evidently supports that the return distribution of capital assets is not normal or symmetrical. It includes high-level kurtosis of the asset return distribution, skewed return distribution of assets and portfolios and greater anomalous returns in highly volatile capital markets (Chunhachinda *et al.*, 1997; Tavakoli Baghdadabad & Glabadanidis, 2013).

Therefore, the evaluation of the literature on asset pricing dynamics clearly reveals the inclusion of new risk measures such as semi-variance, semi-deviation, and semi-covariance in place of conventional risk measures. These risk measures encapsulate the downside risk dimension of asset and portfolio returns and should be considered in the APT model for asset pricing in various capital markets. These risk proxies capture the security returns on the downside or negative side below the mean, pre-targeted level return or in some situations below the risk-free return and intuitively more appealing as compared to variance (Galagedera, 2007). Another deficiency of the conventional variance and standard deviation risk measures is that these risk measures are not able to encapsulate the effects of security transaction costs. Thus, the downside risk proxies, accurately complemented with investor risk instincts and hypothesis, earned both empirical and practical acceptance among the community.

Moreover, the recent past literature on the application of the downside risk beta proxies of the semi-variance, semi-deviation, and semi-covariance is tested on the single index asset pricing models (Ang *et al.*, 2001; Estrada, 2005, 2007). The allied empirical studies provide strong empirical support for the downside risk-based beta superiority compared to the conventional beta in asset pricing. The inclusion of the downside risk beta confirms the hypothesis that the downside risk-based asset pricing models outperform the conventional risk-based models tested in various stock markets (Harvey & Siddique, 2000).

In single index model testing, Estrada (2002) and Estrada and Serra (2005) suggest the new downside risk proxy based on semi-variance and semi-covariance, named the downside systematic risk. The augmented model based on the downside risk, named DCAPM outperforms the conventional risk-based CAPM and has greater explanatory power than the traditional single-factor capital asset pricing model. The empirical evidence indicates that the downside risk-based beta is theoretically and contextually a better risk measure than conventional beta based on the systematic risk (Post & Van Vliet, 2006). Considering these different strands of literature on various asset pricing models for asset pricing in various markets, it is observed that none of the studies have applied or tested the concept of the downside beta in the APT framework in comparison across emerging and developed markets.

In order to bridge the critical gap figured out in the existing asset pricing literature on single factor and multifactor asset pricing models, explicitly the APT, previous empirical literature indicates that the traditional APT model has some limitations with respect to selection and deficiency of factor betas, the inclusion of merely macroeconomic variables in pricing stock return. But most significantly, none of the previous studies in the APT framework contemplates the application of the downside risk-based betas, measured by semi-variance and semi-covariance for asset pricing through the APT model. This study is designed to fill out this empirical and methodological gap found in past literature by considering the application of the downside risk-based beta constructed on the notion of semi-variance and semi-covariance in the APT model for pricing asset returns.

Second, the study proposes the new augmented methodology named the DR-APT, the better and superior model of pricing stock returns across emerging and developed markets, compared to the conventional APT. Third, this study elongates the previous studies done on the single factor asset pricing models to multifactor pricing models based on the downside risk. Finally, the study proposes and tests the relationship between hybrid index factors based on financial, economic and global financial-economic factors and stock returns in the framework of the DR-APT.

The selection and inclusion of a mix of economic and financial variables in the DR-APT model are based on the conventional empirical relationship of economic policies, decisions and stock returns. The prior literature both theoretically and empirically provides evidence of a country's economic policies and decisions on the stock market performance (Shivangi, 2012). The economic news is directly and indirectly incorporated in stock prices that are ultimately used in various asset pricing models for the cost of equity and valuation calculations.

Review of Empirical Studies

The study carried out on the capital markets of emerging and developed markets from 1970 to 2000 report that the semi-variance and semi-covariance are a better measure of risk than the variance (Estrada, 2002, 2004). The semi-variance and semi-covariance method is effective in capturing the maximum portion of the expected returns and has greater explanatory power in risk-return mechanics. Estrada (2007), in its extended study, recommended the augmented CAPM model based on the beta ratio of the inverse values. Utilizing the data of the capital markets of emerging and developed markets from 1988 to 2000, the proxy beta ratio of the inverse values explicated 55% of the capital market return volatility in emerging markets and almost 44% of stock return volatility in developed markets. The average stock return depicted more sensitivity to the variation of the negative beta values compared to the variations of the conventional beta ratio. Furthermore, the downside risk methods in emerging markets perform better with the skewed return distribution.

The expected return comparison across developed and emerging markets, based on the downside risk, indicates the relative findings. The emerging markets, compared to the developed markets, realized higher mean-expected returns based on the downside risk proxies. Dobrynskaya (2014) and Post and Vliet (2004) confirm the higher significance of the negative beta ratio, which is directly reflected in the average stock return of the security or the portfolio. Dobrynskaya's (2014) currency market analysis revealed that the higher-level movements in the interest rates in a particular economy determines the increase in the level of the currency downside risk and its impact on the resulting asset pricing. Jaama, Lam and Isa's (2011) empirical study in the dynamics of the Kuala Lumpur Stock Market, based on the downside risk insinuations on the efficiency of investment portfolios, discloses decisive results. The findings report that the downside risk measure is a more effective measure of risk, compared to the conventional mean-variance method. The methodology proposed in this study is proved to be a better option for investors, and portfolio managers alike, who want to avoid risk.

Alles and Murray (2013) studied the association between the downside risk-based methods and the mean asset returns in the growing Asian stock markets, over 10 years, from June 1999 to May 2009. In contrast to past empirical studies, they split the entire example into two sub-samples, comprising of analysis in the downturn and upturn periods. In the downturn period, asset returns were under or over the targeted risk-free rate. In the two timeframes, all downside-based risk methods were valued. In the upturn or downturn period, the study found that the risk for the downside beta was reasonably high. At the point when the upturn and downturn were joined, this premium ended up irrelevant.

The downside risk-based beta is a typical measure utilized by evaluators and researchers in downside risk estimation. Nonetheless, as per Pedersen and Hwang (2007), the downside risk-based beta is not a fitting proportion of the downside risk in all stock or security markets. Numerous scholars have recommended other methods of the downside-based risk; to be specific, downside co-skewness, drawdown risk method, Value at Risk (VaR) and Conditional Value at Risk (CVaR). For instance, in the US capital markets, for the time frame from July 1963 to December 1993, Harvey and Siddique (2000) see that contingent co-skewness elucidates the cross-sectional variability in the expected stock returns, and restrictive co-skewness seizures the asymmetry in the targeted risk, specifically the downside risk. Galagedera and Brooks (2007) confirm that downside co-skewness is better at describing the cross-sectional returns in twenty-seven developing markets than the drawback beta, with test periods starting in December 1987, else 1992 through December 2004.

The implications of the downside risk methods, to explain the cross-sectional variation in return in relation to the excess return was tested in emerging and developed markets (Galagedera, 2009). The information for emerging markets began from January 1993 to June 2006, and for developed markets, from January 1970 to June 2006. The study utilized both the downside-based risk beta and the downside co-skewness as measures of the downside risk. The findings of the study recommend that in developed markets, neither proxies of the downside are superior to the conventional CAPM beta. On the other hand, in emerging stock markets, downside co-skewness elucidates stock returns superior to either the downside risk-based beta or the CAPM beta. In this way, downside co-skewness and downside risk-based beta are both utilized as proportions of the downside risk in this study. The empirical results contrast from past studies in putting together downside skewness, with respect to the proportion of deliberate co-skewness risk proposed by Ang *et al.* (2006), instead of the proportion of the deliberate co-skewness chance proposed by Kraus and Litzenberger (1976) in past empirical studies.

In the groundwork of empirical literature on downside risk, it is worth a mention to include the downside risk in asset pricing. Prior studies largely supported the use of the downside risk and various downside risk measures, such as semi-variance and semi-covariance rather than the conventional variance-based beta in the single-factor asset pricing models, like the CAPM. Based on the empirical support for the single-factor asset pricing models, the use of the downside risk and its various measures for asset pricing in the framework of a multifactor asset pricing model like the APT is considered to be a valuable contribution to both theoretical and empirical research.

The above-mentioned literature indicates the two key points related to asset pricing studies. First, these studies deliberated various factor-betas in the APT framework, based on the conventional risk measures of variance, standard deviation, and covariance in their traditional format. Second, the majority study findings reported that the asset and portfolios were influenced by a number of economic, financial and other factors that directly influenced their pricing and valuation. Based on the empirical literature, various methods are suggested for the selection and extraction of economic, financial and other global factors. This study implemented the Chen *et al.* (1986) technique in the selection and extraction of various factors included in the DR-APT model for factors' selection. These extracted factors include economic factors, financial factors, and global factors.

New Augmented DR-APT Model

The augmented form of the APT model, based on the convention of the downside risk, named DR-APT, is empirically and statically elucidated in this section. The augmented model is based on the new measures of risk, namely semi-variance, semi-covariance, and semi-deviation, in place of the traditional variance and standard deviation risk method. This study further extends this notion to model factor-specific betas and considers the use of the downside risk-based betas to substitute the traditional factors' betas. This extended and augmented model is called the DR-APT, and is mathematically expressed as follows:

$$R_{it} = E(R_{it}) + [\bar{\delta}_{i1} - R_f]b_{i1}^d + \ldots\ldots + [\bar{\delta}_{kt} - R_f]b_{ik}^d + \mu_{it}, \qquad i = 1, \ldots\ldots, N$$

The terms in the equation given above for the DR-APT model, $E(R_{it}),\ R_{it},\ \bar{\delta}_{kt},\ R_f$ and b_{it}^d represent the ex-ante anticipated return of the *i*th security, the return on stock I in time t, the expected return on the stock or portfolio with unit sensitivity to the *k*th factor and zero sensitivity to all other factors or the *k*th factor with $E(\mu_{it}) = 0$ $E(\delta_{kt}\mu_{it}) = 0$, and $E(\mu_{it}\mu_{it}) = 0$ when i≠j or σ^2 when I=j, the risk-free rate, and the sensitivity of lower returns than a mean return on the *i*th asset to the *k*th factor (downside risk proxy based on semi-variance and semi-covariance).

The DR-APT equation given above postulates the forecasting error of the security returns based on K-factors, that is communal to all the selected stocks ($\bar{\delta}_k - R_f$). Similar is the case with the idiosyncratic term (μ) specific to stock *i*. Accordingly, Ross's (1976) model states the equilibrium projected return of a stock *i* is linearly associated with various factors' loading b^d, expressed in the equation below:

$$(ER_{it}) = \lambda_0 + [\lambda_1 - \lambda_0]b_{i1}^d + \ldots\ldots\ldots\ldots + [\lambda_k - \lambda_0]b_{ik}^d$$

The symbols λ_0 and λ_k denote the return of the risk-free security (R_f) and the variation in the market price with respect to the k^{th} factor. The equation above is the representation of the DR-APT model that explicates the relationship between the security return and the downside risk premia related to the systematic risk factors in the economy. In the case of the CAPM related model, based on the downside risk, k=1 is the description of security returns as the linear function of the asset downside beta in the DCAPM models (Estrada, 2002).

The DR-APT, in its empirical implications, provides several advantages. First, this model is testable and is able to assimilate non-linear restrictions on the cross-model equation of the linear factor asset pricing model. In this situation, the value of the risk of the i^{th} factor is considered to be similar for all the selected securities. Second, these pricing restrictions posit the essential conditions for testing the empirical validity of the DR-APT model. Finally, the conditions imposed also permit one to test the robustness of the model at various times and across samples.

Data and Methodology

The aim of this research study is to empirically test the new augmented model of the multifactor asset pricing based on downside risk, named the DR-APT across emerging and developed markets. Panel regression, based on time series data of 199 listed stocks of PSX and 1073 listed stock of NYSE were tested. The stock returns as the dependent variable and seven economic, financial and global factors as the independent variables were used on a monthly basis from 1997 to 2017, to test the DR-APT model. The reason to test the relationship between the various economic, financial and global factors and stock returns is to study the implications of the economic and financial outcomes reflected in stock prices. The stock prices emulate the risk spawned by the economic, financial and global factors.

In the DR-APT model, the dependent variable, that is the month-wise asset returns greater than the risk-free rate of return, is measured as [Min (R_i - R_f, 0)]. The security returns are the dividend-adjusted returns, based on the end-of-month adjusted closing prices. The independent variables are a combination of economic, financial and global predetermined factors. The factors include inflation, represented by the Consumer Price Index (CPI), Industrial Production Index (IPI), lending interest rate, exchange rate, exports, total reserves, and benchmark index returns. These factors, comprising the independent variables in the DR-APT model, are measured as [Min (R_i^f - R_f, 0)]. Based on the changing dynamics of both the Pakistan and US capital markets and the financial global atmosphere, it is anticipated that the capital market prices mimic the varying level of risks spawned by these economic, financial and global factors. The data of these factors and the stock returns were extracted from DataStream, World Bank economic indicators publications and the international financial statistics of IMF.

Interpretation and Analysis of the Results

This section of the paper reports the empirical results of the various econometric tests that corroborate whether the augmented DR-APT is better able to price stock returns compared to the conventional APT. The test of the relationship between security returns and the economic, financial and global factors is conducted to report the implications of the augmented DR-APT model. For analyzing the multiple factors in the pricing of the stock returns, the study tested both the linear factors model and the unrestricted linear factors models with the DR-APT model, pricing restrictions for PSX and NYSE stocks. The significance of factors in pricing stock returns and test to assess the validity of both pricing the risk and pricing the restrictions at 5% and 10% were conducted.

The analysis begins with the correlation test of independent variables. Tables 1 and 2 reveal that the variables had a range between -.57 and .91 for Pakistan and -.41 and .87 for the USA. This result could overcome the chance of the autocorrelation effect in the regression test.

Table 1: *Correlation Test of the Study Variables - Pakistan*

Variables	Stocks return	CPI	IPI	Interest Rate	Exchange Rate	Exports	Total Reserves	Market return
Stocks return	1.00							
CPI	-.53	1.00						
IPI	.59	-.38	1.00					
Int-Rates	.91	-.57	.81	1.00				
Ex-Rate	-.21	.01	-.48	-.29	1.00			
Exports	.26	-.39	.56	.47	.64	1.00		
Total Reserves	.39	-.46	.27	-.42	-.22	.55	1.00	
Market return	.33	-.41	.71	.59	-.04	.59	.47	1.00

Table 2: *Correlation Test of the Study Variables - USA*

Variables	Stocks return	CPI	IPI	Interest Rate	Exchange Rate	Exports	Total Reserves	Market return
Stocks return	1.00							
CPI	.47	1.00						
IPI	.64	.46	1.00					
Int-Rates	.87	.62	.76	1.00				
Ex-Rate	-.19	.28	.56	-.25	1.00			
Exports	.31	-.33	.68	.31	.46	1.00		
Total Reserves	.27	-.41	.53	-.38	-.22	.44	1.00	
Market return	.68	-.53	.64	.38	-.15	.51	.56	1.00

Tables 1 and 2 illustrate the output of the serial correlation test of the study variables to examine whether the variables stand independent from each other in both markets, for the period 1997-2017. The stock returns are the individual selected firm stock returns with dividend adjustments. The monthly CPI represents inflation, computed as the proportionate change in the cost to the consumer of purchasing a basket of goods and services for the targeted period. The IPI measures the monetary value of the industrial output on a monthly basis. It is the raw volume of the output produced by the various industries, computed mainly as Fisher's indices with the base year weight. Interest rates are the monthly lending interest rates charged by the commercial banks against loans. The exchange rate is the rate of the Pakistani Rupee computed against the US Dollar, on a monthly basis. For the US it is calculated against UK Pound sterling. Exports are the value of goods and services measured in million US Dollars, sold and delivered to various countries on a monthly basis. Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The market return is the monthly return of the benchmark indexes.

Table 3: *Fixed and Random Effects Model Results*

	Pakistan			USA		
Tests	Statistic	df	Prob.	Statistic	df	Prob.
Redundant fixed effects test						
Cross-section (*F*)	258.34	(21,946,428)	.000*	279.09	(513,942,120)	.000*
Cross-section (Chi-Square)	35,109.12	199	.000*	94,117.23	1072	.000*
Correlated random effects-Hausman test						
Cross-section (random)	.000	7	1.000	.000	7	1.000

*Significant at 1%

Table 3 shows the results of both the fixed and random effects test in the time series regression, for the period 1997-2017, to see whether the random effect or fixed effect is more suitable in the given context. The cross-section, χ^2 and F assessed the mutual implication of the cross-section effect, using the F-test and the χ^2-test, at the given significance level. The results reject the adoption of the random-effects model and support the adoption of the fixed effects model in this study for both countries.

Table 4: *Estimates of Factor Significance in DR-APT Model*

	Pakistan			USA		
Factors	F-statistic	Likelihood ratio	Prob. (χ^2)	F-statistic	Likelihood ratio	Prob. (χ^2)
CPI	94.01	95.01	.000	91.01	83.21	.001
IPI	115.08	117.09	.000	119.10	107.11	.002
Int-Rates	57.88	57.98	.000	63.76	53.07	.004
Ex-Rate	476.32	474.97	.000	411.52	424.43	.004
Exports	19.88	19.99	.002	17.56	16.32	.000
Total Reserves	73.16	49.33	.000	23.06	59.66	.000
Market return	13739.78	13109.34	.000	12787.34	141562.78	.000
D-APT pricing restrictions	χ^2 (1,49,433) = 1.06			χ^2=1.29		

To estimate the augmented DR-APT model, based on the various factors for pricing stock returns, the study estimates the downside risk price in combination with the likelihood ratio test for the DR-APT pricing limits, as reported in Table 4. The results corroborate that the study could not reject H_0, which indicates that cross-sectional limits stand correct at the 5% significance level. This means that the new augmented DR-APT model provides the reasonable explication of the return performance of the stocks traded on the PSX and NYSE. The findings further show that the stock returns are explained by the significant downside risk premium of the seven different factors. All these pricing factors are substantively significant in pricing the security returns in the emerging and developed markets. This is conducted at the 1% and 5% significance level throughout the sample period.

Table 5: *Panel Unit Root Test for DR-APT Model Variables*

	Pakistan						USA					
Variables	Breitung Statistic	T-stat. Prob.	Lm, Pesaran & Shin Statistic	W-stat. Prob.	ADF-Fisher Statistic	χ^2 Prob.	Breitung Statistic	T-stat. Prob.	Lm, Pesaran & Shin Statistic	W-stat. Prob.	ADF-Fisher Statistic	χ^2 Prob.
Returns	-39.35	.000	-23.04	.000	1167.09	.000	-27.873	.001	-28.10	.002	1334.04	.003
CPI	-28.18	.000	-23.15	.000	1090.18	.000	-24.342	.003	-26.87	.000	1125.09	.000
IPI	-23.02	.000	-9.80	.000	473.18	.000	-19.459	.000	-11.56	.000	409.35	.000
Int-Rates	-21.09	.000	-10.82	.000	589.10	.000	-26.173	.000	-14.45	.000	493.23	.000
Ex-Rate	-19.13	.000	-4.98	.000	385.18	.030	-17.897	.000	-7.34	.000	346.45	.005
Exports	-13.18	.000	-4.98	.000	329.10	.041	-15.457	.002	-2.34	.003	367.24	.045
Total Reserves	-29.82	.000	-26.66	.000	1208.44	.000	-30.773	.000	-26.07	.000	1333.66	.000
M-Return	-47.23	.000	-25.19	.000	1437.67	.000	-51.672	.000	-29.45	.000	1309.14	.000

Results in Table 5 are based on the stationarity test of the study variables in both markets, at the 1% and 5% level. To investigate the stationarity of the time series, the study used three different unit root tests, including the Breitung T-stat, Lm, Pesaren and Shin test, and the ADF Fisher χ^2 test. These tests follow that the distribution is asymptotically normal. The findings indicate that all the selected variables used and tested in the augmented DR-APT models are stationary.

Table 6: *Estimates of Coefficients of the Factors Downside Betas of the DR-APT Model*

	Downside Beta Coefficient Estimates					
	Pakistan			USA		
Statistic	Coefficient	t-statistic	p-value	Coefficient	t-statistic	p-value
Constant	.282	8.001	.000	.205	6.004	.000
CPI	.004	3.873	.000	.028	5.322	.000
IPI	.152	8.522	.000	.266	8.829	.000
Interest Rate	.027	3002	.003	-.116	-3.425	.002
Exchange Rate	.038	3.105	.002	-.121	-2.755	.040
Exports	.012	1.381	.179	.218	1.003	.399
Total Reserves	.023	4.104	.000	.138	5.008	.000
Market Return	.823	126.228	.000	.669	108.449	.000
R-Square	.853				R-Square	.557
Adj R-Square	.833				Adj R-Square	.539
Observation	47079				Observation	270396

Table 6 presents the results of the panel regression, based on the data of listed stocks on the PSX and the NYSE, for the period 1997-2017. The findings of the seven factors of the DR-APT model corroborate that the increase in inflation, industrial production, interest rate, exchange rate, export, total reserves, and benchmark return increase the stock returns for Pakistan. In terms of the magnitude of their impact, market return, industrial production, inflation, exchange rate, interest rate, total reserves, and export, in this sequence, have a substantial impact on the returns of Pakistan's capital market. The reported p-values in the table show that the relationships between the various independent variables, except for exports, and dependent variable stock returns, are significant at the 5% level. For USA, a decrease in interest and exchange rate results increase in stock returns, else brings otherwise. The p-values indicate except for interest rate and exports other explanatory variables are significant to influence stock returns.

Earlier studies in this area of research provided evidence of an inverse association between variation in interest rates, inflation and asset returns. On the contrary, contemporary studies, such as those of Czaja *et al.* (2009), Korkeamäki (2011) and Reilly *et al.* (2007), revealed that this association does not remain constant over time. In particular, the interest rate and asset pricing connection seem to unveil a downward movement over the past years, the reason for this variant tendency is the increased availability of better tools for managing interest rate risk premia. More precisely, the remarkable growth in interest rate derivative markets and the expansion of corporate bond markets as a result of the Euro's adoption may have played a key role in this respect. In addition, companies' asset returns incline to be more closely linked to movements in long-run interest rates compare to the movements in short-term rates (Bartram, 2002; Czaja *et al.*, 2009; Ferrer *et al.*, 2010; Olugbode *et al.*, 2014).

Some of the other profound theoretical reasons that justify a positive connection between these variables are given below. First, interest rates and stock markets may spillover in the same direction, ensuing variations in macroeconomic factors such as economic projections. Second, the presence of flight-to-quality effects from stocks to bonds in an environment of increased financial market uncertainty, such as that in force during the recent global financial crisis, may also have contributed to the emergence of a positive association between changes in bond yields and equity returns as well the inflation. Flight-to-quality occurs in times of financial crises as investors move capital away from risky assets such as shares toward safer investments of Government treasury securities. This brings to a dramatic decrease in the return on long-term government bonds because of the large increase in the demand for this type of securities and generates a positive association between variation in returns on sovereign bonds and security returns.

Table 7: *Results of the Factors Semi-variance, Risk Premium, Downside Risk and its Price*

	Pakistan				USA			
Factors	Factors semi-variance	Risk premium	Factors downside betas	Price of downside risk	Factors semi-variance	Risk premium	Factors downside betas	Price of downside risk
CPI	5.191	-3.041	1.792	-.586	4.457	-2.099	1.027	-.471
IPI	1.972	-1.292	1.382	-.655	1.879	-1.003	1.003	-.533
Interest Rates	15.187	-5.135	4.872	-.338	12.164	-4.045	3.180	-.333
Exchange Rate	16.136	-5.099	5.121	-.316	13.112	-3.989	3.782	-.304
Exports	7.190	-1.934	1.892	-.269	5.341	-1.087	1.072	-.204
Total Reserves	21.987	-7.007	6.778	-.319	28.227	-6.882	5.118	-.244
Market return	.220	-.392	.502	-1.785	.287	-.430	.217	-1.498
Average	9.697	-3.414	3.191	-.610	9.353	-2.791	2.200	-.512

The results in Table 7 provide the calculation and measurement of the semi-variance, risk premium and downside betas for the selected factors and the relationship between them. Earlier research studies on asset pricing indicate that risk premium is driven by the number of financial and economic variables (Azeez & Yonezwa, 2006; Lii, 1998). This study based its findings on the relationship between the factors semi-variance and downside risk premia with the restrictive instabilities of the economic, financial, and global risk factors.

The study findings indicate the significant relationship between the semi-variance risk measure, downside risk beta and the worth of the downside risk of the seven factors. The increase in the semi-variance of the respective factor brings an increase in the downside risk beta and ultimately the rise in the price of the downside risk. The rise in the factor semi-variance causes a decline in the downside risk premium for each of the economic, financial and global risk factors. Due to this, both the measures, the downside risk price, and factors downside betas increase as a result of the increase in the factor semi-variance during the study period. In this study, the downside risk is measured as $\lambda_i = Min\ [E(R_i) - R_f]$, where R_i denotes a factor return.

The results of the study are in corroboration with earlier studies that incorporate the downside risk factor in the asset pricing model. Estrada (2002, 2005 and 2007), Post and Vilet (2004), Ang, Xing, and Chen (2006), Javid and Ahmad (2011), Foong, and Goh (2012), Tahir *et al.* (2013) and Rashid and Hamid (2015) report the stocks that plunge with downward volatility should be compensated for bearing downside risk suggested by this study. The results reveal that the investor exposed to downside volatility earns an extra positive return in upturns period, but they confront excess losses in downturn periods (Galagedera & Brooks, 2007). The values of the downside risk premium and downside betas stipulate the exposure to downside risk and are priced in both markets. The downside risk methods of semi-variance and semi-deviation are proved to be more plausible measures of risk for pricing returns concerning excess returns reported by Galagedera (2009) and Estrada (2002, 2004) in CAPM related models.

Conclusion

In this study, the conventional APT model is amended using augmented downside risk factors to form a new model, named DR-APT, for pricing stock returns of PSX and NYSE. The study, in its first stance, discovers various economic, financial and global factors affecting the asset returns, and as the ultimate source of systematic or idiosyncratic risk. In the second stance, the various economic, financial and global factors, with their downside betas are tested against asset returns to see whether these risk factors are better able to value the stock returns.

The results of the study show that the pricing-based limits of the augmented DR-APT model could not be precluded in the case of the unconditional linear factors' model. As reported, six out of the seven risk factors for PSX and five out of seven factors for NYSE significantly explained the stock returns and were adequate to price it in the DR-APT model. The findings of all statistical tests confirm the DR-APT as a valid and better multi-factor asset pricing model. Over the entire sample period of the study, the DR-APT model performs well and empirically supports the downside risk-based pricing mechanism of the asset pricing theory. Similarly, the findings of the robustness control model also endorse the application of the DR-APT model for pricing stock returns. The majority of the various study variables, except exports for the PSX, and both exports and interest for the NYSE, are statistically significant over the target period.

Seven different risk factors are representing the economic, financial and global outcomes of policies and decisions and are the source of systematic risk. These factors significantly explained the variation and volatility in the returns of the emerging and developed capital markets over the period.

The results of the study have implications for asset pricing, portfolio construction, valuations and cost of equity calculations for capital budgeting decisions. Specifically, the findings of the study are of useful interest to the investors on PSX for formulating investment strategies. Explicitly, the outcomes benefit the investors to figure out the suitable measure of risk under given conditions and to construct an optimal portfolio. For the fund and firm managers to conduct cost of equity calculations in the capital investment decisions under adverse situations. The outcomes of the study reveal that the risk-return relationship based on the mean-variance hypothesis is negative. This mechanism is not appropriate for assessing the risk of securities on PSX and NYSE in downward conditions. Compared to the Mean-Variance Hypothesis (MVH), the Mean Semi-variance Hypothesis (MSH) outperforms in quantifying the risk premium of factors driving the stock returns.

References

Acheampong, P., & Agalega, E. (2013). Does the capital assets pricing model (CAPM) predict stock market returns in Ghana? Evidence from selected stocks on the Ghana Stock Exchange. *Research Journal of Finance and Accounting*, *4*(9), 27-26.

Alles, L., & Murray, L. (2013). Rewards for downside risk in Asian markets. *Journal of Banking & Finance*, *37*(7), 2501-2509.

Ang, A., Hodrick, R., Xing, Y.H., Zhang, X.Y., 2006a. The cross-section of volatility and expected returns. *Journal of Finance 61*(1), 259–299.

Antoniou, C., Doukas, J. A., & Subrahmanyam, A. (2015). Investor sentiment, beta, and the cost of equity capital. *Management Science*, *62*(2), 347-367.

Azeez, A. A., & Yonezawa, Y. (2006). Macroeconomic factors and the empirical content of the Arbitrage Pricing Theory in the Japanese stock market. *Japan and the World Economy*, *18*(4), 568-591.

Beenstock, M., & Chan, K. F. (1988). Economic forces in the London stock market. *Oxford Bulletin of Economics and Statistics, 50*(1), 27-39.

Brown, S. J., & Otsuki, T. (1990). *A global asset pricing model*. Working paper, New York University.

Burmeister, E., & Wall, K. D. (1986). The arbitrage pricing theory and macroeconomic factor measures. *Financial Review*, *21*(1), 1-20.

Cho, D. C., Elton, E. J., & Gruber, M. J. (1984). On the robustness of the Roll and Ross arbitrage pricing theory. *Journal of Financial and Quantitative Analysis, 19*(1), 1-10.

Chunhachinda, P., Dandapani, K., Hamid, S., & Prakash, A. J. (1997). Portfolio selection and skewness: Evidence from international stock markets. *Journal of Banking & Finance, 21*(2), 143-167.

Connor, G., & Korajczyk, R. A. (1986). Performance measurement with the arbitrage pricing theory: A new framework for analysis. *Journal of Financial Economics, 15*(3), 373-394.

Connor, G., & Korajczyk, R. A. (1988). Risk and return in an equilibrium APT: Application of a new test methodology. *Journal of Financial Economics, 21*(2), 255-289.

Dittmar, R. F. (2002). Nonlinear pricing kernels, kurtosis preference, and evidence from the cross-section of equity returns. *The Journal of Finance, 57*(1), 369-403.

Dobrynskaya, V. (2014). Downside market risk of carrying trades. *Review of Finance, 18*(5), 1885-1913.

Estrada, J. & Serra, A. P. (2005) Risk and Return in Emerging Markets: Family Matters. *Journal of Multinational Financial Management*, *15*(3), 257-272.

Estrada, J. (2002). Systematic Risk in Emerging Markets: The D-CAPM. Emerging Markets.

Estrada, J. (2007). Mean-semivariance behaviour: Downside risk and capital asset pricing. *International Review of Economics & Finance*, *16*(2), 169-185.

Estrada, J., & Serra, A. P. (2005). Risk and return in emerging markets: family matters. *Journal of Multinational Financial Management*, *15*(3), 257-272.

Galagedera, D. U. (2009). The economic significance of the downside risk in developed and emerging markets. *Applied Economics Letters*, *16*(16), 1627-1632.

Galagedera, D. U., & Brooks, R. D. (2007). Is co-skewness a better measure of risk in the downside than downside beta? Evidence in emerging market data. *Journal of Multinational Financial Management*, *17*(3), 214-230.

Gan, C., Lee, M., Yong, H. H. A., & Zhang, J. (2006). Macroeconomic variables and stock market interactions: New Zealand evidence. *Investment Management and Financial Innovations*, *3*(4), 89-101.

Gilbert, T., Hrdlicka, C., Kalodimos, J., & Siegel, S. (2014). Daily data is bad for the beta: Opacity and frequency-dependent betas. *The Review of Asset Pricing Studies*, *4*(1), 78-117.

Harvey, C. R., & Siddique, A. (2000). Conditional skewness in asset pricing tests. *The Journal of Finance*, *55*(3), 1263-1295.

Huang, X. (2008). Mean-semivariance models for fuzzy portfolio selection. *Journal of Computational and Applied Mathematics*, *217*(1), 1-8.

Iqbal, J., Brooks, R., & Galagedera, D. U. (2010). Testing conditional asset pricing models: An emerging market perspective. *Journal of International Money and Finance, 29*(5), 897-918.

Jaaman S. H., Lam W. H., Isa Z. (2011), Different downside risk approaches in portfolio optimization. *Journal of Quality Measurement and Analysis, 7*(1), 77-84.

Lehmann, B. N., & Modest, D. M. (1988). The empirical foundations of the arbitrage pricing theory. *Journal of Financial Economics*, *21*(2), 213-254.

Levy, M., & Roll, R. (2010). The Market Portfolio May Be Mean/Variance Efficient After All: The Market Portfolio. *The Review of Financial Studies*, *23*(6), 2464-2491.

Pedersen, C. S., & Hwang, S. (2007). Does downside beta matter in asset pricing? *Applied Financial Economics*, *17*(12), 961-978.

Post, T., & Levy, H. (2005). Does risk-seeking drive stock prices? A stochastic dominance analysis of aggregate investor preferences and beliefs. *The Review of Financial Studies*, *18*(3), 925-953.

Post, T., & Van Vliet, P. (2005). Conditional downside risk and the CAPM REPORT SERIES. *Management*.

Post, T., & Van Vliet, P. (2006). Downside risk and asset pricing. *Journal of Banking & Finance*, *30*(3), 823-849.

Roll, R., & Ross, S. A. (1977). Comments on qualitative results for investment proportions. *Journal of Financial Economics*, *5*(2), 265-268.

Roll, R., & Ross, S. A. (1980). An empirical investigation of the arbitrage pricing theory. *The Journal of Finance*, *35*(5), 1073-1103.

Roll, R., & Ross, S. A. (1994). On the cross‐ sectional relation between expected returns and betas. *The Journal of Finance*, *49*(1), 101-121.

Sadorsky, P. (2001). Risk factors in stock returns of Canadian oil and gas companies. *Energy Economics*, *23*(1), 17-28.