THE PERFORMANCE OF ASSET PRICING MODELS BEFORE, DURING, AND AFTER AN EMERGING MARKET FINANCIAL CRISIS: EVIDENCE FROM INDONESIA

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ABSTRACT

Due to the dynamic nature of stock market risk and return measurement, financial practitioners and academics are continuously concerned with the development of asset pricing studies. Moreover, validity of the existing theories in the recent Asian financial crises years stimulates additional challenges to the discipline. This paper investigates the ability of Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) in explaining excess returns of portfolios of stocks traded on the Jakarta Stock Exchange (JKSE). The study assesses the theories using data from 3 different periods: the pre-crisis period (1992-1997), the crisis period (1997-2001), and the post-crisis period (2001-2007). Our finding show that Beta does not single handedly explain portfolio excess returns. The, APT is able to explain the portfolio excess returns in the observation periods were excess return averages are found to be consistently negative. We also find that spread between the central bank rate and commercial bank rate is a constantly significant variable, while risk-premiums vary over the observation periods.

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KEYWORDS*:* CAPM, APT, Financial Crisis

INTRODUCTION

The transformation in financial science and practice has engendered significant advancement in asset pricing approaches. This progress has been proven to be much influenced by the dynamic phenomena of macroeconomic indicators. Since most of the invented asset pricing models are constructed and re-examined using financial and macroeconomic data of developed economies, which is more stable and predictable than that of developing economies, performance of the models using developing economies' data remains questionable. To be more specific, the recent, unanticipated destructive Asian financial crisis has provided more tough challenges to the validity of the models in emerging markets.

Two popular asset-pricing models, namely the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT), had been well accepted by financial practitioners and academics in emerging economies prior to the Asian financial crises. Both models certainly show some strengths and weaknesses. Nevertheless, the models and the associated assumptions have been theoretically and empirically proven to be highly accurate and are generally accepted. This acceptance occurs because of the models' ability to identify dominant factors in asset pricing.

In this study, we examine how valid the two models are in three different periods based on Indonesian economic performance. In particular, the study is aimed at revealing the validity of CAPM and APT before, during, and after the Asian crisis affected the Indonesian economy. In this study, we conduct tests using Indonesian macroeconomic data, as well as data of stocks traded on the Jakarta Stock Exchange (JKSE). The observation periods include a before-crisis period (1992-1997), during-crisis period (1997-

2001), and after-crisis period (2001–2007). The total number of observations used for each period of ranges between 40,159 and 67,012. In this research, we investigate whether there are linear and positive relationships between Beta of economic factors and the expected excess return, and whether APT is effective in pricing assets in the three different periods. Indonesia is chosen as the subject of the study as its economy was the most affected by the crises. The more important reason is that Indonesian stock market development has been influenced by banking industry circumstances and regulation change, which were widely believed to be the main mechanism for the contagious crisis.

The remainder of the paper is organized as follows. In session 2, we briefly summarize the CAPM and APT principles, and reveal some relevant studies conducted in Asian markets. In session 3, we explain the division of data and periods of observation, as well as the research methodology. We use rolling period mechanism to overcome some obstacles from the transaction data. In session 4, we explain the empirical results and findings. We describe validation of CAPM and APT in the three different periods. At the end, we conclude with a brief discussion.

LITERATURE REVIEW

Sharpe (1961) proposed the Capital Asset Pricing Model (CAPM) and revised his theory in 1964. This model was supported by Lintner (1965). The basic tenet of the model is in line with a theory proposed by Markowitz, in which covariance of an asset related to market index is defined as beta. Following the invention, some academics and practitioners tried to empirically test the model, such as Roll (1977, 1978) who criticizeded the model, and Merton (1973) who offered an alternative concept (i.e. Inter-temporal CAPM). Another asset-pricing model was introduced by Ross (1976), namely Arbitrage Pricing Theory (APT).

In the CAPM theory, the market model is used to estimate beta. The market model of Fama (1976: 132) is formulated as $\widetilde{R}_{it} = \widetilde{a}_i + \widetilde{b}_i.\widetilde{R}_{mt} + \widetilde{e}_{it}$, where t=1,2,3,…,T. When the joint distribution of $\widetilde{R}_{it}$ and $\widetilde{R}_{mt}$ is Bivariate Normal then $E(\widetilde{R}_{it}\left|\widetilde{R}_{mt}\right.)$ is a linear function of: $E(\widetilde{R}_{it}|R_{mt}) = \alpha_i + \beta_i.R_{mt}$, where α_i and β_i is constant; a_i and b_i are random variables as they are unobserved determined from a probability distribution. If $\widetilde{R}_{it}$ and $\widetilde{R}_{mt}$ are a known sample then we move from the estimator arena to the estimation arena, where all Tilde signs are removed, and a_i and b_i are estimators of α_i , β_i and $\widetilde{e}_{it}$ (residual).

In the CAPM tests, two pass regressions are conducted, i.e. Time Series Regression (First Pass), and Cross Sectional Regression (Second Pass). In the first pass, the calculation is aimed at estimating beta, resulting from regression between actual returns of stock *I* and market return, as well as at investigating the suitability between the data and the model through examination of the excess returns ($\mu_j - r_f$ and $\mu_m - r_f$). In the second pass, the calculation involves average excess returns of each asset and estimation beta obtained from the first pass. The objective is to estimate the Security Market Line (SML). To estimate the line, the following regression equation is employed:

$$r_i = \gamma_0 + \gamma_1 \beta_j + \eta_j \quad (1)$$

where j = 1,2,3,...n, γ_0 is the excess return that can be expected from a zero beta portofolio and γ_1 is the excess return that can be expected from a market portofolio less the excess return expected from zero beta portofolio.

Alternatively, we can utilize the Fama and Machbeth (1973*)* equation:

$$R_{it} = \gamma_{it} + \gamma_{2t} \beta_{im} + \eta_{it} \quad (2)$$

where j = 1,2,3,...n, γ_{it} is the intercept of a standard zero-beta portfolio[$E(R_{om})$] return with conditions of: $\sum_{i=1}^{n} X_{i1} = 1$ and $\sum_{i=1}^{n} X_{i1}\beta_{im} = 0$, γ_{2t} is the return of a zero Investment portfolio [$E(R_m)$-$E(R_{om})$] and that with $\beta_{pm} = 1,0$, under the conditions of: $\sum_{i=1}^{n} X_{i2} = 0$ and $\sum_{i=1}^{n} X_{i2}\beta_{im} = 1$. If the test were done on portfolio, the equation would be:

$$R_{pt} = \gamma_{it} + \gamma_{2t}\ \beta_{pm,\,t-1} + \eta_{pt} \quad (3)$$

where j = 1,2,3,...n

The APT was initiated by Ross (1976, 1977). This approach is used to assess the equilibrium relationship between risk and expected return. In the middle of his critique on the CAPM, Roll (1977, 1978), Ross (1976) developed APT as an alternative that can explain problems in the CAPM. In contrast to Sharpe (1963) that introduced a Single Index Model (SIM), through APT, Ross (1976, 1977) suggested a Multi Factor Model for measuring systematic risk. Multiple Factor Models indicate a linear relationship between return of asset *I* and *N* influencing specific factors, through the following formula:

$$R_i = b_{i0} + b_{i1} I_1 + b_{i2} I_2 + \ldots + b_{ij} I_j + \ldots bi_F I_F + e_i \quad (4)$$

Where I_j is a factor from *I* to F, b_{i0} is an unsystematic predictable constant component, e_i is a component of unpredictable unsystematic return that is normally distributed with zero average and constant variance. The value of bij is the beta of asset *I* on factor *j*, I = 1,2,3,…and *N* is the number of assets. In APT calculations, it is necessary to consider variables of time-series observation, such as interest, yield spread, inflation, and other economic variables that influence asset returns. Therefore, APT reveals the effects of combination of all possible risk factors.

Among several popular studies on CAPM, Fama and French (1992) find that the relationship between beta and portfolio return is flat, and that size effects exist. Result of a study done by Jaganathan and Wang (1993) contradict that of Fama and French (1992), as they find that the relationship is positive and significant, as long as beta is allowed to be non-constant due to the business cycle. Meanwhile, on the APT side, Chen Roll and Ross (1986), testing APT, using unpredictable macroeconomic variables, find that some of the respective variables are significantly negatively or positively correlated with portfolio returns. However, there has been debatable whether CAPM or APT is better in explaining expected returns. Bower and Logue (1984), using 1971-1979 data on utility stocks, find that the APT outperforms the CAPM. In contrast, Husnan (1990), who compares performances of the two models on the Jakarta Stock Exchange, find that CAPM outperforms the APT and summarizes seven factors influencing returns.

Similar studies using data from stock markets in some Asian countries show varied conclusions. A study done in China shows that beta exists, and idiosyncratic variance variable and firm size have no effect on the returns. Meanwhile, similar studies in Taiwan and Singapore show that the size effect and book to market value are correlated with portfolio returns. In the Philippines, beta is found to explain stock returns. Hossari (1994), employing Kuala Lumpur Stock Exchange's 1989-1990 data, finds that the APT fails to explain stock returns.

DATA AND METHODOLOGY OF THE STUDY

Data employed in this study includes monthly data of closing price, outstanding number, and dividend of stocks traded on the Jakarta Stock Exchange during the period of 1992:7 – 2007:6. We extraxt the necessary data from the JSX's monthly publication and annual report of the Indonesian Capital Market

Supervisory Agency. We also gather relevant information regarding the stocks, such as stock split, delisted stocks, and suspended stocks from the same sources. Only actively traded stocks are selected for analysis, so that thin trading and non-synchronous trading effects are minimized. Such effects may result in autocorrelation in stock returns. We also employ a rolling period mechanism, due to limited number of transactions and large number of inactively traded stocks. The authors utilize some macroeconomic variables (risk factors) in the analysis. The time-series variables, include unpredictable factors of inflation, $index_{ew}$, production index, exchange rate, and spread (balance between 1-month deposit rate and 1-month central bank rate/*SBI*). The spread is the only variable that has never been used in previous studies.

The calculated stock returns are divided into 2 categories. In the first category, stock returns are used to estimate pre-beta (up-dated in 3-year periods). Stock returns in the second category are calculated using a portfolio formation formula (up-dated in 1-year periods). To observe the consistency level of the models, we separate the observation time frame into some rolling periods, by which we up-date the data to the following 1-month period. This process produces rolling period 1 (1992:07 - 1997:06), period 2 (1997:07 - 2001:06), and period 3 (2001:07 - 2007:06). In this study, we conduct beta estimation three times in searching for an estimated portfolio beta. By doing so, we expect that we can reduce bias from estimated individual stock betas. In testing the two asset pricing models, we utilize approaches that have been used by earlier studies, such as approaches used by Sharpe and Lintner (SL, 1965), Black Jensen and Scholes (BJS, 1972), Fama and Macbeth (FM, 1973), Fama and French (FM, 1992), as well as Chen, Roll and Ross (CRR, 1986).

In this study, we also consider market capitalization value to assess the existence of a size effect in both CAPM and APT validation tests. To check for a surprise factor in the macroeconomic variables, we employ Auto-regressive Integrated Moving Average (ARIMA) model. Through the model, we check the white noise residual (autocorrelation-free residual). The analysis is started from descriptive analysis. Next we use an F-test, t-test, as well as the classical assumption tests (multicollinearity, heteroscedasticity and autocorrelation). In addition to that, we estimate ordinary least square (OLS) and generalized least square (GLS) in our regression to reduce autocorrelation that frequently occurs in pooling data.

EMPIRICAL RESULTS AND FINDINGS

We identify several anomalies taking place in Indonesian economy, particularly in JKSE. From the observed rolling periods, only 65% of the samples satisfy the criterion of being actively traded, meaning that the other 35% of the stocks are not active (not traded at least once a month). We observe portfolios that are constructed based on rolling periods of data.

In size effect context, another anomaly is revealed. The average beta of stocks with large capitalization is higher than that with small capitalization. This finding stands out against findings of previous studies carried out both in Indonesia and overseas. In those studies, stocks with large capitalization are found to have less average beta than that of stocks with small capitalization, since the latter stocks are mostly less liquid. Thus, we can infer that during our study observation period, largely capitalized stocks in JKSE are less liquid. The rationale behind this finding is that during the Asian crisis, USD-denominated debts of the largely capitalized listed companies ballooned without appropriate hedging. This finding further suggests that the long accepted theory of high risk for high return did not hold. In this case, during the crisis, investors realized a poor return on their high-risk stock investment. Another important finding is that stock price movement was quite sensitive to interest rate (spread variable) changes during the crisis. We find that portfolio excess return is less than the market risk premium, which is also negative, demonstrating that portfolio excess return (ERP) is not always greater than market excess return (ERM), violating the CAPM principle (ERP>ERM).

Table 1: Results Cross Sectional Regression Test on CAPM Using Data in 3 Different Periods (FF 1992a)

Fama and French Model $E(r_{pt}) - r_f = y_0 + y_1\hat{\beta}_{pt} + n_{pyz}$

	Y_0	Y_1	R^2	$Obs*R^2$	*Prob*
PERIOD - 1					
OLS	-0.089***	0.054****	0.293		
	(-7.635)	(-4.710)			
White Test				9.501	0.009
LM Test				46.631	0.000
GLS - AR(2)	-0.154	0.008	0.916		
	(-1.982)	-1.436			
White Test				0.872	0.647
LM-Test				2.049	0.163
PERIOD - 2					
OLS	-0.135***	0.067***	0.584		
White Test	(-11.87)	-8.053		23.731	0.010
LM Test					
GLS - AR(2)	-0.064	0.01	0.812		
	(-1.924)	(-1.562)			
White Test				0.342	0.843
LM Test				2.640	0.267
PERIOD - 3					
OLS	-0.096***	0.050***	0.586		
White Test	(-5.781)	-5.772		0.578	0.749
LM Test				10.185	0.001
GLS - AR(1)	-0.113	0.013**	0.940		
	(-1.180)	(2..213)			
White Test				8.772	0.012
LM Test				0.337	0.712

The resulting regression coefficients show that the model passes assumption tests of Multicollinearity, Heteroskedasticity and Autocorrelation at significance level of 10% (*), 5 %(**) and 1 %(***). The asterix signs show the associated t-statistics. One period = 100 Portfolios.

Table 2: Results Cross Sectional Regression Test on CAPM Using Data in 3 Different Periods (FF 1992b)

Fama and French Model $E(r_{pt}) - r_f = y_0 + y_1\hat{\beta}_p + y_2 MV_p + \delta_p$

	Y_0	Y_1	Y_2	R^2	$Obs*R^2$	*Prob*
PERIOD - 1						
OLS	-0.086***	0.036****	-7.10E-17	0.268		
	(-7.635)	(-4.910)	(-0.125)			
White Test					16.859	0.001
LM Test					48.597	0.000
GLS - AR(2)	-0.0662	0.0082	6.33E-15			
	(-0.677)	(-1.591)	(-0.301)			
White Test					7.542	0.110
LM-Test					2.260	0.152
PERIOD - 2						
OLS	-0.161***	0.060***	2.19E-14			
	(-6.405)	(-5.096)	(-1.086)			
White Test						
LM Test						
GLS - AR(2)	-0.006	0.008	-6.65E-15	0.897		
	(-0.215)	(-1.036)	(-0.530)			
White Test					12.675	0.167
LM Test					3.689	0.159
PERIOD - 3						
OLS	-0.113	0.069***	-4.79E-14	0.595		
	(-0.265)	(-5.758)	(-1.572)			
White Test						
LM Test						
GLS - AR(1)	0.05	0.043	-2.93E-14**	0.932		
	(-1.878)	(-0.340)	(-2.268)			
White Test					9.305	0.128
LM Test					1.767	0.515

The resulting regression coefficients show that the model passes assumption tests of Multicollinearity, Heteroskedasticity and Autocorrelation at significance level of 10% (*), 5 %(**) and 1 %(***). The asterix signs show the associated t-statistics. One period = 100 Portfolios.

In addition, the market return is less than the risk-free rate, represented by the 1-month Indonesian central bank rate (BI rate). On average, returns on individual stocks were also less than the BI rate, which was much higher than interest rates in most of other economies at the time. When the BI rate showed down trend, market return was consistently below the BI rate, implying a negative market risk premium. The reward required by investors should be higher when an economic downturn occurs, so the risk premium should have been positive ($R_M > R_f$). The rationale is that investment in Indonesian stock markets was not as attractive as investment in banking services. Meanwhile, investors' high dependence on banking in accessing capital in Indonesia has been demonstrated to be the main factor to induce the crisis. Therefore, this finding may suggest the urgent need for more progressive stock market development in Indonesia, to avoid the reoccurrence of the crisis.

Table 3: Results Cross Sectional Regression Test on CAPM Using Data in 3 Different Periods (FM 1973**)**

Fama and Macbeth Model	$E(r_{p,t}) - r_f = \hat{\gamma}_{0,t} + \hat{\gamma}_{1,t}\beta_{p,t} + \hat{\gamma}_{2,t}\beta^2 p + \hat{\gamma}_{3,t}S_{ep}\eta_{i,t}$						
PERIOD -1	Y_{0t}	Y_{1t}	Y_{2t}	Y_{3t}	R^2-*Adj*	*Obs*R²*	*Prob*
OLS	-0.0152	-0.008	0.014	-4.265**	0.362		
	(-0.563)	(-0.322)	(-1.776)	(-2.747)			
White Test						9.349	0.096
LM Test						44.973	0.000
GLS - AR(2)	-0.056	0.009	0.000	-0.051			
	(-1.756)	(-0.823)	(-0.083)	(-0.034)			
White Test						10.580	0.060
LM-Test						2.156	0.340
PERIOD - 2							
OLS	-0.155	0.122	-0.017	-2.295	0.636		
	(-4.536)	(-3.744)	(-1.940)	(-1.716)			
White Test						9.113	0.105
LM Test						20.550	0.000
GLS - AR(2)	-0.073	0.016	-0.002	0.533	0.797		
	(-1.784)	(-0.942)	(-0.388)	(-0.285)			
White Test						12.758	0.026
LM Test						2.808	0.256
PERIOD - 3							
OLS	-0183***	-0.087***	-0.015**	14.241***	0.85		
	(-8.477)	(-3.972)	(-2.711)	(-5.254)			
White Test						6.246	0.657
LM Test						1.567	0.443

The resulting regression coefficients show that the model passes assumption tests of *Multicollinearity*, *Heteroskedasticity* and *Autocorrelation* at significance level of 10% (*), 5 %(**) and 1 %(***). The asterix signs show the associated t-statistics. One period = 100 Portfolios.

In this study, we also clarify factors that are related to the portfolio excess return through the CAPM and APT tests. Validation process of CAPM and APT are carried out through two stages, i.e. time series regression and cross sectional regression. The former is aimed at assessing the relationship among variables in one period. The latter is intended to see the relationship in multiple periods. Results gained from the models of SL 1965, BJS 1972 and FM 1973 are not adequate, as can be seen in Tables 1, 2, and 3. Therefore, this study is focused on models of FF 1992 and CRR 1986, whose results are explained in this section.

The results show that the CAPM is not effective when JKSE data and Indonesian macroeconomic indicators are used, since beta is not the only factor that explains portfolio excess return. Meanwhile, the finding shows the existence of a size effect, meaning that market capitalization is significant variable (please see Table 2 and 3). The findings also show that the residual variable (variance) in a model, which is positively and significantly correlated with portfolio excess return and the CAPM formula, is not linear. This is indicated by a negative and significant regression coefficient. However, in predicting potential risk, the CAPM is able to explain portfolio excess return in all different rolling periods. In these different economic circumstances, the CAPM model results in R^2-adj ranging from 42.82% to 94.00% (see Table 1, 2, and 3), where almost all regression coefficients of beta (risk premium) are positive.

Table 4: Results Cross Sectional Regression Test on APT Using Data in 3 Different Periods (CRR 1986a)

Chen, Roll and Ross Model	$E(R_{pt}) - r_f = \lambda_{0t} + \lambda_1 bp_{1t} + \lambda_2 bp_{2t} + \lambda_3 bp_{3t} + \lambda_4 bp_{4t} + \lambda_5 bp_{5t} + \varepsilon_{pt}$									
	λ_0	λ_{UI}	λ_{UIEW}	λ_{UIP}	λ_{UK}	λ_{URS}	R^2	$R^2 - adj$	$Obs * R^2$	Prob
PERIOD - 1										
OLS	-0.096***	0.001	0.073***	-0.023**	-0.009	0.002***	0.574	0.523		
	(-5.225)	(-1.699)	(-5.788)	(-2.587)	(-1.036)	(-3.735)				
White Test									6.178	0.822***
LM Test									16.134	0.000
GLS - AR(2)	-0.056**	0.001	0.010	-0.016	-0.0227	0.003*	0.926	0.902		
	(-1.657)	(-0.433)	(-1.422)	(-1.862)	(-0.724)	(-1.876)				
PERIOD - 2										
OLS	-0.084**	0.001	0.060	-0.021	0.016	0.015	0.592	0.479		
	(-2.343)	(-0.907)	(-2.126)	(-1.045)	(-1.073)	(-2.302)				
GLS - AR(1)	-0.092**	0.001	0.035	-0.023	0.02	0.014**	0.755	0.671		
	(-2.374)	(-0.962)	(-1.400)	(-0.959)	(-0.634)	(-2.588)				
White-Test									14.849	0.138***
LM-Test									5.508	0.064
PERIOD - 3										
OLS	-0.040*	0.002	0.0186**	-0.040**	-0.059***	0.027***	0.790	0.722		
	(-1.597)	(-0.767)	(-2.271)	(-2.512)	(-5.132)	(-4.813)			9.930	0.043***
White Test									0.176	0.675***

The resulting regression coefficients show that the model passes assumption tests of Multicollinearity, Heteroskedasticity and Autocorrelation at significance level of 10% (*), 5 %(**) and 1 %(***). The asterix signs show the associated t-statistics. 1 period = 100 Portfolios

In order to get the cross sectional APT test result, we include five different variables that are not anticipated. The result only shows higher risk or vice versa when a lesser period is anticipated. Most significant variables associated with the excess returns of portfolio would be the production index and spread. During the assessment of the risk premium variables or portfolio beta, the overall regression coefficient are significant with a positive sign, which means that the beta variables still exist even though all the variables are included in the APT model. I_{ew} and spread variables (see Table 4, 5, and 6) are still significant and associated positively. From the above statements, it can be inferred that the three variables mentioned could be used to predict the excess returns of the portfolio. When we add a market value variable to the model (see Table 8), our calculation result shows that the variable is positively correlated and significant in the three different periods. Similar procedures were applied to the spread variable and exchange rate with the finding that the two variables are also significant and consistent in the three different periods. The exchange rate variable forms the highest risk in the third period. However, the risk would decrease proportionately with the time duration. In this case, Indonesia needs a more stable exchange rate rather than lower exchange rates.

The changes in the exchange rates would be better at a safe range, since almost all manufacturing industries still rely on USD-denominated, imported raw materials. High volatility of exchange rates lead to production uncertainty and weakens the overall performance of the industries, which in turn ruins their stocks performance. Furthermore, the matter would affect the JKSE listed companies whose debts are in USD but revenues are in IDR. Nevertheless, the employment of these six variables with the exclusion of the market risk premium variable shows that all independent variables are significant, and the residual is very small and not correlated with the portfolio excess return. This is shown by the results of several cross sectional tests in three different periods.

Table 5: Results Cross Sectional Regression Test on APT Using Data in 3 Different Periods (CRR 1986b)

Chen, Roll and Ross Model	$E(R_{pt})-r_f = \lambda_0 t + \lambda_1 bp_{1t} + \lambda_2 bp_{2t} + \lambda_3 bp_{3t} + \lambda_4 bp_{4t} + \lambda_5 bp_{5t} + \lambda_6 bp_{6t} + \varepsilon_{pt}$										
	λ_0	λ_{PR}	λ_{ui}	λ_{uiew}	λ_{uip}	λ_k	λ_{urs}	R^2	R^2 - adj	$Obs*R^2$	Prob
PERIOD -1											
OLS	-0.122	0.026***	0.001**	0.064***	-0.039	-0.004	0.012***	0.763	0.738		
	(-9.627)	(-9.633)	(-1.754)	(-8.227)	(-0.592)	(-0.723)	(-4.382)				
White Test										10.897	0.54***
LM Test										3.575	0.06*
PERIOD - 2											
OLS	-0.145***	0.064**	0.001	0.057*	0.006	0.001	0.018***	0.708	0.605		
	(-5.125)	(-2.625)	(-0.681)	(-2.536)	(-0.415)	(-0.082)	(-3.260)				
White Test										18.403	0.10***
LM Test										0.428	0.51***
PERIOD - 3											
OLS	-0.045*	0.031*	-0.002	0.033**	-0.013	-0.033***	0.016***	0.842	0.786		
	(-1.792)	(-2.140)	(-0.498)	(-2.995)	(-1.214)	(-4.132)	(-3.554)				
White Test										8.172	0.77***
LM Test										0.271	0.61***

The resulting regression coefficients show that the model passes assumption tests of Multicollinearity, Heteroskedasticity and Autocorrelation at significance level of 10% (*), 5 %(**) and 1 %(***). The asterix signs show the associated t-statistics. 1 period = 100 Portfolios

Spread variables or the spread factor is the only variable that is consistently significant in all periods of observations (as can be seen on Table 4, 5, 6, 7, and 8). The balance of 1-month deposit rate and BI certificate rate is a variable that has not been tested in Indonesia. Both rates mature in 1 month. The balance of both rates has had a dominating influence on investors' preference changes in Indonesia. Theoretically, assuming the risk-free rate is constant; the increase in deposit rates would inevitably lead to a mass investment transfer from the stock market to banks, and vice versa. However, in Indonesia, our study shows that an increase in deposit rates leading to larger spread is also followed by an increase in portfolio excess return. This phenomenon is possible when most investors in the two markets are the same players. In this case, the negative correlation between interest rate and stock excess return only holds temporarily. The rise in deposit interest rates stimulates some of the investors to sell their stocks and transfer to bank deposits, which puts more pressures on stock prices. Stock prices fall at the beginning until speculators and scalpers take advantage on the lower stock prices. As the speculation grows, the prices rebound to a particular level that is enough to provide higher excess return.

The APT is found to be valid in JKSE, which is indicated by the finding that all regression coefficients are significant in the third period (see Table 6) and the residual variable is not correlated with the expected portfolio return. There are two interesting points in this finding. Firstly, when the risk premium, which is also the beta in the CAPM, is excluded, the APT becomes the valid model in JKSE. Secondly, the cross sectional regression test on the CAPM shows that the regression coefficient of residual (variance) is 14.24 and significant (see Table 3). This implies that there are unknown variables that are positively correlated with the portfolio excess returns. This is by some means in line with the results of the APT cross sectional regression in the third period. The unknown variables in CAPM test are identified by the results of the APT cross sectional regression, which show that the five regression coefficients are positively associated with the portfolio excess return (see Table 6). The APT model can explain the level of excess returns in the three different observation periods with R^2-adj ranging from 48.63% to 90.07% (see Table 4, 5, 6, 7, and 8). It is worth noting that, in this study, the longer the time interval used in risk estimation, the better the APT model explains the portfolio excess return.

Finding of this study shows that APT model is more effective in explaining portfolio excess return in JKSE than is CAPM. R^2-adj maximum of APT model test is 94%, which is higher than that of CAPM (90.07%).

Table 6: Results of Cross Sectional Regression Test on APT Using Data in 3 Different Periods (CRR 1986c)

Chen, Roll and Ross Model $E(R_{pt}) - r_f = \lambda_0 t + \lambda_1 bp_{1t} + \lambda_2 bp_{2t} + \lambda_3 bp_{3t} + \lambda_4 bp_{4t} + \lambda_5 bp_{5t} + \varepsilon_{pt}$

	λ_0	λ_{ui}	λ_{uiew}	λ_{uip}	λ_{uk}	λ_{URS}	R^2	R^2 - adj	$Obs*R^2$	Prob
PERIOD-1										
OLS	-0.024*	-0.002**	0.009	-0.025**	0.008	0.005	0.227	0.135		
	(-1.859)	(-2.057)	(-0.944)	(-2.257)	(-0.782)	(-1.064)				
White Test									25.227	0.003
LM Test									33.813	0.000
GLS - AR(2)	-0.002	0.000	0.003	-0.003	0.002	0.003*	0.925	0.9121		
	(-0.399)	(-0.924)	(-0.613)	(-0.342)	(-0.539)	(-1.860)				
White Test									20.542	0.124***
LM Test									1.780	0.183***
PERIOD - 2										
OLS	-0.095***	-0.001**	0.000	0.012	0.023**	0.021***	0.598	0.475		
	(-3.875)	(-1.591)	(-0.054)	(-0.873)	(-2.125)	(-3.203)				
White Test									10.659	0.487***
LM Test									0.953	0.329***
PERIOD - 3										
OLS	0.005	-0.003**	0.018*	-0.039**	-0.042***	0.020***	0.802	0.756		
	(-0.535)	(-2.292)	(-1.981)	(-2.675)	(-5.880)	(-4.355)				
White Test									10.365	0.409***
LM Test									0.227	0.635***

The resulting regression coefficients show that the model passes assumption tests of Multicollinearity, Heteroskedasticity and Autocorrelation at significance level of 10% (*), 5 %(**) and 1 %(***). The asterix signs show the associated t-statistics. 1 period = 100 Portfolios

Table 7:Results Cross Sectional Regression Test on APT Using Data in 3 Different Periods (CRR 1986d)

Chen, Roll and Ross Model $E(R_{pt}) - r_f = \lambda_0 t + \lambda_1 bp_{1t} + \lambda_2 bp_{2t} + \lambda_3 bp_{3t} + \lambda_4 bp_{4t} + \lambda_5 bp_{5t} + \varepsilon_{pt}$

	λ_0	λ_{PR}	λ_{UI}	λ_{UIP}	λ_{UK}	λ_{URS}	R^2	R^2-ADJ	Obs*R^2	Prob
Period-1										
OLS	-0.625***	0.028***	-0.001	-0.015	-0.002	0.004	0.374	0.299		
	(-3.781)	-3.329	(-1.086)	(-1.439)	(-0.217)	(-1.008)				
White Test									20.684	0.023*
LM Test									26.603	0.322***
GLS - AR(2)	-0.053	0.002	-0.000	-0.001	-0.004	0.001	0.907	0.890		
	(-1.350)	(-0.465)	(-0.234)	(-0.186)	(-0.797)	(-0.291)				
White –Test									17.958	0.056*
LM-Test									2.265	0.322***
PERIOD - 2										
OLS	-0.100***	0.004	-0.001	0.023	0.03	0.021***	0.606	0.496		
	(-3.923)	(-0.055)	(-0.487)	(-0.885)	(-1.345)	(-3.165)				
White Test									12.373	0.262***
LM Test									0.482	0.497***
PERIOD - 3										
OLS	-0.001	0.008	-0.002	-0.027*	-0.054***	0.019***	0.762	0.691		
	(-0.048)	(-0.484)	(-0.960)	(-1.899)	(-5.515)	(-3.699)				
White Test									6.404	0.780**
LM Test									0.084	0.772***

The resulting regression coefficients show that the model passes assumption tests of Multicollinearity, Heteroskedasticity and Autocorrelation at significance level of 10% (*), 5 %(**) and 1 %(***). The asterix signs show the associated t-statistics. 1 period = 100 Portfolios

Table 8: Results Cross Sectional Regression Test on APT Using Data in 3 Different Periods (CRR 1986e)

Chen, Roll and Ross Model $E(R_{pt}) - r_f = \lambda_0 t + \lambda_1 bp_{1t} + \lambda_2 bp_{2t} + \lambda_3 bp_{3t} + \lambda_4 bp_{4t} + \lambda_5 bp_{5t} + \lambda_6 bp_{6t} + \lambda_7 bp_{7t} + \varepsilon_{pt}$

	λ_0	λ_{PR}	λ_{UI}	λ_{UIEW}	λ_{UIP}	λ_{UK}	λ_{URS}	λMV	R^2	R^2-adj	*Obs x R*	*Prob*
OLS	-0.18***	0.062***	0.001	0.052***	-0.001	-0.007	0.014***	0.00**	0.796	0.762		
	(-6.84)	(-7.32)	(-1.43)	(-5.95)	(-0.19)	(-0.1)	(-5.21)	(-2.55)				
White											19.354	0.15***
LM											3.068	0.09**
P - 2												
OLS	-0.40***	0.016	0.001	-0.008	0.029*	0.03*	0.024***	0.00***	0.857	0.761		
	(-5.54)	(-0.66)	(-1.12)	(-0.34)	(-0.75)	(-2.39)	(-5.33)	(-3.82)				
White											16.313	0.31***
LM											0.083	0.77***
P - 3												
OLS	-0.09	0.02	-0.0007	0.045*	-0.032	-0.04***	0.021**	0.00***	0.791	0.741		
	(-1.74)	(-1.25)	(-0.57)	(-2.31)	(-1.39)	(-4.22)	(-3.13)	(-0.96)				
White											6.992	0.95***
LM											0.764	0.40***

The resulting regression coefficients show that the model passes assumption tests of Multicollinearity, Heteroskedasticity and Autocorrelation at significance level of 10% (*), 5 %(**) and 1 %(***). The asterix signs show the associated t-statistics. 1 period = 100 Portfolios. P-1, P-2, and P-3 are period-1, period-2, and period-3 respectively. White and LM are tests

However, the models' ability to explain portfolio excess return depends on particular characteristic of the macroeconomic circumstances. The CAPM is more useful during the economic downturn, indicated by the fall of JKSE index. The APT is also useful during the economic crisis, if the crisis is defined by the poor performance of macroeconomic indicators (e.g., high inflation and interest rate, and highly volatile exchange rate).

If we face a situation, in which all the four macroeconomic indicators (JKSE index, inflation rate, interest rate, and exchange rate) are poor, then it is more appropriate to test whether the CAPM is more competent in estimating future risk level than the APT. The accuracy of the CAPM's prediction also depends on the chosen market index proxy. For instance, a study may choose JKSE index, or Surabaya Stock Exchange (SSE), or new index based on the equally weighted portfolio of the two markets as the proxy for the Indonesian case. However, it would be more difficult, if not impossible, for an Indonesian case study if the study should follow the CAPM's perfect assumption that the Indonesian market index should be a representation of all Indonesian wealth anywhere. In this case, adoption of the relevant assumption is more appropriate. Meanwhile, application of APT highly relies on the ability to determine factors influencing portfolio/stock excess return the most.

CONCLUSION

This paper is aimed at examining the ability of the CAPM and APT in explaining excess returns of a portfolio of stocks traded in an emerging market, i.e. Jakarta Stock Exchange (JSX). We test validation of the theories using data from 3 different periods around the Asian crisis, i.e. pre-crisis period (1992-1997), crisis period (1997-2001), and post-crisis period (2001-2007). From the tests, we find that overall the APT is a better model of trading behavior and process in the Indonesian stock market. The CAPM has been less effective in the Indonesian stock market. While the APT is able to explain the returns in the three different research periods, beta is not the variable in the estimation activities. We also notice that two variables, i.e. exchange rate, and spread between the central bank rate and the commercial bank rate, are consistently significant in all APT test results. Investors in the JSX should pay careful attention to these two variables, since they consistently influence variability of returns of JSX stocks.

In conducting the CAPM model test, there are usually limitations emerging from several assumption

requirements. One of ways to overcome the obstacles is to employ historical data for the model, instead of expected data. The market portfolio proposed by CAPM includes all wealth in the universe, which is impossible to calculate. Thus, this study assumes that the CAPM portfolio is the one consisting of all stocks consistently in the market. In addition to that, most risk premiums calculated in this study are negative in all periods of observation, especially during the crisis. This is because the rate of Bank Indonesia exceeds most rates of returns for JSX stocks. The number of not-actively traded stocks during the observation period is quite large, i.e. approximately 30% of all listed stocks. Largely capitalized stocks dominantly influence the market index, while their number is quite small, i.e. around 11%. All these characteristics of JSX may not be found in other emerging markets in Asia, which were also hit by the Asian crisis. Thus, similar studies conducted in other emerging markets in Asia may result in different findings and implications. We suggest the use of more frequent stock data (e.g., daily or weekly data) and the maximum likelihood estimation (MLE) to enhance accuracy of the parameter estimation.

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