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Conditional Risk Premiums of Asian Real Estate Stocks

JIANPING (J. P.) MEI AND JIAWEI HU[1*]
E-mail: jmei@stern.nya.edu

Abstract

This paper uses a multi-factor latent variable model to examine the time variation of expected returns on Asian property stocks. Using data from 1990 to 1997, we found strong evidence of time-varying risk premium, suggesting property development based on constant discount rate may underestimate the cost of capital. A further study using a multi-country model suggests that conditional excess returns of many crisis-stricken economies appear to move quite closely with each other. This supports the hypothesis that the risk premiums in these Asian markets move closely over time As a result, they provide a partial explanation of market contagion in the region.

Key Words: contagion, multi-factor model

I. Introduction

The Asian financial crisis in 1997 caught many economists, investors and regulators by surprise. While the crisis could be attributed to a confluence of many factors, excessive real estate speculation, which undermined the countries' banking system, has been identified as one important factor (see Krugman, 1998 and Malkiel and Mei, 1998).

There was a common perception in Asia before the crisis that real estate investment, including real estate stocks, is low risk due to the fact that real estate represents tangible assets. This paper develops a framework for measuring volatility and conditional risk premiums in real estate stocks. This methodology allows us to relate movements in required risk premiums to currency, interest rates and real-estate market conditions. We conclude that real estate investment is actually quite risky in Asia. Moreover, conditional risk premiums vary substantially over time. As a result, better financial planning is required since many viable projects planned in the past could fail if market conditions and risk premiums change.

This paper also attempts to shed light on the issue of contagion in Asian real estate markets. Why do those real estate companies that develop properties in different markets and that are traded on different stock exchanges tend to rise and collapse together? Using an integrated capital markets model, we show that one possible explanation is that the conditional risk premiums of these markets are driven by a similar set of world market variables. As a result, the conditional equity premiums tend to rise and fall together, which help contribute to market contagion.

*Author for correspondence: Department of Finance, New York University, 44 West 4th Street, New York, N.Y. 10003. Phone: (212) 998–0354.

The paper is organized as follows Section 2 describes the asset pricing framework. Section 3 provides an analysis of conditional excess returns under the assumption that the world's equity markets are segmented by national markets. Section 4 examines conditional excess returns on property shares under the assumption that the world real estate securities markets are integrated Section 5 concludes the study.

II. The asset pricing framework

The asset pricing framework used in this study assumes that the equity markets are perfectly competitive and frictionless with investors believing that asset returns are generated by the following K-factor model.

$$\widetilde{r}_{i,t+1} = E_t[\widetilde{r}_{i,t+1}] + \sum_{k=1}^{K} \beta_{i,k}\widetilde{f}_{k,t+1} + \widetilde{\varepsilon}_{i,t+1}. \tag{1}$$

Here $\widetilde{r}_{i,t+1}$ is the excess return on asset i held from time t to time $t+1$, and represents the difference between return on asset i and the riskfree rate of interest. $E_t[\widetilde{r}_{i,t+1}]$ is the expected excess return on asset i, conditional on information known to market participants at the end of time period t, $\widetilde{f}_{K,t+1}$ is one of the K pricing factors and $\widetilde{\varepsilon}_{i,t+1}$ is the error term. We assume that $E_t[\widetilde{f}_{K,t+1}] = 0$ and that $E_t[\widetilde{\varepsilon}_{1,t+1}] = 0$. The conditional expected excess return is allowed to vary through time in the current model but the beta coefficients are first assumed to be constant through time.

This ability of $E_t[\widetilde{r}_{i,t+1}]$ to vary through time is absent in prior REIT studies. However, if $E_r[\widetilde{r}_{i,t+1}]$ is not restricted to be constant then we need to look at both the similarities in beta(s) and the co-movement of $E_t[\widetilde{r}_{i,t+1}]$ through time when analyzing the co-movement of excess returns on two or more assets. In other words, it is possible for the risk premiums and excess returns of two assets to move independently even though they have similar betas. However, this problem will not occur if the following linear pricing relationship holds:

$$E_t[\widetilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik}\lambda_{kt} \tag{2}$$

where λ_{kt} is the ''market price of risk'' for the kth factor at time t.[2]

Now suppose that the information set at time t consists of a vector of L forecasting variables $X_{nt}, n = 1 \ldots L$ (where X_{1t} is a constant), and that conditional expectations are a linear function of these variables. We can then write λ_{kt} as

$$\lambda_{kt} = \sum_{n=1}^{L} \theta_{kn} X_{nt} \tag{3}$$

and therefore equation (2) becomes

$$E_t[\tilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik} \sum_{n=1}^{L} \theta_{kn} X_{nt} = \sum_{n=1}^{L} \alpha_{in} X_{nt} \tag{4}$$

α_{in} is the risk premium for the forecasting variable X_{nt}. Equations (1) and (4) combined are sometimes called a multi-factor ''latent-variable'' model.[3] The model implies that expected excess returns are time-varying and can be predicted by the forecasting variables in the information set. From equations (3) and (4), we can see that the model places the following restrictions on the coefficients of equation (4):

$$\alpha_{ij} = \sum_{k=1}^{K} \beta_{ik} \theta_{kn}. \tag{5}$$

Here, β_{ik} and θ_{kn} are free parameters. Normally, the (α_{ij}) matrix should have a rank of P, where P is defined as $P = \min(N, L)$ and N denotes the number of assets. Equation (5) restricts the rank of the (α_{ij}) matrix to be K, which is smaller than P. To test the restriction in equation (5), we first normalize the model by setting the factor loadings of the first K assets as follows: $\beta_{ij} = 1$ (if $j = i$) and $\beta_{ij} = 0$ (if $j \neq i$) for $k = 1 \ldots K$. Next, we partition the excess return matrix $R = (R_1, R_2)$. Define T as a $1 \times K$ matrix, then R_1 is a $T \times K$ matrix of excess returns of the first K

$$R_1 = X\Theta + \mu_1$$
$$R_2 = X\alpha + \mu_2$$

assets and R_2 is a $T \times$ (N-K) matrix of excess returns on the rest of the assets. Using equations (4) and (5), we can derive the following regression system where X is a $T \times L$ matrix of the forecasting variables, Θ is a matrix of θ_{ij} and α is a matrix of α_{ij}. If the linear pricing relationship in equation (2) holds, the rank restriction implies that the data should not be able to reject the null hypothesis H_0: $\alpha = \Theta B$, where B is a matrix of β_{ij} elements. The objective of the paper is to use the regression system in equation (6) to see to what extent the forecasting variables, X, explain the conditional excess returns under the asset pricing constraint (4).

It is worth noting that, while equation (4) has derived the conditional excess returns $E_t[r_{i,t+1}]$ with the pricing restrictions (5), one can also obtain an *unrestricted* conditional excess returns directly from linear projections *without* using the asset pricing framework of equations (1)–(5). In other words, given that conditional expectations are linear in the forecasting variables, we can simply project the excess returns on the forecasting variables:

$$E_t[r_{i,t+1}] = \sum_{n=1}^{L} \mu_{in} X_{nt}. \tag{4'}$$

Since (4′) is derived directly from linear projection, μ_{in}, the risk premium for X_{nt}, does not have to be the same as α_{in} in equation (4) In what follows we call estimates of conditional excess returns, using equation (4′), unrestricted conditional excess returns, and those estimates derived using equations (4) and (5) together, restricted conditional excess returns.

III. The single country model

We assume that financial markets are segmented internationally but they are frictionless domestically.[4] This implies that the market price of each macro risk factor is the same across all asset markets, including stocks, bonds and real estate (see Ling and Naranjo, 1999, for evidence to support this assumption). As a result, we can use the latent variable model to estimate the conditional premiums for real estate portfolios. It also allows us to estimate the sensitivities of real estate stocks to domestic factors. To ensure that the pricing model holds for a wide range of assets, we use returns on six equity portfolios for each economy, a value-weighted market index, a value-weighted banking portfolio index, a value-weighted property portfolio index plus three other industry indices. In other words, a wide range of asset portfolios is employed to test the asset pricing model restriction and to estimate the required risk premiums for property stocks. A generalized method of moments (GMM) approach, similar to Campbell and Hamao (1992) and Ferson (1989), is employed to estimate the unrestricted model of equation (4′) and the restricted model of equations (4) and (5). Equation (5) is a cross-equation restriction with unknown parameters. Thus, equation (4) must be estimated simultaneously across a number of assets to appropriately test the restriction imposed by equation (5). We also need to adjust for possible heteroskedasticity and serial correlation in regression (4).

The forecasting variables chosen to estimate the unrestricted and the restricted model (equations (4′) and (4)) reflect those widely used in previous studies of conditional risk premiums on stocks in general (see Bakaert and Harvey, 1995; Ferson, 1989; Bessler and Booth, 1994), which can be expected, *a priori*, to act as important variables in determining the conditional risk premiums on real estate stocks. The local variables included are a constant, short-term interest rates, the spread between long- and short-term rates,[5] changes in the dollar exchange rates, the dividend yield on the market portfolio, and the proportion of property company market capitalization in the total market capitalization. This last variable is a proxy for real estate market speculation. Due to its illiquidity, real estate market prices are hard to obtain and thus we use the proportion of properties in the total market capitalization as a proxy. Generally, a real estate market boom tends to make the property index outperform the market index, thus raising the proportion of property stocks in the total market capitalization.

To estimate the asset pricing model (4), we employ six industry portfolios for each economy. We choose six portfolios rather than three (market, banking, property or building) portfolios to ensure the pricing model is estimated across a wide range of industries so that factor pricing is not biased by one single industry.[6] The model is estimated separately for each economy, since there is significant evidence of market segmentation (see Bakaert and Harvey, 1995). In essence, we are assuming different economies are driven by different latent systematic factors. The returns are computed in local currencies and they include both dividends and capital gains. The excess returns are computed over the short-term local interest rates.

Table 1 provides summary statistics for the sample period covered, the monthly means, and the standard deviations (SD's) of two portfolios (i) the market portfolio, (ii) the real estate stock portfolio for each economy. One can see that those economies that were severely hit by the 1997 Asian crises had negative market and property returns during the sample period. These include Indonesia, Malaysia, the Philippines, and Thailand. The monthly volatility was also quite high, with the Thai market having a monthly volatility of 20 percent.[7] Clearly, real estate investment in Asia is anything but low risk.

Table 2 gives the estimates for the explanatory variables slope coefficients. One can see that high short-term rates predicted lower excess returns for many Asia economies. The term-spread variable tended to predict lower excess returns in general. Appreciation in the dollar predicted lower excess returns for all the crisis economies in Asia. This should not be surprising since the dramatic currency devaluation last year triggered sharp fall in real estate stock prices. The dividend yields generally predicted higher excess returns. The proportion of real estate companies in the total market capitalization appears to have differential effects across markets. But generally, a high proportion of real estate companies in the total market capitalization tend to predict lower expected returns for the future. This should not be too surprising, since a rapidly growing real estate equity market relative to the market as a whole tends to indicate excessive development and thus lower future expected returns. Finally, the t-statistics and the adjusted R-squares indicate that the expected excess returns do vary across countries.

Table 1. Monthly excess returns in local currency for the market and real estate company portfolios for each country during the sample periods.

Country	Time Period	Mean (Market)	S.D. (Market)	Mean (Real State)	S.D. (Real State)
Hong Kong	86.1–97.12	1.46	8.64	1.74	10.57
Singapore	87.1–97.12	0.43	6.52	0.91	9.42
Indonesia	91.9–97.12	– 0.21	7.70	– 1.37	16.04
Malaysia	91.1–97.12	– 0.03	6.55	– 0.59	9.49
Philippines	90.1–97.12	– 0.03	8.99	– 0.94	11.22
Thailand	92.1–97.12	– 1.08	10.42	– 3.35	18.99

Note. Source: Datastream.

Table 2. Unrestricted conditional risk premiums. Regression of excess returns on real estate stock portfolios at time $t+1$ on a constant, a short-term rate, the spread between long and short rate, percentage change on the dollar exchange rate, the market dividend yield in each country, and the proportion of property companies in the total market capitalization.

Country	Constant	Short	Spread	Percent FX	DivYld	Pmv/mv	$\overline{R}^2$
Hong Kong	3.504	− 2.278**	− 3.926**	3.808	4.461**	− 0.073	0.080
	(0.23)	(− 3.52)	(− 2.34)	(0.69)	(3.11)	(− 0.19)	
Singapore	8.423	− 1.732**	− 3.485	− 0.108	4.650*	− 0.80**	0.067
	(1.13)	(− 2.37)	(− 1.29)	(− 0.14)	(1.95)	(− 2.29)	
Indonesia	9.680	− 0.810	0.995	− 1.610	1.733	− 1.642	0.168
	(0.69)	(− 1.16)	(0.76)	(− 1.49)	(0.25)	(− 0.67)	
Malaysia	− 3.748	− 0.910	− 4.044	− 1.540**	3.180	1.438	0.080
	(− 0.18)	(− 0.41)	(− 0.84)	(− 3.11)	(1.08)	(0.49)	
Philippines	15.35**	− 0.946**	− 3.786**	− 0.024	4.700*	− 0.258	0.082
	(2.55)	(− 2.19)	(− 3.45)	(− 0.06)	(1.94)	(1.65)	
Thailand	29.24	− 1.593	0.906	− 1.299**	0.692	− 4.372	0.067
	(1.14)	(− 0.81)	(0.69)	(− 2.12)	(0.19)	(− 1.46)	
Japan	− 10.89	1.179	11.75	− 0.096	435.8	0.106	− 0.022
	(− 0.55)	(0.08)	(0.38)	(− 1.24)	(0.49)	(0.99)	
US	10.40*	− 0.835	− 0.781	0.066*	− 2.622	− 7.302	0.017
	(1.78)	(− 0.68)	(− 0.62)	(1.70)	(− 0.92)	(− 0.69)	

Notes. One asterisk indicates significance level at 10 percent while two asterisks indicates significance level at 5 percent.

The top panels of Figures 1–8 show the co-movement of excess returns, $\tilde{r}_{i,t+1}$, and the expected excess returns, $E_t(\tilde{r}_{i,t+1})$, for all the real estate stock portfolios. An inspection of these figures reveals that the conditional risk premiums for property stocks do vary over time, which accounted for a portion of the volatility in Asian real estate stocks. The predictability in expected excess returns that we document does not necessarily imply that the markets are inefficient but rather could reflect rational pricing in an efficient market under different business conditions. However, the huge variation in expected excess returns or the risk premiums is still astonishing given the seemingly stable risk tolerance of market participants and the stable payoff structure for portfolio fund managers.

Table 3 presents the beta estimates for the property portfolios in the asset pricing model and performs the tests for the number of latent factors in each market. We estimate the regression system under the assumption that there is only one ''priced'' systematic factor (Ling and Naranjo, 1997, allow for multiple risk factors), $\tilde{f}_{1,t+1}$, in the economy $(K = 1)$. Here, we have normalized the single factor so that the market portfolio in each economy has a beta of one. We find that the single factor model cannot be rejected for most economies. Thus, we will use the single factor model for the computation of restricted conditional risk premiums.

The bottom panels of Figures 1–6 give an alternative visual presentation of the results reported in Table 3. The figures plot the unrestricted and restricted fitted values of $E_t(\tilde{r}_{1,t+1})$ for property stocks using a solid line and a dashed line respectively. These charts show that the expected excess returns estimated under the rank restriction closely resemble

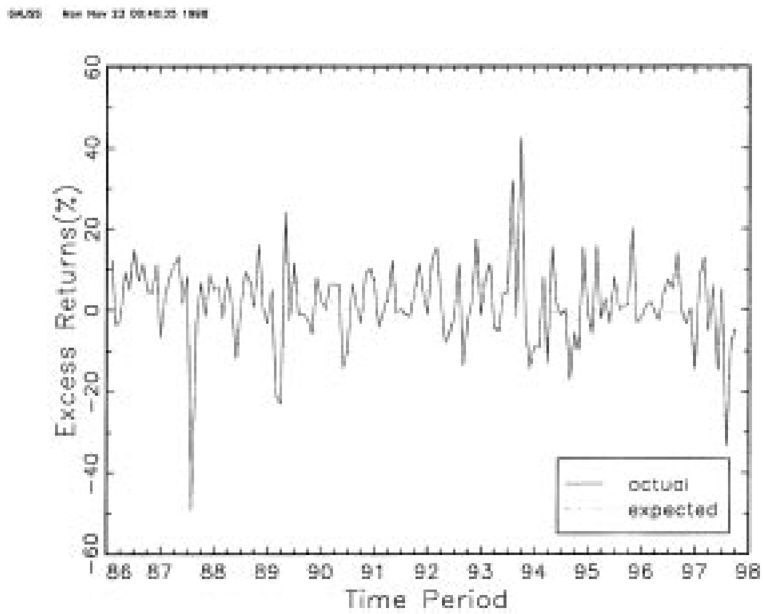

Figure 1A. Actual and expected returns for Hong Kong real estate stocks.

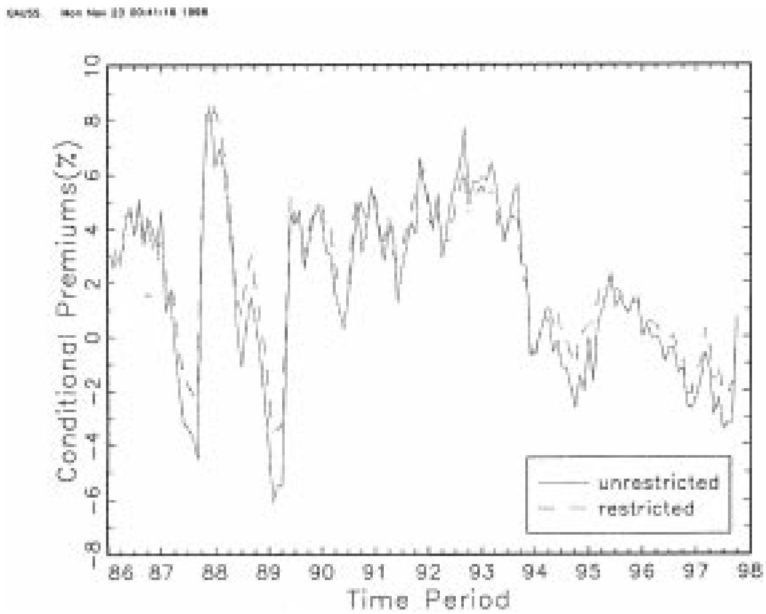

Figure 1B. Restricted and unrestricted risk premiums for Hong Kong real estate stocks.

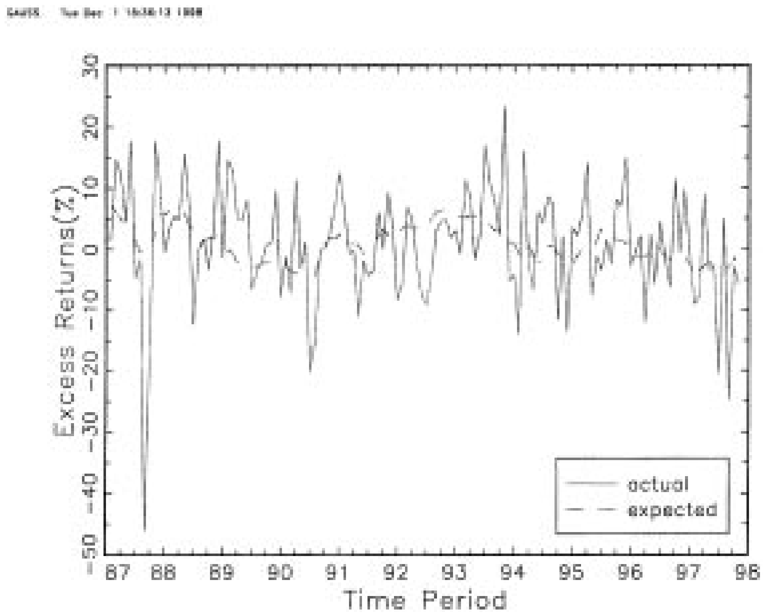

Figure 2A. Actual and expected returns for Singapore real estate stocks.

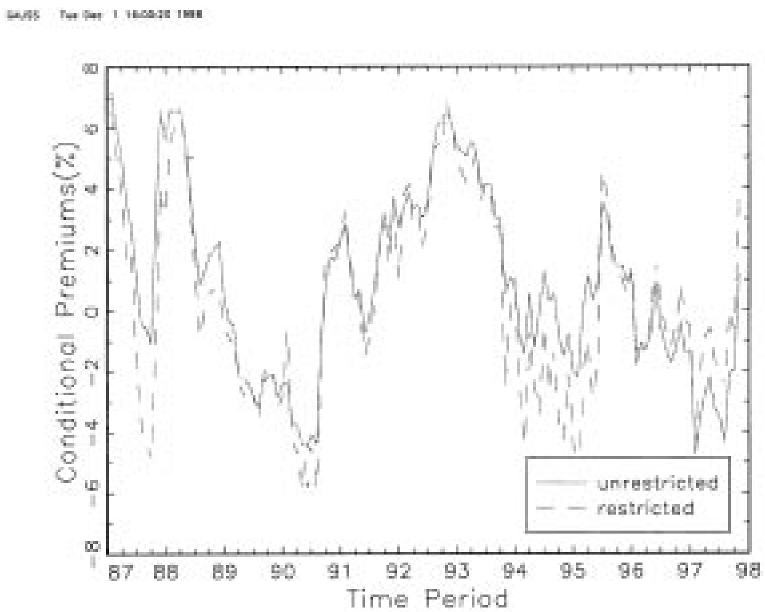

Figure 2B. Restricted and unrestricted risk premiums for Singapore real estate stocks.

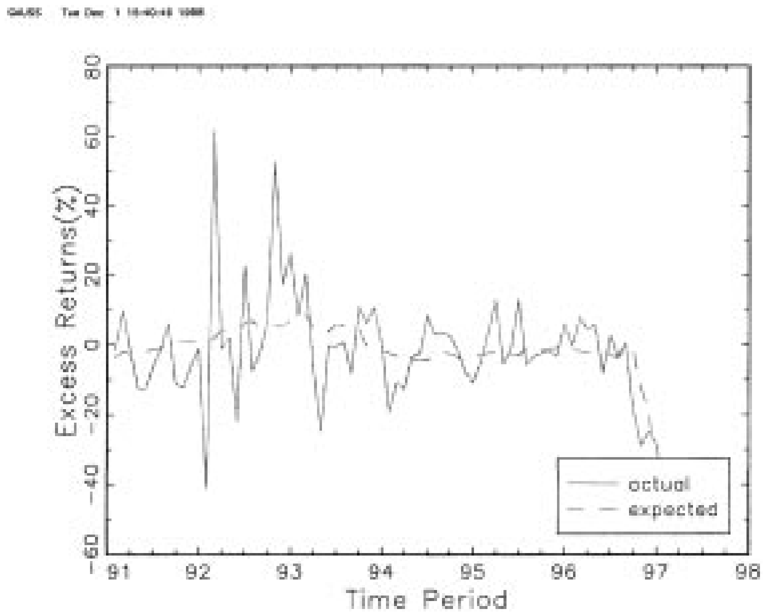

Figure 3A. Awaiting report.

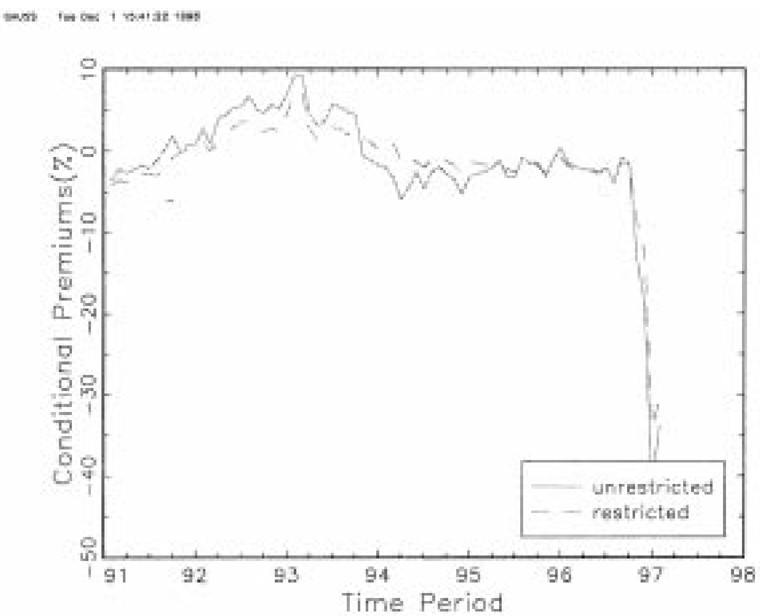

Figure 3B. Restricted and unrestricted risk premiums for Indonesian real estate stocks.

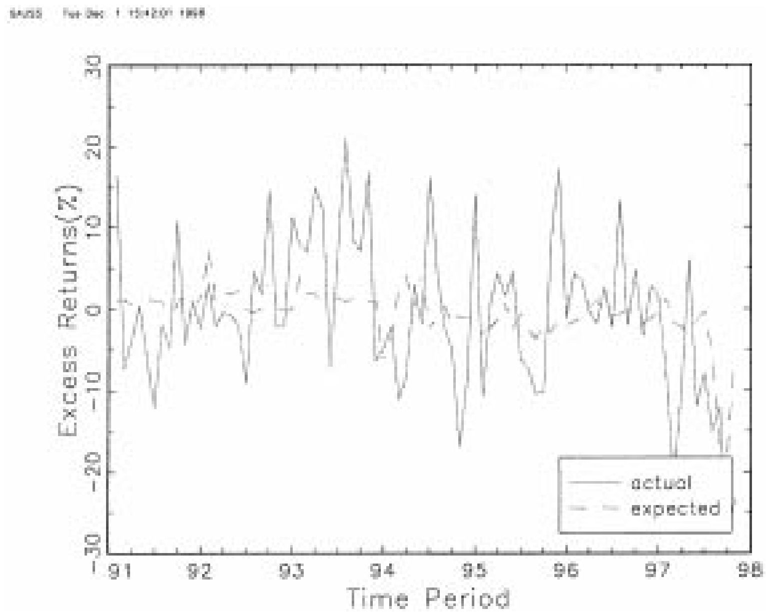

Figure 4A. Actual and expected returns for Malaysian real estate stocks.

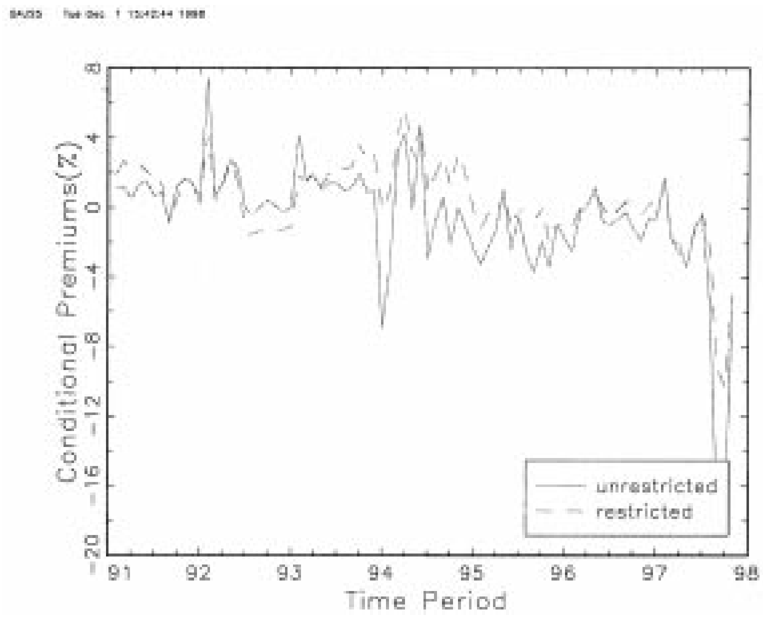

Figure 4B. Restricted and unrestricted risk premiums for Malaysian real estate stocks.

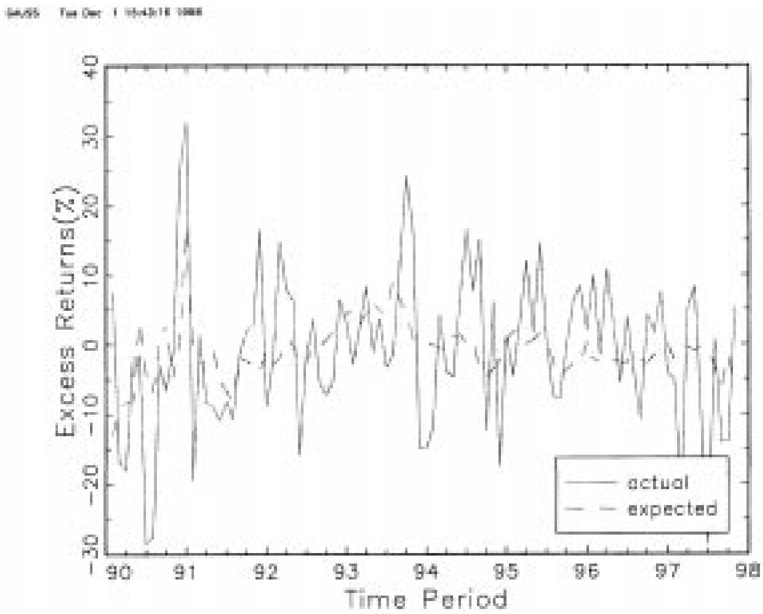

Figure 5A. Actual and expected returns for Philippines real estate stocks.

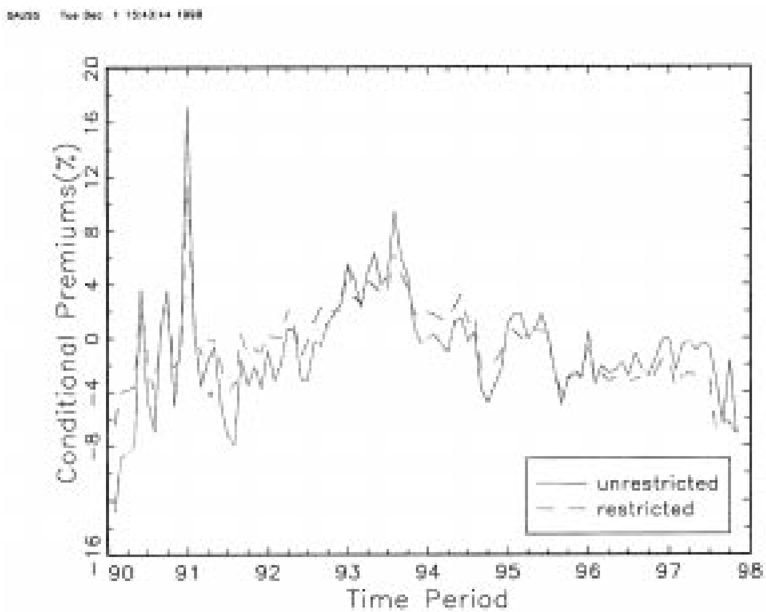

Figure 5B. Restricted and unrestricted risk premiums for Philippines real estate stock.

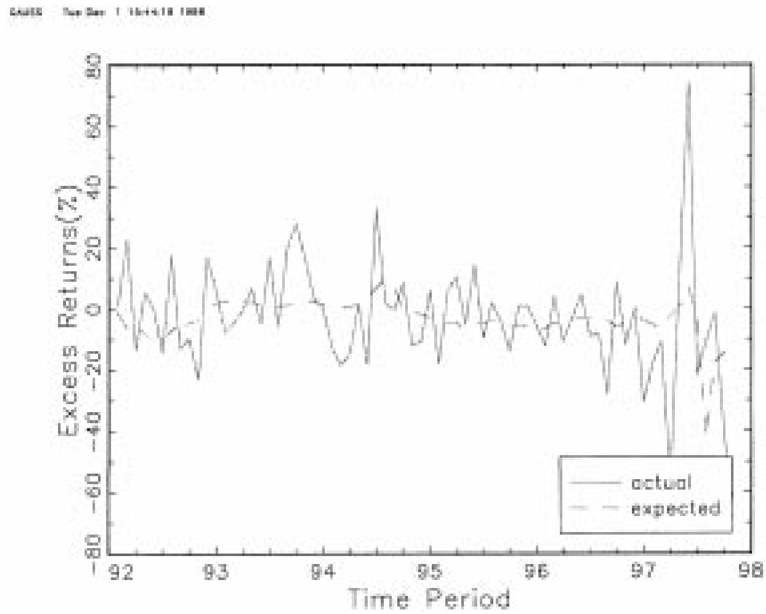

Figure 6A. Actual and expected returns for Thailand real estate stocks.

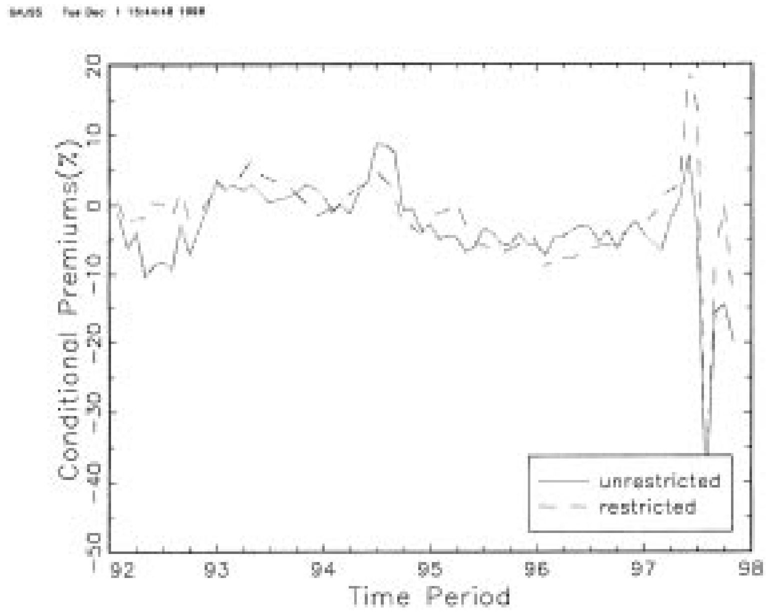

Figure 6B. Restricted and unrestricted risk premiums for Thailand real estate stocks.

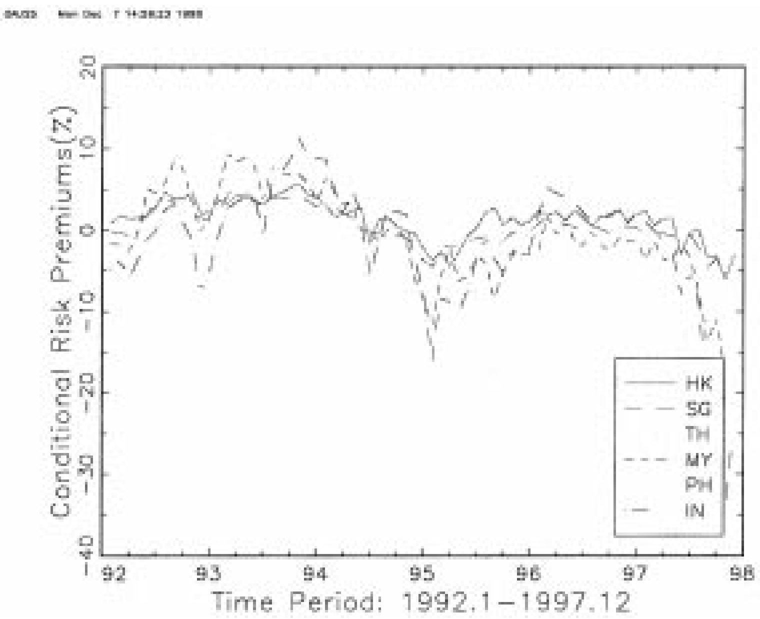

Figure 7. Conditional premiums in an integrated model.

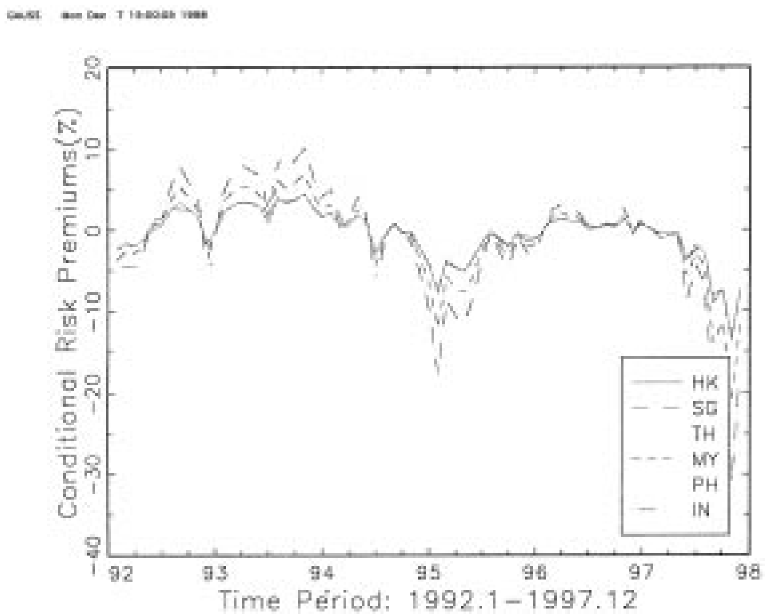

Figure 8. Conditional premiums in an integrated model.

Table 3. Beta for the property portfolios and test for the number of factors in each market. A single country model is used in estimating the betas.

Country	Market Beta	χ^2-Test	Significance Level
Hong Kong	1.206 (0.061)	20.35 ($K = 1$)	0.727
Singapore	0.926 (0.075)	25.21 ($K = 1$)	0.450
Indonesia	1.507 (0.188)	31.53 ($K = 1$)	0.171
Malaysia	0.913 (0.162)	26.70 ($K = 1$)	0.371
Philippines	0.860 (0.122)	25.17 ($K = 1$)	0.452
Thailand	1.448 (0.204)	29.83 ($K = 1$)	0 230

those estimated without the restriction. The figures also show that the ''single factor'' latent-variable model provides a fairly good fit of the unrestricted conditional excess returns for most countries and results in an impressive degree of movement in conditional expected excess returns. We can see that, while the conditional premiums were often positive for real estate investors, they also turned negative during some sample periods, offering investors inadequate compensation for risk taking. One may conclude from this evidence that market timing based on conditional risk premium could help enhance investment returns. But it is worth noting that the transaction costs associated with the market timing strategy are often quite high in emerging markets.

IV. The multi-country model

While the single country model allows us to examine conditional risk premiums of all industries in a single country, it does not permit us to examine the co-movement of property shares across countries. To solve this problem, we begin by assuming the property markets of the above six countries are integrated and a multi-factor asset pricing model applies. As a result, we can use the latent variable model to examine the conditional premiums for real estate portfolios across different markets.[8] It also allows us to estimate the sensitivities of real estate stock returns to domestic factors. The forecasting variables used here include a constant term, the yield on HK one-month deposit rate, the spread between the yields on one-year deposit rate and one-month deposit rate in HK, the percentage change in the yen exchange rate in dollars, the price-earnings ratio and dividend yields on a Southeast Asian property portfolio constructed by Datastream. The one-month deposit rate describes the short-term interest rate. The spread variable tells us the term structure of interest rates. The *P*/*E* ratio and dividend yield variables are used to capture information on expectations about future cash flows and required returns in the property market. These variables have been used by Campbell (1987), Campbell and Hamao (1991), Fama and French (1988, 1989), Ferson (1989), Ferson and Harvey (1989), Ling and Naranjo (1997), among others.[9]

Table 4 gives the parameter estimates for the unrestricted conditional risk premium on property portfolios based on equation ($4'$). It is interesting to see that high HK short-term

Table 4. Unrestricted conditional risk premiums in a multi-country model. Regression of excess returns on real estate stock portfolios at time $t+1$ on a constant, one-month HK deposit rate, the spread between the yields on one-year deposit rate and 1-month deposit rate in HK, the percentage change in the yen exchange rate in dollars, the price-earnings ratio and dividend yields on an Southeast Asian property portfolios constructed by Datastream.

Country	Constant	1mDr	Spread	Percent FX	P/E	DivYld	$\overline{R}^2$
Hong Kong	19.73	− 2.504	− 0.699	0.316	− 0.113	− 1.856	0.011
	(1.11)	(− 1.65)	(− 0.24)	(0.77)	(− 0.40)	(− 0.49)	
Singapore	18.19	− 2.471*	− 1.384	− 0.126	− 0.084	− 1.726	0.136
	(1.21)	(− 1.91)	(− 0.55)	(− 0.36)	(− 0.35)	(− 0.53)	
Thailand	− 4.099	− 3.569	− 5.207	− 1.046	0.735	1.622	0.157
	(− 0.14)	(− 1.39)	(− 1.05)	(− 1.49)	(1.55)	(0.25)	
Malaysia	37.12*	− 5.432**	− 1.182	− 0.344	− 0.197	− 3.525	0.045
	(1.92)	(− 3.28)	(− 0.37)	(− 0.76)	(− 0.64)	(− 0.85)	
Philippines	18.87	− 2.705*	0.964	− 0.300	− 0.007	− 3.939	0.241
	(1.10)	(− 1.84)	(0.34)	(− 0.75)	(− 0.03)	(− 1.07)	
Indonesia	62.75**	− 7.917**	− 0.130	0.261	− 0.258	− 12.38**	0.402
	(2.99)	(− 4.41)	(− 0.04)	(0.53)	(− 0.78)	(− 2.74)	

Notes. One asterisk indicates significance level at 10 percent while two asterisks indicate significance level at 5 percent.

rates predicted lower excess returns for many Asia economies. None of the other variables appear to explain much of the variation in Asian property expected returns, including the yen-dollar exchange rates. Finally, a joint F-test of all the parameters indicates that the coefficients of the regression parameters are not all zero, suggesting that expected excess returns do vary over time.

Figure 7 shows the co-movement of expected excess return (unrestricted), $E_t(\widetilde{r}_{1,t+1})$, for the real estate stock portfolios of Hong Kong, Singapore, Indonesia, Malaysia, the Philippines and Thailand. Here, the conditional excess returns appear to move quite closely with each other. This supports the hypothesis that the risk premiums in these four markets move closely over time. As a result, they provide an explanation of market contagion across these markets. This conclusion is further confirmed by the bottom panel of Table 4, which tests the hypothesis that there is only one ''priced'' systematic factor, $\widetilde{f}_{1,t+1}$, in the economy ($K = 1$). (Here, we have normalized the single factor so that the US property portfolio has a beta of one.) We find that the single factor model is not rejected by the data. Thus, we can not reject the hypothesis that a single factor model drives restricted conditional risk premiums across all Asian markets. Figure 8 shows the co-movement of expected excess return (restricted), $E_t(\widetilde{r}_{1,t+1})$, for the six real estate stock portfolios. By comparing Figures 7 and 8, we can see that the one-factor model (Figure 8) provide an adequate description of the unrestricted conditional premium in Figure 7. Thus, our result is consistent with the view that Asian real estate secruities markets are integrated, since the law of one price (risk premium) seems to hold.

V. Summary and conclusions

This paper uses a multi-factor latent variable model to examine the time variation of expected returns on Asian property stocks. Using data from 1990 to 1997, we find strong evidence of time varying risk premium, suggesting property development based on constant discount rate may misspecify the cost of capital. A further study using a multi-country model suggests that conditional excess returns of many crisis economies appear to move quite closely with each other. This supports the hypothesis that the risk premiums in these Asian markets move closely over time. As a result, they provide a partial explanation of market contagion in the region. Moreover, graphical evidence indicates that risk premiums vary substantially over time and suggests that market timing might be a fruitful endeavor.

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Notes

1. Associate Professor of Finance and Graduate Student, Stern School of Business.
2. Equation (2) states that the conditional expected rate of return should be a linear function of factor risk premiums, with the coefficients equal to the betas of each asset. This type of linear pricing relationship can be generated by a number of intertemporal asset pricing models, under either a no arbitrage opportunity condition or through a general equilibrium framework. See, for example, Ross (1976) and Campbell (1990).
3. For more details on this model, see Hansen and Hodrick (1983), Gibbons and Ferson (1985), Campbell (1987), and Ferson and Harvey (1990).
4. Several recent studies suggest emerging equity markets are segmented. See Bakaert and Harvey (1995).
5. The short-term interest rates used for each economy are one-month deposit rate for Hong Kong, one-month deposit rate for Singapore, 91-day deposit rate for South Korea (closest available), one-month money rate for Taiwan, one-month deposit rate for Indonesia, one-month deposit rate for Malaysia, 91-day treasury bill rate for the Philippines (closest available), and one-month deposit rate for Thailand. The long-term interest rates used for each economy are one-year deposit rate for Hong Kong, one-year deposit rate for Singapore, one-year bond invest trust rate for South Korea, six-month money rate for Taiwan, one-year deposit rate for Indonesia, one-year deposit rate for Malaysia, one-year treasury bill rate for the Philippines, and six-month deposit rate for Thailand. These data are obtained from Datastream, Central Bank of China, and Bank of Malaysia.
6. The other three industrial portfolios chosen for each economies are: utilities, textiles and general industry for Hong Kong; consumer goods, services and general industry for Singapore; consumer goods, services and steel for Taiwan; consumer goods, general industry and plantation for Indonesia; consumer goods, services and oil industry for Malaysia; consumer goods, general industry and utilities for the Philippines; consumer goods, services and oil industry for Malaysia; consumer goods, general industry and electronics for Thailand. These data are obtained from Datastream, the Hong Kong Stock Exchange, and the Taiwan Securities Exchange.
7. In comparison to the US property market, the Thai real estate market is over five times as volatile as the US market.
8. Formally testing whether these markets are integrated or not is beyond the scope of this paper, due to the fact that the data series are too short to perform an integration test such as those of Bakaert and Harvey (1997).

9. Fama and French (1989) also uses the spread between yields of a low grade long-term corporate bond and a long-term treasury bond to capture the default risk in the financial market. But they find the variable to be capturing the same information as the dividend yield. Thus, we only include dividend yield in the study.

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