行政院國家科學委員會專題研究計畫成果報告

香港不動產因子風險貼水之研究

On the Real Estate Factor Premium in Hong Kong

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一、中文摘要

由於不動產具不可移動性、高度異質性、高交易成本、以及缺乏充分交易資訊等特性，因此，不動產之風險性質與其他主要金融性資產有相當大的差異性。以美國市場為主的研究中，對於是否存在不動產因子風險貼水的結論相當歧異。然而美國不動產市場長期以來，波動幅度遠較亞洲主要國家或地區如日本及港香為小，是否大幅波動市場之風險特性與美國市場相似，攸關國際投資人投資組合決策之制訂，在學術上的意涵更值得探討。然而，有系統的探討美國以外市場不動產因子風險貼水的嚴謹實證研究相當少。香港是亞洲主要市場之一(就全世界而言，其不動產價格可能僅次於東京)，而且自 1980 **以來，有完整且系統性關於公開與個別不動產市場的資料。因此，香港是探討上述議題一個理想的研究對象。**

在多因子資產評價模型的架構下，本研究將以自 Gibbons & Ferson（1995）、Ferson (1989, 1990)， Campbell (1987)，Liu and Mei (1992)， Mei and Lee (1994)，**一系列以降，所發展之多因子隱性變數模型（**multi-factor latent variable Model**）為基礎，探討香港不動產與其他資產間風險特徵之異同，風險貼水之可預測性。此資產評價模型的架構假設資產之預期風險貼水為多個不可觀測到的風險因子之風險貼水的線性組合。雖然這些風險因子無法觀測到，但是其風險貼水卻可以由數個可觀測到的經濟變數加以預測，而且風險因子貼水與這些可觀測到的經濟變數呈線性關係。**

本研究有四個主要的發現。首先，所研究的三個主要資產的期望的風險溢酬, 具有相當高的可預測性。其次，對股票及不動產投資人而言，市場時機選擇非常重要。因為，此兩種資產的風險溢酬隨時間變動非常劇烈。第三，與債券資產比較起來，不動產的性質更接近股票組合。最後，在香港市場中，主要影響不動產市場的風險因子是股票市場風險，因此, 不動產投資並無法達到分散票投資風險的目的。

關鍵詞：香港、不動產因子、風險貼水

Abstract

In this study we analyze the predictability of expected returns on property stocks, equity stock portfolios and bond portfolios using a multi-factor model allowing time varying risk premiums. In this process, we examine the resemblance among assets and the existence of real estate factor in Hong Kong markets.

There are four major findings. First, expected excess returns of three assets investigated in this study are quite predictable. Second, right market timing is important to equity and property investors since evidences show that the risk premiums of these two assets vary substantially over time. Third, property stocks are closer in similarity with stocks than bonds. Finally, property stocks have a high sensitivity toward stock market portfolio. This indication suggests that in Hong Kong real estate investments are influenced by market factor and are not good instruments to help diversify stock risk.

Keywords：Hong Kong, Real estate factor, risk premium

I. Introduction

Due to the immobility of real estate, the heterogeneity of the properties, the high transaction cost, and the lack of sufficient information flows about the traded property, the risk attributes of real estate is very different from other major financial assets. In the studies on the market of States, the answers to the question whether there is real estate factor are not unanimous. However, in a long-term perspective, the real estate price volatility of the States is much smaller than those of some major Asian markets such as Japan and Hong Kong. Whether real estate risk attributes of the market with high volatility are different from those of the States is crucial to international investors and is also important to academic literature. Nonetheless, academic researches on the markets outside the States are few. Hong Kong is a major Asian market (probably the second most expensive real estate market in the world after Tokyo), which have systematically collected both the private and public real estate market data on a regular and homogeneous basis since 1980. Hong Kong therefore provides an ideal case for studying the issue.

Closely Related researches are almost all on the U.S. market. Liu and Mei (1992) suggests that the variation in the expected returns on various assets including real estate can be explained by two common factors, a stock market factor and a bond factor. In this study, they use equity REITs as proxy for real estate asset. The results are different from Mei and Lee (1994). In this study, they find three common factors explaining asset returns. A real estate factor is among the three. The latter study includes an appraisal-based real estate index as a proxy for real estate asset. The different results of these two studies suggest that different real estate proxies may cause significantly different empirical results. Real estate proxies from public market are inclined to be overwhelmed by stock market factor. Similarly, Liu, Hartzell, Greg, and Grissom (1990) also finds evidence of real estate premiums when appraisal based returns are used. This study hence will used both appraisal based data and public market data as the proxies for real estate asset.

Within the multifactor asset pricing framework and following the line of studies including Gibbons & Ferson (1995), Ferson (1989, 1990), Campbell (1987), Liu and Mei (1992), Mei and Lee (1994), this study will use the multi-factor latent variable model[i]. to examine the risk attributes of Hong Kong real estate and other major financial assets. This asset pricing framework assume that asset's risk premium is the linear combination of the risk premiums of several unobservable factors. And the risk premiums of these unobservable factors can be predicted by several observable economic variables in a linear form.

The rest of the paper is organized as follows. Section 2 describes the data and sources. Section 3 contains the discussion of the empirical results. Section 4 concludes this study.

II. The Data

II-1 The forecasting variables

We apply the similar forecasting variables as those used by Liu and Mei (1992). These variables are widely used in studies concentrated on stock return studies[ii]. The variables include the dividend yield on a market portfolio, the level of interest rates, the spread between the yields on long-term bonds and short-term bill rate, and the capitalization rate [iii], a proxy for the earnings-price ratio on a large well-diversified portfolio of real estate assets.

In this study, the corresponding forecasting variables are the dividend yield on the Hang Seng portfolio, the yield rate of the month Hong Kong exchange fund bill rate, the spread between the yields on 10 year exchange fund note and three month exchange fund bill, and the dividend yield on Hong Kong property stock. Due to the limitation of the data source, the data period is 1996.11–2001.01, with 39 observations. The data are obtained from the Data Stream.

II-2 The assets

Three assets are included in the study, including the Hong Kong property stocks, Hang Seng stock porfolio, and 10 year exchange fund note. The returns and yields data are also obtained from Data Stream.

IV. Empirical Results

Summary Statistics

Exhibit 1 provides summary statistics on the behavior of the excess returns for each of the three asset classes as well as the forecasting variables. This exhibit reveals that property stocks have a much lower mean excess return and the highest standard deviation among the assets. In Exhibit 1, we also notice that only long term bond has positive mean excess returns with lowest standard deviation. It is because that the sample period covers the 1997 financial crisis. In the sample period, both equity market and real estate market are bearish markets. In addition, the returns on all assets exhibit positive first order autocorrelation.

Exhibit 1 also reports the correlation of returns among three asset classes. We find the excess returns on property stocks are highly correlated with Hang Seng portfolio (ρ=0.704). It coincides with common understanding about the close relationship between real estate markets and economic situation in Hong Kong. Bond assets correlated at a lesser extent with both Hang Seng portfolio (ρ=.359) and property stocks (ρ=.419). It is expected that bond market is primary affected by interest rate while the factors influencing equity and real estate markets are much more complicated. The correlation results primarily tell us that property stocks are more similar to equity stocks than bonds. Even though this may be true, as pointed out by Liu and Mei (1992), the resemblance among assets should also be judged by *ex ante* returns[iv].

<Insert Exhibit 1 here>

III-2 Regression results

Exhibit 2 reports the results of regressing assets' excess returns on a constant term and the four forecasting variables. We find that all three assets are quite predictable. Approximately 23%, 27%, 22% of the variations in monthly excess returns on stocks, bonds, and property stocks, respectively are accounted for by the four forecasting variables. The high predictability of these three assets found here is consistent with previous studies[v].

What accounts for the high predictability of the three assets? To answer the question, we examine which the forecasting variables significantly influence asset returns. For stocks and property stocks, only the level of interest rate variable has significantly and negatively impact. The nature of this relationship is negative suggesting that stocks and real estate securities exhibit "perverse" inflation behavior[vi].

It is surprise to us that both the dividend yield on a market portfolio and the dividend yield on a property stock portfolio do not significantly influence the returns of stock portfolio and property stocks. As suggested by prior studies, the major movements in the dividend yield series are related to long-term business conditions. This unexpected result might be explained by the fact that the sample period covers the important event of the change of political administration and the 1997 Asian financial crisis. Both major events exerted seriously on the equity market and the property market.

<Insert Exhibit 2 here>

Exhibit 3 presents a visual impression of the results in Exhibit 2. Exhibit 3 plots the actual excess returns on asset ($\tilde{r}_{i,t+1}$) and the conditional expected excess return [$E_t(\tilde{r}_{i,t+1})$] using a symbol line and a solid line respectively. Exhibit 3 shows that the expected excess returns do vary over time. However, even though the volatility of the actual security returns is changing over time, the variation in the conditional risk premium does not appear to be fluctuating over time.

<Insert Exhibit 3 here>

Exhibit 4, Exhibit 5 and Exhibit 6 show the co-movements of the expected excess returns between individual assets An inspection of these figures reveals that the conditional risk premiums for stocks and property stocks appear to move in tandem and those of these two assets and that of bonds seem to move in different tracks.

<Insert Exhibit 4 here>

<Insert Exhibit 5 here>

<Insert Exhibit 6 here>

In Exhibit 7 we report our estimates of the restricted version of the model shown in Exhibit 2. In Panel A, we estimate the regression system under the assumption that there is only one "priced" systematic factor, $\tilde{f}_{1,t+1}$, in the economy (K=1). With beta of equity stocks being normalized to 1, we observe that the beta for property stocks (1.35) is closer to that of bond assets (0.035). Since property stocks move so close with stocks, it is a reasonable conjecture that the factor underlying property stocks is to very high extent the same with the one underlying equity stocks. We can then further conclude that basing on the above results it is no need to have a independent real estate factor in asset pricing model.

<Insert Exhibit 7 here>

V. Conclusion

In this study we analyze the predictability of expected returns on property stocks, equity stock portfolios and bond portfolios using a multi-factor model allowing time varying risk premiums. In this process, we examine the resemblance among assets and the existence of real estate factor in Hong-Kong markets.

There are four major findings. First, expected excess returns of three assets investigated in this study are quite predictable. Second, right market timing is important to equity and property investors since evidences show that the risk premiums of these two assets vary substantially over time. Third, property stocks are closer in similarity with stocks than bonds. Finally, property stocks have a high sensitivity toward stock market portfolio. This indication suggests that in Hong Kong real estate investments are influenced by market factor and are not good instruments to help diversify stock risk.

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Exhibit 1. Summary Statistics

Mean (%)	S.D.(%)	ρ_1	C.V.
Dependent Variables:			
Excess return on Hang Sang Portfolio(Stock)			
-4.32	11.43	0.104	-2.645
Excess return on 10 yr exchange fund note(Bond)			
1.62	1.09	0.477	0.673
Excess return on property stocks (Property)			
-5.33	15.83	0.180	-2.970
Forecasting Variables:			
Yield on 3-month exchange fund bill (EFB)			
6.13	1.600		
Yield spread between 10 yr exchange fund note and 3 month exchange fund bill (Spread)			
1.62	1.092		
Dividend yield on Hang Sang portfolio (DY)			
3.22	0.797		
Dividend yield on property stock (Pdiv)			
3.15	1.783		

Notes: The sample period for this table is 1996.11 –2001.01, with 39 observations. Units are percentage per month for assets and percentage per annum for forecasting variables.

Correlations

	Stock	**Bond**	**Property**
Stock	1.000	0.359	0.704
Bond		1.000	0.419
Property			1.000

Exhibit 2

Regression of the excess returns on each asset class at time t+1 on the forecasting variables at time t.

Model: $Asset_{i,t+1} = Constant + \beta_1 T\text{-}Bill_t + \beta_2 Spread_t + \beta_3 DivYld_t + \beta_4 CAPR_t + \varepsilon_t$

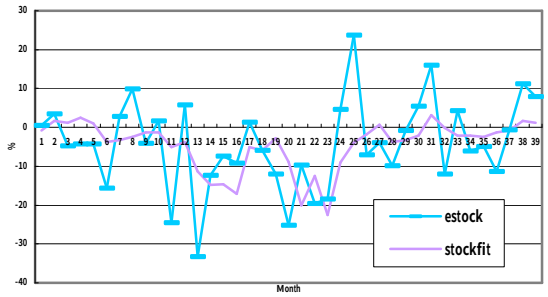
Constant	T-Bill	Spread	DY	Pdiv	R^2	DW
Stocks						
52.6	-7.14	-4.06	-0.74	4.93	0.23	2.68
(1.75)*	(-1.79)*	(-1.11)	(-0.97)	(0.99)		
Govt. Bonds						
3.48	0.004	0.38	-1.28	0.44	0.27	2.05
(1.25)	(0.01)	(1.11)	(-1.99)*	(1.09)		
Property Stocks						
62.1	-10.2	-5.85	-1.99	2.88	0.22	2.41
(1.48)	(-1.82)*	(-1.14)	(-0.20)	(0.47)		

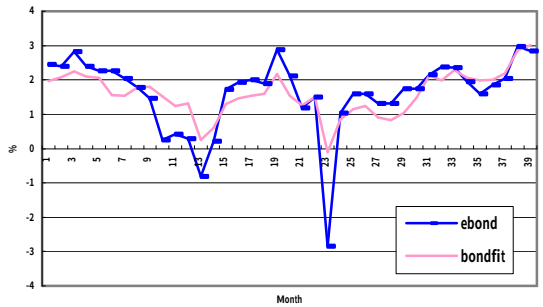
Note: number in parentheses are t statistics. (*) indicates a 10% significance. R^2 has been adjusted.

Exhibit 3

Exhibit 3. Excess returns on Assets and their conditional risk premiums.

(The actual excess returns on asset $(\tilde{r}_{i,t+1})$ and the conditional expected excess return $[E_t(\tilde{r}_{i,t+1})]$ uss a symbol line and a solid line respectively.)





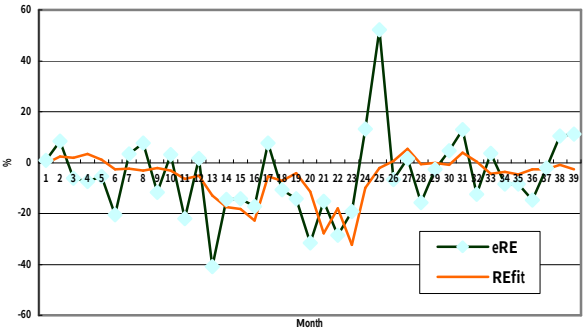


Exhibit 4. Conditional Risk Premiums on Bond and Stock portfolios

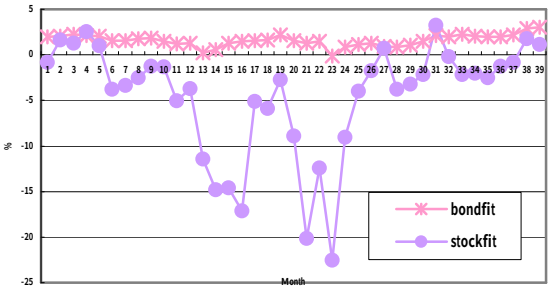


Exhibit 5. Conditional Risk Premiums on Bond and Property stock portfolios

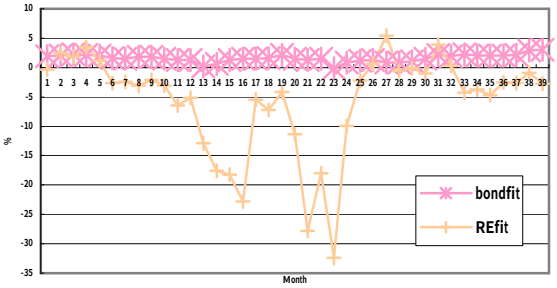


Exhibit 6. Conditional Risk Premiums on Property stock and Stock portfolios

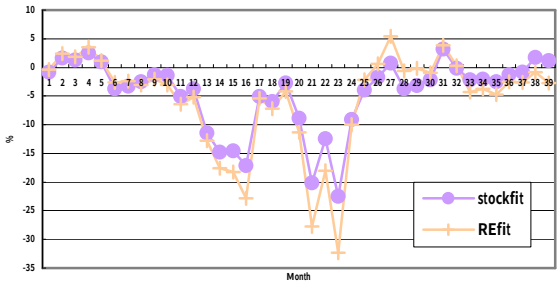


Exhibit 7

. Estimation of the latent variable model with the rank restriction imposed

Latent variable model:

$$E_t[\quad] = \sum_{k} \quad \left[\sum_{L} \quad Y_{pt}\right] = \sum_{L} \quad Y_{pt}$$

Rank restriction:

$$\sim_{ip} = \sum_{k} \quad {}_{ik} \quad {}_{kp}$$

A. The number of systematic factors in the economy equals one (k=1)

	β_{i1}	S.D.
Estimated Beta Coefficients for the following assets:		
Stock	1.000*	---
Bond	0.035	0.0148
Property	1.306	0.0775

Note: Asterisks (*) indicates these number are normalized to be one or zero. The sample period for this table is 1996.11 –2001.01, with 39 observations.

B. The number of systematic factors in the economy equals one (k=2)

	β_{i1}	S.D.	β_{i2}	S.D
Estimated Beta Coefficients for the following assets:				
Stock	1.000*	---	0.000*	---
Property	0.000*	---	1.000*	---
Bond	0.094	0.0435	-0.045	0.0313

Note: Asterisks (*) indicates these numbes are normalized to be one or zero. The sample period for this table is 1996.11 –2001.01, with 39 observations.

End Notes

[i] In a k factor mult-factor pricing framework, if we let λ_{mt} denote the risk premium of factor m at time t in, then Ross (1976) has shown that the conditional expected risk premium is a linear function of factor risk premiums, with the coefficients equal to the beta of each factor. That is, the following equation holds:

$$(1) \qquad E_t[\tilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik} a_{kt},$$

If there are L forecasting variables, say $X_1, X_2, \ldots X_L$, and each λ_{kt} can be expressed as follows:

$$(2) \qquad \lambda_{kt} = \sum_{p=1}^{L} \theta_{kp} X_{pt} \qquad k = 1 \ldots k,$$

where θ_{kp} is the coefficient for observable variable X_{pt} (where $p = 1 \ldots L$), and λ_k is a linear function of observable variables X_{pt}. Substituting (2) into (1), we get

$$(3) \qquad E_t[\tilde{r}_{i,t+1}] = \sum_{k=1}^{K} \beta_{ik} \left[\sum_{p=1}^{L} \theta_{kp} X_{pt} \right] = \sum_{p=1}^{L} \gamma_{ip} X_{pt}$$

Equation (1) and (3) combined are called a multi-factor "latent-variable" model. The model implies that expected excess returns are time-varying and can be predicted by the forecasting variables in the information set. From equations (2) and (3), we can see that the model puts some restrictions on the coefficients of equation (3), which is

$$(4) \qquad \gamma_{ip} = \sum_{k=1}^{K} \beta_{ik} \theta_{kp}$$

Here, β_{ik} and θ_{kp} are free parameters. For more details on this model, see Hansen and Hodrick (1983), Cibbons and Ferson (1985), Campbell (1987), Ferson (1989), Ferson (1990), Ferson and Harvey (1990), Liu and Mei (1992), and Mei and Lee (1994).

[ii] See Campbell (1987), Fama and French (1989), Keim and Stambaugh (1986), Ferson and Harvey (1989), Liu and Mei (1992), and Mei and Lee (1994).

[iii] In all these studies, a dummy variable is also included. Since in the early stage of this study, the dummy variable was found not significant in predicting expected returns on assets within the study period, we only present the results without the dummy variable later.

[iv] Liu and Mei (1992) pointed out that "although it is tempting here to conclude from the correlation matrix that EREITs are much closer to stocks than to bonds, a closer look at the return generating process reveals that the correlation between two types of assets come from two sources, the co-movement of expected returns and the co-movement of unexpected returns. In general, it is possible for two assets to have high correlation but with neither their expected excess returns nor their unexpected excess returns moving together. Only under the null hypothesis, where the expected returns are restricted by equation (1), do high correlation imply that the two parts move together across the two assets".

[v] Such as Harvey (1989), Liu and Mei (1992), and Mei and Lee (1994) among others.

[vi] This finding supports the results of Chan, Hendershott, and Sanders [1990] and Liu and Mei (1992).