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Pacific Basin stock markets and international capital asset pricing

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Abstract

In this paper, we follow Harvey (1991) to investigate whether rates of return on Pacific Basin stock markets can be explained by conditional version of International Capital Asset Pricing Model (ICAPM), which allows for time-varying expected returns, variances, and covariances. The results show that most individual Pacific Basin markets can be described by the conditional ICAPM. However, the multiple markets' tests do not support the conditional ICAPM formulation, and the estimates of world reward to risk ratio are not the same across these markets. Furthermore, the Ghysels and Hall test (Ghysels & Hall, 1990a, 1990b) shows that the estimates of parameter are also unstable in the conditional ICAPM formulation. This implies that it is difficult to use world return to describe the relationship between expected return and risk for the Pacific Basin stock markets.

Keywords: Capital asset pricing model; International Capital Asset Pricing; Generalized method of moment; Pacific Basin stock markets; Structural stability test

1. Introduction

A number of studies have found that Pacific Basin markets can play an important role in improving diversification effects. For example, Bailey and Stulz (1990) have explored a

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substantial benefit to global investors from diversifying into these markets. The benefit results from the fact that most Pacific Basin markets are uncorrelated with each other and with developed markets. Unfortunately, little is known about how to measure the risks of investments in these markets.

This paper investigates whether expected rates of return on Pacific Basin stock markets can be explained by International Capital Asset Pricing Model (ICAPM). There are two primary motivations for this study. Firstly, the market size of Pacific Basin stock markets have been a sharp increase in the 1980s (see Solnik, 1991), and the rates of return are higher than those of US and European markets. However, there is lack of a promising empirical model to describe the price behavior of these markets. As a result, the high rates of return are hard to interpret. If the expected rates of return can be described by the ICAPM, the performances of Pacific Basin stock markets can be compared with other markets. Besides, the benefits of international diversification can be reinforced by including these markets with clearer understanding.

The second motivation is that Pacific Basin markets are removing barriers and becoming more integrated into the world capital market. However, the capital flows from developed countries to emerging markets are substantially small than what should be observed,[1] e.g., Tesar and Werner (1995). Both works of Bekaert and Harvey (1995a, 1995b) and Claessens (1995) show that the stock markets of Pacific Basin countries have become more, although not fully, integrated with world financial markets. In a fully integrated market, two different markets with the same risk must command the same expected return. Thus, if the ICAPM can explain the expected rates of return on the Pacific Basin stock markets, the results can be used to support the statement that these markets have been integrating into the world capital market.

We follow Harvey (1991) to employ a version of conditional ICAPM that allows for time-varying expected returns, conditional variances, and conditional covariances to study the risk–return relationships for 10 Pacific Basin stock markets. A number of studies have indicated that risk premia are time-varying condition on some information variables, e.g., Fama and French (1989), Gibbons and Ferson (1985), and Whitelaw (1994). The works of Harvey (1989, 1991) show that a conditional ICAPM can help in explaining difference in developed countries. However, the result of Harvey (1995) exhibits that the conditional ICAPM fail to price emerging market assets correctly on average and are unable to account for the time variation in expected returns. The explanatory powers of the conditional ICAPM are apparently different in different markets. In this paper, we further use a test of Ghysels and Hall (1990a, 1990b) to examine the structural stability of the conditional ICAPM in the Pacific Basin stock markets.

Our empirical results show that Hansen's (1982) J test of the conditional ICAPM cannot be rejected for most Pacific Basin stock markets. However, the structural stability test shows that the parameters of our ICAPM specification are not stable over time. Only the tests of constant β specification are not rejected for most markets, but most estimated β's are not statistically significant. The results are similar to the work of Garcia and Ghysels (1998) for other

[1] This phenomenon may result from home bias puzzle, which has several possible explanations, such as non-traded goods, market inefficiencies, and capital flow restrictions. See, e.g., Lewis (1994).

emerging markets. The failure of the conditional ICAPM to explain the Pacific Basin markets may be due to the choice of information variables,[2] and improper assumptions of fully integration with world market and an efficiency world market portfolio.

The paper is organized as follows. In Section 2, the methodology is outlined. Section 3 describes the data. Section 4 presents the empirical results. Some concluding remarks are made in Section 5.

2. Methodology

If Pacific Basin markets are part of a global market, the ICAPM[3] argues that the expected return should be proportional to its covariance of the market's return with the world market's return. Harvey (1991) has shown that a conditional ICAPM which allows the first and second moments varying over time can be verified by the following system of equations,

$$e_t = r_t - z_{t-1}\delta \tag{1.1}$$

$$e_{mt} = r_{mt} - z_{t-1}\delta_m \tag{1.2}$$

$$p_t = e_{mt}^2 z_{t-1}\delta - e_t e_{mt} z_{t-1}\delta_m \tag{1.3}$$

where r_t is an $n \times 1$ vector excess return on the markets to be examined from time $t-1$ to t, r_{mt} is the excess return on the world portfolio from $t-1$ to t, e_t is the investor's forecast errors for the market returns, e_{mt} is the investor's forecast error for the return on the world portfolio, z_{t-1} is s information variables that are available to the investors, and δ are n sets of parameters, p_t is the pricing errors. A negative pricing error implies that the model is overpricing, while a positive pricing error indicates that the model is underpricing.

Under rational expectations, the error terms in Eqs. (1.1)–(1.3) must be zero conditional on the information variables. Hence, Eqs. (1.1)–(1.3) can be estimated by Hansen's (1982) generalized method of moments (GMM). There are $(2n+1) \times s$ orthogonality conditions and $(n+1) \times s$ parameters, which implies that the number of the overidentifying conditions is equal to $n \times s$. As shown in Hansen (1982), Eqs. (1.1)–(1.3) can be tested by these overidentifying restrictions, which is a chi-square statistic, χ^2, with $n \times s$ degrees of freedom.

All conditional moments, which include the means, variances, and covariances, are allowed to change through time in Eqs. (1.1)–(1.3). If some of these moments are restricted to be constant, then more powerful tests can be posed. The traditional CAPM restricts the expected excess return on an asset to be proportional to the expected excess return on the market portfolio. This proportion is β, which is the ratio of the asset's covariance with the market portfolio to the variance of the market portfolio. If β is imposed

[2] Dumas (1994) pointed out that a major drawback of conditional moment specification is an arbitrary choice of information variables.

[3] One of the convincing methods for investigating whether a particular market is internationally integrated is based on an analysis of a security's price (see Adler & Dumas, 1983). Under complete integration, two different markets with the same risk must command the same expected return.

to be constant and other moments are time varying, the conditional ICAPM can be examined by following equation,

$$k_t = r_t - \beta r_{mt} \tag{2}$$

where k_t is also the pricing error associated with the specification. Once the model is specified, Eq. (2) can form $n \times s$ orthogonality conditions, and GMM estimation can be used to estimate these n parameters, leaving $n \times (s-1)$ overidentifying conditions to be tested.

Another moment that could be constant is the world reward to risk ratio. Under this restriction, we can follow Harvey (1991) to test the conditional ICAPM by following system equations,

$$e_{mt} = r_{mt} - z_{t-1}\delta_m \tag{3.1}$$

$$\nu_t = r_t - \lambda r_t e_{mt} \tag{3.2}$$

where λ is the ratio of conditionally expected excess return to conditional variance on the world portfolio, and ν_t is the pricing errors corresponding to this specification. This formulation has $(n+1) \times s$ orthogonality conditions. With $s+1$ parameters, there are $n \times s - 1$ overidentifying conditions.

Although the Hansen's J test have been used widely to test the orthogonality of instruments and errors, its power to distinguish a variety of alternatives is challenged. For example, Newey (1985) showed that such test may fail against general misspecification that causes estimator inconsistency. To examine the structural stability of the conditional ICAPM, we used Ghysels and Hall (1990a, 1990b) to test whether the formulas in Eqs. (1.1)–(1.3) Eqs. (2)–(3.2) are stable. Ghysels and Hall proposed a test for the structural stability of models estimated by GMM that focused on the moment conditions across subsamples. Specifically, this test is a split-sample test of structural stability. The Ghysels and Hall test statistic is [Eq. (4)]

$$\mathrm{GH} = \left[n_2^{-1/2}\sum_{t=1}^{n_2}\varepsilon_2(r_t,\delta)\right]\mathrm{V}_2^{-1}\left[n_2^{-1/2}\sum_{t=1}^{n_2}\varepsilon_2(r_t,\delta)\right] \tag{4}$$

where n_2 is the second subsample size, and ε_2 is the error term corresponding to the conditional ICAPM for the second subsample evaluated at the parameter estimates from the first subsample. The matrix $\mathbf{V}_2$ is a weighting matrix defined as [Eq. (5)]

$$\mathbf{V}_2 = \mathbf{S}_2 + c\tilde{D}_2(D_1'\mathbf{S}_1^{-1}D_1)^{-1}\tilde{D}_2' \tag{5}$$

where $\mathbf{S}_1$ and $\mathbf{S}_2$ are estimates of the weighting matrices for the first and second subsamples[4], c is the ratio of n_2/n_1, and D_1 and D_2 are the derivatives of first and second subperiod moment conditions with respect to the parameter vector. The Ghysels and Hall test is asymptotically distributed χ^2 with degrees of freedom equal to the number of orthogonality conditions.

[4] We use the estimates over the second subsample to construct $\mathbf{S}_2$. Oliner, Rudebusch, and Sichel (1996) showed that the Ghysels and Hall test can be very sensitive to the choice of a weighting matrix $\mathbf{S}_2$. In their numerical results, using the estimates over the second subsample to construct $\mathbf{S}_2$ have more power against alternative.

The Ghysels and Hall test applies to cases where there are prior knowledge about regime switches.[5] In this study, we use a 50–50 sample split to examine the structural stability.

3. Data and summary statistics

Most of the data used in this study are local indices that are major broad-based indices published in their own countries. This is because most global financial institutions have not constructed market indices for some Pacific Basin markets (e.g., Morgan Stanley Capital International (MSCI)), or some indices that include only 10–20% of the listed stock selected on the basis of large capitalization may not reflect the whole market's behavior (e.g., International Finance Corporation's Emerging Markets Data Base). There are 10 local indices included in this study: Taiwan Weighted Index, Hong Kong Hang Seng Index, Japan Nikkei 225 Index, Malaysia Kuala Lumpur Composite Index, Stock Exchange of Thailand, Korea Seoul Composite Index, Singapore Straits Times Index, Indonesia Jakarta Composite Index, Philippine Manila Composite Index, and Australia All Ordinary Share Index.

The local indices for Hong Kong, Malaysia, Thailand, and South Korea come from Pacific Basin Capital Markets Databases (PACAP), and the Taiwan Weighted Index comes from the Taiwan stock market statistics database. The remaining five local indices are drawn from the German and International Financial Database (GERFIN). Each local index is treated as a stock portfolio. Monthly index data are available for seven markets from January 1979 to July 1995; data for the Philippines and Australia start from January 1986, while data for Indonesia start from December 1987.

We chose the Standard and Poor's 500 Composite Share Index (S&P 500) as the market portfolio of the United States. The world portfolio is represented by the MSCI world index, which contains 20 countries and 1467 companies. To avoid the critique of Roll (1977), we must assume that the MSCI world index is an efficient benchmark portfolio. Fortunately, some studies fail to reject the efficiency of the MSCI world index, e.g., Harvey (1991).

All the market returns are calculated in US dollars and represented as the excess return over the holding yield on the 1-month US Treasury bill rate from the US Financial (USFIN) database. The instrumental variables should have the ability to predict the future prices and be available to the investors. There are two sets of instrumental variables: common and local instruments. While all markets share the same common instrumental variables, each market has its own local instrumental variables. The instrumental variables are treated as the linear filter and used to catch the time variation of the expected return, volatility of return, and covariance of the market return with the world return.

The selections of common instrumental variables were drawn from studies of US stock returns. Following Dumas and Solnik (1995) and Harvey (1991), we used the following instrumental variables as common set: the lagged world excess stock return, the lagged US excess stock return, the US dividend yield, the US term structure premium between

[5] There are some works that can be used to test structural stability with unknown change point, e.g., Andrews (1993) and Wright (1997).

Table 1
Summary statistics for the market returns and the instrumental variables

Variable	Mean	Standard deviation	Reward/risk	Autocorrelation rho1	rho4	rho12	Skewness	Kurtosis
Panel A: market returns								
Philippines	0.0274	0.120	0.2276	0.17	−0.00	0.05	0.78	3.62
Indonesia	0.0178	0.110	0.1614	0.33*	−0.03	−0.01	3.15	19.08
Taiwan	0.0147	0.125	0.1181	0.15*	0.11	0.09	0.65	3.30
Hong Kong	0.0112	0.094	0.1186	0.04	−0.12	−0.01	−0.57	2.59
Singapore	0.0080	0.071	0.1127	0.09	0.07	0.00	−1.17	6.48
Malaysia	0.0077	0.080	0.0965	0.10	0.04	−0.01	−0.30	1.97
Japan	0.0055	0.067	0.0818	0.06	0.04	0.10	0.25	1.35
Australia	0.0048	0.069	0.0699	0.09	−0.03	−0.14	−2.17	13.73
Thailand	0.0047	0.078	0.0606	0.18*	−0.09	0.08	0.07	2.85
South Korea	0.0046	0.072	0.0637	0.05	0.09	0.10	0.52	0.90
US	0.0038	0.042	0.0909	0.02	−0.07	−0.08	−0.70	4.17
World	0.0038	0.042	0.0900	0.02	−0.01	−0.01	0.48	1.80
Panel B: instrumental variables								
US dividend yield	0.0337	0.008	4.1098	0.96*	0.84*	0.58*	–	–
Treasury bill spread	0.0051	0.007	0.7391	0.23*	−0.08	0.18*	–	–
Junk bond spread	0.0124	0.005	2.5833	0.95*	0.82*	0.58*	–	–

* Significant at the 5% level based on an approximate standard deviation of $1/\sqrt{\text{obs}}$, where obs is usable observations.

the 1-month and 3-month Treasury bill rate, the US default risk yield spread between Moody's Baa and Aaa bonds, and a dummy variable for the month of January. We used the US excess stock return as an extra instrument variable, because Hamao and Masulis (1988) showed that the US market leads the Pacific Basin markets. The local information set contains the lagged world excess return, the US term structure premium, the US default risk yield spread, a January dummy variable, the lagged own-market excess return and the return on the exchange rate.[6] The return on the exchange rate was included as a local instrumental variable because of its significant influence on the national index return, which was found by Roll (1992).

The summary statistics for the 10 Pacific Basin markets, the MSCI world index and the United States market are presented in Table 1, which contains the unconditional means, standard deviations, reward to risk ratios, skewness, kurtosis, and autocorrelations of the monthly returns calculated by excess returns over the 1-month bill rate. All the 10 Pacific Basin markets have mean excess returns exceeding returns on the US market and the MSCI world index. However, the volatilities of returns of the US market and the world portfolio are lower than those of Pacific Basin markets. There are six markets (the Philippines, Indonesia,

[6] The local instrumental variables are chosen because they improve the adjusted coefficient of determination for nine of the 10 Pacific Basin markets during the sample period, which is not presented in the paper and is available from the authors upon request. The exchange rates are drawn from the Foreign Exchange (FOREX) Database.

Table 2
Unconditional correlations of the market returns

Market	Ph	In	Tw	HK	Sg	My	Jp	Au	Th	Ko	US
World	0.27	− 0.02	0.25	− 0.08	0.50	0.43	0.72	0.52	0.01	0.27	0.76
Philippines	Ph	0.22	0.10	0.03	0.41	0.42	0.12	0.16	0.08	0.14	0.25
Indonesia		In	− 0.03	0.20	0.14	0.18	− 0.14	0.16	0.18	0.09	0.09
Taiwan			Tw	0.08	0.36	0.32	0.25	0.30	0.11	0.14	0.20
Hong Kong				HK	− 0.01	0.01	− 0.11	0.04	0.36	0.07	0.04
Singapore					Sg	0.89	0.36	0.56	− 0.02	0.15	0.49
Malaysia						My	0.26	0.43	0.04	0.13	0.44
Japan							Jp	0.32	− 0.12	0.32	0.35
Australia								Au	0.04	0.08	0.50
Thailand									Th	0.09	0.06
South Korea										Ko	0.15
US											US

Taiwan, Hong Kong, Singapore, and Malaysia), which have higher reward to risk ratios than those of the US market and the MSCI world index. The high reward–risk ratios may reflect the economical growth for these countries during the sample period.

The markets that exhibit significant first-order autocorrelation are Indonesia, Taiwan, and Thailand. The other seven markets have not yet reached the significant level, but all of them have first-order autocorrelations higher than those of the US and the world portfolio. At the same time, the skewness and kurtosis measures also imply that the return patterns of Pacific Basin markets are not likely drawn from normal distributions. The nonnormality may result from the serial correlation in these markets.

Summary statistics for some of the instrumental variables are also presented in Table 1. All of the three variables (US dividend yield, Treasury Bill Spread and Junk Bond Spread) exhibit significant first-order autocorrelation.

The correlation matrix of total market returns in Table 2 shows that most Pacific Basin markets are generally less correlated with the world portfolio than the US market is. However, Japan, Australia, and Singapore exhibit more than 0.5 correlation with the world portfolio. Some of the Pacific Basin markets have not moved together on average. This is because of the autocorrelation patterns existing in these returns, which cause the unexpected returns to be measured with noise and biased.[7]

4. Empirical results

Tests of the conditional ICAPM are examined for 10 Pacific Basin markets. The conditional moments are allowed to be time varying. The constant β and constant world

[7] To compute the true relation between stock returns across markets, Bailey and Stulz (1990) suggested that the return should be subtracted from a predicted return that is based on past returns before the return is used to compute the correlation.

reward to risk ratio are also imposed on these tests. These tests are presented for individual markets as well as multiple markets.

4.1. Conditional ICAPM with time-varying moments

Table 3 presents tests of Eqs. (1.1)–(1.3), which is the conditional ICAPM that allows for time-varying expected returns, variances, and covariances. The test for an individual market may not be powerful because the same conditional expected return to conditional variance on the world portfolio is not imposed across the 10 Pacific Basin markets. Hence, when the test for an individual market is rejected, this market cannot be interpreted by the conditional ICAPM. However, the contrary may not be true.

The J test shows that Hong Kong and Thailand are rejected at the 1% significant level, and Japan is rejected at the 10% significant level, when common instruments are used. For local instruments, Hong Kong and Thailand are rejected at the 1% level, and Indonesia and Malaysia are rejected at the 10% level. Only Hong Kong and Thailand are rejected at the 1% significant level for either instrument set among the 10 Pacific Basin markets. The sizes of the adjusted coefficient of determination (R^2) for error terms with instrumental variables are noticeable in the Hong Kong and Thailand markets. These two markets have adjusted R^2 greater than 6.8%, no matter what instruments are used. This implies that the assumptions for the GMM estimation are not satisfied because the instrumental variables are correlated with the error terms. For the US market, this model cannot be rejected by common instruments.

Next, the seven markets whose tests are not rejected at the 5% level are gathered into two groups: group 5, which starts in January 1979, consists of Taiwan, Singapore, Malaysia, Japan, and Korea; group 7, which starts in January 1986, consists of group 5, the Philippines, and Australia.[8] Using common instruments, the results are different for these two groups. While group 5 is not rejected, group 7 is rejected at the 1% level. The rejection of group 7 may indicate that the conditional world reward to risk ratio is not the same for these seven markets. This may either suggest that the world portfolio is not conditionally mean–variance efficient or that some Pacific Basin markets have not integrated into the world market.

Some additional results are also presented in Table 3. The average pricing errors and the average absolute pricing errors are reported in the fourth and fifth columns. Most Pacific Basin markets have positive average pricing errors, indicating that the actual returns are on average higher than the expected returns predicted by the conditional ICAPM. When compared to the US market, it is very interesting to see that the average pricing error and average absolute pricing error for the US market are close to zero. This indicates that the conditional ICAPM is suitable for the US market and the US market has integrated into the world markets.

We used Ghysels and Hall (1990a, 1990b) to examine the structure stability of GMM estimations. The results are represented in the last column. Most markets are rejected. Only Hong Kong in the common instrument and Malaysia in the local instrument are not rejected.

[8] The sample period for Indonesia is from December 1987 to July 1995, which is too short to be employed for the multiple markets test.

Table 3
Tests of the conditional ICAPM with time-varying moments

Market	Average return	I[a]	Average pricing error[b]	Average absolute error[c]	$\bar{R}^2$[d]	J[e]	GH[f]
Philippines	0.0274	C	0.0025	0.0113	−0.0201	6.1667	n.c.
		L	0.0016	0.0115	−0.0186	8.4671	n.c.
Indonesia	0.0178	C	0.0004	0.0043	−0.0277	7.0962	n.c.
		L	0.0011	0.0038	−0.0195	13.2625*	173.87***
Taiwan	0.0147	C	0.0001	0.0063	0.0131	8.0794	32.224*
		L	0.0004	0.0066	0.0184	7.8810	52.840***
Hong Kong	0.0112	C	0.0012	0.0075	0.1507	21.9947***	18.472
		L	−0.0084	0.0246	0.0680	33.1971***	65.531***
Singapore	0.0080	C	−0.0001	0.0043	−0.0016	10.0107	33.103**
		L	0.0003	0.0052	−0.0020	10.0823	36.857**
Malaysia	0.0077	C	−0.0003	0.0042	−0.0078	7.1122	34.743**
		L	−0.0004	0.0056	−0.0072	13.1020*	26.148
Japan	0.0055	C	0.0003	0.0033	0.0159	13.0535*	33.250**
		L	0.0006	0.0062	0.0154	6.7227	74.357***
Australia	0.0048	C	−0.0001	0.0062	−0.0164	8.7129	75.234***
		L	0.0008	0.0061	0.0195	11.5729	n.c.
Thailand	0.0047	C	0.0006	0.0052	0.1445	28.5331***	60.030***
		L	0.0001	0.0061	0.1448	20.3076***	169.98***
South Korea	0.0046	C	0.0003	0.0034	0.0112	7.4871	183.81***
		L	−0.0026	0.0087	0.0036	7.7253	34.137**
US	0.0034	C	−0.0000	0.0018	−0.0220	4.9995	50.992***
Group 5[g]	–	C	–	–	–	43.4463	–
Group 7[h]	–	C	–	–	–	83.7227***	–

The system of equations in Eqs. (1.1)–(1.3) is estimated with the GMM. n.c. denotes that the GMM estimation in the first subsample is not convergence.

[a] The instrumental variables contain two sets: common instruments (C) and local instruments (L).

[b] This average error is p_{jt} divided by the average conditional variance of the world portfolio for market j.

[c] This average absolute error is p_{jt} divided by the average conditional variance of the world portfolio for market j.

[d] The adjusted coefficient of determination is obtained from a regression of the error term p_{jt} on the instrumental variables.

[e] The minimized value of the GMM criterion function. For the individual market test, there are 21 orthogonality conditions and 14 parameters leaving seven overidentifying conditions. For the multiple market test, there are 35 and 49 overidentifying conditions for group 5 and group 7, respectively.

[f] Ghysels and Hall (1990a, 1990b) structural stability test, which is an asymptotically distributed χ^2 with degrees of freedom equal to the number of orthogonality conditions.

[g] Taiwan, Singapore, Malaysia, Japan, and Korea. These markets are not rejected at the 5% significant level in the individual market test and start from 1979:2.

[h] Group 5, the Philippines and Australia, which are not rejected at the 5% significant level in the individual market test and start from 1986:2.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

However, these two markets are also rejected in the Hansen's J test. Although the time-varying second moment specification allows the expected returns, variances, and covariances to change over time, its usefulness depends on the stability of linear filter parameters. When the stability is rejected, caution must be observed in using this specification to measure the relationship between return and risk.

4.2. Conditional ICAPM with constant β's

Table 4 presents results for testing Eq. (2), which is the conditional ICAPM with constant β. This is a test of the conditional version of the original Sharpe–Lintner formulation, which assumes that expected market excess returns are proportional to the expected world portfolio excess return.

For the J test, only Thailand is rejected at the 5% level with common instruments. When local instruments are used, Indonesia, Malaysia, and Thailand are rejected at the 10% level. For the markets whose tests are rejected, their corresponding adjusted R^2 are larger than those of other markets. This indicates that the error terms are correlated with the instruments for these rejected markets. The test for the US is not rejected at the 10% level. The Hong Kong market is rejected when time-varying moments are used, but is not rejected when the constant β restriction is imposed. In Hong Kong, the linear filter used to form the conditional first and second moments may perform unsatisfactory, resulting in the rejection of time-varying moments formulation.

The markets whose tests are not rejected at the 5% level are gathered into two groups: group 6, which starts in January 1979, consists of Taiwan, Hong Kong, Singapore, Malaysia, Japan, and Korea; group 8, which starts in January 1986, consists of group 6, the Philippines, and Australia. Tests for these two groups are not rejected with common instruments, reinforcing the assertion that this model is well fitted for these markets.

The fourth column of Table 4 provides the information about the β. The order of the β's is almost the same as the order of the average returns for the markets whose tests are not rejected. A difference between the estimated β's of Pacific Basin markets and that of the US market lies in their consistent standard errors. Only two markets of the 10 Pacific Basin markets have estimated β's with more than 2 standard errors from zero with common instruments. When local instruments are used, there are five markets with more than 2 standard errors from zero. However, the β of the US market is statistically different from zero. Buckberg (1995) has pointed out that an insignificant β implies that the market is noisy and volatile, leading to a large standard error and making the β unstable. From this viewpoint, Japan has the lowest standard error with respect to β of the 10 Pacific Basin markets.

The pricing errors are also presented in the fifth and sixth columns on Table 4. The average errors are positive for most Pacific Basin markets, indicating that the realized returns of these markets are larger than the returns predicted by the conditional ICAPM. On the other hand, the average error for the US market is negative and smaller than those of the Pacific Basic markets. The average absolute error of the US is also smaller than those of the Pacific Basin markets.

Table 4
Tests of the conditional ICAPM with constant betas

Market	Average return	I[a]	β_j	Average pricing error[b]	Average absolute error[c]	$\bar{R}^{2d}$	J^e	GH[f]
Philippines	0.0274	C	2.189 (1.048)	0.0152	0.0965	−0.0186	2.608	4.657
		L	3.169 (1.599)	0.0098	0.1191	−0.0371	2.335	5.024
Indonesia	0.0178	C	−0.358 (1.572)	0.0187	0.0725	−0.0278	5.711	n.c.
		L	1.601 (2.598)	0.0137	0.0844	0.0795	10.822*	n.c.
Taiwan	0.0147	C	4.094 (2.345)	−0.0001	0.1454	−0.0182	2.544	7.599
		L	3.003 (1.619)	0.0034	0.1194	−0.0008	2.933	6.302
Hong Kong	0.0112	C	2.902 (1.531)	0.0003	0.1228	0.0363	10.103	16.10**
		L	3.746 (1.872)	−0.0029	0.1450	0.0374	8.493	12.306*
Singapore	0.0080	C	2.570 (1.341)	−0.0017	0.0731	−0.0264	1.570	4.527
		L	2.044 (0.936)	0.0002	0.0611	−0.0188	2.160	4.851
Malaysia	0.0077	C	1.732 (1.139)	0.0012	0.0643	0.0142	4.104	5.431
		L	1.946 (1.209)	0.0004	0.0681	0.0140	12.205*	12.839*
Japan	0.0055	C	1.389 (0.611)	0.0002	0.0372	0.0375	8.334	8.492
		L	1.894 (0.470)	−0.0017	0.0440	−0.0207	1.802	4.830
Australia	0.0048	C	0.605 (0.552)	0.0015	0.0424	0.0012	6.462	5.084
		L	0.429 (0.515)	0.0024	0.0432	−0.0050	7.679	1.182
Thailand	0.0047	C	1.688 (1.196)	−0.0016	0.0796	0.0595	13.65**	8.971
		L	0.596 (0.816)	0.0025	0.0593	0.1066	12.406*	11.400
South Korea	0.0046	C	0.335 (0.934)	0.0033	0.0527	0.0150	7.618	3.188
		L	1.577 (0.813)	−0.0014	0.0621	0.0063	8.120	8.924
US	0.0034	C	1.106 (0.331)	0.0004	0.0234	−0.0163	2.776	5.779
Group 6[g]	–	C	–	–	–	–	46.872	–
Group 8[h]	–	C	–	–	–	–	54.295	

Eq. (2) is estimated with GMM. n.c. denotes that the GMM estimation in the first subsample is not convergence.

[a] The instrumental variables contain two sets: common instruments (C) and local instruments (L).

[b] This average error is k_{jt} based on the individual market estimation for market j.

[c] This average absolute error is k_{jt} based on the individual market estimation for market j.

[d] The adjusted coefficient of determination is obtained from a regression of the error term k_j on the instrumental variables.

[e] The minimized value of the GMM criterion function. For the individual market test, there are seven orthogonality conditions and one parameter leaving seven overidentifying conditions. For the multiple market test, there are 36 and 48 overidentifying conditions for group 6 and group 8, respectively.

[f] Ghysels and Hall (1990a, 1990b) structural stability test, which is an asymptotically distributed χ^2 with degrees of freedom equal to the number of orthogonality conditions.

[g] Taiwan, Hong Kong, Singapore, Malaysia, Japan, and Korea. These markets are not rejected at the 5% significant level in the individual market test and start from 1979:2.

[h] Group 6, the Philippines and Australia, which are not rejected at the 5% significant level in the individual market test and start from 1986:2.

* Significant at the 10% level.

** Significant at the 5% level.

The last column of Table 4 shows the structural stability test. Hong Kong is rejected at the 5% significance level for the common instruments. For the local instruments, Hong Kong and Malaysia are rejected at the 10% significance level. The constant β ICAPM does not depend on any linear filter parameters. This makes its specification more reliable than time-varying moment ICAPM. However, most estimated β's are not significant to price the market assets.

4.3. Conditional ICAPM with a constant world reward to risk ratio

Table 5 shows estimates for testing Eqs. (3.1) and (3.2), which is the conditional ICAPM that employs time-varying conditional covariances and a constant world reward to risk ratio. This ratio is a compensation for the volatility of the world portfolio and is not restricted to be the same across markets in the single market estimation, however.

The J test shows that only Hong Kong is rejected among the 10 Pacific Basin markets when common instruments are used. When local instruments are used, the model's restrictions are rejected at the 10% level for Malaysia and the 5% level for Hong Kong, Japan, and Korea. The Hong Kong market is rejected by both instruments, and its corresponding adjusted R^2 is more than 13%, implying that the model's formulation may be false for this market.

For the multiple markets test, the 10 markets are gathered into two groups: group 5, which starts in January 1979, consists of Taiwan, Singapore, Malaysia, Japan, and Korea; group 7, which starts in January 1986, consists of group 5, the Philippines, and Australia. The exclusion of Indonesia, Hong Kong, and Thailand is because of the shortness of the sample period, the rejection of the model's restriction in the single market test, and the abnormal value for the world reward to risk ratio, respectively. The two group tests are not rejected at the 5% significant level with common instruments, but there is the caution that the multiple market's test may lack power.

An alternative test is presented in the last two rows of Table 5. This is a Newey and West (1987) test, which proceeds in two steps. First, the two groups are estimated with market specific world reward to risk ratios. Second, the two groups are estimated by imposing the same world reward to risk ratio. In the restricted estimation, the weighting matrix is estimated using the unrestricted estimation. The difference in the final χ^2 statistics is distributed χ^2 with degrees of freedom equal to the numbers of market being tested. Using common instruments, the test for group 5 provides evidence for the null hypothesis, which has the same ratios, while group 7 provides evidence against the null hypothesis. The difference in these two tests can be seen from the fourth column of Table 5, which shows the world reward to risk ratios. Using common instruments, the group 5 markets have similar ratios. In addition to group 5, group 7 adds two more markets: the Philippines and Australia. The ratios for the Philippines (9.14) and Australia (0.70) are different from those of group 5 (around 4.0). This may explain the different results between group 5 and group 7.

The world reward to risk ratios are provided in the fourth column. There are negative ratios for Thailand no matter what instruments are used, for Indonesia using common instruments, and for Hong Kong and Australia using local instruments, implying that the asset pricing model may be misspecified for these markets.[9] The ratios and their disturbances for most

[9] Thomas and Wickens (1993) have argued that the negative world reward to risk ratios are largely due to the exchange risk in holding foreign assets.

Table 5
Tests of the conditional ICAPM with constant world reward to risk ratio

Market	Average return	I[a]	λ_j	Average pricing error[b]	Average absolute error[c]	$\bar{R}^{2d}$	J^e	GH[f]
Philippines	0.0274	C	9.1350 (7.467)	0.0125	0.0829	0.007	5.102	39.796***
		L	3.1145 (6.102)	0.0223	0.0862	0.026	7.961	50.593***
Indonesia	0.0178	C	− 6.3844 (9.24)	0.0176	0.0682	− 0.018	6.379	31.829***
		L	78.650 (40.76)	0.0200	0.1796	− 0.030	4.764	n.c.
Taiwan	0.0147	C	3.6669 (5.014)	0.0097	0.0842	0.017	8.508	32.588***
		L	0.4793 (4.632)	0.0141	0.0848	0.036	8.164	13.869
Hong Kong	0.0112	C	14.127 (4.831)	0.0150	0.0691	0.137	22.084***	31.594***
		L	− 25.694 (8.02)	0.0043	0.0928	0.131	15.847**	37.640***
Singapore	0.0080	C	4.0515 (3.688)	0.0017	0.0522	0.008	9.627	22.121*
		L	4.9254 (3.970)	0.0004	0.0523	0.012	10.097	27.071**
Malaysia	0.0077	C	4.0196 (3.941)	0.0018	0.0605	− 0.001	6.064	37.509***
		L	5.9030 (4.209)	− 0.0010	0.0605	0.016	11.427	23.445*
Japan	0.0055	C	3.0676 (2.259)	− 0.0008	0.0498	0.011	7.759	19.886
		L	2.8934 (2.367)	− 0.0005	0.0499	0.019	13.457**	28.107**
Australia	0.0048	C	0.7033 (3.799)	0.0037	0.0499	− 0.016	7.223	40.349***
		L	− 0.099 (3.702)	0.0050	0.0497	− 0.010	9.571	13.297
Thailand	0.0047	C	− 45.48 (16.75)	0.0063	0.1041	− 0.012	3.704	46.065***
		L	− 20.69 (11.06)	0.0055	0.0658	0.039	4.998	31.324***
South Korea	0.0046	C	3.3462 (5.314)	0.0017	0.0537	0.011	7.785	28.900**
		L	20.997 (5.855)	− 0.0133	0.0553	0.024	15.638**	n.c.
US	0.0034	C	3.5582 (2.405)	− 0.0010	0.0310	− 0.010	4.195	42.215***
Group 5[g]	–	C	4.3803 (2.102)	–	–	–	39.234	–
Group 7[h]	–	C	0.1082 (2.274)	–	–	–	49.041	–
Group 5[i]	–	C	$\lambda_j = \lambda$	–	–	–	4.412	–
Group 7[j]	–	C	$\lambda_j = \lambda$	–	–	–	38.968***	–

GMM is used to estimate the system of equations in Eqs. (3.1) and (3.2). n.c. denotes that the GMM estimation in the first subsample is not convergence.

[a] The instrumental variables contain two sets: common instruments (C) and local instruments (L).

[b] This average error is ν_{jt} for market j.

[c] This average absolute error is ν_{jt} for market j.

[d] The adjusted coefficient of determination is obtained from a regression of the error term ν_t on the instrumental variables.

[e] The minimized value of the GMM criterion function. For the individual market test, there are 14 orthogonality conditions and eight parameters leaving six overidentifying conditions. For the multiple market test, there are 34 and 48 overidentifying conditions for group 5 and group 7, respectively.

[f] Ghysels and Hall (1990a, 1990b) structural stability test, which is an asymptotically distributed χ^2 with degrees of freedom equal to the number of orthogonality conditions.

[g] Taiwan, Singapore, Malaysia, Japan, and Korea. These markets are not rejected at the 5% significant level in the individual market test and start from 1979:2.

[h] Group 5, the Philippines and Australia, which are not rejected at the 5% significant level in the individual market test and start from 1986:2.

[i] The χ^2 test has 5 degrees of freedom.

[j] The χ^2 test has 7 degrees of freedom.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significance at the 1% level.

Pacific Basin markets are more than the corresponding values for the US market, which implies that the degree of risk aversion for Pacific Basin markets is higher than that of the US market. This high risk aversion may reflect the inefficiency of the markets and investor's anxiety about financial and political reform.

The average pricing errors and the average absolute pricing errors reported in the fifth and sixth columns exhibit the same patterns as those in the previous two tables: the average errors are positive for most Pacific Basin markets, and the error and its disturbance for the US market are always less than those of the 10 Pacific Basin markets.

Most markets are not rejected in the *J* test. However, the Ghysels and Hall structure stability test tell the different story. The Ghysels and Hall test displayed in the last column shows that only three tests are not rejected at 10% significance level: Japan in the common instruments and Taiwan and Australia in the local instruments. Therefore, the parameters of the linear filter and the world reward to risk ratios may be not stable. The results are similar to the work of Garcia and Ghysels (1998). Although the conditional ICAPM formulations cannot be rejected using Hansen's *J* test for overidentifying restrictions, the structural stability tests do not support the formulations.

5. Conclusions

The Pacific Basin stock markets have stand out as the world's fastest growing region. To gain the benefits of investing into these markets, we need an asset pricing model to connect the expected market's return to the market's risk. In this paper, we examine whether the conditional ICAPM can fill this gap.

The results show that the tests of the conditional ICAPM formulations are not rejected for most individual markets, but are rejected in the multiple markets. This suggests that the estimates of the reward to risk ratio for the world market are not the same across the Pacific Basin stock markets. Consequently, it is inappropriate to use the ICAPM to compare the investment performance among the Pacific Basin stock markets.

The results also find that the conditional ICAPM formulations lack the stability to connect the expected return to the risk in the Pacific Basin stock markets. The time-varying moment formulations mainly depend on the linear filter specification, making the number of parameters exaggerated. As a result, even a few unstable parameters can make the structural stability of the conditional ICAPM formulation be rejected. The rejection of stability test of Pacific Basin stock markets may be largely from the result of economical and political changes that have taken place over the past decade. The liberal policies of trade and capital market have contributed to a rapid growth of economy and increased the degree of integration of these markets with international financial markets. However, the regulations of capital market in most Pacific Basin countries are far from tight. The regulations are likely changed whenever the economical situations change. This will change the agent's expectations, which make the investment risk in Pacific Basin stock markets unstable. The results imply that there are some unobservable risks in the Pacific Basin stock markets. Using undiversified risk with global markets alone cannot explain the expected returns of Pacific Basin stock markets.

There are a number of cautions in this study. Firstly, we assume that the Pacific Basin stock markets are integrated with the world market. However, these markets may exist a time-varying degree of market integration with the world market, e.g., Bekaert and Harvey (1995a, 1995b). This may also explain the reason why the structural stability tests are rejected in the Pacific Basin stock markets. Secondly, we treat the MSCI world index as an efficiency world market portfolio. The benchmark error (e.g., Reilly & Akhtar, 1995) may clarify why we cannot use the ICAPM to compare the investment performance of the Pacific Basin stock markets to that of the developed markets. Thirdly, the information variables employed in the studies of developed market's may lack the predictability in the Pacific Basin markets. This may result in a poor fit of conditional first and second moments of the market's returns and possibly make the parameters unstable. Finally, using one-factor model to explain the investment risk may ignore the market infrastructure of the Pacific Basin markets. For example, Domowitz et al. (1998) showed that there are country and currency risks in the emerging markets. Therefore, the omitting factors may disturb the conditional ICAPM and make the formulations rejected.

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