CAUSAL RELATIONSHIP BETWEEN LOCAL AND FOREIGN TRANCHE STOCK RETURNS IN THE MALAYSIAN SECURITIES MARKET

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ABSTRACT

This paper tests for cointegration and establishes the Granger causal relationship between the local and foreign tranche returns of seven stocks listed in the Kuala Lumpur Stock Exchange (KLSE) that have the company's memoranda of association amended to allow for foreign ownership of these shares. Long-run relationship is present in the case of Arab Malaysian Finance Berhad, Southern Bank Berhad and Pacific Bank Berhad. It is found that the local and foreign tranche returns of all seven stocks are causally related but the causality direction differs. Three stocks, Malaysian International Shipping Corporation, Public Finance Berhad and Pacific Bank Berhad, witnessed the local tranche returns Granger causing the foreign tranche returns. The foreign tranche is found to lead the local tranche in the case of Public Bank Berhad and Southern Bank Berhad, while feedback exists between the two tranches of the stocks of Arab Malaysian Finance Berhad and Hock Hua Bank Berhad. The causality direction can possibly be explained by average return as well as return volatility if at least one of the tranches of a stock earns positive return.

INTRODUCTION

The Malaysian securities market has developed reasonably within the last decade. Over the period 1990-1998, the number of companies listed in the Kuala Lumpur Stock Exchange (KLSE) increased by two-thirds from 285 to 736, the market capitalisation increased more than three-fold from RM156.1 billion at the end of 1989 to RM499.5 billion as at 21 September 1999 and the trading volume expanded by almost 4-fold from RM29.5 billion in 1990 to RM115.2 billion in 1998.

The Malaysian stock market is one of the emerging markets in the East Asian region that has attracted a considerable amount of foreign portfolio investment. In order to manage and control the foreign interest in their stocks, some companies have amended their memoranda of association to allow for a maximum of 30-49 percent ownership of their shares by the foreigners. They have also applied for separate listing and trading of their shares in the KLSE. There are currently eight stocks which have local and foreign tranches listed on the KLSE. They are Arab Malaysian Finance Berhad (AMFB), Public Bank Berhad (PBB), Public Finance Berhad (PFB), Malaysian International Shipping Corporation (MISC), Tai Wah, Southern Bank Berhad (SBB), Pacific Bank Berhad (PAC) and Hock Hua Bank Berhad (HHB). The shares in the local tranche of a stock can only be registered in the names of Malaysian citizens while the shares in the foreign tranche can be registered in the names of non-citizens. While a foreigner can still trade in the local tranche of the stock, the scrip cannot be registered in his/her name. In other words, in stock market parlance, the foreigner can trade in "street names".

The pricing of dual-listed stocks has received considerable attention in the literature (see, e.g., Ma (1996), Chakravarty et al. (1998), Chen and Su (1998), Sun and Tong (2000)). An inherent characteristic of the models used in some of these studies is that the market is segmented between the two tranches of the same stock. A reason for market segmentation is the presence of information asymmetry between the local and foreign investors. Chen and Su (1998), for example, reported evidence of the segmentation in the Chinese stock markets that involves listing of both domestic and foreign shares. Their results suggest that return differentials between the two tranches are largely explained by asymmetric information. Segmentation of this nature implies that the stock exchange lacks certain features that could otherwise mitigate information asymmetry for foreign investors.

Since a major reason for issuing two classes of shares is to attract foreign investment without worrying about the loss of ownership control to foreign investors, market segmentation due to information asymmetry may act as an impeding factor. The objective of the current study is to examine if price information between the local and foreign tranches is segmented for the case of the KLSE. This is accomplished by establishing whether long-run equilibrium relationship is present between the local and foreign tranche stock returns of each of the above stocks except Tai Wah, which has very infrequent trading and therefore excluded from our study.

Another common observation related to dual listing is that the class of stocks allocated to foreign investors trades at a premium relative to domestic class stocks. This is because foreign investors can gain benefits of international diversification that domestic investors cannot, and consequently, they are willing to pay higher prices for foreign stocks than what they would pay at home. Empirical evidence supporting this observation can be found in Hietala (1989), Bergstrom et al. (1993), Bailey and Jagtiani (1994), and Stulz and Wasserfallen (1995), among others. As a result of this willingness, the foreign tranche returns is expected to have a delayed effect on the local tranche returns of the same stock. The second objective of this paper is to investigate the Granger-causal relationship between the local and foreign tranche returns, and if the local tranche is led by the movements of the foreign tranche returns.

DATA AND METHODOLOGY

The weekly closing prices of the local and foreign tranches of the seven stocks MISC, AMFB, PBB, PFB, SBB, PAC and HHB are used in this study. For stocks MISC and PBB, the period of study is January 1992 – December 1998. For the other five stocks AMFB, PFB, SBB, PAC and HHB, the period of study is from the date of listing of their foreign tranches, 11 March 1993, 15 February 1993, 23 January 1995, 8 February 1996 and 30 August 1995, respectively, to December 1998. Weekly returns of the local and foreign tranches of these seven stocks are calculated with adjustment for capital changes such as bonus and rights issues.

Before testing for cointegration and establishing the Granger-causal relationship, the local and foreign tranche stock prices are passed through a series of tests. First is the test of unit roots to determine the order of integration of the individual series. Let P_t represent the price series. The null hypothesis of a unit root is tested using the augmented Dickey-Fuller (1979) t-test. The test statistic, t_a, is the usual t-statistic for testing H_0: a = 0 in the following equation:

$$\Delta \log P_t = \mu + \alpha \log P_{t-1} + \sum_{i=1}^{m} \theta_i \Delta \log P_{t-i} + e_t \tag{1}$$

where $t = 1, 2, \ldots, n$, n is the sample size and e_t is the error term. The empirical distribution of t_a is tabulated by Mackinnon (1991). A rejection of the null hypothesis implies that the log price series is integrated of order 0 or I(0), and is stationary. Otherwise, the series is at least I(1). The lag length m is chosen to ensure that the residuals are not serially correlated.

To allow for the possible presence of deterministic time trend, equation (1) is augmented with a time trend component, as below:

$$\Delta \log P_t = \mu + \beta t + \alpha \log P_{t-1} + \sum_{i=1}^{m} \theta_i \Delta \log P_{t-i} + e_t \tag{2}$$

The augmented Dickey-Fuller t_t statistic, which is the usual t-statistic for testing H_0: a = 0 in equation (2), is used to test for the presence of a unit root. The empirical distribution of the t_t statistic is also given in Mackinnon (1991). If the null hypothesis of unit root is not rejected in the above models, the order of integration of log P_t could be one or higher. We would then proceed to test for the presence of a unit root in the first difference of the log price series (or log price relative). The hypothesis H_0: a = 0 is tested in the following equation:

$$\Delta^2 \log P_t = \mu + \alpha \Delta \log P_{t-1} + \sum_{i=1}^{m} \theta_i \Delta^2 \log P_{t-i} + e_t \tag{3}$$

A rejection of the null hypothesis would imply that the log price series is I(1), while the log price relative series is I(0).

As is shown below, all the log price series included in this study are I(1). After establishing the order of integration, we check if the prices of the local and foreign tranches of a stock are cointegrated. This test is also necessary for determining the type of model that should be used for a causality test. If cointegration exists, the vector error-correction (VEC) model is the right model to use. Otherwise, the vector autoregression (VAR) model is to be used. The methodology developed by Johansen (1991) is used to test for cointegration.

Let $y_t = (\log P_{Lt} \quad \log P_{Ft})'$ where the subscripts L and F denote the local and foreign tranches, respectively. Consider the following model:

$$\Delta y_t = \delta + \pi y_{t-1} + \sum_{i=1}^{p} \Gamma_i \Delta y_{t-i} + u_t \tag{4}$$

where $\delta = \begin{bmatrix} \delta_L \\ \delta_F \end{bmatrix}$, $\pi = \begin{bmatrix} \alpha_L \\ \alpha_F \end{bmatrix} [\beta_L \quad \beta_F]'$, $\Gamma = \begin{bmatrix} \Gamma_{L1,i} & \Gamma_{F1,i} \\ \Gamma_{L2,i} & \Gamma_{F2,i} \end{bmatrix}$, $i = 1, 2, \ldots, p$ and

$u_t = \begin{bmatrix} u_{Lt} \\ u_{Ft} \end{bmatrix}$.

The rank of the coefficient matrix π gives the number of cointegrating vectors. Johansen's method is based on estimating the π matrix in an unrestricted form, and then test if the restrictions implied by the reduced rank of π can be rejected. This is achieved by testing the null hypothesis of r cointegrating vectors against a general alternative hypothesis of more than r cointegrating vectors, based on the likelihood-ratio trace test statistic given by:

$$Q_r = -n \sum_{i=r+1}^{2} \log(1 - \lambda_i) \tag{5}$$

where $r = 0$, 1 and λ_i is the i-th largest eigenvalue as defined by Johansen (1991). The critical values for the test can be obtained from Osterwald-Lenum (1992). The cointegration test is based on the assumption that the series of y_t contain linear trends and the cointegrating equations have only intercepts.

If the prices of the local and foreign tranches are cointegrated, the following null hypothesis

$$H_0: \alpha_L = 0 \text{ and } \Gamma_{F1,i} = 0 \; \forall \; i$$

is tested to examine whether the returns of the foreign tranche are Granger-causing the returns of the local tranche. This direction of causality is true if the null hypothesis is rejected. Similarly, to examine whether the returns of the local tranche is Granger-causing the returns of the foreign tranche, the relevant null hypothesis is given by:

$$H_0: \alpha_F = 0 \text{ and } \Gamma_{L2,i} = 0 \; \forall \; i.$$

A more general testing approach that allows for possible cross-equation correlation in the dual-equation system of (4) is preferred. This is to avoid pre-empting existence of correlated contemporaneous shocks that may affect both the local and foreign tranche returns. The likelihood ratio (*LR*) test is used for this purpose. The test statistic is given by:

$$LR = (n - p - 1)(\ln|\hat{\Omega}_R| - \ln|\hat{\Omega}_U|) \tag{6}$$

where $|\hat{\Omega}_U| = \det(\sum_t \hat{u}_t \hat{u}_t' / n)$, $\hat{u}_t$ represents the residuals for the system of equations defined in (4). The matrix $\hat{\Omega}_R$ is calculated in a similar manner but using the residuals for the same system with the imposition of the restrictions under the null hypothesis. Under H_0, the *LR* statistic follows a chi-squared distribution with $p + 1$ degrees of freedom.

In the absence of cointegration, causality testing is conducted based on the VAR model given by:

$$\Delta y_t = \delta + \sum_{i=1}^{p} \Gamma_i \Delta y_{t-i} + u_t \tag{7}$$

The null hypothesis of interest to examine whether the foreign tranche returns Granger-cause the local tranche returns is

H_0: $\Gamma_{F1,i} = 0 \forall i$

The returns of the local tranche is Granger-causing the returns of the foreign tranche if the null hypothesis of

H_0: $\Gamma_{L2,i} = 0 \forall i$

is rejected. The LR test statistic is given by:

$$LR = (n-p-1)(\ln|\hat{\Omega}_R| - \ln|\hat{\Omega}_U|) \quad (8)$$

where $\hat{\Omega}_U$ and $\hat{\Omega}_R$ are computed as before but based on the system of equations in (7). The LR statistic follows a chi-squared distribution with p degrees of freedom under H_0.

To determine the lag order p in (4) and (7), we use the Schwarz (1978) criterion

$$SC = -\frac{2l}{n} + \frac{k \log n}{n} \quad (9)$$

where k is the number of parameters estimated in the model and l is the value of the log-likelihood function evaluated at these k estimates. As the models considered involve systems of equations, the full system log likelihood is used to compute SC. Assuming a multivariate normal distribution, this function is given by:

$$l = -\frac{nq}{2}(1 + \log 2\pi) - \frac{n}{2}\log|\hat{\Omega}_U| \quad (10)$$

where q is the number of equations in the system.

RESULTS

The results of the tests of unit root on the local and foreign tranche log price series for the models with and without time trend component, and the log price relative series are presented in Table l. Equations (1) to (3) were estimated using $m = 10$. The null hypothesis of a unit root cannot be rejected for the log price series, except for the case of the foreign tranche of PAC using t_r. In this case, however, no evidence against the presence of a unit root is found based on the t_a statistic. The tests provide sufficient evidence to reject the null hypothesis for the log price relative series, thereby indicating that these series are all stationary and hence I(0). Thus, the log price series are all I(l).

The cointegration test is therefore applied on the log price series and the results are given in Table 2. We reported the results for inclusion of one to ten lags of Δy_{t-i} in equation (4). One cointegrating vector is found using lag order of 4, 8, 3 and 1 for AMFB, SBB, PAC and HHB, respectively. However, the evidence of cointegration is very weak in the case of HHB. No evidence of cointegration is found between the foreign and local tranche prices of MISC, PBB and PFB. As 3 out of 7 cases supported strongly the presence of a long-run relationship, there is evidence to show that the market is integrated at least for some stocks.

The findings show that the VEC model is appropriate for AMFB, SBB and PAC, while the VAR model is appropriate for the other stocks, namely, MISC, PBB, PFB and HHB. The VEC models of the lag length that indicated cointegration in Table 2 were estimated. We also estimated the VAR model for $p = 1$ to 10. The Schwarz criterion was used to determine the optimal lag length in both cases. The VEC and VAR models with the optimal lag length are reported in Tables 3 and 4, respectively. Having established the appropriate models to use, we then examine the Granger-causal relationship between the local and foreign tranche return series of each of the seven stocks. The results of the causality test are presented in Table 5. This test is based on the models with the optimal lag length.

It can be observed that all seven stocks exhibit some form of Granger-causal relationship between their local and foreign tranches. However, the causality direction differs among the stocks. Unidirectional relationship is observed for the 5 stocks PBB, SBB, MISC, PFB and PAC. The first two stocks, PBB and SBB, witnessed their foreign tranche Granger-causing their local tranche. But for the other three other stocks, MISC, PFB and PAC, the reverse is true, that is, the local tranche Granger-causes the foreign tranche. Bidirectional causality relationship exists for the remaining 2 stocks, AMFB and HHB, showing that there is feedback between returns of their foreign and local tranches. This provides only weak evidence to support the notion that foreign tranche returns would lead their local counterpart.

Comparing the findings to those obtained for other markets in the region, a recent study by Lam and Pak (l993) showed that the market for local and foreign tranches of the same stock listed on the Stock Exchange of Singapore (SES) is segmented. On the other hand, Ng (l994) found that the foreign tranche returns Granger-caused the local tranche returns of each of the five SES stocks which have separate listing. Limit on foreign ownership varied from 27.5 percent for Singapore Airlines to 49.0 percent for Singapore Press Holdings. The other three were bank stocks with a foreign ownership limit of 40 percent. Evidently, our results are different from both of these studies.

Ng postulated that his results could be due to the difference in the trading volume of the local and foreign tranches of each stock. For all the stocks included in the study, the mean daily trading volume for the foreign tranche was consistently higher than the corresponding volume for the local tranche, ranging from 1.18 times to 12.72 times higher. However, in our study, no such pattern is detected. The ratio of trading volume for the foreign tranche to that for the local tranche is reported in Table 6. The trading volume for the foreign tranche is higher, but yet the local tranche could be leading the foreign tranche as is the case of MISC and PFB. On the other hand, this ratio is less than one when the foreign tranche is leading the local tranche for PBB and SBB. This could perhaps be that the trading volume for a particular tranche is at most about 3 times higher than that for the other tranche, and given that this ratio is not remarkably high, the trading volume is less useful in explaining causality direction. This is supported by the only exception, PAC, where Ng's postulation is applicable. For this stock, the trading volume for the local tranche is more than 160 times higher than the corresponding volume for the foreign tranche, resulting in the local tranche Granger causing the foreign tranches.

The summary statistics given in Table 6 reveal further possible explanations for the causality direction found in this study. This relates to the average return, and also the volatility of return after standardizing for the mean, as measured by the coefficient of variation. First are the cases where at least one of the tranches shows positive average return. The tranche with positive mean return leads the tranche with negative mean return, which is true for MISC and PAC. Second, when the average return of both tranches is positive, return volatility comes into play. The tranche with higher return volatility leads the other with lower volatility, as witnessed in PBB. Third are the cases where both tranches suffer negative average return. Unless they behave similarly in terms of mean and volatility, these two stock performance measures are not useful for explaining the causality direction. For AMFB and HHB where both tranches behave rather similarly, feedback is found. However, no systematic market behaviour can be observed for stocks with very dissimilar behaviour when both tranches show negative average returns. This covers PFB and SBB that exhibit very different volatility.

CONCLUSION

The results of this study show that the foreign and local tranche prices of 3 out of 7 stocks are cointegrated. Long-run relationship is found for AMFB, SBB and PAC. There is evidence of Granger-causal relationship between the local and foreign tranche returns of Malaysian stocks but the causality direction differs. Three stocks, MISC, PFB and PAC witnessed the local tranche returns Granger-causing the foreign tranche returns. The foreign tranche is found to lead the local tranche in the case of PBB and SBB, while feedback exists between the two tranches of the stocks of AMFB and HHB.

Unless the trading volumes of the local and foreign tranches differ greatly, our analysis shows that their relative magnitude cannot explain the causality direction. The return behaviour of the tranches seems to offer a better explanation, with the proviso that at least one tranche generating positive average return. The tranche with positive return has been found to lead that with negative return. If both tranches show positive return, it meets our expectation that the tranche with a higher return volatility will be leading. In other words, the leading tranche will be the one that exhibits good performance in return and is volatile enough to attract the interest of investors.

The findings of this paper suggest that separate listing and trading of the shares of local and foreign tranches do not always create market segmentation. The market behaviour seems integrated in the long run for 3 of the 7 stocks considered in this study. Hence, we cannot reject strongly the possibility of market segmentation given this limited evidence, as more than half the cases considered exhibited only short-run relationship.

Another implication of the results is that foreign portfolio investments in Malaysia channelled through the foreign tranches of the domestic stocks can have a significant impact on the Malaysian stock market. They can influence the prices and hence returns of the corresponding local tranches. However, this effect is not always domineering in that such investments are also led by the market sentiment of local investors, and sometimes strongly so. The market integration and causal relationship reported in this study is useful from the practitioners' point of view as they can be exploited for forecasting the prices of stocks involved.

Table 1

Dickey-Fuller Tests for Presence of Unit Root in Log Price and Log Price Relative Series of Local and Foreign Tranches of Seven Stocks

Stock		Log Price		Log Price Relative
		t_α	t_τ	t_α
MISC	Local	-2.38	-2.55	-5.59**
	Foreign	-2.17	-2.15	-6.17**
AMFB	Local	-1.18	-1.94	-4.85**
	Foreign	-1.01	-1.76	-5.03**
PBB	Local	-2.28	-2.21	-5.15**
	Foreign	-2.25	-2.18	-4.68**
PFB	Local	-1.74	-2.17	-4.66**
	Foreign	-1.55	-2.30	-4.81**
SBB	Local	-0.91	-1.96	-4.50**
	Foreign	-1.03	-2.16	-3.37*
PAC	Local	-0.70	-2.53	-3.78**
	Foreign	-0.65	-3.59*	-3.19*
HHB	Local	-1.23	-1.96	-3.27*
	Foreign	-1.15	-1.96	-3.05*

Notes: * Significant at the 5 percent level.** Significant at the 1 percent level.See Mackinnon (1991) for critical values.The test statistics are computed based on the regression that includes 10 lags of the first difference of the dependent variable.

Table 2

The Trace Test Statistics for Test of Cointegration between the Local and Foreign Tranche Price Series

	Lags of Δy_t included									
Stock	1	2	3	4	5	6	7	8	9	10
MISC										
$r = 0$	14.96	11.54	10.24	9.03	8.69	10.48	10.76	10.64	8.84	8.46
$r \leq 1$	4.24*	4.60*	3.19	2.97	3.14	3.62	3.50	3.44	1.73	1.02
AMFB										
$r = 0$	19.78*	16.17*	11.20	11.94	11.40	12.98	14.17	15.71*	17.54*	17.50*
$r \leq 1$	0.56	0.93	1.61	2.13	2.82	2.82	2.90	3.36	4.08*	3.19
PBB										
$r = 0$	8.41	7.92	7.12	7.06	6.65	8.00	8.23	8.04	9.43	7.54
$r \leq 1$	2.73	2.86	1.99	1.57	1.22	1.63	2.90	2.78	2.87	1.97
PFB										
$r = 0$	11.30	9.80	11.49	10.68	9.45	8.87	10.30	10.20	9.08	8.49
$r \leq 1$	1.06	1.07	1.81	1.64	2.19	2.20	1.91	1.95	2.47	2.17
SBB										
$r = 0$	18.31*	18.85*	19.84*	19.19*	23.78**	22.90**	20.73**	16.18*	14.84	11.01
$r \leq 1$	0.83	0.63	0.58	0.49	0.44	1.05	1.64	1.72	2.10	1.21
PAC										
$r = 0$	19.84*	17.10*	12.67	11.82	12.04	12.37	10.72	15.58*	11.59	9.96
$r \leq 1$	0.42	0.60	0.50	0.30	0.40	0.57	0.36	1.04	0.88	0.69
HHB										
$r = 0$	19.99*	10.14	8.07	9.40	7.12	6.56	8.18	8.27	6.52	5.65
$r \leq 1$	0.94	1.04	1.20	1.34	1.59	1.33	0.97	0.99	0.47	0.17

Notes: * Significant at the 5 percent level.

** Significant at the 1 percent level.

r refers to the number of cointegrating vector.

The two null hypotheses considered are H_0: $r = 0$ and H_0: r £ 0.

See Osterwald-Lenum (1992) for critical values.

Table 3

The Vector Error Correction Models

Independent variable	AMFB		SBB		PAC	
	$\Delta \log P_{Lt}$	$\Delta \log P_{Ft}$	$\Delta \log P_{Lt}$	$\Delta \log P_{Ft}$	$\Delta \log P_{Lt}$	$\Delta \log P_{Ft}$
Constant	-0.003	-0.004	-0.002	-0.003	-0.006	-0.007
	(-0.528)	(-0.724)	(-0.439)	(-0.617)	(-0.553)	(-0.668)
z_{t-1}	-0.151**	-0.064	-0.099	0.105	-0.158	0.254
	(-3.252)	(-1.238)	(-1.401)	(1.535)	(-1.259)	(1.919)
$\Delta \log P_{L,t-1}$	-0.008	-0.023	-0.173	-0.062	-0.054	-0.001
	(-0.070)	(-0.188)	(-1.575)	(-0.582)	(-0.367)	(-0.005)
$\Delta \log P_{F,t-1}$	0.002	-0.053	0.058	0.026	0.042	-0.001
	(0.019)	(-0.469)	(0.514)	(0.240)	(0.322)	(-0.010)

Notes: ** Significant at the 1 percent level.

Figures in parentheses are t-statistics.

P_L and P_F refer to prices of the local and foreign tranche, respectively.

z_t is the error correction term given by:

AMFB: $z_t = \log P_{Lt} - 0.914 \log P_{Ft} - 0.046$

SBB: $z_t = \log P_{Lt} - 0.898 \log P_{Ft} - 0.106$

PAC: $z_t = \log P_{Lt} - 0.830 \log P_{Ft} - 0.202$

Table 4

The Vector Autogression Models

Independent variable	MISC $\Delta \log P_{Lt}$	MISC $\Delta \log P_{Ft}$	PBB $\Delta \log P_{Lt}$	PBB $\Delta \log P_{Ft}$	PFB $\Delta \log P_{Lt}$	PFB $\Delta \log P_{Ft}$	HHB $\Delta \log P_{Lt}$	HHB $\Delta \log P_{Ft}$
	Dependent variable							
Constant	0.001	-0.001	0.002	0.001	-0.001	-0.002	-0.002	-0.003
	(0.377)	(-0.239)	(0.767)	(0.286)	(-0.166)	(-0.418)	(-0.385)	(-0.518)
$\Delta \log P_{L,t-1}$	-0.095	0.362**	-0.131	0.052	-0.072	0.192	-0.298	0.279
	(-1.434)	(3.818)	(-1.800)	(0.616)	(-0.681)	(1.546)	(-1.817)	(1.664)
$\Delta \log P_{F,t-1}$	0.011	-0.293**	0.184**	-0.098	0.017	-0.269*	0.236	-0.326*
	(0.251)	(-4.625)	(2.921)	(-1.334)	(0.187)	(-2.572)	(1.511)	(-2.037)
$\Delta \log P_{L,t-2}$							0.104	0.486**
							(0.639)	(2.920)
$\Delta \log P_{F,t-2}$							-0.028	-0.360*
							(-0.180)	(-2.236)

Notes: * Significant at the 5 percent level.

** Significant at the 1 percent level.

Figures in parentheses are t-statistics.

P_L and P_F refer to prices of the local and foreign tranche, respectively.

Table 5

Results of the Granger Causality Test for the Local and Foreign Tranches

Stock	Model	Optimal Lag	Causality Direction: Foreign causes Local *LR*-stats	(*p*-value)	Local causes Foreign *LR*-stats	(*p*-value)
MISC	VAR	1	0.101	(0.751)	22.571**	(0.000)
AMFB	VEC	1	39.861**	(0.000)	6.348*	(0.042)
PBB	VAR	1	16.826**	(0.000)	0.765	(0.382)
PFB	VAR	1	0.125	(0.723)	8.478**	(0.004)
SBB	VEC	1	6.512*	(0.039)	5.563	(0.062)
PAC	VEC	1	5.108	(0.078)	10.277**	(0.006)
HHB	VAR	2	13.902**	(0.001)	37.712**	(0.000)

Notes: * Significant at the 5 percent level.

** Significant at the 1 percent level.

Optimal lag refers to the lag length selected using the Schwarz criterion.

VEC denotes vector error-correction and VAR denotes vector autoregression.

These models are reported in Tables 3 and 4, respectively.

Table 6

Summary Statistics of Returns and Ratio of Trading Volumes

	Returns		Volume Ratio	Causality
	Local	Foreign	(Foreign to Local)	Direction
MISC	0.1127	-0.0020	3.20	L causes F
	(0.0422)	(0.0627)		
	[37.4445]	[-3135.00]		
AMFB	-0.2017	-0.2146	2.55	Feedback
	(0.0882)	(0.0980)		
	[-43.7283]	[-45.6664]		
PBB	0.2724	0.1132	0.55	F causes L
	(0.0596)	(0.0687)		
	[21.8796]	[60.6890]		
PFB	-0.0561	-0.1145	2.07	L causes F
	(0.0639)	(0.0759)		
	[-113.9037]	[-66.2882]		
SBB	-0.1653	-0.2385	0.51	F causes L
	(0.0667)	(0.0639)		
	[-40.3509]	[-26.7925]		
PAC	0.0599	-0.5625	0.006	L causes F
	(0.0985)	(0.1038)		
	[164.4407]	[-18.4533]		
HHB	-0.2522	-0.3126	0.47	Feedback
	(0.0664)	(0.0688)		
	[-26.3283]	[-22.0090]		

Note: Figures in parentheses are standard deviations and those in square brackets are coefficients of variation.

L causes F means that local tranche return Granger causes foreign tranche return.

F causes L means that foreign tranche return Granger causes local tranche return.

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