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Is the Liberalization Policy Effective on Improving the Bivariate Cointegration of Current Accounts, Foreign Exchange, Stock Prices? Further Evidence from Asian Markets

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Abstract**—**This paper fist examines three set of bivariate cointegrations between any two of current accounts, stock markets, and currency exchange markets in ten Asian countries. Furthermore, we examined the effect of country characters on this bivariate cointegration. Our findings suggest that for three sets of cointegration test, each sample country at least exists one cointegration. India consistently exhibited a bi-directional causal relationship between any two of three indicators. Unlike Pan et al. (2007) and Phylaktis and Ravazzolo (2005), we found that such cointegration is influenced by three characteristics: capital control; flexibility in foreign exchange rates; and the ratio of trade to GDP. These characteristics are the result of liberalization in each Asian country. This implies that liberalization policies are effective on improving the cointegration between any two of financial markets and current account for ten Asian countries.

Keywords**—**Current account; stock price; foreign exchange rate; country characteristics, bivariate cointegration, bi-diectional causal relationships

JEL Classifications: G15; F30

I. Introduction

IN Asian countries, a series of liberalization policies have been launched which contain relaxation of foreign capital controls and flexible exchange rate regimes Since 1990s. These polices could induce variation of foreign exchange market and stock markets, and bring the risk of international investment through portfolio diversification. These influences have increased the interest of academics and practitioners in studying the interrelation between two financial markets. Recent numerous studies propose empirical evidence of a linkage between exchange rate and stock price for Asian economies (see references [1],[2], [3],[4]). The reference [1] found that the degree of foreign exchange restrictions is not an important determinant of the relation between stock and foreign exchange market. This makes the effect of liberalization policy on two markets not to be detected easily. In other words, if openness degree of foreign exchange significantly influenced the relation between the two markets, it could be proven that liberalization policies had been effective, and vice versa. For example, when a country with greater flexibility in foreign exchange policy seeks to strengthen the linkage between the two markets, then liberalization policies would be more effective, and vice versa. The reference [1] findings might be the omission of an important variable which serves as a conduit between markets. What a economic variable is appropriate for entering into the two financial market?

In previous studies, current account interacts with stock price as well as exchange rate closely. Recently global current account imbalance which mostly stems from large deficit in U.S. and surplus in Asian economics has attracted substantial attention among academics and policy makers. Following such tendency, the issues about current account have become an important subject of recent literatures. Numerous studies proposed evidences on a linkage between current account and exchange rate ([5],[6],[7],[8],[9]). A number of researches compared stock price with exchange rate shocks to explore which is more important for current account adjustment ([10]). Previous studies analyzed theoretical connection of security prices and current account ([11],[12],[13]). However, there is yet no systematic evidence on the three sets of relationship between any two of current account, stock price, and exchange rate. Hence, this paper fist examines three sets of bivariate cointegration between any two of three economic variables. Figure1 diplays the bivariate frameworks including the relationships among exchange rate market, stock market, current account.

Moreover, each Asian economy's liberalization policy would bring about three country characters, i.e., degree of capital restrictions, foreign exchange flexibility, trade ratio to GDP. Based on the goods market theory, for a country with high trade ratio and high exchange rate exposure, it has a strong bi-directional relation between stock price and exchange rate. The portfolio balance approach indicated that, a country with freely floating exchange rate and less capital control, exhibits a more significant bi-directional relation between stock price and exchange rate. However, recent studies could not completely obtain evidences in favor of theoretical prediction ([1] [2]). Previous studies supported that among three characteristics, two (i.e., degree of capital control, and the ratio of trade to GDP) have influence on the relationship of foreign exchange and stock markets. The reference [1] proposes openness in exports and imports to explain a linkage between foreign exchange market and stock market, yet fail to examine this characteristic (i.e., trade ratio). Similar to the

reference [1], [2] suggested that capital control could weaken this cointegration, but there is no examination in this characteristic (i.e., degree of capital control). As the early mentioned, if three characteristics significantly influenced the relation between the two financial markets, it could be proven that liberalization policies were effective, and vice versa. Thus, to detect the effect of liberalization policy for Asian economies, secondly, we examined the effect of country characters on the three sets of bivariate cointegration. That is, we attempt to answer a question, "do various country characters arising from liberalization policies have different cointegration relationship between any two of exchange rate, stock price, and current account?". If the answer is positive, this implies that liberalization policies are effective on improving the relationship between financial markets and current account for ten Asian countries.

This paper begins by extending the proposition of [1] that financial integration is closely related to economic integration. Because current accounts signify the volume of external trade with other countries and measures the degree to which the two countries are integrated, this paper introduce current accounts to the relationship between stock markets and foreign exchange markets, and examine three kinds of relationship. We proposed a bivariate framework connecting financial integration with economic integration. Our findings present that first, for three cases concerning the relationship between any two of three indicators, except that Korea and the Philippines have two cointegrations consistently, and other eight countries at least have one cointegration. For the three cases, India consistently exhibited a bi-directional causal relationship between any two of three indicators.

Second, unlike assertion of references [1] and [2], showing that whether exchange rate and stock prices are cointegrated or not was not influenced by foreign exchange regimes. Our finding implies that three country characteristics (i.e., the degree to which capital is controlled, flexibility in foreign exchange mechanisms, the ratio of trade to GDP) indeed influence these cointegrations. With regard to the direction of influence, our findings show that a relaxation of restrictions on exchange rates and capital control enhance the cointegration in favor of the portfolio balance approach. Moreover, we found that a stronger relationship between current account and exchange rate occurs in the countries with a higher ratio of trade, being closely consistent with the proposition of the good market theory. This implies that liberalization policies are effective on improving the relationship between any two of financial markets and current account for ten Asian countries.

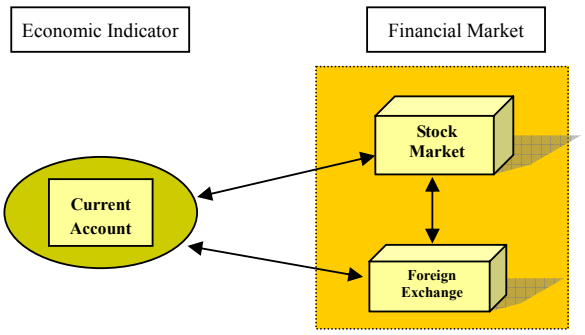


Fig. 1. The framework of interrelationship among stock market, foreign exchange market, and current account.

II. Literature Review

In this section, we introduce the relevant theories and empirical studies concerning the relationship between any two of stock price, exchange rate, and current account.

The relationship of exchange rate and stock price

With regard to a relationship between stock price and exchange rate, two theories are as follows. One is the goods market theory [14] proposes that a change in exchange rate affect international competitiveness, trade balance and output of a country, thereby influencing firms' cash flow and stock prices. Other is the portfolio balance approach suggests that, exchange rates are determined by stock market mechanisms (see references [15] [16])[1]. Numerous works have provided evidences which have been quite mixed for the sign and causal direction[2]. Several empirical studies present evidence on Asian countries in favor of a causal relation between exchange rate and stock price ([17]; [18]; [19]; [1]; [2]; [3]; [4]; [20]; [21])[3].

The relationship of current account and exchange rate

The reference [22] proposed a present value model of current account incorporated with exchange rate to improve ability of forecasting in current account. Their model provides evidence that a causal relationship from exchange rate to current account, which is supported by recent studies [23][24]. On the contrary, monetary model augmented with current account provides theoretical basis of a causal relationship from current account to exchange rate. Prior empirical studies[4] show supportive evidences on this model. Along this line, numerous evidences on recent studies that exchange rates of Asian economies cointegrate with current account were found continuously [25][26] [5].

The relationship of current account and stock price

Previous studies continuously verify a cause relationship from current account to stock price. The references [27],[28] proposed a notion that current account can predict performance of stock market. Recently, numerous studies support a linkage between current account and stock price. (see the references [11],[12], [29],[13],[10]). In contrast, a cause relationship from stock price to current account could be stated from three theoretical aspects: the wealth effect, uncertainty, a leading indicator effect. The reference [30] illustrated the wealth effect, indicating that stock price adjustment would alter permanent income and consumption of people in real world, based on permanent income hypothesis. The reference [31] stated that investor uncertainty resulting from deterioration in stock market would reduce

[1] An increase in stock price induces investors to demand more domestic money and thereby causes an appreciation in domestic currency.
[2] Numerous studies show mix results for sign and direction, for instance, Jorion (1990), Bartov and Bodnar (1994), He and Ng (1998), Griffin and Stulz (2001), Aggarwal (1981), Rather et al.(1988), Donnelly and Sheehy (1996), Ajayi and Mougoue (1996), Chamberlain et al.(1997), Ma and Kao (1990), Bahnabi Oskooee and Sohrabian (1992).
[3] The reference [2] suggests that a blooming stock market of a country would attract capital inflows from foreign investors and hence causes an increase in the demand of currency.
[4] Previous studies support the notion that monetary model incorporated with current account is a valid framework to analyze movements in currencies ([33],[34],[35], McNown and Wallace, 1994; Moosa, 1994). The reference [33] found that monetary model not only provides sensible long run relationships between exchange rates and fundamental variables, but also outperforms a random-walk model in out-of sample forecasting exchange rate.

consumption on durable goods, and decrease balance of current account. With regard to a leading indicator effect, [32] indicated that according to permanent income theory, stock price could predict future income, and further lead to variation in current account.

Influence of country characteristics on relationship between any two of stock prices, exchange rates, and current accounts

A number of theories and previous studies indicated influence of three country characteristics for each Asian country (i.e., flexibility in foreign exchange regimes, degree to capital control, and the ratio of trade to GDP) on the relationship between any two of three economic indicators.

A portfolio balance approach indicates that in countries without a free floating exchange rate, fluctuations in exchange rates are not necessarily met with a corresponding movement in stock prices. This suggests that a free exchange rate regime could enhance the relationship between stock prices and exchange rates. However, recent studies tend to not support this theoretical prediction. The reference [1] found that a relaxation in restrictions to foreign exchange was not a determinant of a link between foreign exchange and domestic stock markets. Hence, they stated free trade of import and export in five Asian countries as a possible explanation contributing to this linkage. Their proposition is in accordance with a goods market theory, which indicates a stronger bi-directional causal relationship between exchange rates and stock prices for countries with higher levels of trade ([2], p.513). Similar to [1], [2] proposed evidence on whether exchange rate and stock prices are cointegrated or not was not influenced by foreign exchange arrangements. They yet suggested that capital control could weaken this cointegration. In sum, empirical researches supported that among three characteristics, two (i.e., degree to capital control, and the ratio of trade to GDP) have influence on the relationship of foreign exchange and stock markets.

Recent study obtained evidence that increasing the ratio of trade would improve the relationship of exchange rate and current account. [6] found that implementing policy to increase trade alters exchange rates, thereby helping to improve an imbalance in current accounts. We proceed to discuss the influence of three characteristics on the relationship of current account and stock price. According to wealth effect of [30], in countries with a free exchange rate and less control of capital, a rise in stock prices facilitates lending to international financial markets, which smoothes the consumption in those countries, causing a shift in current accounts. In a country with a high trade to GDP ratio, any change in current accounts increases import and export trade, further stimulating cash flow and bolstering stock prices.

III. Research Design

Data description

Table 1 shows data series which this paper utilized for ten sample Asian countries, Taiwan, Hong Kong, Japan, Singapore, Malaysia, Thailand, Philippines, Korea, Indian, and Indonesia. Sample period spans from January, 1970 to July, 2010. Except that Hong Kong, Japan, Singapore are developed countries, other countries are developing ones which often are regarded as emerging markets. Data series were extracted from AREMOS Statistical Data Bank of Taiwan's Ministry of Education. This study adopts 4625 monthly observations of stock price indices and real exchange rate as local currency per U.S. dollar, and 1915 quarterly ones of current accounts.

TABLE I OBSERVATIONS OF STOCK PRICE, EXCHANGE RATE, CURRENT ACCOUNT

Country	Sample period	Frequency	Observations: stock price indices	Observations: foreign exchange rate	Observations: current account
Developed Countries					
Honk	1970M01~2010M07	monthly	487	487	
Kong	1970Q1~2010Q2	quarterly			162
Japan	1970M01~2010M07	monthly	487	487	
	1985M01~2010M01	monthly			301
Singapore	1970M01~2010M02	monthly	482	482	
	1980Q1~2010Q1	quarterly			121
Total			1456	1456	584
Developing Countries (Emerging Market)					
Taiwan	1970M01~2010M02	monthly	482	482	
	1981Q1~2010Q1	quarterly			119
Korea	1970M01~2010M02	monthly	482	482	
	1980M01~2010M01	monthly			361
Malaysia	1973M12~2010M02	monthly	435	435	
	1987Q1~2010Q1	quarterly			93
India	1970M01~2010M02	monthly	482	482	
	1970Q1~2010Q2	quarterly			162
Indonesia	1977M12~2010M02	monthly	387	387	
	1981Q1~2010Q1	quarterly			117
Philippines	1970M01~2010M02	monthly	482	482	
	1977M01~2010M02	monthly			398
Thailand	1975M04~2010M02	monthly	419	419	
	1990Q1~2010Q1	quarterly			81
Total			3169	3169	1331

Note: the data that this paper utilized for ten Asian countries during sample period from January, 1970 to July, 2010.were presented in Table 1. This study divided the data into two subsets: one is developing countries including Taiwan, Malaysia, Thailand, Philippines, Korea, Indian, and Indonesia. Other is developed countries consisting of Hong Kong, Japan, Singapore. The 4625 monthly observations of individual country indices, real exchange rate as local currency per U.S. dollar, and 1301 quarterly observations of current account, were selected from AREMOS database. To compare the impact of 1997 Asian financial crisis, this paper divided all data into two subsample periods, pre-1997 and post-1997.

Liberalization policy which Asian economies have launched since 1990s would reflect three country characters, i.e., degree of capital control restrictions, foreign exchange flexibility, and trade ratio to GDP. Hence, Table 2 reports three country characters for each Asian economy, which contain exchange rate arrangement, capital mobility controls and international trade size. Developing countries except Korea, exhibit managed floating foreign exchange and moderate (or strong) capital control. Except Malaysia, these developing ones display low ratio of trade to GDP consistently. Developed countries, Hong Kong, Japan and Singapore, show no capital control, and they present high ratio of international trade except Japan.

TABLE II EXCHANGE RATE REGIMES, DEGREE OF CAPITAL CONTROLS, THE RATIO OF TRADE TO GDP

Country	exchange rate regimes	degree of capital controls	the ratio of trade to GDP
Developed Countries			
Hong Kong	Fixed	None	2.575(H)
Singapore	managed floating	None	2.983(H)
Japan	freely floating	None	0.347(L)
Developing Countries (Emerging Market)			
Taiwan	managed floating	Moderate	0.927 (L)
Korea	freely floating	None	0.958(L)

Malaysia	managed floating	Strong	2.069(H)
India	managed floating	Moderate	0.389(L)
Indonesia	managed floating	Moderate	0.378(L)
Philippines	managed floating	Moderate	0.898(L)
Thailand	managed floating	Moderate	1.092(L)

Note: the ratio of trade to GDP is measured by the ratio of exports and imports divided by GDP. The data were collected from AREMOS and Global Financial Database. The exchange rate regimes and capital control are from World Currency Yearbook. "H" and "L" denotes high and low ratio of trade respectively. Moderate and strong capital control is attributed to "H", and none capital control is denoted by "L". The ratio of trade to GDP above two belongs to high degree, otherwise is low degree.

Fig. 2 shows the series trends of current account, stock price indices, and exchange rates for ten Asian economies. This study's sample Developing Countries (Emerging Market).

periods from 1970 to 2010 include 1997 Asian financial crisis and 2007 subprime mortgage financial storm, and hence can capture a full impact before and after two events on three indicators. Most countries show that after 1997, three variables series exhibit an up-and-down pattern dramatically. The drops in stock price indices accompany depreciation in currency, and current account variation, which are consistent with theoretical expectation of the portfolio balance approach.

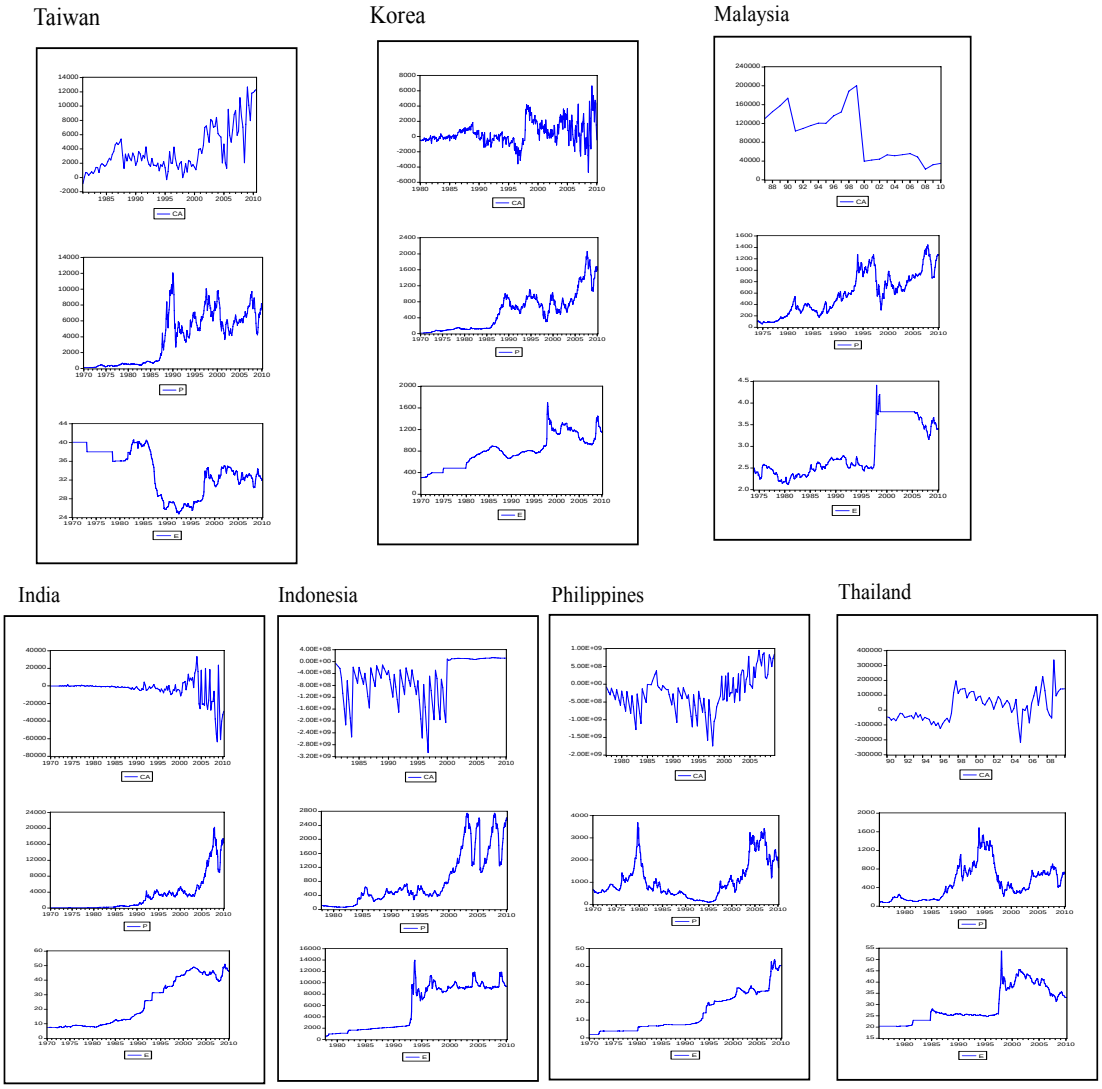
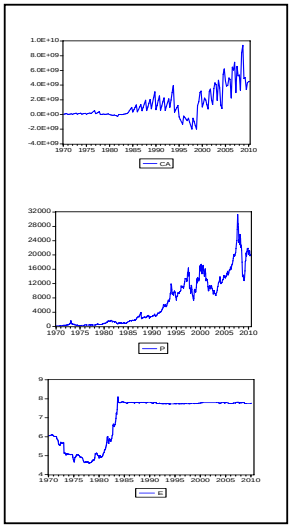


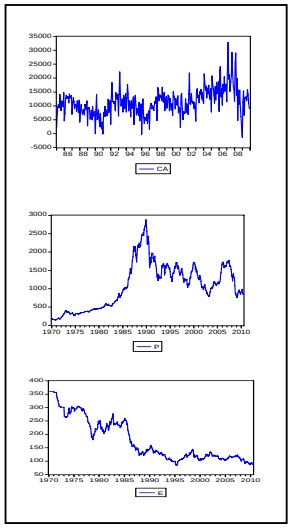
Fig. 2 data series of current account (CA), stock price indices (P), foreign exchange rate (E) for developed and developing countries in Asia

Developed Countries

Hong Kong



Japan



Singapore

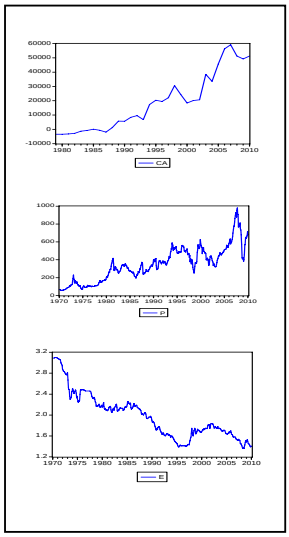


Fig. 2. data series of current account (CA), stock price indices (P), foreign exchange rate (E) for developed and developing countries in Asia (continue)

Unit root tests of Augmented Dickey-Fuller and Phillips-Perron

In order to avoid spurious regression problem of Granger and Newbold (1974) from non-stationary variables, we implemented the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to examine current account, exchange rate and stock price index. The optimal lag length in the ADF regressions was determined by Akaike Information Criterion and Schwartz Bayesian Criterion. Table 3 shows the result of unit root tests, revealing that for each country, at least two of three variables exhibit I (0), i.e., non-stationary. This suggests a possibility of cointegration between any two of three economic indicators.

TABLE III UNIT ROOT TESTS OF STOCK PRICE INDICES, EXCHANGE RATE, AND CURRENT ACCOUNT

country	variable	ADF test		Phillips-Perron test		testing result
		level	difference	level	difference	
Developed Countries						
Hong Kong	CA	-5.553***	-	-5.474***	-	I(0)
	E	-3.371	-5.649***	-3.314	-5.684***	I(1)
	P	-3.236*	-4.854*	-1.882	-2.345*	I(1)
Japan	CA	-8.089***	-	-8.322***	-	I(0)
	E	-2.544	-12.702***	-1.659	-12.679***	I(1)
	P	-1.719	-9.676***	-1.631	-9.944***	I(1)
Singapore	CA	-2.575	-3.336***	-2.278	-2.414***	I(1)
	E	-2.711	-7.261***	-2.661	-9.111***	I(1)
	P	-1.975	-5.209***	-2.424	-5.289***	I(1)
Developing Countries (Emerging Market)						
Taiwan	CA	-4.667***	-	-4.933***	-	I(0)
	E	-1.493	-4.649***	-1.583	-8.172***	I(1)
	P	-3.161*	-3.135*	-3.239*	-3.845**	I(1)
Korea	CA	-5.913***	-	-6.000***	-	I(0)
	E	-3.158*	-4.185**	-3.326*	-4.785**	I(1)
	P	-2.200	-10.996***	-2.665	-11.088***	I(1)
Malaysia	CA	-3.597***	-	-2.732*	-	I(0)
	E	-2.620	-7.619***	-2.718	-7.562***	I(1)
	P	-3.522**	-4.153**	-3.307*	-3.562**	I(1)
India	CA	-5.515***	-	-5.436***	-	I(0)
	E	-1.923	-5.255***	-2.385	-5.327***	I(1)
	P	-2.126	-5.329***	-2.126	-5.191***	I(1)
Indonesia	CA	-1.532	-3.777***	-1.969	-3.835**	I(1)
	E	-3.754**	-	-3.229*	-	I(0)
	P	-3.398*	-4.785**	-2.435	-4.528*	I(1)
Philippines	CA	-8.439***	-	-8.381***	-	I(0)
	E	-1.601	-7.608***	-1.663	-7.508***	I(1)
	P	-1.704	-10.319***	-2.007	-10.468***	I(1)
Thailand	CA	-4.472***	-	-4.458***	-	I(0)
	E	-1.785	-6.043***	-1.957	-6.096***	I(1)
	P	-2.621	-6.283***	-2.803	-6.331***	I(1)

Note: *, **,*** denote the null hypothesis that unit-root exists is rejected at 10%,5%,1% statistical significance level. CA, E, P denote current account, exchange rate, and stock price indices respectively. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are under the null hypothesis of unit root (H0: unit root) that its critical value is decided on the critical value table of MacKinnon (1991).

3.3 Cointegration methodology

This paper aims to examine bi-directional cointegration relationship between any two of stock market index prices, exchange rates and current account series. In this study, cointegration method was employed to expolre, which was proposed by [37], [38] including maximum likelihood ratio test and trace test.

Let cointegration vectors to be $Y_t \equiv [E_t, P_t]'$, $Y_t \equiv [CA_t, P_t]'$, $Y_t \equiv [CA_t, P_t]'$ respectively, where CA_t denotes current account, P_t denotes stock market index prices and E_t denotes real exchange rate for ten Asian economies. Null hypothesis of trace statistics $\text{trace} = -T\sum_{i=r+1}^{n} \ln(1-\lambda_i)$ presents that there are at most r cointegration vectors $0 \le r \le n$ and (n-r) common stochastic trend. If $\mathbf{Y}_t$ is cointegrated, a vector error correction model (**VECM**) can be generated by:

$$\Delta Y_t = \mu + \pi_p Y_{t-1} + \sum_{i=1}^{p-1} \pi_i \Delta Y_{t-i} + e_t \quad (1)$$

Where $\boldsymbol{\mu}$ is 2×1 vector of drift, $\boldsymbol{\pi}$ are 2×2 matrices of parameters, $\boldsymbol{\pi}\mathbf{Y}_{t-1} = \boldsymbol{\alpha}\boldsymbol{\beta}\mathbf{Y}_{t-1}$ is error correction term, and $\mathbf{e}_t$ is 2×1 white noise vector.

IV. Empirical Result

Cointegration between any two of current account, stock price, and exchange rate

Table 4 provides the results of the Johansen-Juselius cointegration test for ten Asian countries. Each has a long-run cointegration relationship between exchange rate and stock price for seven countries except two cointegrations which each has for Korea, the Philippines, and Thailand. Specifically, conforming to [20], showing that Taiwan has one cointegration between stock price and exchange rate (NTD/USD). For the case of current account and exchange rate, Korea, Malaysia, Indonesia, the Philippines have two conitegration relationships. Other countries have one for each. For Taiwan, Korea, Indonesia, the Philippines, current account and stock price of each country are cointegrated with two vectors, while other six countries have one cointegrating for each. In sum, for three cases, except that Korea and the Philippines have two cointegrations consistently, other sample countries at least have one cointegration.

TABLE IV JOHANSEN-JUSELIUS COINTEGRATION TEST PANEL A EXCHANGE RATE AND STOCK PRICE (E , P)

Country	Period	H_0	Trace statistics	p-value	lags
Developed Countries					
Hong Kong	1970M01~2010M07	r =0	15.179***	0.0557	13
		$r \le 1$	0.214	0.6437	13
Japan	1970M01~2010M07	r =0	45.513***	0.0000	13
		$r \le 1$	7.809	0.0891	13
Singapore	1970M01~2010M02	r =0	21.389***	0.0057	3
		$r \le 1$	3.389	0.0656	3
Developing Countries (Emerging Market)					
Taiwan	1970M01~2010M02	r =0	73.734***	0.0000	4
		$r \le 1$	4.104	0.3968	4
Korea	1970M01~2010M02	r =0	149.278***	0.0001	6
		$r \le 1$	54.382***	0.0000	6
Malaysia	1973M12~2010M02	r =0	50.956***	0.0000	11
		$r \le 1$	2.221	0.1362	11
India	1970M01~2010M02	r =0	129.307***	0.0000	4
		$r \le 1$	50.351	0.0001	4
Indonesia	1977M12~2010M02	r =0	42.666***	0.0000	11
		$r \le 1$	0.417	0.5183	11
Philippines	1970M01~2010M02	r =0	85.915***	0.0000	8
		$r \le 1$	34.483***	0.0000	8
Thailand	1975M04~2010M02	r =0	128.304***	0.0001	6
		$r \le 1$	44.228***	0.0000	6

Panel B Current account and Exchange rate (CA , E)

Country	Period	H_0	Trace statistics	p-value	lags
Developed Countries					
Hong Kong	1999Q1~2009Q3	r =0	15.567***	0.0488	3
		$r \le 1$	0.697	0.4037	3
Japan	1985M1~2010M1	r =0	21.009***	0.0394	13
		$r \le 1$	6.221	0.1744	13
Singapore	1980Q1~2010Q1	r =0	65.744***	0.0000	2
		$r \le 1$	31.484***	0.0000	2
Developing Countries (Emerging Market)					
Taiwan	1990Q1~2009Q4	r =0	27.014***	0.0050	2
		$r \le 1$	5.921	0.1969	2
Korea	1980M1~2010M1	r =0	50.645***	0.0000	12
		$r \le 1$	10.634**	0.0261	12
Malaysia	1987Q1~2010Q1	r =0	50.124***	0.0000	3
		$r \le 1$	18.946***	0.0000	3
India	1970Q1~2010Q1	r =0	40.149***	0.0000	4
		$r \le 1$	1.945	0.1631	4
Indonesia	2000Q1~2010Q1	r =0	15.546***	0.0491	3
		$r \le 1$	3.552***	0.0595	3
Philippines	1999M1~2010M2	r =0	42.661***	0.0000	2
		$r \le 1$	8.856***	0.0029	2
Thailand	1990Q1~2010Q1	r =0	22.117***	0.0043	4
		$r \le 1$	3.258	0.0711	4

Panel C Current account and Stock price (CA , P)

Country	Period	H_0	Trace statistics	p-value	lags
Developed Countries					
Hong Kong	1999Q1~2010Q2	r =0	19.505***	0.0118	4
		$r \le 1$	1.456	0.2274	4

Japan	1985M1~2010M1	r =0	27.661***	0.0040	13
		r ≤ 1	6.981	0.1274	13
Singapore	1979A~2010A	r =0	22.708***	0.0034	6
		r ≤ 1	0.227	0.6339	6
Developing Countries (Emerging Market)					
Taiwan	1981Q1~2010Q3	r =0	116.461***	0.0001	2
		r ≤ 1	41.027***	0.0000	2
Korea	1980M1~2010M1	r =0	51.467***	0.0000	13
		r ≤ 1	12.969***	0.0003	13
Malaysia	1987Q1~2010Q1	r =0	20.003**	0.0502	4
		r ≤ 1	6.168	0.1781	4
India	1970Q1~2010Q2	r =0	59.872***	0.0000	4
		r ≤ 1	0.113	0.7369	4
Indonesia	2000Q1~2010Q1	r =0	25.260***	0.0094	1
		r ≤ 1	12.219***	0.0128	1
Philippines	1999M1~2010M2	r =0	46.568***	0.0000	2
		r ≤ 1	10.831***	0.0239	2
Thailand	1990Q1~2010Q1	r =0	25.912***	0.0074	4
		r ≤ 1	4.213	0.3814	4

Note:
1.The optimal lengths of lags reported are chosen by Schwartz information, Akaike information, LR statistics criterion. Bivariate Vector Autoregression (BVAR) is estimated through residual auto- correlation test (Q-test), residual normality test (Jarque-Bera test).
2.Trace statistics indicates that either developed countries or developing countries in ten Asian countries, at least have one cointegrating vectors at 1% significance level.

Table 5 reports that the results of exclusion restrictions and weak exogeneity tests. We found that a cointegration exists between stock prices and exchange rates. In Table 5, Singapore, Korea, India, the Philippines, and Thailand show that the exclusion hypotheses (β_E =0 and β_P =0) were rejected at 1, 5, and 10 % significance level, respectively. This implies that exchange rates and stock prices were cointegrated over the long-term. In table 6, these countries' coefficients of stock price in cointegration vector presented significant at 1,5,10% level. Singapore, India, the Philippines, and Thailand, their two hypotheses of weak exogeneity (α_E =0 and α_P =0) were rejected, suggesting that exchange rates and stock prices have a bi-directional causal relationship adjusted toward long-term equilibrium. This finding is consistent with the prediction of the good market theory and portfolio balance approach, and supports previous results concerning a connection between exchange rates and stock prices. Table 6 shows that the largest cointegration coefficient of stock price was found in Japan at a 1 % significance level.

In Table 5, for Hong Kong, Japan, Malaysia, and the Philippines, two exclusion hypotheses (β_{ca} =0 and β_E =0) were rejected at 1, 5, and 10 % significance level, respectively. This implies that current accounts and exchange rates were cointegrated. In table 6, these countries' coefficients of exchange rate in cointegration vector presented significant at 1,5,10% level. For Taiwan, Korea, Malaysia, India, and Thailand, their two hypotheses of weak exogeneity (α_{ca} =0 and α_E =0) were rejected, revealing that current accounts and exchange rates had bi-directional causal relationships following equilibrium adjustment over the long-term. Malaysia is only one country which has both cointegration and bi-directional cause relationship. This finding upholds the monetary model and augmented present value model of current accounts, and provides evidence to support the previous results in which exchange rates and current accounts in Asian economies are cointegrated. In Table 6, the largest cointegration coefficient of exchange rates (3221556) occurred in Thailand at 1 % significance level, implying that a 1 % change in exchange rates would result in 32215 changes in the multiplier in current accounts.

Further evidence was found in current accounts and stock prices. In table 5, Singapore, India and Philippines demonstrated that the exclusion hypotheses of β_{ca} =0 and β_P =0 were rejected at 1, 5, and 10 % significance level, respectively. This implies that current accounts and stock prices are cointegrated over the long-term. In table 6, these countries' coefficients of stock price in cointegration vector presented significant at 1,5,10% level. For Korea, Malaysia, India, and Thailand, their two hypotheses of weak exogeneity (α_{ca} =0 and α_P =0) were rejected, suggesting that current accounts and stock prices had a bi-directional causal relationship adjusted toward long run equilibrium. India is only one country which has both cointegration and bi-directional cause relationship. This result reconciles with the prediction of the background theory (i.e., wealth effect, uncertainty, and leading indicator effect), and supports previous empirical results concerning a connection between current accounts and stock prices. In Table 6, the largest cointegration coefficient of stock prices (-6588) was found in Thailand at a 1 % significance level.

TABLE V TESTS OF EXCLUSION RESTRICTIONS AND WEAK EXOGENEITY
PANEL A EXCHANGE RATE AND STOCK PRICE (E , P)

Country	Period	exclusion restrictions		weak exogeneity	
		H_0	LR statistics	H_0	LR statistics
Developed Countries					
Hong Kong	1970M01~2010M07	β_E =0	14.7498***	α_E =0	14.546***
		β_P =0	0.2367	α_P =0	0.057
Japan	1970M01~2010M07	β_E =0	0.630	α_E =0	0.121
		β_P =0	29.883***	α_P =0	29.857***
Singapore	1970M01~2010M02	β_E =0	14.402***	α_E =0	7.598***
		β_P =0	12.169***	α_P =0	4.274**
Developing Countries (Emerging Market)					
Taiwan	1970M01~2010M02	β_E =0	65.422***	α_E =0	62.774***
		β_P =0	1.323	α_P =0	0.005

Korea	1970M01~2010M02	β_E =0	38.309***	α_E =0	32.307***
		β_P =0	19.941***	α_P =0	2.115
Malaysia	1973M12~2010M02	β_E =0	46.483***	α_E =0	44.785***
		β_P =0	0.216	α_P =0	0.028
India	1970M01~2010M02	β_E =0	17.319***	α_E =0	9.381***
		β_P =0	13.978***	α_P =0	12.122***
Indonesia	1977M12~2010M02	β_E =0	41.826***	α_E =0	41.830***
		β_P =0	0.0003	α_P =0	0.404
Philippines	1970M01~2010M02	β_E =0	14.104***	α_E =0	16.341***
		β_P =0	26.601***	α_P =0	12.042***
Thailand	1975M04~2010M02	β_E =0	23.106***	α_E =0	23.891***
		β_P =0	25.552***	α_P =0	17.611***

Panel B Current account and Exchange rate (CA , E)

Country	Period	exclusion restrictions		weak exogeneity	
		H_0	LR statistics	H_0	LR statistics
Developed Countries					
Hong Kong	1999Q1~2009Q3	β_E =0	7.515***	α_E =0	0.961
		β_{ca} =0	11.572***	α_{ca} =0	14.087***
Japan	1985M1~2010M1	β_E =0	7.178***	α_E =0	8.156***
		β_{ca} =0	4.773**	α_{ca} =0	0.602
Singapore	1980Q1~2010Q1	β_E =0	1.412	α_E =0	1.141
		β_{ca} =0	1.516	α_{ca} =0	1.548
Developing Countries (Emerging Market)					
Taiwan	1990Q1~2009Q4	β_E =0	0.011	α_E =0	5.484**
		β_{ca} =0	15.023***	α_{ca} =0	11.405***
Korea	1980M1~2010M1	β_E =0	30.919***	α_E =0	13.444***
		β_{ca} =0	2.297	α_{ca} =0	11.124***
Malaysia	1987Q1~2010Q1	β_E =0	4.989**	α_E =0	3.609**
		β_{ca} =0	10.387***	α_{ca} =0	7.761***
India	1970Q1~2010Q1	β_E =0	24.109***	α_E =0	6.738***
		β_{ca} =0	0.861	α_{ca} =0	32.695***
Indonesia	2000Q1~2010Q1	β_E =0	8.425***	α_E =0	1.032
		β_{ca} =0	1.653	α_{ca} =0	8.208***
Philippines	1999M1~2010M2	β_E =0	23.545***	α_E =0	0.384
		β_{ca} =0	10.339***	α_{ca} =0	23.465***
Thailand	1990Q1~2010Q1	β_E =0	15.408***	α_E =0	6.448**
		β_{ca} =0	0.010	α_{ca} =0	11.408***

Panel C Current account and Stock price (CA , P)

Country	Period	exclusion restrictions		weak exogeneity	
		H_0	LR statistics	H_0	LR statistics
Developed Countries					
Hong Kong	1999Q1~2010Q2	β_P =0	16.389***	α_P =0	0.352
		β_{ca} =0	0.999	α_{ca} =0	15.767***
Japan	1985M1~2010M1	β_P =0	13.595***	α_P =0	0.194
		β_{ca} =0	0.733	α_{ca} =0	13.179***
Singapore	1980Q1~2010Q1	β_P =0	12.658***	α_P =0	0.813
		β_{ca} =0	21.773***	α_{ca} =0	18.337***
Developing Countries (Emerging Market)					
Taiwan	1981Q1~2010Q3	β_P =0	0.206	α_P =0	0.694
		β_{ca} =0	34.372***	α_{ca} =0	33.768***
Korea	1980M1~2010M1	β_P =0	23.691***	α_P =0	7.757***
		β_{ca} =0	0.223	α_{ca} =0	18.929***
Malaysia	1987Q1~2010Q1	β_P =0	15.725**	α_P =0	5.812**
		β_{ca} =0	0.852	α_{ca} =0	12.347***
India	1970Q1~2010Q1	β_P =0	55.149***	α_P =0	2.999*
		β_{ca} =0	4.245**	α_{ca} =0	59.275***
Indonesia	2000Q1~2010Q1	β_P =0	0.616	α_P =0	0.060
		β_{ca} =0	0.110	α_{ca} =0	0.772
Philippines	1999M1~2010M2	β_P =0	24.349***	α_P =0	0.033
		β_{ca} =0	6.149**	α_{ca} =0	23.383***
Thailand	1990Q1~2010Q1	β_P =0	16.725***	α_P =0	5.716**
		β_{ca} =0	0.828	α_{ca} =0	12.359***

Note: if LR statistics is larger than $\chi^2_{(1)}$ statistics with one degree of freedom, then it implies that the hypothesis (H_0) is rejected. ***,**,* denote statistic significance at 1%,5%, 10% level respectively.

TABLE VI BIVARIATE LONG-RUN COINTEGRATING VECTOR PANEL A EXCHANGE RATE AND STOCK PRICE (E, P)

Country	Period	$E_t = a_0 + a_1 P_t + \varepsilon_t$	
		$a_{0,ep}$	$a_{1,ep}$
Developed Countries			
Hong Kong	1970M01~2010M07	0.007	-4.682
Japan	1970M01~2010M07	195.234	24.019
Singapore	1970M01~2010M02	2.698	-0.002** (3.124)
Developing Countries (Emerging Market)			
Taiwan	1970M01~2010M02	0.045	9.232

Korea	1970M01~2010M02	3.333	-0.448*
			(2.451)
		1.897	-4.586
Malaysia	1973M12~2010M02	0.0004	3.391
India	1970M01~2010M02	0.130	-0.001**
			(2.054)
Indonesia	1977M12~2010M02	21.828	0.0004
Philippines	1970M01~2010M02	0.101	-0.0064*
			(1.987)
Thailand	1975M04~2010M02	0.059	-0.0194**
			(2.478)

Panel B Current account and Exchange rate (CA, E)

Country	Period	$CA_t=a_0+a_1E_t+\varepsilon_t$	
		$a_{0,eca}$	$a_{1,eca}$
Developed Countries			
Hong Kong	1999Q1~2009Q3	10696560.567	-1368751***
			(4.578)
Japan	1985M1~2010M1	40109.677	-251***
			(5.94
			6)
Singapore	1980Q1~2010Q1	143.806	-51026
		166.108	-47351
Developing Countries (Emerging Market)			
Taiwan	1990Q1~2009Q4	-101359.345	2517513
Korea	1980M1~2010M1	815.674	-415
		522.882	-14.310
Malaysia	1987Q1~2010Q1	2771.804	-160096***
			(6.845)
India	1970Q1~2010Q1	21112.112	-95691
Indonesia	2000Q1~2010Q1	-814708.332	96
Philippines	1999M1~2010M2	238.291	-1008*
			(3.245)
Thailand	1990Q1~2010Q1	-299084.897	3221556

Panel C Current account and Stock price (CA , P)

Country	Period	$CA_t=a_0+a_1P_t+\varepsilon_t$	
		$a_{0,pca}$	$a_{1,pca}$
Developed Countries			
Hong Kong	1999Q1~2010Q2	-33718.741	-68.335
Japan	1985M01~2010M01	12185.192	521.727
Singapore	1979A~2010A	-1533.622	7.677*
			(2.768)
Developing Countries (Emerging Market)			
Taiwan	1981Q1~2010Q3	103.535	-0.078
Korea	1980M01~2010M01	-2299.232	605.676
		392.044	15.824
Malaysia	1987Q1~2010Q1	412.542	23.834
India	1970Q1~2010Q2	5483.101	-81.002**
			(2.132)
Indonesia	2000Q1~2010Q1	5876.107	-72.236
Philippines	1999M01~2010M02	156.587	8.365*
			(2.145)
Thailand	1990Q1~2010Q1	62548.002	-6588.067

Note: When a country has the cointegration between exchange rate and current account, the coefficients a_1 of exchange rate in $E_t=a_0+a_1P_t+\varepsilon_t$ present statistic significance at 1,5,10% level. When a country has the cointegration between stock price and exchange rate, the coefficients a_1 of exchange rate in $CA_t=a_0+a_1E_t+\varepsilon_t$ exhibit statistic significance at 1,5,10% level. If there exists the cointegration between stock price and current account, then the coefficients a_1 of stock price in $CA_t=a_0+a_1P_t+\varepsilon_t$ show statistic significance at 1,5,10% level.

The effect of country characteristics on cointegration between any two of stock prices, exchange rates, and current accounts. The effect of relaxation of foreign exchange and capital control on the cointegration

Since the 1990s, the liberalization policy which Asian economies launched has presented three economic characteristics unique to each country, i.e., the degree to capital control, flexibility in foreign exchange mechanisms, and the ratio of trade to GDP. Our findings support the contention that relaxization of foreign exchange rates and capital control influences the cointegration between any two of the three variables (i.e., current account, stock price, exchange rate). Ten Asian countries, with various foreign exchange regimes and varying degrees of capital control had different cointegration relationships. Panel A in Table 4 shows that, for the cointegration between exchange rate and stock price, Taiwan, Malaysia, India, and Indonesia had more tightly constrained exchange rate regimes and more capital control, and exhibited one cointegration while Korea had free exchange rate regime and far less capital control, exhibiting two cointegration relationships. Panel B in Table 4 shows that, for the cointegration between current account and exchange rate, Taiwan, India, and Thailand had more tightly constrained exchange rate regimes and more capital control, and exhibited one cointegration while Singapore,Korea had free exchange rate regime and far less capital control, exhibiting two cointegration relationships. Panel C in Table 4 shows that, for the cointegration between current account and stock price, Malaysia, India, and Thailand had more tightly constrained exchange rate regimes and more capital control, and exhibited one cointegration while Korea had free exchange rate regime and far less capital control, exhibiting two cointegration relationships. These findings uphold the portfolio balance approach showing that a relaxation of restrictions on exchange rates can enhance the relationship between stock prices and exchange rates.

The effect of the international trade ratio on the cointegration

Table 4 shows that the ten economies, with various proportions of international trade, differed in the cointegration between any two of three economic indicators, supporting the contention that the ratio of international trade influences the cointegration. In Table 4 panel A, for the cointegration between exchange rate and stock price, Korea, the Philippines and Thailand with a low ratio of trade had two cointegrations while three economies (Hong Kong, Malaysia, and Singapore) with high ratios of trade, had one cointegration relationships. This result is contrary to the goods market theory, showing a stronger causal relationship between exchange rates and stock prices in countries with a higher proportion of trade. In Table 4 panel B, for the cointegration between current account and exchange rate, four countries (Japan, Taiwan, India and Thailand) with a low ratio of trade had one cointegration while Malaysia and Singapore with high ratios of trade, had two cointegration relationships. This

result closely advocates the assertion of goods market theory that a high share of share can enhance a linkage between financial markets. In Table 4 panel C, for the cointegration between current account and stock price, four countries (Taiwan, Korea, Indonesia and the Philippines) with a low ratio of trade had two cointegrations while Hong Kong, Malaysia and Singapore with high ratios of trade, had one cointegration relationships. This result is closely opposite to the contention of goods market theory that a high share of share can enhance a linkage between financial markets.

V. Conclusion

Unlike previous studies exploring relationship between any two of current accounts, stock prices and exchange rates respectively, this article examines the cointegration between any two of the three economic indicators simultaneously. We employ the cointegration methodology proposed by [37],[38] to explore ten Asian countries over the period from January 1970 to July 2010. Our findings reveal that first, for three cases concerning the relationship between any two of three indicators, except that Korea and the Philippines have two cointegrations consistently, and other eight countries at least have one cointegration. For the three cases, India consistently exhibited a bi-directional causal relationship between any two of three indicators.

Second, sample countries which have different foreign exchange regimes and the degree to capital control, and ratio of trade to GDP, had different cointegration relationships. Our finding presents an implication that three country characteristics (i.e., the degree to which capital is controlled, flexibility in foreign exchange mechanisms, the ratio of trade to GDP) indeed influence these cointegrations. With regard to the direction of influence, our findings show that a relaxation of restrictions on foreign exchange rates and capital control enhance the cointegration between any two of the three economic indicators in favor of the portfolio balance approach. Moreover, we found that a stronger relationship between current account and exchange rate occurs in the countries with a higher ratio of trade, being closely consistent with the proposition of the good market theory. These results differ from assertion of [1] that degree to which foreign exchange is restricted is not necessarily a condition for a linkage between foreign exchange and stock market. Our finding also differs from the contention from [2] that exchange rate mechanisms do not influence whether stock prices and exchange rates are cointegrated (see [2], p.512). To sum up, by introducing current accounts to a linkage between the two financial markets, this paper constructs a bivariate VECM framework to provide evidence of cointegration relationship between any two of three economic indicators (i.e., current account, stock markets, and foreign exchange markets) in Asian countries, in favor of the proposition that liberalization policy have impact on the cointegration of current account and two financial markets in Asian economies.

Further research might accumulate numerous and reliable evidence on the studies about interrelationship between any two of stock prices, exchange rates, and current accounts by using cointegration methods. This study verifies the cointegration of seven Asian developing countries, yet little evidence occurs in developed countries. Hence, next question “what about developed or industrial countries are?” would be leaved for future research. We recommend that analysis of cointegration could be implemented by employing alternative data from multi-countries and a variety of securities in Europe and America.

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