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Assessing regional financial integration: What about the East Asian stock markets?

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Abstract: The aim of this paper is to assess the regional financial integration of the East Asian stock markets. To this end, we use the international capital asset pricing model (ICAPM) to assess the evolution of market integration through time in the hope of a regional exchange-rate agreement; we also construct an Asian currency basket in order to obtain a reference currency in this area. Our empirical analysis is based on the multivariate GARCH approach with time-varying correlations. First, the investigation of nine East Asian countries shows that their stock markets were partially segmented (except for Japan) until approximately 2008. However, the last years are characterised by an upward trend in the regional integration of stock markets. Second, the currency risk premium, linked to the unexpected variation of the exchange rate, plays an important role in determining the degree of financial integration of several stock markets. Third, as the currency risk is significant for five of the nine countries studied, an exchange-rate agreement allows for better sharing of this risk, as well as those related to the stock markets, and accordingly promotion of financial integration with the regional market.

Keywords: East Asia, Regional Exchange-Rate Agreement, Financial Integration, ICAPM.

JEL classification: C32, F36, G15.

Résumé : L'objectif de ce papier est d'évaluer le degré d'intégration financière régionale des pays d'Asie de l'Est. À cette fin, nous utilisons le modèle d'évaluation des actifs financiers sous sa version internationale (MEDAFI) afin d'évaluer l'évolution de l'intégration des marchés à travers le temps dans la perspective d'un accord de change régional. Par ailleurs, nous construisons également un panier de monnaies asiatiques afin d'obtenir une monnaie de référence dans cette région. Notre analyse empirique est basée sur une approche GARCH multivarié avec une corrélation dynamique. Nos résultats montrent que les marchés boursiers d'Asie de l'Est sont partiellement segmentés (sauf pour le Japon) jusqu'en 2008, les dernières années étant caractérisées par une tendance à la hausse de l'intégration régionale des marchés boursiers. Deuxièmement, la prime de risque de change liée à la variation inattendue du taux de change joue un rôle important dans la détermination du degré d'intégration financière de plusieurs marchés boursiers. Troisièmement, comme le risque de change est significatif pour cinq parmi les neuf pays étudiés, un accord de change permettrait un meilleur partage de ce risque ainsi que ceux liés aux marchés boursiers et par conséquent de promouvoir l'intégration financière des marchés régionaux.

Mots-clefs : Asie de l'Est, Accord régional de change, intégration financière, MEDAFI.

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1. Introduction

The economic and financial theory teaches us that the process of financial integration can play an important role in promoting monetary integration. Following Mundell (1973) and McKinnon (2002), the degree of financial integration has been highlighted as a facilitating factor in joining a monetary union. A large body of literature shows that financial market integration plays a key role in the transmission of a common monetary policy (Asdrubali et al., 1996; Kalemli-Ozcan et al., 2008 among others). Giving up monetary policy can have significant costs for these countries, particularly in the absence of capital mobility. According to Mundell's Trinity, a country that gives up its autonomous monetary policy must choose a fixed exchange rate in the case where there is perfect capital mobility. In fact, perfect financial integration can play an important role in the transmission of monetary policy and better risk sharing.

The Asian crisis (1997-8) has highlighted the role of regional contagion in financial turmoil. The vulnerability of East Asian countries to these regional contagion effects has been explained by their high degree of openness (Corsetti et al., 1999), as well as their interdependence (Kaminsky et al., 2003). This crisis has prompted these countries to strengthen their monetary cooperation on a regional scale in order to improve their monetary stability. Thus, in the aftermath of this crisis, a first wave of initiatives to implement cooperative devices between East Asian countries took place: Chiang Mai Initiative (CMI), Asian Bonds Market Initiatives, Asian Bonds Fund, SEANZA and EMEAP.[2] After the Lehman Brothers' collapse, and in response to the global crisis, the authorities have strengthened their financial cooperation by signing an agreement officialising the multilateralisation step of the Chiang Mai Initiative announced in early 2009. These agreements created a $120 billion fund meant to prevent a liquidity crisis in one of the signing countries.[3]

In this paper we propose an evaluation of the regional financial integration of East Asian countries (EAC) in order to determine whether there is a favourable environment to establish an exchange-rate agreement. Many research papers have studied the integration of countries within a region, such as the euro area (Hardouvelis et al., 2006; Boubakri and Guillaumin, 2011), the Gulf Countries Council (GCC) (Espinoza et al., 2011) and EAC (Kim et al., 2006;

[2] See, for example, Guillaumin (2009a) for a complete review.
[3] See Aizenman and Pasricha (2010) for the details of these agreements.

Guillaumin, 2009b; Allegret et al. 2012). Most of these investigations show that the countries studied are characterised by a growing regional convergence in a number of macroeconomic indicators. Regarding EAC, studies show that these countries are influenced more by real external shocks than by monetary and financial external shocks but, since the financial crisis in 1997, financial external shocks have tried to play a role given the low financial openness of these countries (Lane and Milesi-Ferretti, 2007). Allegret et al. (2012) also show that countries which do not play a significant role in the world financial markets are influenced more by a regional financial shock than by a global one. However, the process of regional financial integration is far from complete. For example, Espinoza et al. (2011), in their investigation of GCC countries, have shown that the financial markets of these countries, at different stages of development, are quite varied. However, the study of interest rates shows a relatively fast convergence (less than five months), which is probably due to the peg of these countries on the US dollar. Conversely, the integration of equities markets is low or zero (in comparison with other financial emerging markets) due to insufficient development of financial markets (lack of liquidity and market depth). As highlighted by Espinoza et al. (2011), "The relatively open capital accounts in the GCC in part explain the relatively fast convergence, despite the existence of some restrictions and the illiquidity of markets.". Guillaumin (2009b) studied the case of EAC using a Feldstein-Horioka approach with developed panel data unit root tests and cointegration techniques. The findings offer two interesting results. Before measuring the degree of financial integration, the difficulty lay in the heterogeneity of the countries in the study area, at the level of either financial or economic development. That is why, in addition to the first measurement (which can be considered global), he made a distinction between countries according to their level of income [GDP per capita]: low, medium and high. He relied on it for the classification established by the World Bank. First, the degree of financial integration of EAC is high, and investments and savings appear weakly bound. Without being perfect, capital mobility thus appears quite strong. Second, financial integration is stronger for countries with high incomes and is conditioned by the financial development of the countries.

This was precisely the crisis of 1997, which led the *Asean+3*' countries to begin a process of institutional cooperation in monetary and financial order to accompany an already well-advanced de facto regionalisation (Plummer and Wignaraja, 2006). Moreover, trade integration is also well advanced. Asia's share in world trade has increased in the last 25 years. Much of this increase is due to intra-regional trade, particularly with the emergence of

China and a slight slowing of Japan (Zebregs, 2004). Table A.1 shows the movement of intra-zone trade with (i) strong dependence vis-à-vis Japan, China and, to a lesser extent, South Korea and Singapore (ii) less dominance at regional level, of Japan in favour of China between 1999 and 2010. Table A.2, which includes the weight of the partner country in the world, analyses the intensity of trade between countries. It shows that a high trade intensity vis-à-vis Japan and Singapore exists, but is now slightly lower with China, except for Korea and Hong Kong. We also find intensive trade between Singapore, Malaysia, the Philippines and Thailand. Following the seminal work of Eichengreen and Park (2005), which indicates that financial integration follows trade integration, we seek to assess regional financial integration given the strong regional trade integration between these countries. We also note that regional trade integration has been made possible despite the great diversity of domestic exchange-rate strategies that still characterised the area in 2012 (Table A.3). These dispersion practices in the field of exchange rates came after the 1997 crisis (Patnaik and Shah, 2010). Previously, a *de jure* or de facto currency peg on the US dollar was the rule (see Shirono, 2009, for a review); the exchange rate of the region evolved fairly harmoniously. However, this "harmony" disappears when a shock appears, as was the case in 1997 and 2007.

Different methods have been used to measure financial integration: *de jure* measures based on legal restrictions, *de facto* measures as a quantity-based approach,[4] price-based approach,[5] and saving-investment approach of Feldstein and Horioka (1980). All of these approaches suffer from a variety of shortcomings.[6] In particular, none of these methods takes the impact of the volatility of equity markets or the importance of risk premium into account. Specifically, it is now well known that financial integration and currency risk premium[7] are singularly linked in the case of developed markets (Dumas and Solnik, 1995; De Santis and Gerard, 1997, 1998; Barr and Priestley, 2004). However, this link is more ambiguous in the case of emerging markets (Boubakri, 2012).

These more specific measures for financial markets have included several comprehensive studies (Hardouvelis et al., 2006, among others), with the inclusion of the concept of risk sharing in equity and currency markets. The idea is to provide a measure of financial

[4] These measures usually draw upon the work of Lane and Milesi-Ferretti (2007).

[5] Indicators based on the uncovered interest rate parity.

[6] *De jure* measures do not reflect the actual degree of integration of an economy into international capital markets (Kose et al., 2006). Quantity-based assessments and price-based approach cannot measure regional financial integration. Finally, the measure of Feldstein and Horioka (1980) is difficult to interpret and to operationalise (Boubakri et al., 2012).

[7] Currency risk premium takes into account purchasing power parity (PPP) deviations and volatility of local inflation.

integration, taking into account the weight of each source of risk, including those linked to financial markets and foreign exchange markets in the assessment of total risk. Indeed, if the risk premium to the global market is prominent in the formation of the total risk premium, the studied stock market is now perfectly integrated (i.e. perfect capital mobility, risk sharing, common shocks). Otherwise, the market is perfectly segmented and the risk premium is linked solely to the local stock market. Our investigation is based on the model of international capital asset pricing model (ICAPM). It seems to be the most appropriate approach to answer the question about the possibility of an exchange-rate agreement. To our knowledge, any investigation has studied regional financial integration, taking into account the importance of currency risk premium in East Asia.

The aim of this paper is to study the dynamics of regional financial integration of EAC and evaluate their currencies' risk premium in order to establish an exchange-rate agreement. To this end, we start by determining a reference currency (anchor currency) for EAC, which allows us to derive the bilateral exchange rate. We call this anchor *MACU* for *Modified Asian Currency Unit*. Then, we study the relationships between currency premium and financial integration. We assess these two aggregates by estimating the ICAPM. Finally, we discuss the potential role of financial integration, which can play a role in promoting monetary integration.

The reminder of the paper is organized as follows. Section 2 presents our approach. Section 3 describes data and displays some preliminary statistics. Section 4 reports the results and comments our findings. Section 5 concludes.

2. Assessing regional financial integration

The ICAPM is frequently used to study the degree of international financial integration. However this model is used less often to study regional financial integration. To our best knowledge, Hardouvelis et al. (2006) are the only researchers to apply the ICAPM in a regional context in order to measure the degree of financial integration between the founding countries of the euro area. Any investigation was made, using the ICAPM, in the case of EAC.

Our empirical ICAPM resembles that of Hardouvelis et al. (2006) and takes into account purchasing power parity (PPP) deviations.[8] Like Carrieri et al. (2006), since inflation rates are often high and volatile in emerging markets, we use real exchange-rate measures, which provide a better proxy for PPP deviations since they capture both inflation and nominal exchange-rate risk.

The ICAPM used here allows an estimation of the degree of financial integration assuming that markets are partially segmented. The model can be written as follows[9]:

$$E_{t-1}\left(r_{i,t}\right)=\phi_{t-1}^{i}\left[\lambda_{t-1}^{ea}Cov_{t-1}\left(r_{i,t},r_{ea,t}\right)+\lambda_{t-1}^{k}Cov_{t-1}\left(r_{i,t},r_{k,t}\right)\right]+\left(1-\phi_{t-1}^{i}\right)\lambda_{t-1}^{i}Var_{t-1}\left(r_{i,t}\right) \quad (1)$$

where $E_{t-1}\left(r_{i,t}\right)$ is the expected excess return on the local stock market index, $r_{i,t-1}$ the return of the local market portfolio, $r_{ea,t}$ the excess return on the East Asian market index, $r_{k,t}$ the excess currency return, λ_{t-1}^{ea}, λ_{t-1}^{k} and λ_{t-1}^{i} are time-varying prices of the East Asian region risk, currency risk and local risk, ϕ_{t-1}^{i} is the conditional integration measure that falls in the interval [0,1]: $\phi_{t-1}^{i}=1$ refers to the case of perfect integration, and $\phi_{t-1}^{i}=0$ to strict segmentation. The case where $\phi_{t-1}^{i}\in\left]0,1\right[$ corresponds to the situation of partial segmentation. *Var* and *Cov* respectively denote the variance and covariance operators. All expectations are conditioned on the data that investors use to set prices at time $t-1$.

For each country *i*, the following system of equations must hold at any point in time:

$$r_{i,t}=\phi_{t-1}^{i}\left(\lambda_{t-1}^{ea}h_{i,ea,t}+\lambda_{t-1}^{k}h_{i,k,t}\right)+\left(1-\phi_{t-1}^{i}\right)\lambda_{t-1}^{i}h_{i,t}+\varepsilon_{i,t} \quad (2)$$

$$r_{ea,t}=\lambda_{t-1}^{ea}h_{ea,t}+\lambda_{t-1}^{k}h_{ea,k,t}+\varepsilon_{ea,t} \quad (3)$$

$$r_{k,t}=\lambda_{t-1}^{ea}h_{ea,k,t}+\lambda_{t-1}^{k}h_{k,t}+\varepsilon_{k,t} \quad (4)$$

Where $h_{i,ea,t}$, $h_{i,k,t}$, and $h_{i,t}$ are the columns of the matrix of variance-covariance of size $\left(N\times N\right)$ measuring the risk exposures of the regional market (*i.e.* East Asia – *ea*), to the currency risk and the local market risk, ε_{t} with $\varepsilon_{t}=(\varepsilon_{i,t},\varepsilon_{ea,t},\varepsilon_{k,t}/X_{t-1})\sim \mathrm{N}(0,\mathrm{H_t})$, represents the vector of errors conditional to the matrix of information variables *X* at time $t-1$ and H_{t} designates the conditional variance-covariance matrix of excess returns. As

[8] See for example, Black (1974), Stulz (1981), Errunza and Losq (1985), Eun and Janakiramanan (1986), Cooper and Kaplanis (2000), De Jong and De Roon (2005). All of these studies provide an excellent survey of the main properties of the theoretical asset pricing model.

[9] For more details, see, for example, Bekaert and Harvey (1995) and Hardouvelis et al. (2006).

Hardouvelis et al. (2006) state, time-variant parameter ϕ_{t-1}^{i} is conditioned on a set of variables that measure integration:

$$\phi_{t-1}^{i} = \exp\left(-\left|g_i^{'} Z_{t-1}^{i}\right|\right) \tag{5}$$

where $\exp(.)$ denotes exponentiation, $|.|$ denotes absolute value, Z_{t-1}^{i} is a vector of country-specific information variables related to convergence toward East Asian region, and g_i is the weight associated with each variable Z_{t-1}^{i}.

Following Hardouvelis et al. (2006), equation (3) above is used to retrieve the price dynamics of the regional market. Moreover, as our model includes the currency risk related to the exchange market, we use equation (4) to retrieve the price of currency risk.

Equation (2) incorporates the price of a risk related to the regional market, the exchange rate and the local market. The three equations, (6), (7) and (8), specify the evolution of these prices of risk:

$$\lambda_{t-1}^{ea} = Exp\left(\delta_{ea}^{'} X_{t-1}\right) \tag{6}$$

$$\lambda_{t-1}^{k} = (\delta^{'}{}_{k}\ X_{t-1}) \tag{7}$$

$$\lambda_{t-1}^{i} = Exp\left(\gamma_i^{'} Z_{t-1}^{i}\right) \tag{8}$$

Where X_{t-1} denotes all the information on regional variables available at $t-1$, $\delta_{ea}^{'}$ and $\delta_{k}^{'}$ represents the weights associated with these variables; Z_{t-1}^{i} is the vector of local information variables observable on the market *i* at $t-1$, and $\gamma_i^{'}$ represents the weights associated with these variables. The price of currency risk can theoretically take positive or negative values; it is supposed to vary as a linear function of information variables.

The time-varying conditional covariance matrix is parameterised using the *DCC* (Dynamic Conditional Correlation) model proposed by Engle (2002) and Tse and Tsui (2002). Their approach is written as follows:

$$\begin{cases} H_t = D_t R_t D_t \\ D_t = diag\left(\sqrt{h_{11,t}}, \sqrt{h_{22,t}}, ..., \sqrt{h_{NN,t}}\right) \\ R_t = diag\left(Q_t\right)^{-\frac{1}{2}} Q_t \left(diag Q_t\right)^{-\frac{1}{2}} \end{cases} \tag{9}$$

Where D_t is the diagonal matrix of conditional standard deviations and R_t is the matrix representing the structure of correlations between variables; Q_t is a matrix of dimension $(N \times N)$, symmetric and positive definite. It is given by:

$$Q_t = (1-\theta_1-\theta_2)\overline{Q} + \theta_1 u_{t-1} u_{t-1}^{'} + \theta_2 Q_{t-1} \quad (10)$$

Where $\overline{Q}_t$ denotes the unconditional matrix of variance-covariance of dimension $(N \times N)$, symmetric and positive definite, and $u_t = (u_{1t}, u_{2t}, ..., u_{Nt})^{'}$ is a column vector of standardised residuals of the N assets in the portfolio at time *t*; $u_{it} = \frac{\varepsilon_{it}}{\sqrt{h_{iit}}}$ to $i = i, ..., N$. The coefficients θ_1 and θ_2 are parameters to estimate. The sum of these coefficients must be less than 1 to satisfy the positivity of the matrix Q_t.

3. Data and preliminary analysis

We consider three groups of data (i) series of stock market returns in each country and for the regional market, (ii) series of exchange rates expressed *vis-à-vis* the reference currency, (iii) information variables used to condition the estimation of the risk prices and integration degree. Among the set of all Asian countries, we select 9 EAC: China (CH), South Korea (KOR), Hong Kong (HK), Indonesia (IND), Japan (JAP), Malaysia (MAL), Philippines (PHIL), Singapore (SING) and Thailand (THAI). This choice is made taking into account the economic, monetary and financial links between these countries. Data are monthly and cover the period from January 1990 to August 2012 in order to include the main economic episodes which have characterized the integration process of EAC (financial liberalization at the end of 1980s, 1997-1998 crisis, world crisis appeared in 2007-2008, setting up of financial and monetary regional agreements[10]). The only exception is China for which data cover the period from January 1994 to November 2008, due to a problem of data availability as explained below.

3.1. Series of asset returns

The monthly stock returns in each i_{th} market and in the East Asia area are calculated including dividends, and extracted from *Morgan Stanley Capital International* (MSCI) database; the exception is China, for which we retain the *Global International Finance Corporation* (IFCG) index, which provides a better approximation of the impact of capital market liberalisation on the returns. However, the data are only available until 2008. Stock market returns are defined as $R_{i,t} = \ln(P_{i,t} / P_{i,t-1})$, where $P_{i,t}$ is the stock market index at time *t* (including dividends).

[10] See, for example, Fukasaku and Martineau (1999), Guillaumin (2009) or Allegret et al. (2012) for a literature review.

The excess return of each index is calculated from a risk-free rate at one month extracted from *Datastream*. Unit root tests show that all series of stock returns are stationary.[11]

Some descriptive statistics are presented in Table 1. As it is usual in the literature, they show that returns display high volatility and are negatively skewed. With the exception of Malaysia and the Asia area, returns are auto-correlated, as indicated by the Q(z)12 statistics.

Table 1: Distributional Statistics on stock returns

	CH	KOR	HK	IND	JAP	MAL	PHIL	SING	THAI	Aar
Mean	-0.12	0.42	0.49	1.35	-0.29	0.65	0.62	0.41	0.57	0.34
StdDev	10.34	8.70	7.54	8.84	5.69	7.05	7.74	6.58	9.39	7.51
Skewness	-0.02**	-0.05**	-0.21*	-0.36*	-0.04**	0.06**	-0.11**	-0.59	-0.27	-0.42
Kurtosis	1.38	0.88	1.75	0.57**	0.03***	1.56	0.63*	1.95	1.10	0.75*
B-J	18.82	8.87*	36.66	9.66*	0.07***	27.6	4.96**	59.27	16.97	14.38
Q(z)12	18.81**	8.93**	18.66**	10.45**	9.38**	43.14	12.00**	12.70**	14.83**	27.48

Notes: significant at 1% (***), 5% (**) and 10% (*).
StDev is the Standard Deviation. B-J is the Jarque-Bera statistics.
Aar corresponds to Asia area.

3.2. Series of exchange rates

Our objective is to determine a reference/anchor currency for EAC. Should the US dollar be this reference/anchor? If there is abundant literature revealing the predominant role of the US dollar (Williamson, 2005) and the absence of a Yen bloc (Shirono, 2009), it seems that, since the 1997-8 crisis, EAC would like to be less peg to the US dollar (with some exceptions, as in China and Hong Kong), and this fact should be upgraded with the subprime crisis (Park and Song, 2011; Ma and McCauley, 2011). For this reason, we decided to build an Asian currency basket. To do this, as in Ogawa and Shimizu (2006), we take up the countries incorporated in the Asian Currency Unit (*ACU*).[12] However, given that we have only 9 countries in our sample against 13 countries in the *ACU*, we have decided, as in Guillaumin (2009a), to call this currency basket *MACU* for *Modified Asian Currency Unit*.[13] The value of the *MACU* in terms of currency *i* (the *MACU* rate of currency *i*) is defined as follows:

$$MACU^{i} = \sum_{j} \alpha_{j} E_{j}^{i} \qquad (11)$$

[11] Detailed results of unit root tests are available upon request from the authors.

[12] The Asian Currency Unit is a common currency basket composed of 13 East Asian currencies, which form *Asean+3*. *Asean+3* is made up of the following countries: Indonesia, Malaysia, Singapore, Thailand, the Philippines, Brunei, Vietnam, Myanmar, Laos, Cambodia, Timor, China, Japan, and Korea. The Asian Development Bank is responsible for exploring the feasibility and construction of the basket.

[13] Brunei, Cambodia, Myanmar, Timor and Vietnam were removed from the sample due to data availability issues. For this reason we call our currency basket *MACU*.

where α_j is the amount of currency *j* in the basket and E_j^i is the price of currency *j* in units of currency *i* (the bilateral exchange rate). If, for example, we consider the US dollar to be the curency *i* and assume that the weight is based on the share of GDP measured at purchasing power parity (PPP), equation (11) becomes:

$$MACU^{\$} = \sum_j \alpha_j E_j^{\$} \tag{12}$$

where:

$$\alpha_j = \gamma_j E_j^{\$} \tag{13}$$

with $E_j^{\$}$ as the price of the US dollar in units of currency *j* (*USD/j* exchange rate) and with:

$$\gamma_j = \frac{GDP(PPP)_j}{\sum_j GDP(PPP)_j} \tag{14}$$

with $GDP(PPP)_j$ as the GDP measured at purchasing power parity (PPP) of the country *j*.

Finally, we express each East Asian currency against *MACU* as in equation (11).

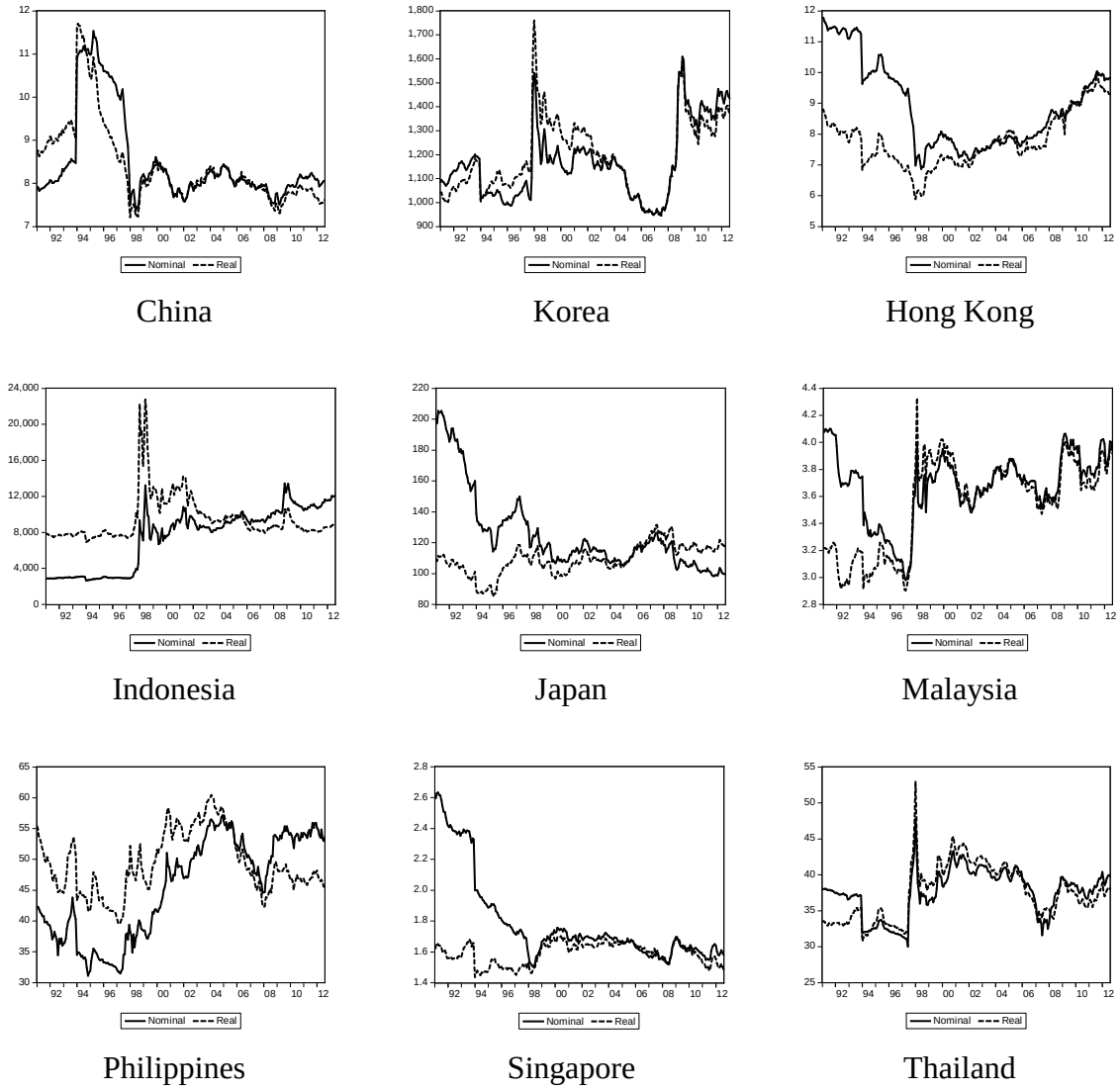
In order to determine the weight of each country (and therefore of each currency), we can choose three types of measure: GDP measured at purchasing power parity (PPP); GDP measured at current prices (in US); and trade volume (the sum of exports and imports) in the total of sampled countries. We choose the *MACU* constructed from the GDP measured at PPP.[14] Then, Figure 1, we express each East Asian currency against the *MACU* (nominal and real exchange rates).

All nominal exchange rates (against the US dollar) and the consumer price index data used for the construction of *MACU* come from IMF's *International Financial Statistics*.

GDP measured at PPP, GDP at current prices, and intra-regional trade data are extracted from the *CHELEM*-Cepii database. Series are annual and we choose 2005 as the reference year.

[14] We compare the nominal and the real exchange rates of the *MACU* against the US dollar according to the various weights (Figure A.1). As shown, the three series of each exchange rate (nominal and real) are very close. We calculated the correlation between each nominal and real exchange rate according to the weight. The correlation coefficient is, in each case, included between 0.95 and 1.00 and is statistically significant. Detailed results are available from the authors upon request.

Figure 1: Nominal and Real Exchange rate of East Asian currencies against *MACU*



Note: Authors'own calculations.

3.3. Series of information variables

In our estimations, we consider two sets of information variables that have been widely used in previous research (such as Hardouvelis et al., 2006 and Carrieri et al., 2007). These variables are used in order to condition the estimated prices of different risk factors and integration degree. The regional information variables are: (i) the first lag of the regional market dividend yields in excess of the risk-free rate; (ii) the first lag of the monthly change in the term spread; and (iii) the first lag of the monthly change of default spread. The term spread is the difference between the long-term interest rate (10-years) and a 1-month interest rate. Regarding the default spread, we computed it from the geometric mean for the 10-years Treasury bonds series in the most EAC (Hong Kong, Japan, Korea and Singapore) weighted by the series of market capitalisations of the same countries. All of these information

variables are taken from *Datastream* and are used with a lag behind the series of excess returns.

The set of local information variables includes: (i) the change in the local exchange rate; (ii) the local equity return in excess of the risk-free rate; and (iii) the monthly change in the short-term interest rate. As for the regional information variables, all those local information series are lagged.

4. Empirical results

We present here the results for the assessment of the risk premium and the extent of regional financial integration. Indeed, ICAPM provides an assessment of financial integration based on the weight of each source in the formation of the total risk premium. The parameters of equations (2) to (4) are estimated by quasi-maximum likelihood in order to avoid the problems due to non-normality in excess returns. Given the specificities of our model (large number of parameters, nonlinear properties), we estimate the system of equations in two steps. We first estimate a multivariate GARCH model and a bivariate model of the regional return and currency return (equations (3) and (4)). This step allows us to obtain the terms of conditional variances and covariances, the estimated values for the price of regional market risk (λ_{t-1}^{as}) and the price of currency risk (λ_{t-1}^{k}). To take into account the assumption that the price of regional risk is equal across countries, we then impose this constraint in the estimation of each country (equation (2)).

4.1. Results estimation of the ICAPM

As indicated in Section 2, the ICAPM explains local asset returns as a function of three premia: a global risk premium, a currency risk premium and a local risk premium. We first estimate the system of equations (3), (4), (6) and (7) in order to obtain the regional and currency prices of risk. In the second step, we perform the estimation of equation (2) for each country to obtain the local price of risk. Here, we do not report estimates of the individual coefficients on the local and regional information variables.[15] Panel A of Table 2 reports the residual diagnostic tests related to the estimation of the regional price of risk (λ_{t-1}^{as}). While non-normality has not been eliminated from the residuals, Ljung-Box and White tests reveal the absence of auto-correlation and heteroscedasticity problems.

[15]We focus only on the results of the importance of each risk premium. The other results are not presented in order to save space. The latter are, however, available upon request from the authors.

Table 2: Results of ICAPM estimation

Panel A: residual diagnostic of regional price of risk

Statistics	$JB = 38.65^{*}$	$Ljung\ Box = 4.32$	$White = 10.51$
P-value	0.00	0.98	0.96

Panel B: significance and importance of risk premiums

	PW	*PC*	*PL*	*PW (%)*	*PC (%)*	*PL (%)*
CH	0.26***	-0.27	1.01***	14.06	9.36	76.58
	(7.14)	(-1.90)	(7.45)			
HK	0.31***	**0.04****	0.65***	35.30	**2.94**	61.76
	(38.44)	(10.77)	(80.06)			
IND	-0.21	2.13	-0.92	29.90	15.77	54.33
	(-0.43)	(1.07)	(-0.62)			
JAP	0.67***	**0.22****	0.12***	68.26	**14.57**	17.17
	(24.74)	(6.94)	(17.01)			
KOR	0.45***	**0.18****	0.37***	44.52	**15.27**	40.21
	(49.43)	(28.42)	(35.50)			
MAL	0.35***	0.12	0.54***	38.47	16.58	44.94
	(2.83)	(0.44)	(3.59)			
SING	0.39***	**0.09****	0.52***	42.92	**9.50**	47.58
	(45.97)	(14.11)	(59.11)			
PHIL	0.50**	-0.16	0.66***	27.52	24.23	48.25
	(2.27)	(-0.36)	(3.16)			
THAI	0.31***	**0.11****	0.58***	31.43	**11.91**	56.66
	(22.73)	(5.62)	(43.27)			

Note: significant at 1% (***), 5% (**) and 10% (*).*T-stat* are given in parentheses. *PW* is the regional risk premium, *PC* the currency risk premium, *PL* the local risk premium, *PW (%)* is the percentage of regional premium in the total premium, *PC (%)* the percentage of currency premium in the total premium and *PL (%)* the percentage of local premium in the total premium.

Panel B of Table 2 contains the results of the estimation of equations (2) to (4) and (6) to (10). For each country, we report the estimated coefficient of each risk premium and significance level.

First, we note that the currency risk premium is significant for five of the nine EAC countries studied (Hong Kong, Japan, Korea, Singapore and Thailand). To assess the currency risk, we use the real exchange rate between the domestic currency and the currency basket built – Asian common currency (*MACU*). In equation (2) this premium is represented by $(\lambda_{t-1}^{k} h_{i,k,t})$, where $(h_{i,k,t})$ is the covariance term between the excess currency return and the excess return of local stock market index, weighted by the price of currency risk (λ_{t-1}^{k}).

If the currency risk is globally significant in the case of developed stock markets[16], the results are more mixed in the case of emerging markets.[17] This is explained by the framework used for testing the currency risk premium. Indeed, emerging countries are usually partially integrated with the global market and frequently have a low degree of openness vis-à-vis the rest of the world (Bekaert and Harvey, 1995; Karolyi, 2004; Carrieri et al., 2007). In the case of EAC, the results for the currency risk premium are statistically and economically significant. The second part of Table 2 reports the weight of each risk premium (regional, local and currency premium). Our results show that the weight of the currency risk is significant for some countries, including Japan (15%), Korea and Thailand (12%), and Singapore (10%). For these countries, the establishment of a regional exchange-rate agreement would allow better sharing of asymmetric shocks and to overcome the difficulties related to volatility in the foreign exchange markets. Indeed, here we consider the real exchange rate, which takes into account (i) the deviation to PPP,[18] and (ii) the variation in the inflation rate, which often characterises the case of emerging countries.[19]

The significance and importance of the currency risk premium are related to several factors. Here, the premium is significant for countries like Hong Kong, Japan, Korea and Singapore. Therefore, this result can be explained by the degree of financial development in these countries compared to other Asian countries, such as Indonesia, Malaysia or the Philippines. The latter are less often confronted with various financial and monetary shocks (Allegret et al., 2012).

For the two other risk premiums related to domestic and regional stock markets, the results reported in Panel B of Table 2 show that they are significant for all countries but Indonesia. The second part of the table shows the weight of each source of risk in the formation of the total risk premium. The main findings allow us to classify the countries studied into three groups:

- Countries such as China, Hong Kong, Indonesia, the Philippines, and Thailand have a local risk part that exceeds 50 per cent and is the main component in the formation of the total risk premium. For example, for China, the local risk premium is about five times the premium of the regional market and eight times the currency risk premium. These results are consistent with the level of financial and monetary development of

[16] See, for example, Barr and Priestley (2004).
[17] See, for example, Boubakri (2012).
[18] See, for example, Obstfeld and Rogoff (1995) or Mitchener and Weidenmier (2006).
[19] This phenomenon is due to the Balassa-Samuelson effect. See, for a literature review, Garcia Solanes and Torrejón-Flores (2009).

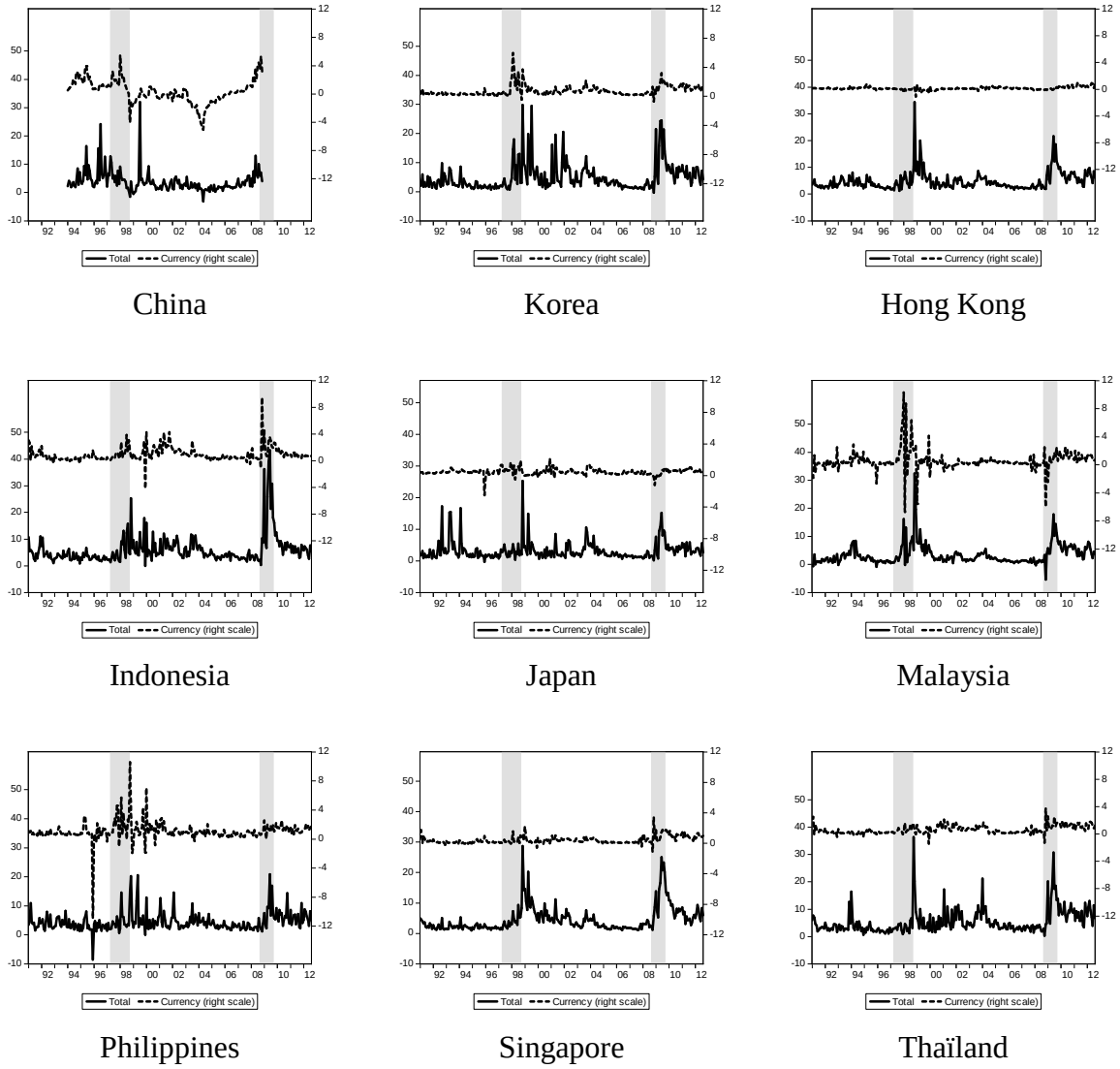
China. Indeed, if China has clearly demonstrated its commitment to internationalising its currency (Cheung et al., 2011), the Yuan has not, at present, the status of international currency (Thimann, 2009). This lack of status is due mainly due to the insufficiency of financial openness and financial development (Bénassy-Quéré et al., 2011). However, it should be noted that the potential for internationalisation of the Yuan is increasing (Angeloni et al., 2011). In financial terms, free movement of capital is restricted and financial markets are underdeveloped (Bénassy-Quéré et al., 2011).[20]

- Countries such as Korea, Malaysia, and Singapore, where the weight of local and regional premiums is quite similar (between 40% and 45% for each premium). These countries are more developed than the previous group and their financial markets are more open than the Thai or Chinese markets.
- Japan has a regional risk premium of about 68 per cent, four times greater than the local premium. This result is consistent with the level of financial development of Japan in the region of East Asia and also throughout the world. Thus, if we rely on the work of Lane and Milesi-Ferretti (2007) for financial integration index, WEF (2010) for financial development index, and Chinn and Ito (2008) for degree of capital account openness, we find that Japan's situation is characterised by: (i) very high financial development, (ii) strong financial integration, and (iii) a nearly full capital account (the exact figure is 98%, 100% indicating a total opening).

Figure 2 presents a comparison between the currency and total risk premiums. We note that in countries where the currency risk is significant (Hong Kong, Japan, Korea, Singapore, Thailand), the associated premium varies over time, takes positive and negative values over time, and varies significantly during periods of crises (Asian 1997-8, world 2007-8). Results for the total premium are more significant. We note two peaks, the first in the mid-1990s due to the Asian crisis, and the second in 2008, due to the global crisis.

[20] If we only take the case of equity markets, they have existed since 1984 and, since 1990, two markets have been created: one in Shanghai, and one in Shenzhen. Market capitalisation is low and there are two compartments: A for domestic investors, and B for foreign investors. See, for example, Allen et al. (2012) for a complete review.

Figure 2: Total and Currency Risk Premiums



China Korea Hong Kong

Indonesia Japan Malaysia

Philippines Singapore Thaïland

To investigate the impact of each crisis on EAC, Figure 2 includes two grey strips corresponding to regional and world crisis periods. In reality, the choice of these two periods is the result of several detailed investigations, because there exists an animated debate about when the crisis started and when it ended. If the study of the Asian crisis has become easier with time, the crisis began in 2007 with the subprime, is more complex. Indeed, this crisis has experienced many episodes and twists, which initially affected the financial market, and then the real economy. In this study, we pay particular attention to the influence of the financial crisis rather than the issue of its transmission to the real economy. For the Asian crisis, we rely on the study of Rüffer et al. (2007) to specify when it started and ended. To determine the world crisis period, we rely on Eichengreen et al. (2009). As in Coudert and Mignon (2013), we study the VIX index (extracted from the database of Saint-Louis' *Fed*), which is considered as an indicator of financial stress (Coudert and Gex, 2008), in order to specify

clearly the period of financial crisis. We also calculate the volatility of the MSCI World index (Figures A.2 and A.3).[21]

Finally, we also conduct unit root tests with endogenous breaks. We use these tests to detect the break dates to confirm or invalidate the studies cited. We use tests developed by Clemente et al. (1998) and Bai and Perron (2003), where at least two endogenous structural breaks are possible. The results of these tests, available from the authors upon request, confirm the two crisis periods chosen using the papers cited and the methodology used previously (VIX index and MSCI World index volatility).

Overall, we can easily distinguish the impact of the regional and world crises on the risk premiums (e.g. total and currency). According to Figure 2, we can see that all countries are clearly affected by the two crises: regional and world. However, there is a slight difference between the countries studied regarding the influence of each crisis on the risk premium. For example, some countries, such as China, Korea, Hong Kong, Malaysia and Thailand, have been relatively more affected by the regional crisis than by the global crisis. Accordingly, these findings show that (i) East Asian countries are affected by both regional and international risk, and (ii) the comparison between the two crises shows that the regional risk is not negligible for EAC and further strengthens the hypothesis of the greater regional integration compared to their opening on the world market.

The significance and importance of the risk premium could be more related to the degree of financial integration, particularly with the regional market, for some countries. In the next section we study the degree of regional financial integration in each country. Precisely, we assess the link between the estimation results of the risk premium and their impact on the regional integration degree: are the markets with a preponderance for local risk premium in the total risk premium strictly segmented? Otherwise, are the markets that have a significant and important share of the regional risk premium (i.e. Asian stock market risk) regionally well integrated?

4.2. Time-varying integration

To account for the dynamics of financial integration, the degree of integration of each Asian country is modelled using equations (2) and (5). The integration coefficient (ϕ^{i}_{t-1}) varies over time to account for the dynamics of financial integration and the convergence, or not, of each

[21] For the MSCI World index (extracted from *Datastram*), we also calculated the implied volatility from a GARCH (1,1) model. Results (Figures A.2 and A.3) are very close to the VIX index.

country towards the regional Asian market. If ϕ^i_{t-1} tends to 1, the local market risk is neglected. The total risk premium is formed mainly by the regional risk premium, and the local market converges to the regional market. The stock returns of the local market portfolio are influenced by the regional economic fluctuations rather than by variation of monetary and financial aggregates related to the local market. If ϕ^i_{t-1} is near to 0, the reverse case occurs: the market is segmented and the total risk premium is mainly composed of the risk premium related to the local market.

Table 3 indicates a mean level of integration of each country. The overall mean varies from one country to another. Japan has the highest degree of integration (0.91 on average) and China has the lowest mean (0.10). For the other Asian countries studied, we distinguish two groups: (i) the first contains three countries (Hong Kong, Korea and Singapore), characterised by partial segmentation (around 0.45 in average). This result is consistent with the findings of the previous section. Indeed, for Korea and Singapore, the weight of local risk premium is almost equal to the regional premium, which matches the case of partial segmentation/integration of markets; (ii) the second includes four countries (Indonesia, Malaysia, the Philippines and Thailand), marked by a low integration degree (around 0.2 to 0.25 on average). This result is compatible with the economic and financial situation of these countries. Indeed, as we have shown in the previous section, the local risk premium is the main component in the formation of the total premium of risk. Also, according to income level, using the classification of the World Bank, Malaysia, the Philippines and Thailand are middle-income countries, and Indonesia a low income country. Guillaumin (2009b) shows that the latter have lower financial integration links than high-income countries (such as Japan and Korea).

Table 3: Time-Varying Integration Indexes

	CH	HK	IND	JAP	KOR	MAL	SING	PHIL	THAI
Overall Mean	0.10	0.40	0.21	0.91	0.40	0.23	0.48	0.19	0.25
- Before 2008	-	*0.33*	*0.12*	*0.92*	*0.35*	*0.17*	*0.41*	*0.17*	*0.17*
- After 2008	-	*0.67*	*0.51*	*0.85*	*0.58*	*0.45*	*0.73*	*0.25*	*0.54*
Min	0.01	0.07	0.03	0.69	0.20	0.03	0.16	0.05	0.01
Max	0.41	0.75	0.65	0.97	0.64	0.56	0.84	0.35	0.66
StdDev	0.09	0.20	0.18	0.05	0.12	0.14	0.17	0.06	0.19

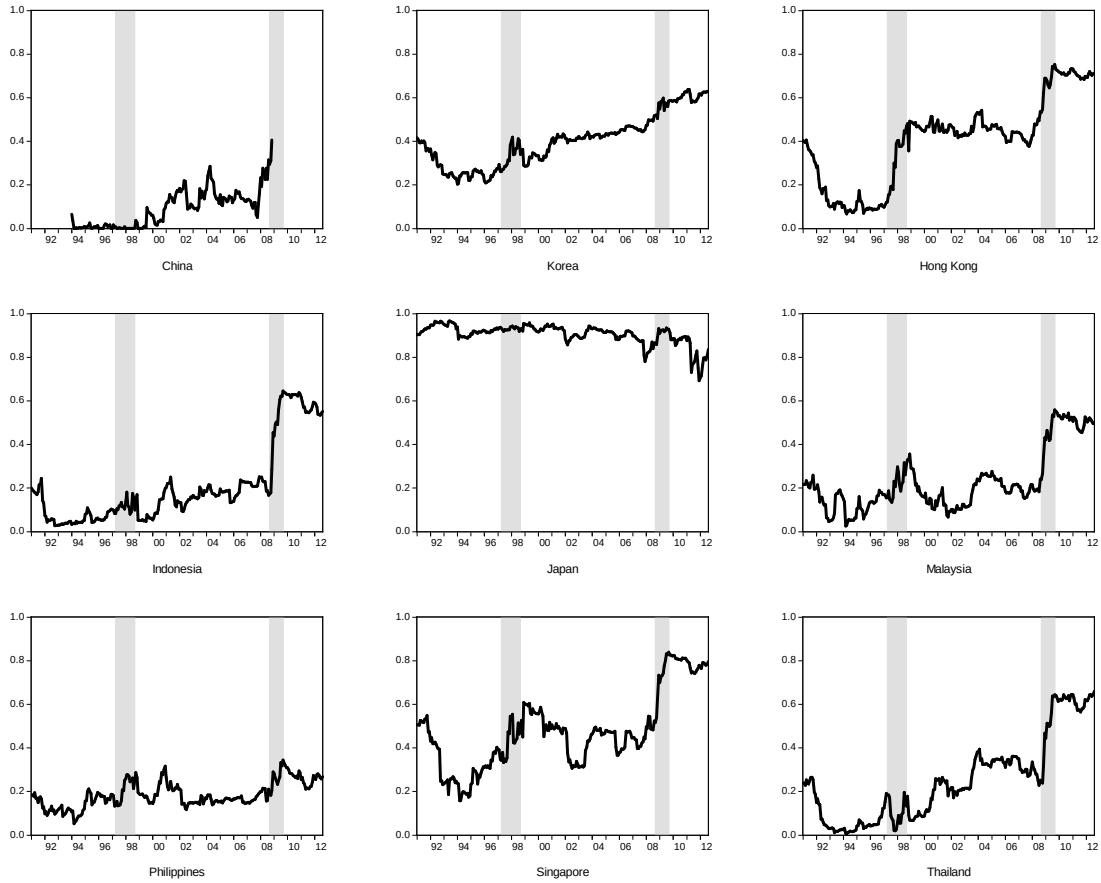
Note: panel of Table 3 contains statistics for the integration indices estimated from the ICAPM (equation (2)). StDev is the Standard Deviation.

We now analyse the dynamics of regional integration. Globally, the results are significant and consistent with the financial and economic reality of the East Asian area. Figure 3 pictures our main results. It portrays the time-varying process of the degree of market integration. Two phases of evolution can be distinguished. The first, before 2008, is marked by a low level of regional integration inferior to 0.3 (i.e. segmented market), except for Japan. However, we note that the degree of integration nevertheless increased between 1997 and 2002 for most Asian countries. This is the period of the Asian crisis that affected the exchange and financial markets and created several fluctuations, as highlighted by the importance of the risk premium in the previous section. The second, after 2008, is marked by a rapid increase in the level of regional integration. Indeed, for several countries the integration measure doubled in the last months of 2008: for example, from 0.4 to 0.75 for Hong Kong; 0.3 to 0.6 for Indonesia; 0.25 to 0.5 for Malaysia; 0.4 to 0.8 for Singapore; and 0.3 to 0.6 for Thailand. This result should be interpreted with caution. Indeed, the integration measure stems from the ICAPM, takes into account the volatility of the financial and exchange markets, and reflects the impact of different regional and international crises.[22] Therefore, the high level of integration after 2008 probably also included a part of the financial market fluctuations linked to the subprime crisis and the bankruptcy of Lehman Brothers. This improvement of regional integration may reflect a common move among Asian countries, which may be a result of the shock propagation from the financial crisis rather than a move specific to each country.

Otherwise, the level of integration found for each country reflects not only the measure suggested by the ICAPM (dynamic covariance between equity stock returns of each local market and the Asian market), but also the contribution of other economic fundamentals in each country, as evidenced by Dumas et al. (2003). According to these authors, it is inappropriate to conclude about the integration of financial markets from the simple calculations of correlations between stock returns alone.

[22] As noted by Rigobon (2000), this is a “contagion” effect.

Figure 3: Time-varying regional financial integration



Furthermore, Figure 3 shows that, independently of the global crisis, the upward trend of the degree of financial integration is confirmed until the end of the study period (August 2012). We know that these Asian countries are, for the most part (except Japan), classified as emerging markets and therefore less exposed to the global crisis compared to more developed countries. In this context of the crisis, and taking into account the difficulties of the euro area and North America countries (subprime crisis, sovereign debt crisis, etc.), Asian countries seem to be moving towards trade with neighbouring countries, thus promoting their regional integration (Saxena, 2005; Rüffer et al., 2007; Rüffer and Moneta, 2006). In addition, a regional market orientation allows them to remove the volatile capital flows coming from developed countries, which have a high level of risk. Accordingly, we can note that the degree of integration, independent of the crisis effect, may also include a significant part reflecting a real increase in financial regional integration. Indeed, after the multiple crises that affected the world market, the EAC seem to "refuge" in their regional market, where the interest of any exchange-rate agreement allows a better growth in this intra-regional trade.

Overall, our findings are consistent with our expectation that the EAC are partially integrated with the regional market (especially during the first part of the study period), and the process

of financial integration has increased after the global crisis. Our results are also consistent concerning the significance of the currency risk premium. Indeed, the literature has often neglected this part of risk linked to the currency market in the case of emerging countries (Bekaert and Harvey, 1995; Carrieri et al., 2007). The significance of the currency risk premium reinforces the idea of a regional exchange-rate agreement to minimise this risk and to promote monetary and financial integration. A regional exchange-rate agreement would then strengthen all the regional economic agreements (commercial, financial and monetary) implemented since the crisis of 1997 in order to "protect" regional integration and accentuate the dynamics developed since 1997-8.

5. Conclusion

The objective of this study was to assess the dynamics of regional financial integration of East Asian Countries (EAC) and evaluate their currencies' risk premium in order to establish a regional exchange-rate agreement. To this end, we started by determining a reference currency (anchor currency) for EAC, which allowed us to derive the bilateral exchange rate. Then, we studied the relationships between currency premium and financial integration, estimated using the ICAPM approach. First, we show that the currency risk premium is significant for five of the nine EAC studied and contributes to formation of the total premium. Second, the assessment of the dynamics of regional integration shows that the stock markets were partially integrated (except for Japan) until about 2008. However, the recent years are characterised by an upward trend in regional integration of the stock markets. Third, as the currency risk is significant for several Asian countries, an exchange-rate agreement allows better sharing of this risk, as well as those related to the stock markets, and accordingly to promote financial integration with the regional market.

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Appendix A – Some statistics

Table A.1 shows the bilateral trade dependence. This indicator is based on the work of Kwan (2005), and is calculated as follows:

$$DC_{ij} = \frac{X_{ij} + M_{ij}}{X_i + M_i}$$

Where X_{ij} and M_{ij} are, respectively, exports from *i* to *j* and imports of *i* from *j*; X_i and M_i indicate total exports and imports of *i* in the rest of the world.

To complete the trade dependency index, we calculate the intensity of trade as:

$$IC_{i/j} = \frac{X_{ij} + M_{ij}}{X_i + M_i} / \frac{X_j + M_j}{X_{world} + M_{world}}$$

This indicator allows the relative importance of trade dependence of country *i* to country *j* as a function of the square of the latter in the world.

Table A.1: Trade dependency index

	China		Korea		Hong Kong		Indonesia		Japan		Malaysia		Philippines		Singapore		Thailand		Asean	
	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010
China	-	-	7.0	7.3	4.6	2.7	1.0	1.4	20.0	11.7	1.3	2.3	0.5	0.7	1.6	1.4	1.2	1.9	6.0	8.8
Korea	10.2	22.7	-	-	1.8	1.0	2.5	2.6	15.8	10.6	2.6	1.8	1.7	1.1	2.3	2.3	1.1	1.2	11.1	10.6
Hong Kong	18.0	32.1	4.9	3.9	-	-	0.7	0.8	10.1	8.9	1.7	1.1	1.4	0.7	6.6	12.1	1.8	1.7	12.6	17.1
Indonesia	4.8	13.4	8.0	7.8	0.9	0.6	-	-	21.1	14.9	2.9	5.7	1.0	1.1	9.3	11.7	2.3	4.2	16.3	24.1
Japan	10.6	22.3	5.8	6.5	1.4	1.4	2.4	3.0	-	-	3.1	2.8	2.0	1.3	2.8	1.9	2.8	3.8	13.7	14.2
Malaysia	3.6	16.9	4.9	4.2	1.2	0.7	1.7	4.4	15.7	10.7	-	-	1.9	1.5	15.5	12.5	3.5	5.5	23.2	25.6
Philippines	2.8	15.8	6.3	7.5	2.0	1.3	1.1	2.6	20.3	15.1	3.9	4.4	-	-	5.1	6.8	2.4	5.1	13.1	20.7
Singapore	3.9	9.7	4.0	5.0	4.2	6.9	4.9	8.4	12.8	6.8	14.1	11.7	2.3	2.1	-	-	4.1	3.0	26.3	27.1
Thailand	4.4	14.8	2.8	3.1	1.7	1.1	1.9	3.6	19.5	15.8	4.8	6.0	1.7	1.9	6.1	3.5	-	-	16.2	18.5
Asean	4.0	14.0	5.0	5.5	2.1	2.3	2.3	4.1	17.0	11.9	5.6	5.6	1.6	1.5	7.1	6.3	2.9	3.7	-	-

Note: authors's own calculations with *CHELEM* (Cepii) database.

Table A.2: Trade intensity index

	Korea		Hong Kong		Indonesia		Japan		Malaysia		Philippines		Singapore		Thailand		Asean	
	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010	1999	2010
China	3.0	2.4	5.2	3.4	1.4	1.4	3.1	2.4	1.1	1.8	0.8	1.7	1.1	1.1	1.3	1.6	1.2	1.5
Korea	-	-	2.1	1.3	3.4	2.6	2.5	2.2	2.1	1.4	2.7	2.5	1.7	1.6	1.2	1.0	2.1	1.8
Hong Kong			-	-	1.0	0.8	1.6	1.8	1.4	0.9	2.2	1.7	4.8	8.8	2.0	1.5	2.4	2.9
Indonesia					-	-	3.3	3.0	2.3	4.4	1.6	2.6	6.7	8.5	2.5	3.6	3.1	4.1
Japan							-	-	2.4	2.2	3.2	3.1	2.0	1.4	3.0	3.2	2.6	2.4
Malaysia									-	-	3.1	3.5	11.2	9.1	3.8	4.6	4.5	4.3
Philippines											-	-	3.7	4.9	2.7	4.3	2.5	3.5
Singapore													-	-	4.4	2.5	5.1	4.6
Thailand															-	-	3.1	3.1

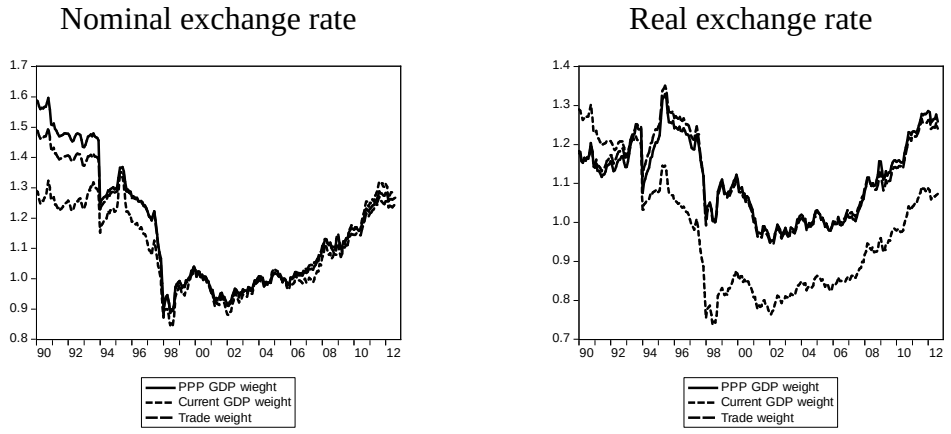
Note: authors's own calculations with *CHELEM* (Cepii) database.

Table A.3: De facto classification of exchange rate arrangements

Exchange rate arrangement	Countries
Currency board	Hong Kong
Crawl-like arrangement	China
Other managed arrangement	Singapore, Malaysia
Floating	Indonesia, Korea, Philippines, Thailand
Free floating	Japan

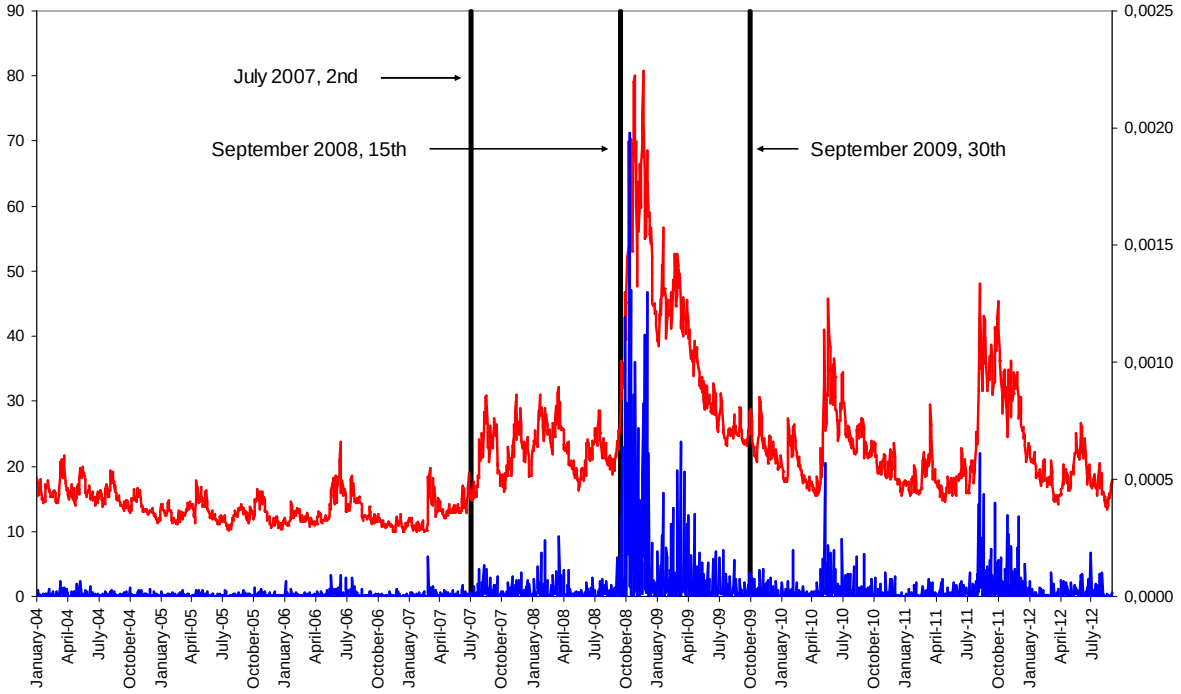
Source: IMF (2012). Reinhart and Rogoff (2009) propose a historical classification (1970-2007) with the following link: http://www.reinhartandrogoff.com/data/browse-by-topic/topics/12/.

Figure A.1: *MACU* exchange rate against the US dollar following three weights



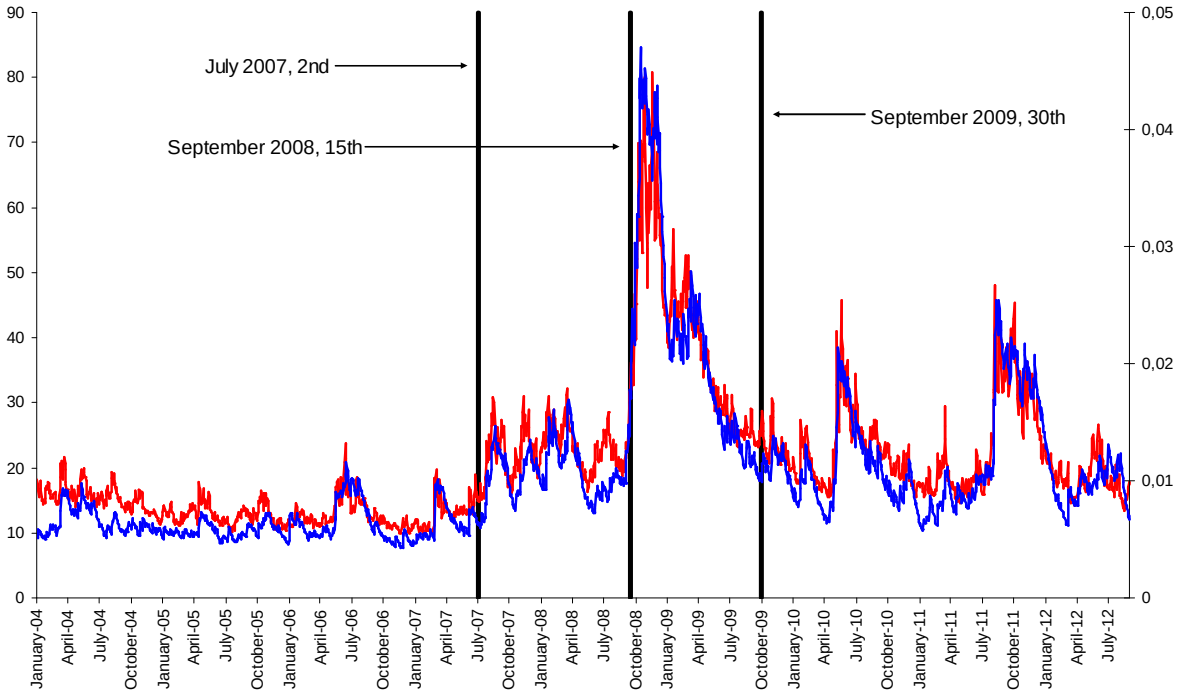
Notes: Authors'own calculations.
PPP GDP: purchasing power parity GDP; Trade: intra-regional trade (sum of exports and imports).

Figure A.2: stock market volatility



VIX index (—) MSCI World index (historical volatility, right scale) (—)

Figure A.3: stock market volatility



VIX index (—) MSCI World index (implied volatility, right scale) (—)