Exchange rates movements in Emerging Economies Global *vs* Regional factors

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Abstract

The aim of the article is to analyze the determinants of emerging markets' exchange rate movements, particularly for Asia. We implement a dynamic latent factor model to investigate the determinants of 24 emerging countries' exchange rates movements and decompose the evolutions into the contribution of a global factor, a regional factor and a country-specific factor. The results indicate that, on the whole period 2000-2015, the common global factor is by far the most important determinant of exchange rates variations for Asian economies and, albeit to a lesser extent, for Latin America. After 2005, there is a strong increase in the explanatory power of the regional factor in Asia, from 6% to 45%, becoming the dominant factor in this area. Then, we use a Vector Autoregressive model (VAR) and show that the regional factor Asia, estimated from the dynamic latent factor model, is mainly explained by Chinese economic variables. Indeed, our results highlight that bilateral exchange rate of China and macroeconomic economic climate in China greatly influence the regional factor Asia.

Keywords: Exchange rates, currencies internationalization, Renminbi bloc, dynamic latent factor model, Bayesian estimation, VAR model

JEL Classification: C32, F15, F31, F36

1. Introduction

Following the 90s' financial crises in Latin America and Asia, emerging countries aimed to develop and reform their economy while protecting against the instability of foreign capital flows and exchange rates' instability. Some of them, notably in Asia, manage exchange rate regime and impose capital controls. It was also the case in 2010 after the Subprimes crisis. At the same time, some emerging markets' currencies are becoming more internationalized. Amongst these countries, China has distinguished itself

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by its economic growth, the geopolitical influence on the Asian zone and on the world and the reforms under way notably concerning a more flexible management of the exchange rate regime since 2005. China is a dominant country. In PPP terms, it represents 17.1% of the world GDP (IMF, 2016) and it is the world's leading exporter (13.8% of the world exports) and the second-largest importer (10.1% of the world imports) in the world (WTO, 2016). Moreover, Asian countries are highly dependent on China: in terms of growth, trade, and financial channels (Rafiq, 2016; Dizioli, Guajardo et al., 2016) and of regional initiatives as CMIM (Eichengreen and Lombardi, 2015). The emergence of China naturally leads to question the dominant role of the Renminbi (RMB). Formally, no country is pegging its currency to the RMB. However, for a trading partner, it is crucial to maintain the stability of its currency to that of the dominant country. One can observe that, in the 2000s', notably in 2015, some Asian currencies seem to move closely with the RMB. Such a dominant-country position does not exist neither in Latin America, nor in Emerging Europe for which the major question is respectively the positioning towards the U.S. and the condition to access the Eurozone. Consequently, the literature is less interested by the status of the currencies of these countries and by the currencies with which they may co-move.

The aim of the article is to analyze the determinants of emerging markets' exchange rate movements, particularly for Asia. Are these determinants global factors in the same vein of the push determinants of capital flows, or are they regional factors which refer to the recent literature on the existence of a de facto monetary bloc in Asia around the RMB, or are they specific or idiosyncratic factors?

More globally, this topic is in line with the literature that concentrates on network effects and the potential of the RMB to challenge the US dollar as the leading global currency. There is an alternative hypothesis: the RMB may be a leading regional currency that has overtaken the US dollar as the dominant reference currency in Asia. Currencies are internationalized when they are increasingly used by non-residents for the composition of international reserves, the use for foreign exchange interventions and operations, the payment and the denomination of trade and financial transactions (Frankel, 2011, Maziad et al., 2011). The literature on the internationalization currency process in emerging countries[1] has primarily dealt with the RMB and the other Asian currencies, notably the Korean won, even if some articles are interested by the progress of the Mexican peso and the Brazilian real in this process and in the FX turnover[2].

If the determinants of exchange rates' movements are global factors, it may mean that the currencies are quite internationalized. If they are regional factors, it may refer to commercial and financial channels that are more relevant on a regional level. If they are specific or idiosyncratic factors, it may indicate that currencies may not be much internationalized and may be quite protected against external shocks.

[1] Rajan and Prakash, 2010; Eichengreen, 2011 ; Frankel, 2011 ; Subramanian, 2011; Maziad et al., 2011 ; Kenen, 2012 ; Kim and Suh, 2012; Rhee, 2012; Ehlers and Packer, 2013; Padmanabhan, 2013; Park and Shin, 2012 ; Gao and Yu, 2012 ; Ma and Villar, 2014; Lee, 2014; He et al., 2015; Eichengreen and Lombardi, 2015; Aizenman, 2015; Chinn and Ito, 2015; Reiss, 2015; Lahet, 2017.

[2] Trading share of a currency (purchase and sale) in the total amounts of transactions in global FX markets.

To shed light on this issue, we implement a dynamic latent factor model to investigate the determinants of 24 emerging countries' exchange rates movements and decompose the evolutions into the contribution of a global factor, a regional factor and a country-specific factor. The results indicate that, on the whole period 2000-2015, the common global factor is by far the most important determinant of exchange rates variations for Asian economies (70%) and, albeit to a lesser extent, for Latin America (53%), and for all the countries in the sample (50%). If we decompose the whole period into sub-periods, the results are quite different. The 2000-2005 sub-period shows the predominance of the global common factor as the main explanation of exchange rate movements, especially for Asian countries (73%). But, after 2005, there is a strong increase in the explanatory power of the regional factor in Asia, from 6% to 45%, becoming the dominant factor in this area. We find evidence, in line with China's dominance hypothesis in the literature, of the increasing influence of regional factors in the evolution of exchange rates in Asia to the detriment of the common global factor. This is not the case for the other emerging zones. We assess that this regional influence could be linked to the internationalization of the Chinese Yuan and to the more flexible management of the Chinese exchange rate regime since 2005 and after 2008. To investigate this issue, we use a Vector Autoregressive model (VAR). We find that the factor Asia, estimated from the dynamic latent factor model, is mainly explained by Chinese economic variables. Indeed, our results highlight that bilateral exchange rate of China (Yuan) and macroeconomic economic climate in China greatly influence the regional factor Asia. We also find that other determinants such as the Barclays Emerging Markets Asia Index are important to explain changes of the factor.

Our contribution to the literature is three-fold. First, we use a new methodology to precise the determinants of exchange rates' movements and the influence exerted by a currency on another one. Second, we supplement the existing literature on a regional de facto monetary bloc in Asia with evidences on the contribution of a regional factor in the exchange rates' movements in Asia, after 2005 and following the subprimes crisis. Finally, our results are in line with the literature on a multi-polar (or tri-polar) international monetary system, considering that the reliance of the International Monetary System on a single dominant currency issued by a country responsible of a global crisis may engender its own fragility (Benassy-Quéré and Pisany-Ferry, 2011; Tovar and Nor, 2018).

The remainder of the paper is organized as follows. In Section 2, we present the literature review. The data and the empirical model are analysed in Section 3. Section 4 presents the results and Section 5 offers a discussion and concludes.

2. Literature review

The topic internationalization vs regionalization of emerging markets' currencies has mainly concerned the Asian currencies with a three-fold aspect. Firstly, Ehlers and Packer (2013), by studying the FX Turnover of emerging markets' currencies from the BIS Triennial Central Bank Survey, show that the offshore trading of Asian currencies is regional and via a regional center (Hong Kong), that is not the case for Latin American ones. Secondly, by studying the ability to fulfil some of the functions of money globally, literature focuses mainly on the RMB regarding its degree of internationalization: large, at an international level, or close, at a regional level (Dobson and Masson, 2009; Eichengreen, 2011 , Gao and Yu, 2012; Eichengreen and Lombardi, 2015). Thirdly, different methodologies have been used to enquire the existence of a regional de facto monetary bloc in Asia; but the conclusions disagree because the findings are sensitive to the methodologies. There are three types of methods. Firstly, the traditional methodology proving the influence of an exchange rate on other exchange rates or co-movements is the linear regression à la Frankel and Wei (1994). For example, the evolution of an Asian local currency vis-à-vis Swiss franc for example (sometimes the US dollar or the DTS) may be explained by the evolution of the following exchange rates: RMB/Swiss franc, US dollar/Swiss franc, yen/Swiss franc, euro/Swiss franc. This allows highlighting the dominant reference currency in Asia: the RMB (Subramanian and Kessler, 2013; Eichengreen and Lombardi, 2015; Shu et al., 2015). Other articles emphasize multicollinearity problems in this method and, to tackle them, propose to use the exchange rates of currencies measured against the New Zealand dollar that is the currency of a small open economy managing floating exchange rate without capital control (Huang et al., 2014; Kawai and Pontines, 2014; Kawai and Pontines, 2016; Ito, 2017; Tovar and Nor, 2018). If these articles conclude on an increasing influence of the RMB on the other Asian exchange rates, notably after 2005 (implementation of the liberalization reforms in China) or after 2008 (following the Subprimes crisis in the US), they don't conclude on the existence of an Asian RMB monetary bloc. Secondly, another methodology consists in quantifying the responses of exchanges rates to shocks on the RMB (VAR (Chow-Tan, 2014; Shu et al., 2016) or event analysis (Ito, 2017)). These articles demonstrate the increasing influence of the RMB on the other Asian currencies after 2008 but there is no conclusion on monetary bloc. Thirdly, an alternative method (convergence with unit roots test: first, second and third generations (Figuière et al., 2013)) proves the convergence of some Asian exchange rates on regional targets, notably Yuan-won-yen and Yuan-yen in the most recent periods. These conclusions support the thesis of an Asian monetary bloc with a crucial role for the RMB[3].

In front of these divergent conclusions on the regional influence of the RMB due to the methodologies used, we decide to investigate the dynamic factor model methodology (Kose et al., 2003) to examine the movements of emerging markets' exchange rates and to decompose them into a global factor, a regional factor or a country-specific component. This methodology has already been applied to examine the degree of comovement of gross capital inflows (Fratzscher, 2012; Forster et al., 2014; Shirota, 2015), of inflation (Neely and Rapach, 2011; Forster and Tillmann, 2014) and of commodity prices (Yin and Han, 2015). To the best of our knowledge, it has not yet been used for exchange rates. The contribution of this article is to test another methodology in order to notably investigate the potential regional component of exchange rates' movements for the Asian

[3] Alongside this topic, one can scarcely find gravity model to investigate the determinants of geographical (and regional) distribution of international currencies in global financial market transactions and FX transactions (He et al., 2015). Moreover, Garcia-Herrero and Xia (2013) and Eichengreen and Lombardi (2015) investigate the determinants of the bilateral financial swaps of China with gravity model. Their results differ about the regional preference of China.

currencies.

3. Econometric methodology and data

3.1 A dynamic latent factor model for exchange rates

In this paper, we apply a dynamic latent factor model proposed by Kose *et al.* (2003) to tackle the issue of co-movements in exchange rates in emerging economies. It is a three level model allowing us to decompose the dynamics of exchange rates in our data into three different categories, namely world, regional and country components.

Let's suppose $e_{i,t}$, the demeaned logarithm of the bilateral exchange rate of country i $(i = 1, ..., N)$ vis-à-vis the New Zealand dollar. This bilateral exchange rate responds to different driving forces. Indeed, a first dynamic factor (f_t^{world}) is common to all countries we consider in our analysis $(N = 24)$. Then, countries are grouped into R regions $(R = 3)$, and all countries in each of the R specific regions share a common factor (f_{rt}^{region}), representing the regional common factor. Finally, purely national influences on exchange rate is captured by $\epsilon_{i,t}$, which represents the country-specific or idiosyncratic component. The model can be expressed as:

$$e_{i,t} = \beta_i^{world} f_t^{world} + \beta_i^{region} f_{r,t}^{region} + \epsilon_{i,t} \tag{1}$$

Where β_i^{world} and β_i^{region} are factor loadings, which, respectively, captures the impact of an individual country's exchange rate to changes in world and regional factors. As in Kose et al. (2003) and Neely and Rapach (2011), we assume that the evolution of each factor follows an AR(p) process, respectively:

$$f_t^{world} = \rho_1^{world} f_{t-1}^{world} + ... + \rho_p^{world} f_{t-p}^{world} + u_t^{world} \tag{2}$$

$$f_{r,t}^{region} = \rho_{r,1}^{region} f_{r,t-1}^{region} + ... + \rho_{r,p}^{region} f_{r,t-p}^{region} + u_{r,t}^{region} \quad (r = 1, ..., R) \tag{3}$$

Where:

$$u_t^{world} \sim \mathcal{N}(0, \sigma_{world}^2)$$
$$u_{r,t}^{region} \sim \mathcal{N}(0, \sigma_{r,region}^2)$$
$$E\left(u_t^{world} u_{t-k}^{world}\right) = E\left(u_{r,t}^{region} u_{r,t-k}^{region}\right) = 0 \;\; for\; k \neq 0$$

The idiosyncratic errors, e.g. the country-specific factors, are assumed to be normally distributed, and to follow an AR(q) process:

$$\epsilon_{i,t} = \rho_{i,1}\epsilon_{i,t-1} + ... + \rho_{i,q}\epsilon_{i,t-q} + u_{i,t} \tag{4}$$

Where $u_t \sim \mathcal{N}(0, \sigma^2)$ and $E(u_{i,t}u_{i,t-k}) = 0$ for $k \neq 0$. Notice that as in Neely and Rapach (2011) and Yin and Han (2015), we assume that all factors are orthogonal and set the orders of the AR processes, p and q, to 2.[4]

As in the seminal paper of Kose *et al.* (2003), we rely on the following conjugate prior to implement Bayesian analysis:

$$\left(\beta_i^{world}, \beta_i^{region}\right)' \sim \mathcal{N}(0, I_2), \quad (i = 1, 2, ..., N) \tag{5}$$

$$(\rho_{i,1}, ..., \rho_{i,q})' \sim \mathcal{N}\left[0, diag\left(1, 0.5, ..., 0.5^{q-1}\right)\right], \quad (i = 1, 2, ..., N) \tag{6}$$

$$\left(\rho_1^{world}, ..., \rho_p^{world}\right)' \sim \mathcal{N}\left[0, diag\left(1, 0.5, ..., 0.5^{p-1}\right)\right], \quad (i = 1, 2, ..., N) \tag{7}$$

$$\left(\rho_{r,1}^{region}, ..., \rho_{r,p}^{region}\right)' \sim \mathcal{N}\left[0, diag\left(1, 0.5, ..., 0.5^{p-1}\right)\right], \quad (r = 1, ..., R) \tag{8}$$

$$\sigma_i^2 \sim IG(6, 0.001), \quad (i = 1, 2, ..., N) \tag{9}$$

Where IG() denotes the inverse-gamma distribution. Note that the prior for the idiosyncratic shock is fairly diffuse and that the AR processes in equations (2), (3) and (4) are assumed to be stationary (Neely and Rapach, 2011). As a consequence, we use the first difference of exchange rates rather than the level, as all bilateral exchange rates in our sample are I(1) processes[5].

Finally, the method also allows us to measure the extent of regional influences on countries' exchange rates expressed in New Zealand dollar by computing the regional factor's contribution to the total variability in a country's exchange rate:

$$\theta_i^{region} = \left(\beta_i^{region}\right)^2 \frac{var\left(f_{r,t}^{region}\right)}{var(e_{i,t})} \tag{10}$$

Where:

$$var(e_{i,t}) = (\beta_i^{world})^2 var(f_t^{world}) + (\beta_i^{region})^2 var(f_{r,t}^{region}) + var(\epsilon_{i,t}), \quad (i = 1, ..., N) \tag{11}$$

θ_i^{region} is the proportion of the total variability in country i's exchange rate which comes from the regional factor. The same variance decomposition can be drawn for the world factor. Note that to estimate the model, a Markov Chain Monte Carlo (MCMC) method is applied and that the results of this study are based on a chain of length 20000 with 10000 burn-in replications.[6]

[4] We test other values for p and q and find very similar results.

[5] We use both ADF and KPSS tests to evaluate the stationarity of our exchange rate series

[6] We use the MATLAB code provided by Dave Rapach (http://sites.slu.edu/rapachde/home/research), which is based on the GAUSS code from Christoph Otrok.

3.2 Data

Monthly data on exchange rates from January 2000 to December 2015 are taken from the Datatastream database except those for Estonia, Latvia, Lithuania, Slovakia, Slovenia that come from Eurostat. Indeed, these local currencies have been measured against the Euro after its adoption. All exchange rates are finally expressed against the New Zealand dollar following Kawai and Pontines (2014, 2016).

The analysis cover 24 countries from three different emerging areas: India, Indonesia, Malaysia, Philippines, South Korea, Thailand, Vietnam[7] (Asian economies); Argentina, Brazil, Bolivia, Chile, Colombia, Mexico, Peru, Venezuela (Latin American economies); Poland, Romania, Hungary, Czech republic, Estonia, Latvia, Lithuania, Slovakia, Slovenia (Eastern European economies)[8].

Table 1 gives summary statistics for the variation of the exchange rates towards the New Zealand dollar for all countries considered in our analysis. We can remark that the Latin American area has experienced the highest average volatility of exchange rates during the studied period, with strongest values for variations recorded for Argentina and Venezuela.

4. Results

4.1 Identifying world, regional and idiosyncratic factors

In Figure 1, we present the mean of the posterior distribution of the world and regional factors (Asia, Latin America and Eastern Europe).

First, it is important to note that, in the dynamic factor model, world and regional factors are orthogonal. As a consequence, results on the world factor do not depend on the regional grouping. The global factor extracted from the dynamic latent factor model reflects the movement of exchange rates since 2000. We can remark a strong decline after the 2007/2008 financial crisis.

While the world factor is common to all regions studied, we can observe some discrepancies among regional factors. Indeed, we see that the regional factor for Latin America has exhibited a stronger increase during the financial crisis. Therefore, the pattern of exchange rates' co-movements changes substantially during severe global crises.

To have a better representation of the relative importance of global and regional factors in the evolution of exchange rates, we present, in Table 2, the decomposition of the variance of the changes in exchange rates over different periods of time.

The results on the whole period (2000-2015) show that the common global factor is by far the most important determinant of exchange rates' variations for Asian economies

[7]We exclude China from the sample because the objective is to measure the potential dominant role of the RMB on other exchange rates in the Asian region.

[8]Table A.1 in Appendix summarizes all country covered by our study.

Table 1: Descriptive statistics for country exchange rates variation (in New Zealand dollar, 2000-2015)

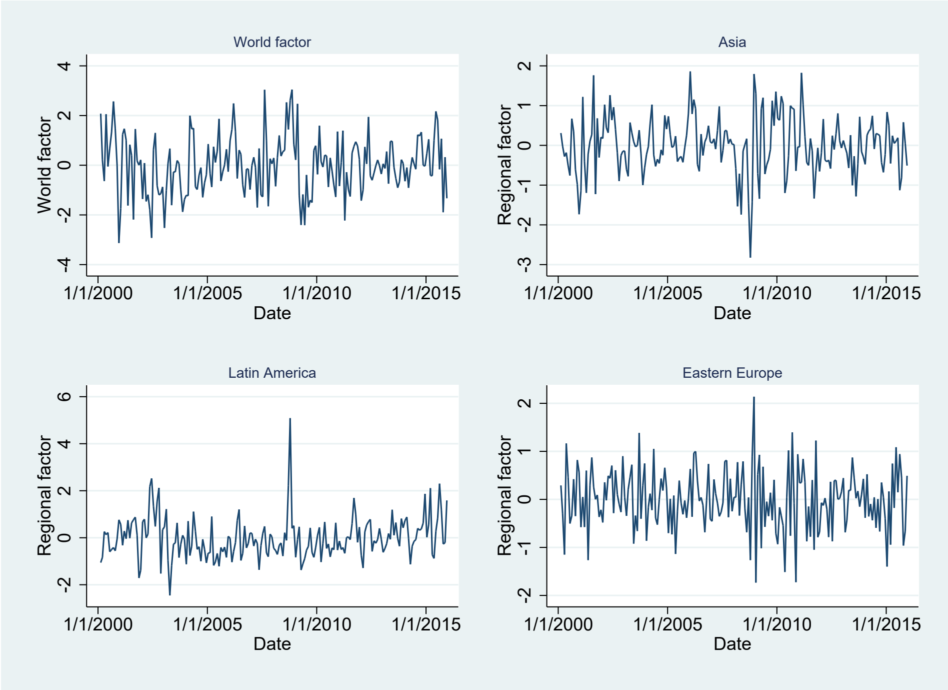
	Mean	Std. Dev.	Minimum	Maximum
Panel A. Asia				
India	-0,004	0,028	-0,071	0,075
Indonesia	-0,005	0,033	-0,096	0,141
Korea	-0,002	0,027	-0,123	0,061
Malaysia	-0,002	0,027	-0,072	0,071
Philippines	-0,002	0,029	-0,075	0,075
Thailand	-0,001	0,027	-0,067	0,091
Vietnam	-0,004	0,032	-0,076	0,094
Panel B. Latin America				
Argentina	-0,014	0,056	-0,359	0,068
Brazil	-0,005	0,038	-0,153	0,107
Bolivia	-0,002	0,032	-0,078	0,097
Chile	-0,003	0,030	-0,092	0,099
Colombia	-0,004	0,031	-0,110	0,079
Mexico	-0,004	0,030	-0,096	0,076
Peru	-0,001	0,028	-0,073	0,077
Venezuela	-0,013	0,064	-0,526	0,095
Panel C. Eastern Europe				
Poland	-0,001	0,029	-0,092	0,059
Romania	-0,006	0,030	-0,091	0,074
Hungary	-0,002	0,029	-0,088	0,071
Czech Republic	0,000	0,029	-0,062	0,085
Estonia	-0,001	0,034	-0,094	0,104
Latvia	-0,002	0,035	-0,094	0,105
Lithuania	0,000	0,036	-0,094	0,121
Slovakia	0,001	0,035	-0,094	0,110
Slovenia	-0,002	0,034	-0,094	0,104

(70 %) and, albeit to a lesser extent, for Latin American economies (53 %). For Eastern European economies, the regional factor is responsible for most of the overall variation of exchange rates during the period 2000-2015 (41 %). Note that, for all regions, the idiosyncratic factor play an important role in explaining exchange rates variations (between 26 % and 37 % of overall variation).

If we decompose the whole period into two sub-periods, the first one from 2000 to 2005, and the second one from 2006 to 2015, results are very different, especially concerning the regional factor[9]. We choose 2005 as breakpoint as it represents the beginning of the internationalization of the Chinese Yuan with a more flexible management of the

[9]The same is true if the breakpoint is 2007, the beginning of the subprimes crisis.

Figure 1: World and regional factors, 2000-2015



Note: The solid lines represent the mean for the posterior distributions for the world and regional factors.

exchange rate regime. Results on the first sub-period confirm the predominance of the global common factor as the main explanation of exchange rates' movements (41 % to 73 %), especially for Asian economies (73%). However, results exhibit some strong discrepancies after 2005 even if the global factor remains the most important when studying all the sample (43%) despite a decrease. Indeed, we find a strong increase (+694%) in the explanatory power of the regional factor in Asia. Between 2006 and 2015, the regional factor accounts for more than 45 % of the variation in exchange rates in Asian economies, whereas this factor only explains 6 % of the variation between 2000 and 2005. This result puts forth the evidence of the increasing influence of regional factors in Asia on the evolution of exchange rates to the detriment of the common global factor. We assess that the increasing impact of regional factors could be linked to the internationalization of the Chinese Yuan since 2005. The Chinese currency can, now, be seen as one of the main drivers of other Asian currencies. For the Latin American economies, the influence of the regional factor has increased by 181%, but the idiosyncratic factor has the highest explanatory power (49%). For these two regions, the influence of the world factor has decreased by around 66%. For the whole sample, the decrease is by 24%. On the contrary, the influence of the world factor has increased in Eastern European economies by 87%, from 41% to 77%, which can mainly be explained by the European integration and the adoption of the Euro, in a floating exchange rate regime, by almost

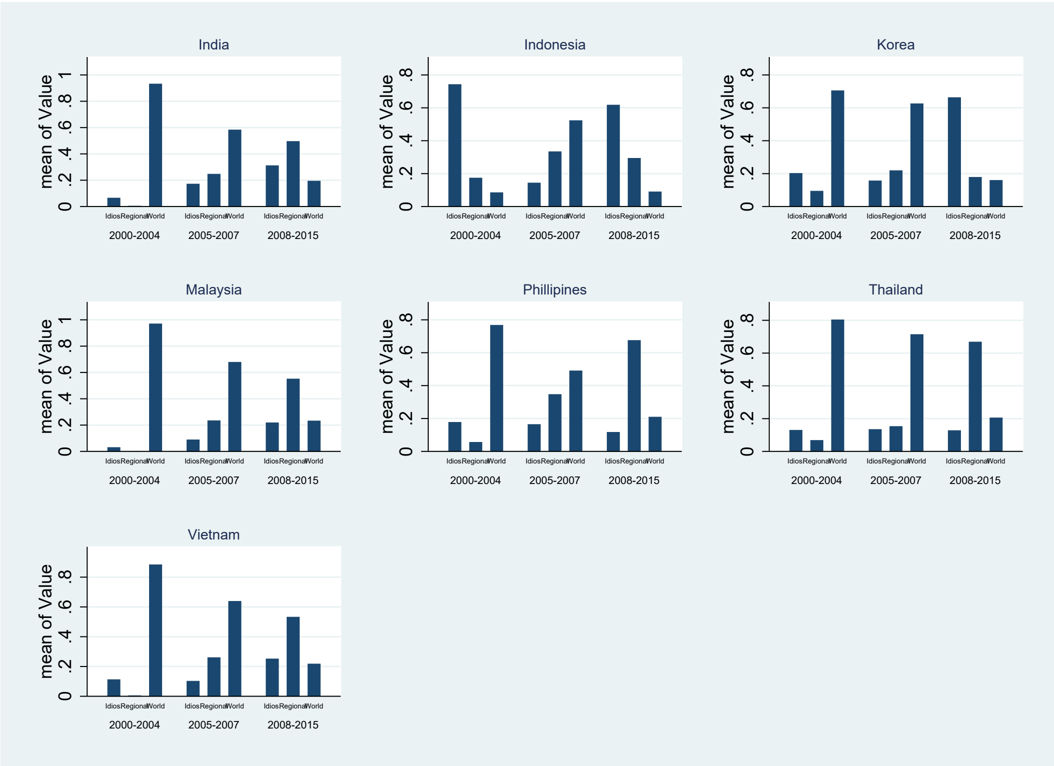
Table 2: Variance decomposition

	2000-2015			2000-2005			2006-2015		
	World	Reg.	Idios.	World	Reg.	Idios.	World	Reg.	Idios.
Asian economies									
India	0,757	0,070	0,174	0,932	0,004	0,065	0,265	0,459	0,276
Indonesia	0,278	0,044	0,678	0,085	0,173	0,742	0,171	0,336	0,493
Korea	0,534	0,105	0,361	0,705	0,094	0,201	0,250	0,224	0,526
Malaysia	0,874	0,015	0,111	0,969	0,001	0,030	0,317	0,502	0,181
Philippines	0,797	0,018	0,185	0,767	0,056	0,177	0,261	0,607	0,132
Thailand	0,818	0,012	0,171	0,803	0,067	0,130	0,300	0,559	0,141
Vietnam	0,862	0,008	0,130	0,884	0,004	0,112	0,285	0,486	0,229
Latin American economies									
Argentina	0,412	0,020	0,567	0,240	0,043	0,717	0,200	0,557	0,243
Brazil	0,243	0,378	0,379	0,294	0,385	0,321	0,090	0,101	0,809
Bolivia	0,931	0,013	0,055	0,975	0,001	0,024	0,317	0,555	0,129
Chile	0,469	0,162	0,369	0,518	0,230	0,251	0,206	0,233	0,561
Colombia	0,357	0,129	0,515	0,686	0,095	0,220	0,092	0,124	0,784
Mexico	0,594	0,098	0,308	0,773	0,016	0,211	0,183	0,302	0,516
Peru	0,897	0,002	0,101	0,944	0,003	0,053	0,322	0,537	0,141
Venezuela	0,342	0,004	0,654	0,421	0,142	0,437	0,102	0,162	0,735
Eastern European economies									
Poland	0,201	0,134	0,664	0,428	0,004	0,569	0,434	0,351	0,215
Romania	0,420	0,125	0,455	0,602	0,020	0,378	0,590	0,161	0,250
Hungary	0,165	0,237	0,598	0,348	0,077	0,574	0,480	0,293	0,227
Czech Republic	0,241	0,213	0,545	0,274	0,068	0,659	0,577	0,231	0,192
Estonia	0,343	0,642	0,015	0,313	0,659	0,028	0,976	0,008	0,016
Latvia	0,441	0,515	0,044	0,598	0,329	0,073	0,969	0,008	0,022
Lithuania	0,400	0,544	0,056	0,507	0,371	0,122	0,976	0,008	0,016
Slovakia	0,316	0,633	0,051	0,317	0,579	0,103	0,949	0,003	0,048
Slovenia	0,350	0,633	0,017	0,313	0,658	0,029	0,976	0,008	0,016
Asia	0,703	0,039	0,258	0,735	0,057	0,208	0,264	0,453	0,283
Latin America	0,531	0,101	0,369	0,606	0,114	0,279	0,189	0,321	0,490
Eastern Europe	0,320	0,408	0,272	0,411	0,307	0,282	0,770	0,119	0,111
All	0,502	0,198	0,300	0,571	0,170	0,259	0,429	0,284	0,287

all Eastern European economies of our sample. Moreover, as currencies are measured against the Euro, an international currency, it makes sens that the world factor is determinant, notably on the recent period because there is no more fluctuation band.

The growing influence of the regional factor in Asia is confirmed in Figure 2, where we decompose the sample in three different sub-samples.

Figure 2: Variance decompositions for country exchange rate variations, 2000-2004, 2005-2007, 2007-2015 sub-samples, Asian economies



We can remark that after the 2007/2008 financial crisis, the effect of the regional factor has increased in Asian economies. It accounts for 48 % of overall variation in the Asia area with highest values for Thailand (67 %), Philippines (67 %), Malaysia (55 %) and Vietnam (53 %). The global common factor, i.e. the factor potentially affecting all countries whatever the region retained, has, after 2008, a very small impact on exchange rates' variations in Asia (less than 22 % in each Asian economies). Therefore, in almost two decades, in Asia, the global common factor has loosen importance in explaining exchange rates' variations whereas the regional factor has gained importance. The regional factor is, after 2008, the most important factor explaining exchange rates' movements in almost all countries of the Asian region. Our results are in line with the existing literature, notably Huang et al. (2014) for the increasing role of the regional integration and the regional role of the RMB after 2005, and Figuière (2013), Chow-Tan (2014), Shu et al. (2016) and Ito (2017) for this growing influence after 2007. The liberalization of the Chinese exchange rate regime after 2005 allowed Asian central banks to give more weight to the RMB in the management of their exchange rate. Following the Subprimes crisis, the Asian countries wanted to be less dependent on the dollar's fluctuations and concentrate on their economic region.

4.2 What drives the regional factor ?

In the previous section, our results have put forth the evidence of the growing influence of the regional factor in Asia for explaining exchange rates' variations over the period 2000-2015. Now, we aim at determining what are the driving forces behind the regional factor in Asia, and particularly, if this factor is connected with the growing influence of the Chinese Yuan in the Asian area.

For this purpose, we develop a Vector AutoRegressive (VAR) model. The equation of the VAR is expressed as follows:

$$\begin{bmatrix} F_t \\ X_t \end{bmatrix} = B(L) \begin{bmatrix} F_t \\ X_t \end{bmatrix} + u_t \tag{12}$$

where F_t represents the Asian factor identified using the dynamic latent factor model, the matrix X_t contains the determinants retained in our analysis, $B(L)$ is the lag polynomial and u_t represents the error term. In this paper, we retain several key drivers of exchange rate dynamics of Asian economies: Chinese ones to precisely measure the influence of China (exchange rate, production, economic sentiment); Asian ones to capture a more regional effect (market return); and external ones as the US monetary policy and global stress[10].

- The bilateral exchange rate of the Chinese Yuan, expressed in New Zealand dollar;
- The Chinese Industrial Production Index (IPI);
- The Macroeconomic Climate Index of China;
- The Barclays Emerging Markets Asia Statistics Index (in U.S. dollar);
- The U.S. FED funds effective rate (in %);
- The volatility index of the U.S. market (VIX).

In this paper, we implement Generalized Impulse Response functions (GIRF) developed by Koop *et al.* (1996) rather than Cholesky Impulse Responses because GIRF are not affected by the ordering of variables in the VAR.

First, we test the time series properties of our different variables using the Augmented Dickey-Fuller (ADF). For robustness check, we complement this test by the stationarity

[10] Source: Datastream, and Bloomberg for The Barclays Emerging Markets Asia Statistics Index.

test developed by Kwiatkowski, Phillips, Schmidt and Shin (1992) which tests the null hypothesis of stationarity instead of the existence of a unit root as in the ADF and PP tests. Using both kind of tests is important because the ADF test has low power if the process is stationary, but with a root close to the non-stationary boundary and tends to reject the non-stationarity hypothesis too often. The KPSS complements the ADF test because contrary to the latter, which assesses the null hypothesis of the unit root, it tests the null hypothesis of stationarity. It is a very powerful test, but it cannot catch non-stationarity due to a volatility shift. Table 3 reports results concerning unit root tests.

Table 3: Results of unit root tests

	Level			
	With Constant	With Constant & Trend	With Constant	With Constant & Trend
ASIA	-9.6471***	-9.4304	0.0548	0.0504
BARCLAYS_EMI	-1.2332	-1.9693	1.6609***	0.1857**
CLIMATE_CHN	-1.4224	-3.9290**	0.5781**	0.2474***
EX_CHN	-2.0655	-1.9284	0.4217*	0.2425***
FED_RATE	-0.9979	-1.2732	1.2811**	0.1493**
IPI_CHN	-2.4949	-3.0309	0.6182**	0.2856***
VIX	-4.0951***	-4.1836***	0.2187	0.1301*
	First Difference			
	With Constant	With Constant & Trend	With Constant	With Constant & Trend
d(ASIA)	-12.3706***	-12.3412***	0.1020	0.1003
d(BARCLAYS_EMI)	-11.1805***	-11.2136***	0.1053	0.0320
d(CLIMATE_CHN)	-6.3515***	-6.7240***	0.0438	0.0268
d(EX_CHN)	-9.7123***	-9.7270***	0.1036	0.0566
d(FED_RATE)	-11.7194***	-11.6961***	0.1106	0.1094
d(IPI_CHN)	-5.3842***	-5.5231***	0.1161	0.0331
d(VIX)	-12.4300***	-12.4011***	0.0632	0.0602

Note: Lags are selected according to Schwartz information criteria (SIC).

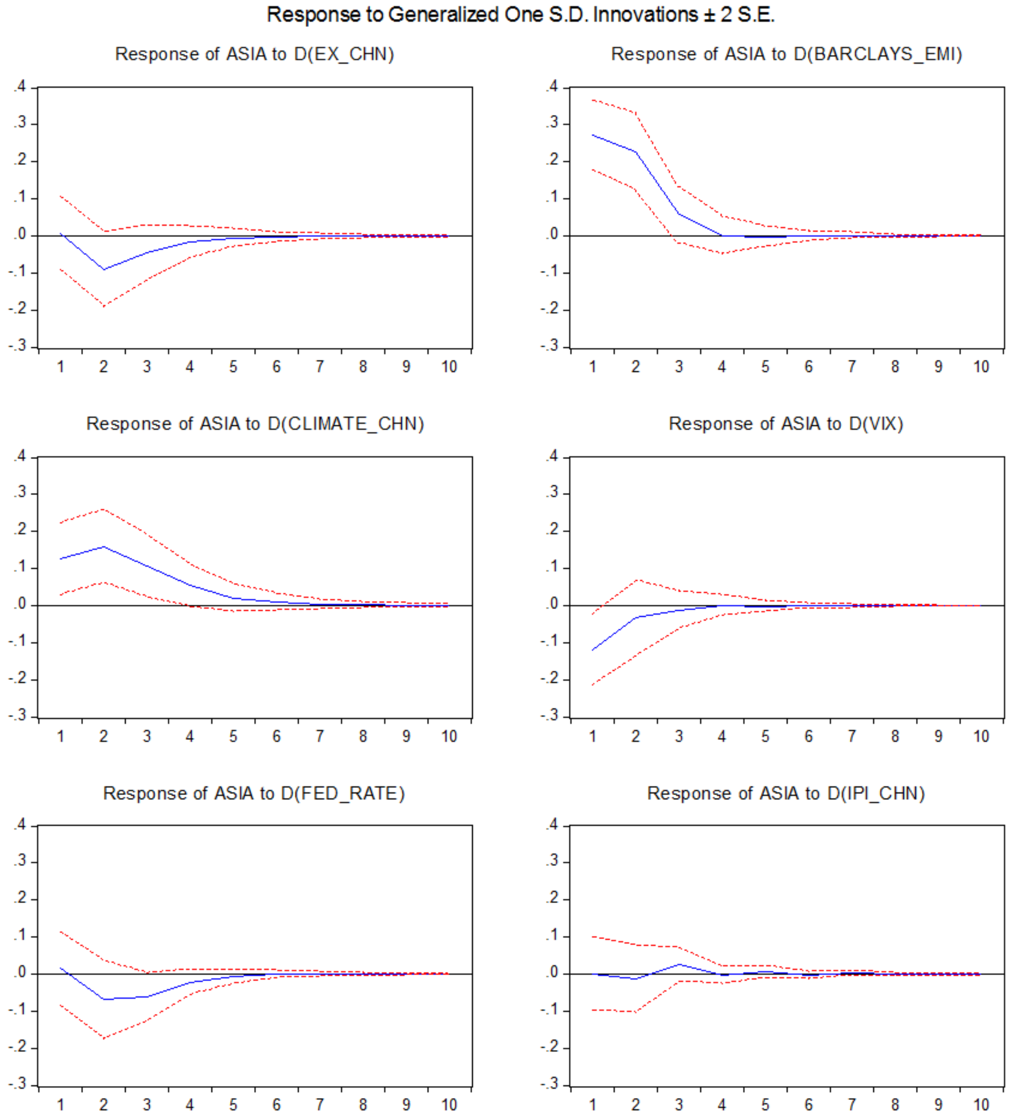
*, **, ***: significant at the 10%, 5%, 1% level, respectively.

Results confirm that the factor Asia is stationary, as we cannot reject the null hypothesis of stationarity using the KPSS test at the 10 % level. All other variables are I(1).

Figure 3 presents general impulse responses from the estimation of our VAR, i.e. the responses of the factor Asia to one standard deviation innovation of the explanatory variables[11].

[11]On the 2000-2015 period with monthly data.

Figure 3: Determinants of the factor Asia



Note: These graphs provide the response of the factor Asia (ASIA) to a generalized one standard deviation innovation in variation of bilateral exchange rate of China ($D(EX\_CHN)$), Barclays EMI ($D(BARCLAYS\_EMI)$), macroeconomic climate in China ($D(CLIMATE\_CHN)$), VIX ($D(VIX)$), FED interest rate ($D(FED\_RATE)$) and IPI in China ($D(IPI\_CHN)$). Also included are two asymptotic standard error bands (10000 Monte Carlo replications).

First, we find that a positive shock on the Barclays Asia EMI leads to an immediate and significant increase in the factor Asia. Second, we find that the factor Asia is greatly influenced by Chinese economic variables. Indeed, our results put forth the evidence that a positive shock on the Yuan exchange rate (appreciation) entails a significant decrease of the factor Asia (depreciation of Asian currencies), two month after the shock, while an increase in the Chinese macroeconomic climate index leads to an immediate increase of the factor Asia, characterized by an appreciation of Asian currencies. Our results also indicate that the VIX has a significant influence on the factor Asia. Indeed, an increase in global risk entails an immediate decrease of the factor Asia, leading to a depreciation of Asian currencies, meaning the classical effect of fly to quality, outside emerging markets. Finally, we also find that the interest rate of the U.S. Fed influences the factor Asia: an increase causes a decrease of the regional factor, namely a depreciation of Asian currencies according to the uncovered interest rate parity. These results highlight the influence of macroeconomic variables of China on the factor Asia even if the Chinese industrial production is not significant and if the most influent driver is regional (the Barclays Asia EMI).

Conclusion

The objective of the article is to analyse the determinants of emerging markets' exchange rates movements. To shed light on this issue, we implement a dynamic latent factor model to investigate the determinants of 24 emerging countries' exchange rates movements and decompose the evolutions into the contribution of a global factor, a regional factor and a country-specific factor. The results are quite interesting for Asia. We show that the exchange rates movements in Asia are mostly explained by the regional factor on the recent period 2006-2015. Using a VAR model, we show that this regional factor is explained by several variables, notably Chinese ones. Among them, nominal exchange rate and macroeconomic climate index are major determinants. Consequently, the results highlight the important and growing influence of the regional factor on Asian currencies movements, and the important role of Chinese variables in the evolution of this regional factor. Our article contributes to the literature on the growing influence of China on its neighbours. Our analysis could be strengthened by the introduction of trade integration or openness variables.

Appendix

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Table A.1. List of studied countries by region

Asian economies	Latin American economies	Easter European economies
India	Argentina	Czech Republic
Indonesia	Brazil	Estonia
Malaysia	Bolivia	Hungary
Philippines	Chile	Latvia
South Korea	Colombia	Lithuania
Thailand	Mexico	Poland
Vietnam	Peru	Romania
	Venezuela	Slovakia
		Slovenia

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