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THE DOUBLE-EDGED SWORD OF FOREIGN PARTICIPATION IN LOCAL CURRENCY GOVERNMENT BOND MARKETS

Key Points:

- *With the objective of reducing the problem of currency mismatch – one of the key causes of the Asian Financial Crisis (AFC) – emerging Asian economies have made a concerted effort to develop the local currency (LC) government bond market over the past couple of decades. The growing LC bond market, simultaneously with the region's robust economic performance since the AFC, has attracted more foreign investors into the region. A larger presence of foreign investors in the market has reduced the problem of currency mismatch, but some recent experiences (e.g. the 2013 "taper tantrum" episode) indicate that a larger reliance on foreign capital also means more vulnerability to capital flight.*

- *This study examines the effects on the yield spread of foreign participation in the LC government bond market. Using weekly data of seven emerging Asian economies from 2004 to 2018, we show that large foreign participation helps reduce yield spread during tranquil periods; but it amplifies a widening of the yield spread in times of market stress, probably because foreign investors concerned about currency risk will flee the market. In support of this argument, we further demonstrate that this effect is mainly reflected in the currency risk component of the yield spread, but not in the credit risk component.*

- *The results underscore the importance of developing accessible and efficient foreign exchange derivatives markets as the LC government bond markets grow, thus enabling foreign investors to hedge against their FX risk and reduce their incentive to flee the market. A larger domestic investor base could also reduce the reliance on foreign capital and thus mitigate the risk of capital flight.*

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1. INTRODUCTION

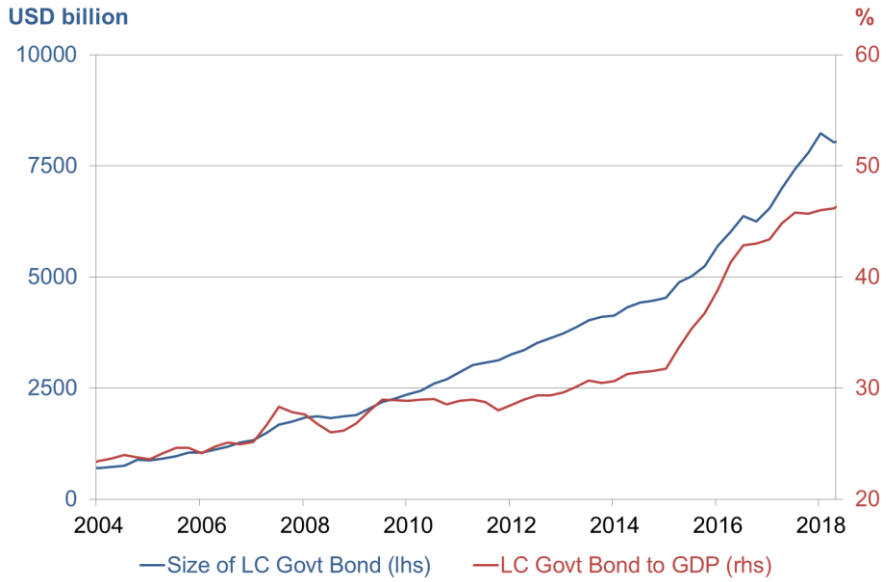
The development of local currency (LC) bond markets over the past couple of decades has been a remarkable achievement for Asian emerging market economies (EMEs) in attracting substantial amounts of foreign capital. But, is there a "double-edged sword" to this development? By examining the potential downside to the presence of foreign investors in the LC bond market, this study answers the question in the affirmative. Indeed, for a panel of emerging Asian economies, we empirically find that while high foreign participation generally leads to a tightening of the LC government bond yield spread, it significantly exacerbates the widening of the currency risk component of the spread when there are strong expectations for currency depreciation or when there is a global negative shock. This likely reflects the rapid flight of foreign investors from LC bond markets in anticipation of related losses on the foreign exchange market.

Before the 2000s, Asian EMEs found it difficult to borrow abroad in local currency or borrow long term. As such, the double mismatches – currency mismatch and maturity mismatch – was a key financial vulnerability in Asia that aggravated the Asian Financial Crisis (AFC) in 1997-98 (Park et al., 2018). This phenomenon is referred to by Eichengreen and Hausmann (1999) as the "original sin" of EMEs. They proposed two solutions to the original sin. The first, dollarisation, abandons the local currency and adopts the US dollar. The second builds deep and liquid local markets of long-term LC securities, which require longstanding reform of market regulations and financial systems. Between these two solutions, Asian EMEs chose to develop a deeper and broader LC bond market to solve the problem.

In the hope of promoting financial stability after the AFC, Asian EMEs worked together to introduce several initiatives to facilitate the development of LC bond markets (e.g. the Asian Bond Markets Initiative, see Park (2017)). Figure 1 shows the development of LC government bonds markets of major Asian EMEs. In the period from 2004 to mid-2018, the size of these markets increased more than tenfold and the market size to GDP ratio also doubled in the period.

The rapid development of the Asian EMEs' LC government bond markets, simultaneously with the region's robust economic performance, attracted foreign investors to search for yield (Burger et al., 2012), especially during the low yield environment after the 2008 Global Financial Crisis (GFC). A larger presence of foreign investors helps reduce the double mismatches problem by allowing Asian EMEs to borrow abroad in local currency in a spectrum of tenors.

Figure 1: Size of LC government bonds and to GDP ratio in EM Asia

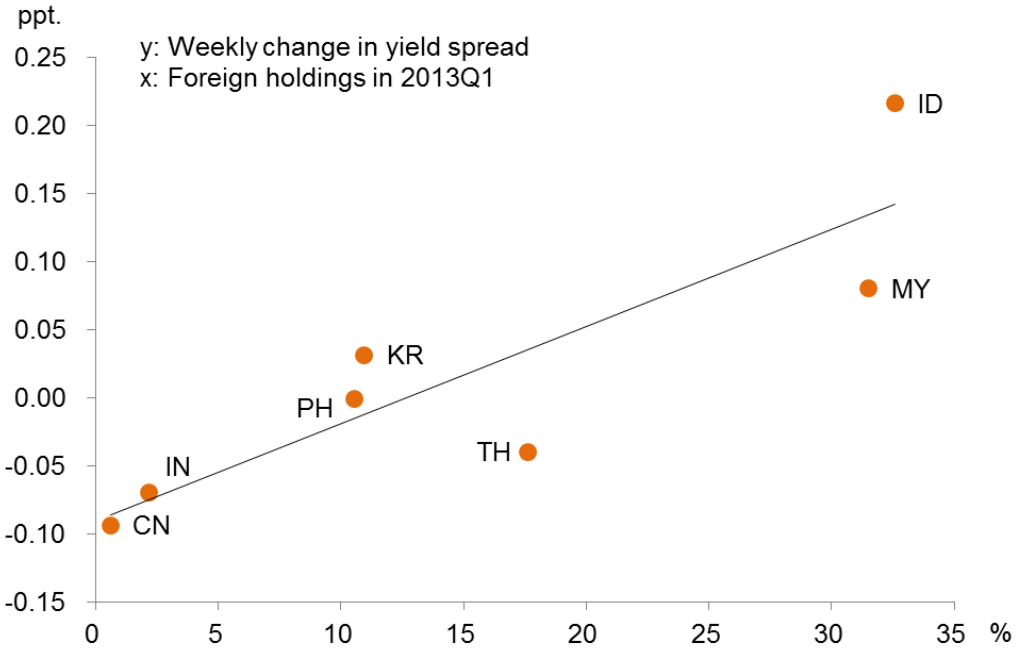


Note: Sample covers China, Hong Kong, Indonesia, South Korea, Malaysia, the Philippines, Singapore and Thailand. Figures in early years also reflect better data availability.

Source: Asian Bonds Online.

However, there is a darker side to this story, as a rising reliance on foreign capital implies a greater chance of capital flight (Calvo and Talvi, 2005). The "taper tantrum" episode in 2013 illustrated the risks associated with a large foreign presence in the LC bond market. On 22 May 2013, then US Federal Reserve Chairman Ben Bernanke mentioned in his Congressional testimony that the Fed would slow the pace of the asset purchasing programme, which had been in place since the GFC. The market reacted strongly to Bernanke's "tapering talk" with a massive sell-off in the international bond and FX markets. Figure 2 shows the weekly change in Asian EMEs' LC yield spread after the chairman's testimony (measured by the five-year generic LC government bond yield over the US Treasury of the same tenor) against the share of foreign holdings in the LC government bond market. The positively sloped trend-line of the scatter plot indicates a positive relationship between level of foreign holdings in the LC government bond market and the change in the yield spread in Asian EMEs during a period of global negative sentiment, i.e. **market with larger exposures to foreign investors suffered larger spread widening than those with lower exposures during the episode.**

Figure 2. Weekly change in LC yield spread after taper tantrum



Note: Changes of five-year generic LC yield spread over US Treasury of the same tenor from 22 to 29 May 2013. The R-squared of the simple linear regression is 0.76.

Source: Bloomberg, Arslanalp and Tsuda (2014) and Asian Bonds Online.

Against this backdrop, the objective of our study is to identify the "double-edged sword" effect of foreign participation in Asian EMEs' LC government bond markets on the yield spread. In particular, we aim to provide empirical evidence of this effect and examine its underlying mechanism. Our empirical findings are consistent with the above observations. When the local currency is expected to weaken significantly in the near-term, markets with a larger presence of foreign investors will experience a stronger sell-off in LC government bonds resulting in a more significant widening in the yield spread than markets with less foreign participation. Nevertheless, in tranquil periods, markets with a larger presence of foreign investors apparently have a smaller yield spread than those with less foreign holdings. That means, foreign participation could help reduce yield spread (i.e. borrowing costs) in good times, but this effect could reverse under certain circumstances when the foreign presence is sufficiently large. Therefore, promoting foreign participation in the LC government bond market would be similar to the effect of a "double-edged sword" in maintaining market stability. In addition to the FX expectation, we found that such a "double-edged sword" effect is as significant as conditioned on global negative shock.

We also empirically demonstrate the impact of foreign participation is through the FX risk channel. By decomposing the LC yield spread into the currency risk and credit risk components, we show that during market stress, the widening in the yield spread associated with a larger foreign presence is broadly reflected in the currency risk component of the yield spread, but not in the credit risk component. Hence, the FX expectation and the global negative shock work through the currency risk premium, implying that foreign investors tend to flee the market when they anticipate losses due to foreign exchange movements.

This study contributes to the literature on the influence of foreign participation in LC bond market in several aspects: First, benefiting from a recently published comprehensive database of foreign holdings in EMEs' LC government bond markets, this study provides a more complete picture on the effects, both positive and negative, of foreign participation on financial market stability. Second, by decomposing the yield spread, this study demonstrates that the effect of foreign participation is largely reflected in the currency risk component but not in the credit risk component. Third, instead of using survey data, spot rates or implied volatility as in previous studies (e.g. Gadanecz et al., 2018), we use currency risk reversal to gauge market expectation on exchange rates. By construction, the risk reversal can precisely reflect market expectation virtually in real-time, which is superior to the mentioned measurements.

The rest of the paper is organised as follows. Section 2 reviews the literature and states the hypothesis of this study. Section 3 discusses the empirical model and data. Section 4 reports the empirical results, and Section 5 checks their robustness. Section 6 discusses the policy implications and concludes the study.

2. LITERATURE REVIEW AND HYPOTHESIS

There are many studies in literature discussing the stabilising effects, positive or negative, of foreign participation in EMEs' LC bond markets. The key advantage of having a larger presence of foreign investors is the reduction in currency mismatch as bond issuers can borrow abroad in local currency (Burger and Warnock, 2007). As foreign investors are seen to be less intent on adopting the buy-and-hold strategy, the increase in foreign participation could also improve market liquidity (Peiris, 2010).

Conversely, the increase in foreign participation could create more uncertainties for EMEs. Calvo et al. (2006) documented the experience of capital

flow reversal due to global risk aversion which is irrespective of EMEs' fundamentals. Based on the findings, Ebeke and Lu (2015) empirically show that foreign participation in LC government bond markets in EMEs, on average, reduces the bond yield, but increases bond yield volatilities. Ebeke and Kyobe (2015) also show that global financial shocks to LC bond markets are amplified if foreign holdings exceed a certain threshold.

However, these previous studies have largely neglected the effect of global credit conditions on EMEs' bond markets. This oversight could distort the results, and the distortion could be significant as in recent years there has been a systemic reduction in the required return for bonds after a decade-long period of low yield environment in advanced economies following the GFC. To better incorporate the effect of global credit conditions, Jiang and McCauley (2004) document the stylised facts of the LC bond yield spread over that of the US Treasury bond. Alternatively, Cepni and Güney (2019) use one-year holding period return on LC government bonds over that of the Treasury to measure the risk premium of LC government bonds. Both approaches demonstrate the rule of thumb that EMEs' LC bond pricing should be compared with that of the US to control for the global bond market conditions. Recent studies, including Du and Schreger (2016) and Liao (2016), further decompose the LC bond yield spread over US Treasury into currency risk and credit risk premia, and study the determinants of these components.

As a key factor of EMEs' LC bond market development, the relationship between the expected exchange rate movement and the bond market has also been widely documented in literature. Fidora et al. (2007) demonstrate that home bias in global bond markets could be largely explained by real exchange rate volatility. Caporale et al. (2015) also suggest that exchange rate uncertainty reinforces home bias to both equity and bond markets. Based on these findings, Gadanecz et al. (2018) attempt to associate exchange rate risk with foreign holdings of LC government bonds. Using a dummy variable to represent EMEs with a high level of foreign holdings, they show that EMEs with large foreign holdings in LC bond market tend to face a smaller impact on yield when the foreign exchange market is volatile.[1]

Based on these studies, we propose that foreign holdings of LC government bonds in Asian EMEs have a conditional effect on their yield spread. In

[1] The results are in contrast to the theory of home bias and the findings of Ebeke and Lu (2015). The gap might be due to omitted variables in the specification and imperfect dependent variable using bond yield instead of yield spread as mentioned above.

tranquil periods, large foreign holdings could increase the demand and liquidity in the market, thus reduce the LC yield spread. However, in periods of foreign exchange market stress, or when there is a global negative shock, foreign investors would abruptly leave the market amid the risk; hence larger foreign holdings in bond market will induce stronger selling pressure and thus widen the yield spread.

The mechanism behind the hypothesis above is that foreign investors are generally exposed to a larger FX risk during market stress. When foreign investors expect a larger depreciation in local currency, a higher premium is required to compensate the risk of holding the LC bonds (Gadanecz et al., 2018). In contrast, domestic investors are faced with less risk from holding LC bonds.[2] Although in the real world it should not be assumed they are completely isolated from the currency risk, their sensitivity to foreign exchange expectation is often considered remarkably less than foreign investors.[3] Such nature allows domestic investors to require less return on LC bonds. In the event a FX risk materialises or a global negative shock occurs, the presence of both domestic and foreign investors in the LC bond market requires heterogeneous returns from the same LC bond. The net effect on the LC yield spread will largely depend on the ratio of the two types of investors (i.e. the level of foreign holdings).

3. METHODOLOGY AND DATA

3.1 MODEL SPECIFICATION

To study the effects of foreign participation in the LC bond market, we estimate a fixed-effect model with the LC bond yield spread as the dependent variable (later, components of LC bond yield spread). The explanatory variables comprise: (i) level of foreign holdings, (ii) risk factors, (iii) interaction between these two variables and (iv) control factors. The baseline model can be represented by Equation (1):[4]

$$y_{i,t} = \beta_1 Foreign_{i,t} + \beta_2 \Delta Risk_{i,t} + \beta_3 Foreign_{i,t} \times \Delta Risk_{i,t} + \sum_m \theta^m Control_{i,t}^m + \alpha_i + e_{i,t} \quad (1)$$

[2] Engel and Matsumoto (2005) further argue that domestic financial assets provide a natural hedge against local non-tradable risk (e.g. labour income).
[3] For example, in the Markowitz-type two-country portfolio selection model proposed by Fidora et al. (2007), the portfolio weights of domestic assets are independent of the deviation of the exchange rate from relative purchasing power parity (PPP), but not the weights of foreign assets.
[4] This is a modification of Ebeke and Lu (2015)'s specification.

where i denotes economy and t denotes time (in week).

Dependent variable $y_{i,t}$ represents the LC yield spread (or components of LC yield spread in the extended model) of LC government bond market. $Foreign_{i,t}$ is the share of foreign holdings, $\Delta Risk_{i,t}$ is the change in risk factor, $Control_{i,t}^{m}$ is the m[th] control variables. α_i is economy fixed-effect and $e_{i,t}$ is the error term. The coefficient β_3 captures the interacting effect of foreign holdings and the change in risk factor, which is the key estimate in this study.

By partially differentiating Equation (1), the marginal effect of change in the risk factor on the dependent variable conditioned on level of foreign holdings is represented by the following, which comprises both the linear effect of change in the risk factor as well as its interactive effect with foreign holdings:

$$\frac{\partial y_{i,t}}{\partial \Delta Risk_{i,t}} = \beta_2 + \beta_3 Foreign_{i,t} \qquad (2)$$

3.2 DATA

There are seven Asian EMEs in our sample, running from January 2004 to June 2018.[5]

i. DEPENDENT VARIABLE: LC BOND YIELD SPREAD AND ITS COMPONENTS

The five-year zero-coupon nominal LC yield spread is used as the dependent variable in the baseline model to examine the effects of foreign participation. To further explore which part of the LC yield spread dominates the effect, we test the hypothesis that the currency risk premium of the LC yield spread is more affected by foreign participation. This is done by decomposing the yield spread into the currency risk and credit risk premia and using them as the dependent variables in two separated estimations. Du and Schreger (2016) use the fixed-for-floating cross currency swap (CCS) and the US dollar interest rate swap to construct an implied long-term forward premium (swap rate) between EM currencies and the US dollar, and then define the LC credit risk premium as the nominal LC bond yield spread less the estimated swap rate. Mathematically, swap rate $swap_{i,t}$ and DS spread $ds_{i,t}$ of economy i at time t can be represented by the following:

[5] The choice of sample is subjected to data availability of level of foreign holdings, which starts from 2004Q1 for most of the economies.

$$swap_{i,t} = r_{i,t}^{LC} - r_t^{USD} \quad (3a)$$

and

$$ds_{i,t} = (yield_{i,t}^{LC} - yield_t^{UST}) - swap_{i,t} \quad (3b)$$

where $r_{i,t}^{LC}$ is the implied rate from the fixed local currency for USD Libor CCS, r_t^{USD} is the implied rate from the fixed USD to Libor interest rate swap, $yield_{i,t}^{LC}$ is the LC government bond yield and $yield_t^{UST}$ is the US Treasury yield. By rearranging Equation (3b), the nominal LC yield spread is decomposed into the currency risk and credit risk components:

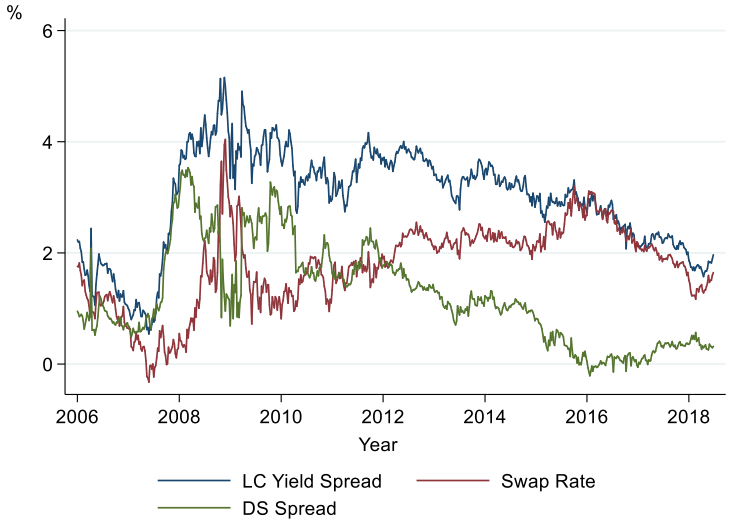
$$yield_{i,t}^{LC} - yield_t^{UST} = swap_{i,t} + ds_{i,t} \quad (3c)$$

We follow the methodology of Du and Schreger (2016) and decompose the five-year nominal LC government bond yield spread into the swap rate and the DS spread, i.e. the currency risk component and the credit risk component, respectively.[6]

Figure 3 shows Asian EMEs' average nominal LC yield spread, swap rate and DS spread across time. It is noteworthy that the currency risk component, or the swap rate, surged during the GFC despite the fact that Asia was not the epicentre of the crisis. The currency risk component also increased in the second half of 2015 amid elevated uncertainty in the region's financial market. However, credit risk component, or the DS spread, dropped during the peak of the GFC, and decreased in the post-GFC period. The divergence between the currency and credit risk components could be a hint that these risk components have different drivers.

[6] Same as Du and Schreger (2016), daily zero-coupon swap and yield curves of five-year tenor are used in this study.

Figure 3. Asian EMEs' average nominal LC yield spread, swap rate and DS spread



Notes: All variables are zero-coupon rates in five-year tender.

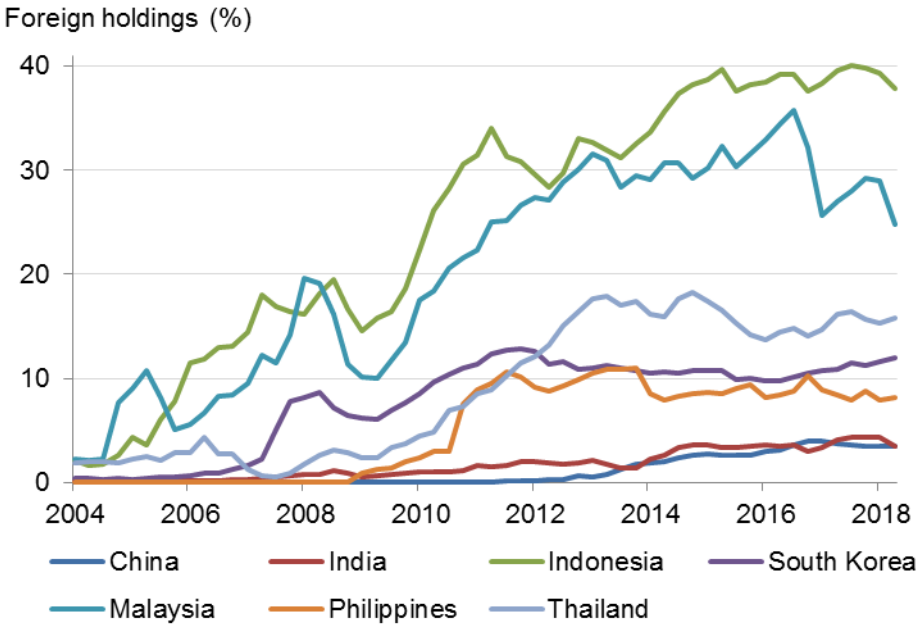
Source: Bloomberg and author's calculation.

ii. FOREIGN HOLDINGS

The data of foreign holdings in LC government debt are mainly retrieved from the data set of Arslanalp and Tsuda (2014). Among the 24 global EMEs covered by that data set, six of them are Asian economies (China, India, Indonesia, Malaysia, the Philippines and Thailand). South Korea's data, retrieved from the Asian Bonds Online database, is also included in our sample.

Figure 4 shows the level of foreign holdings of Asian EMEs from 2004 Q1 to 2018 Q2. There was an overall increasing trend in the period from almost zero in 2004 in most economies to a diverging range up to 40% in 2018.

Figure 4. Level of foreign holdings of LC government debt securities of Asian EMEs



Source: Arslanalp and Tsuda (2014) and Asians Bonds Online.

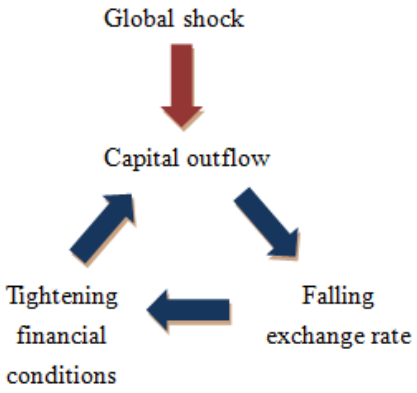
iii. RISK FACTORS: FX EXPECTATION AND GLOBAL SHOCK

The FX expectation is considered as the major risk factor on yield spread in the literature (See Turner (2014) and Gadanecz et al. (2018)). In this study, the FX expectation is measured by currency risk reversal, which is defined as the difference between the implied volatility of the out-of-money call and the put options of an underlying currency with similar maturity and delta. Intuitively, it captures the market expectation for currency appreciation or depreciation (Wong and Fong, 2017). In this study, we use the 3-month 25-delta vis-à-vis USD risk reversal, with higher risk reversal indicating a stronger deprecation expectation of the local currency. Risk reversal is lagged in one period to avoid endogeneity issue in the estimation.[7]

Apart from the FX expectation, global negative shocks could also weaken the local currency and heighten its volatility through financial amplification, i.e. the feedback loop effects (Korinek, 2018). A typical feedback loop starts from an unexpected global negative shock that triggers capital flight from EMEs. The flight then causes depreciation pressures on EMEs' currencies and tightens their financial conditions, further intensifying the outflow and depreciation pressures (see Figure 5).

[7] The specification of using lagged risk reversal proxies for the causality effect in the Granger sense that past risk reversal affects the current LC yield spread, and not vice versa.

Figure 5. Feedback loop effect due to global negative shock



Source: Korinek (2018) and author's adoption.

To proxy the global shock, following Du and Schreger (2016), we use the VIX index to gauge the global investors' risk aversion.[8] We also use the US corporate bond yield spread over US treasury as another measure of global shock in the robustness check.[9]

iv. CONTROL VARIABLES

Two key sets of control variables are used: (1) the liquidity factor and (2) the country-specific factor.

We capture the liquidity factor of the LC government bond and CCS by the bid-ask spreads of the two instruments.[10] To capture the country-specific factor, we include the CPI inflation, real GDP growth, current account balance and FX reserves in the empirical model.

v. FREQUENCY GAP AND STATIONARITY OF THE VARIABLES

The data description and data source, and their descriptive statistics are presented in Table A1 and A2, respectively. Since the variables are available at different frequencies, ranging from intra-daily for financial data to quarterly for national account data, the frequency gap is reduced by using weekly data in the

[8] The index could also be interpreted as a proxy for global liquidity conditions (Bruno and Shin, 2014).
[9] Gerlach et al. (2010) use US corporate spreads as the proxy for the aggregate risk factor to explain the credit spread in the euro area in their main findings.
[10] We follow Du and Schreger (2016) and Gerlach et al. (2010) for the choice of variables to capture the liquidity factor.

estimations. Variables with higher frequency are transformed to weekly data by taking the end-of-week observation, while those in lower frequency are repeated by the previous observation between two data points.

All variables are tested for stationarity. According to the panel unit root test, most variables are stationary at weekly frequency.[11] The only non-stationary variable is foreign holdings, which is also found in previous studies (e.g. Gadanecz et al., 2018). Similar to other studies, we keep the level of foreign holdings in our empirical model and show that the results are robust once this issue is accounted for in Section 5.4.

4. EMPIRICAL RESULTS

4.1 BASELINE MODEL: NOMINAL LC YIELD SPREAD AS THE DEPENDENT VARIABLE

Table 1 shows the estimation results of Equation (1). The key findings are:

- Column (A) shows the estimation without the interaction term between the level of foreign holdings and the change in the lagged risk reversal. In this case, the estimated coefficients on both variables are insignificant.
- Column (B) introduces the interaction term. The estimated coefficients on the level of foreign holdings and change in the lagged risk reversal are again insignificant, but their interaction term has a positive and highly significant coefficient.
- The model is expanded with more control variables in columns (C), (D) and (E). Similar to the results of (B), the estimated coefficient of the interaction term is significant, while the foreign holdings and change in the lagged risk reversal are insignificant. Among the control variables, only the real GDP and inflation are shown to have a significant impact on the dependent variable.

Overall, the interaction between the level of foreign holdings and the change in the lagged risk reversal in these estimations is highly significant and are in the expected sign. This indicates that the level of foreign holdings and the change in lagged risk reversal do not affect the yield spread by themselves, but do affect the

[11] The marginal case is inflation which is stationary at the 10% level in some test statistics. Detailed results are reported in Table A3.

yield spread when conditioned on each other. According to the results, the yield spread widens only when there is a coincidence in a large increase in risk reversal and a high level of foreign holdings.

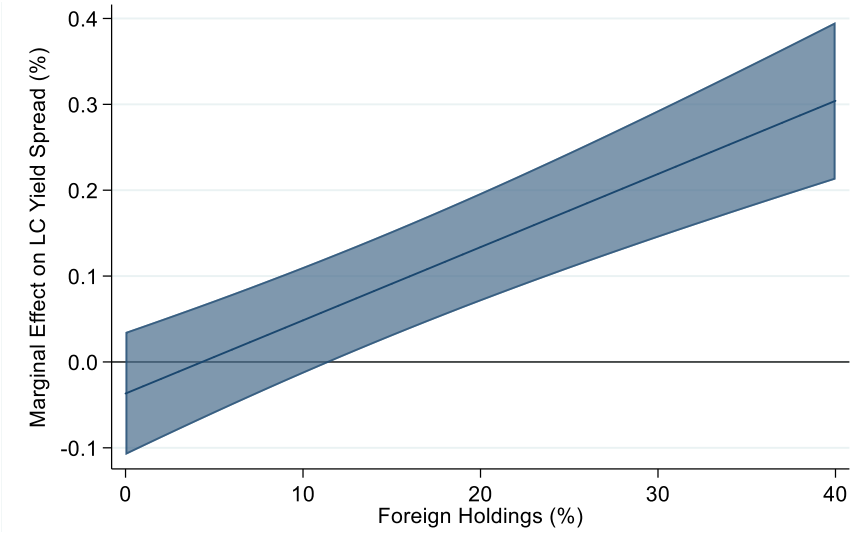
Table 1. Panel fixed effect regression of nominal LC yield spread on Equation (1)

Dep variable: Nominal LC yield spread	(A)	(B)	(C)	(D)	(E)
Foreign holdings	-0.0122	-0.0122	-0.0079	-0.0226	-0.0027
	[-0.29]	[-0.29]	[-0.19]	[-0.51]	[-0.07]
Change in lagged risk rev.	0.0481	-0.0368	-0.0621	-0.0667*	-0.0703
	[0.81]	[-1.01]	[-1.68]	[-2.08]	[-1.76]
Foreign holdings x		0.0085***	0.0078***	0.0076***	0.0079***
Change in lagged risk rev.		[6.33]	[5.25]	[6.20]	[5.44]
VIX			0.0236	0.0285	0.0293
			[1.27]	[1.65]	[1.56]
Change in LC bond bid-ask spread	0.2241	0.2368	0.2381	0.2222	0.2483
	[1.61]	[1.81]	[1.74]	[1.52]	[1.75]
Change in CCS bid-ask spread	0.0167	-0.0051	-0.0326	-0.0314	-0.0384
	[0.46]	[-0.15]	[-0.82]	[-0.89]	[-0.87]
Inflation	0.2644***	0.2646***	0.2519***	0.2190***	0.2390***
	[5.26]	[5.26]	[5.71]	[5.15]	[6.19]
Real GDP growth	-0.2163*	-0.2162*	-0.1876*	-0.1919*	-0.1938*
	[-2.42]	[-2.42]	[-2.00]	[-2.35]	[-2.05]
Current account to GDP				-0.0942	
				[-1.72]	
FX reserves to GDP					-0.0125
					[-0.67]
Constant	3.4330***	3.4320***	2.8331**	3.3121**	4.1198
	[3.99]	[3.99]	[3.00]	[3.34]	[1.63]
N	4636	4636	4636	4636	4636
Fixed effect	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.2170	0.2176	0.2312	0.2667	0.2461
Overall R-squared	0.3045	0.3049	0.3128	0.3692	0.5008

Note: The dependent variable is the nominal LC yield spread, which is the five-year zero-coupon yield spread over that of US Treasury. The risk factor is the lagged risk reversal. All regressions are estimated in weekly frequency with country fixed effect using the Huber-White robust standard error. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

Figure 6 shows the estimated results for Equation (2): the effects of a change in the lagged risk reversal on the LCY yield spread, as a function of foreign holdings. It shows that the marginal effect of change in the lagged risk reversal depends on the level of foreign holdings. According to the margin plot, when the share of foreign holdings exceeds 13%, an increase in risk reversal will raise the yield spread significantly.

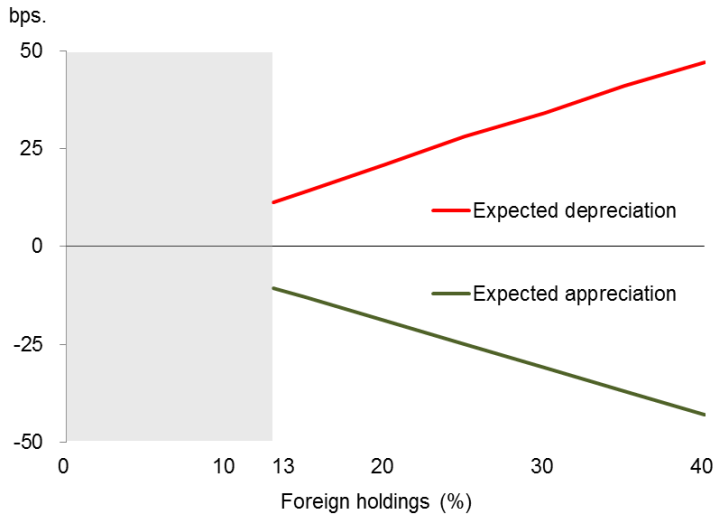
Figure 6. Marginal effect of change in the lagged risk reversal on nominal LC yield spread



Note: Margin plot of Equation (2) based on the estimation of column (B) in Table 1. Shaded area represents 95% confident interval.

Figure 7 illustrates the estimated role of foreign holdings on the LC yield spread, focusing on two-tailed scenarios of FX expectations: when the local currency is strongly expected to appreciate (the green line), or strongly expected to depreciate (the red line). As seen in the chart, with a strong expected appreciation (green line), the yield spread can be narrowed by about 43 basis points when the level of foreign holdings is at 40%, compared with about 10 basis points when foreign holdings are at 13%. By contrast—and this demonstrates the "double-edged sword" nature of foreign participation in the LC bond market—when there is a strong expected depreciation (red line), the spread will widen more as foreign participation increases, peaking at 47 basis points when the level of foreign holdings is at 40%.

Figure 7: Estimated contribution to nominal LC yield spread (bps)



Note: Grey area denotes insignificant estimated contribution. The expected appreciation and depreciation are represented by the cross-economy historical 1st and 99th percentile of the change in risk reversal respectively.

The above result is consistent with the hypothesis that the effect of foreign holdings on Asian EMEs' LC government bond yield spread is non-monotonic. We describe this effect of foreign holdings as a "double-edged sword" with the following features:

- The level of foreign holdings alone does not have an unconditional effect on yield spread i.e. the level of foreign holdings does not shift the overall level of yield spread; rather, it amplifies yield spread reactions to FX expectations.
- When the share of foreign holdings is low, FX expectation does not affect the yield spread.
- When the share of foreign holdings is at a high level, and if the market expects the EM currency to depreciate (appreciate), the yield spread will increase (decrease) markedly.

4.2 EXTENSION: CURRENCY AND CREDIT RISK PREMIUM AS THE DEPENDENT VARIABLES

To explore the reasons why LC yield spreads are sensitive to foreign investor holdings, we re-estimate Equation (1) by replacing the nominal LC yield spread with the swap rate (i.e. currency risk component) and with the DS spread (i.e.

credit risk component) in turns and compare the results with the baseline. The results are reported in Table 2, with the following key findings:

- Column (A) and (B) report the estimations with the swap rate as the dependent variable. Similar to the baseline, only the interaction term of foreign holdings and change in the lagged risk reversal has a significant impact on the swap rate.
- Column (C) and (D) report the estimation with the DS spread as the dependent variable. In contrast, the interaction term is insignificant in the specification.

Figure 8(a) and 8(b) depict the marginal effect of change in the lagged risk reversal on the swap rate and DS spreads respectively. The margin plot on the swap rate is similar to that of the nominal LC yield spread (i.e. Figure 6), showing the "double-edged sword" effect of foreign holdings. By contrast, the margin plot of the effect of change in risk reversal on the DS spread shows no significant effect, regardless of the level of foreign holdings.

These results are consistent with our hypothesis that if the level of foreign holdings in the LC government bond market is large enough, the currency risk premium will increase on the FX depreciation expectation. However, when bonds are mostly held by local investors, who are much less subjected to currency risks, the FX expectations do not move yield spreads. This is an intuitive conjecture as foreign investors are expected to lose money if local currency depreciates and, therefore, tend to sell bonds rapidly, pushing up the currency risk premium and thereby the yield spreads.

The empirical results do not show any evidence that the level of foreign holdings have an impact on the credit risk component of the yield spread. The results are again intuitive, as both foreign and domestic investors should face similar potential loss in the case of credit events (e.g. default) in the LC bond market. Therefore, the level of foreign holdings should not augment the credit risk sensitivity to FX expectation in the model; and there should be no differentiation in the pricing of credit risk by domestic and foreign investors.

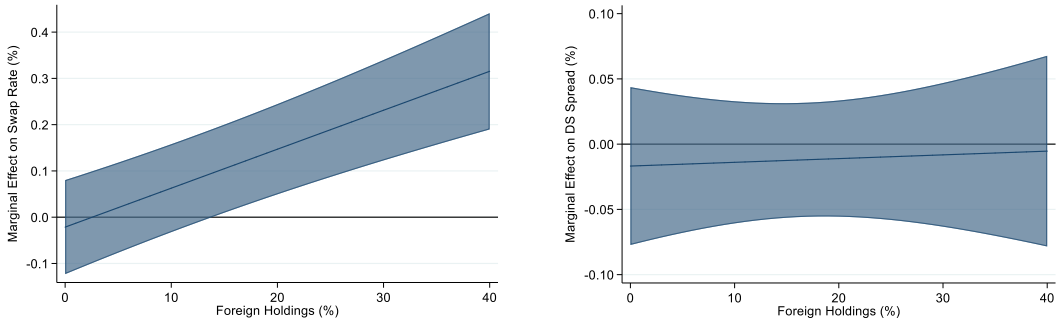
Table 2. Panel fixed effect regression of swap rate and DS spread on Equation (1)

	(A)	(B)	(C)	(D)
Dependent variable:	Swap	Swap	DS	DS
Foreign holdings	-0.0004	-0.0003	-0.0222	-0.0222
	[-0.01]	[-0.01]	[-1.17]	[-1.17]
Change in lagged risk rev.	0.0512	-0.0255	-0.042	-0.0412
	[0.95]	[-0.63]	[-1.80]	[-1.28]
Foreign holdings x		0.0077***		-0.0001
Change in lagged risk rev.		[3.87]		[-0.05]
VIX	0.0077	0.0076	0.0209	0.0209
	[0.46]	[0.45]	[1.59]	[1.59]
Change in LC bond bid-ask spread	-0.0213	-0.0097	0.2320**	0.2319**
	[-0.20]	[-0.10]	[3.19]	[3.12]
Change in CCS bid-ask spread	0.0906	0.071	-0.1026	-0.1024
	[0.82]	[0.66]	[-1.18]	[-1.21]
Inflation	0.039	0.0392	0.1798***	0.1798***
	[0.62]	[0.63]	[3.74]	[3.74]
Real GDP growth	-0.1261	-0.1262	-0.0657	-0.0657
	[-1.85]	[-1.85]	[-1.55]	[-1.55]
Current account to GDP ratio	-0.1102**	-0.1102**	0.016	0.016
	[-2.45]	[-2.45]	[1.06]	[1.06]
Constant	2.5752**	2.5760**	0.736	0.736
	[3.10]	[3.11]	[1.84]	[1.84]
N	4636	4636	4636	4636
Fixed effect	Yes	Yes	Yes	Yes
Within R-squared	0.1363	0.1371	0.2238	0.2238
Overall R-squared	0.2893	0.2896	0.2542	0.2542

Note: The dependent variables are the swap rate and DS spread, which represent the currency risk and credit risk components respectively. The risk factor is the lagged risk reversal. All regressions are estimated in the weekly frequency with country fixed effect using the Huber-White robust standard error. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

Figure 8. Marginal effect of change in the lagged risk reversal

(a) On swap rate (b) On DS spread



Note: Margin plot of Equation (2) based on the estimation of column (B) and (D) in Table 2. Shaded area represents 95% confident interval.

4.3 EXTENSION: GLOBAL NEGATIVE SHOCK AS RISK FACTOR

In addition to the currency depreciation expectation, a more general global negative shock could also be amplified by high levels of foreign holdings. When global investors who hold a significant portion of LC bonds are subjected to a risk aversion or sentiment shock, yield spreads will move more to reflect their departure. Table 3 reports the regression results on Equation (1), replacing the lagged risk reversal with the VIX. Columns (A)-(B), (C)-(D) and (E)-(F) report the estimations using nominal the LC yield spread, swap rate and DS spread as dependent variables, respectively. The major results are:

- In the estimations with the nominal LC yield spread and swap rate as the dependent variables, the estimated coefficients of the interaction terms between the level of foreign holdings and the change in VIX are significantly positive.
- The estimated coefficient of the interaction term in the estimation with the DS spread as the dependent variable is insignificant.

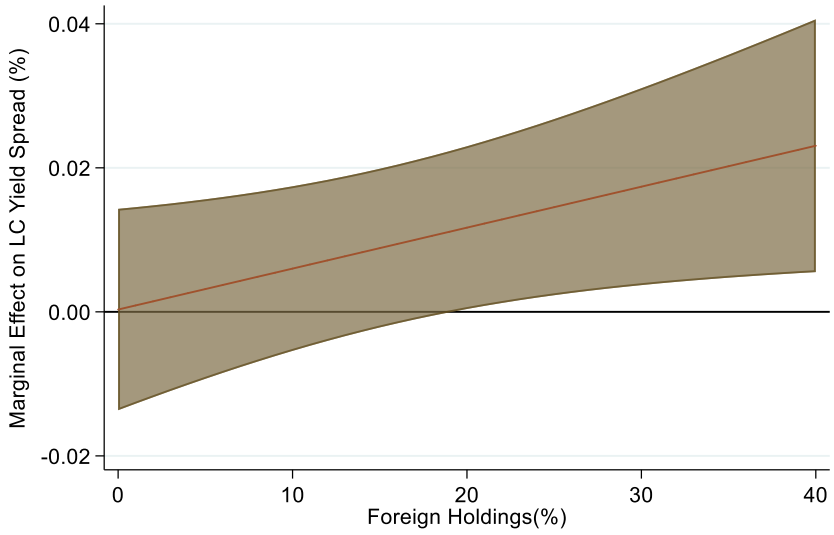
Figure 9 depicts the marginal effect of the change in VIX on the nominal LC yield spread. This chart is similar to that of risk reversal (Figure 6), with the marginal effect of the change in VIX becoming significantly positive if the level of foreign holdings is higher than 20%.

Table 3. Panel fixed effect regression on Equation (1)

	(A)	(B)	(C)	(D)	(E)	(F)
Dependent variable:	Yield spread	Yield spread	Swap	Swap	DS	DS
Foreign holdings	-0.0389	-0.0388	-0.0136	-0.0136	-0.0253	-0.0253
	[-0.91]	[-0.91]	[-0.47]	[-0.47]	[-1.51]	[-1.51]
Change in VIX	0.0061	0.0003	0.0039	0.0023	0.0022	-0.002
	[0.89]	[0.05]	[1.05]	[0.55]	[0.39]	[-0.33]
Foreign holdings		0.0006*		0.0002**		0.0004
x change in VIX		[2.00]		[2.59]		[1.45]
Lagged risk rev.	0.1541**	0.1541**	0.1484	0.1484	0.0058	0.0057
	[2.66]	[2.65]	[1.82]	[1.82]	[0.12]	[0.12]
Change in LC bond bid-ask spread	0.241	0.2442	0.0059	0.0067	0.2352**	0.2375**
	[1.78]	[1.81]	[0.07]	[0.08]	[3.01]	[3.04]
Change in CCS bid-ask spread	0.0534	0.0579	0.1418	0.1431	-0.0884	-0.0851
	[1.60]	[1.65]	[1.44]	[1.45]	[-0.88]	[-0.84]
Inflation	0.2073***	0.2074***	0.0153	0.0153	0.1921**	0.1921**
	[4.02]	[4.02]	[0.23]	[0.23]	[3.65]	[3.65]
Real GDP growth	-0.1937*	-0.1937*	-0.1041	-0.1041	-0.0896	-0.0896
	[-2.36]	[-2.36]	[-1.70]	[-1.70]	[-1.70]	[-1.70]
Current account to GDP ratio	-0.0937	-0.0937	-0.1161**	-0.1162**	0.0225	0.0225
	[-1.88]	[-1.88]	[-2.73]	[-2.73]	[1.76]	[1.75]
Constant	3.8333***	3.8332***	2.6144**	2.6144**	1.2189**	1.2188**
	[4.20]	[4.20]	[3.55]	[3.55]	[2.59]	[2.59]
N	4640	4640	4640	4640	4640	4640
Fixed-effect	Yes	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.2766	0.2767	0.1785	0.1786	0.2046	0.2047
Overall R-squared	0.355	0.3552	0.2715	0.2715	0.2303	0.2303

Note: The dependent variables are the nominal LC yield spread, the swap rate (currency risk) and the DS spread (credit risk). The risk factor is the VIX. All regressions are estimated at the weekly frequency with country fixed effect using the Huber-White robust standard error. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

Figure 9. Marginal effect of change in VIX on nominal LC yield spread



Note: Margin plot of Equation (2) based on the estimation of column (B) in Table 3. Shaded area represents 95% confident interval.

The results of the VIX models show that a global shock to sentiment has a similar "double-edged sword" effect on the yield spread when interacting with foreign holdings. Such effect is also reflected in the currency risk component of the LC yield spread, but not in the credit risk component. Nevertheless, the effect of a global negative shock is relatively less significant than that of the FX depreciation expectation. This finding is consistent with the feedback loop effect theory: a global negative shock causes FX volatility via the capital outflow channel which is less direct than the FX depreciation expectation, thus its effect on the yield spread is less remarkable.

5. ROBUSTNESS CHECKS

5.1 ADDITIONAL MEASUREMENT OF RISK FACTORS

In addition to the VIX in relation to measuring the effect of a global negative shock, the US corporate spread is also a common measurement of global investors' sentiment, particularly of global investors' willingness to take risk (Gerlach et al., 2010). To check the robustness of the effect of foreign holdings on a global negative shock, Equation (1) is re-estimated using US corporate spread as the risk factor, which is defined as the spread between Moody's corporate yield for bonds rated BAA and the 10-year US Treasury yield.

Table 4 reports the estimations using the US corporate spread. It shows that the signs and significance of the interaction terms are comparable with the main results and, therefore, the empirical results are robust to the choice of risk factor.

Table 4. Robustness using US corporate spread as risk factor

	(A)	(B)	(C)	(D)	(E)	(F)
	Yield spread	Yield spread	Swap	Swap	DS	DS
Foreign holdings	-0.0223	-0.0221	0.0068	0.007	-0.0292	-0.0291
	[-0.54]	[-0.53]	[0.21]	[0.22]	[-1.76]	[-1.76]
Change in US corp. spread	-0.0189	-0.4624	0.1504	-0.1675	-0.1693	-0.2949
	[-0.05]	[-0.88]	[0.81]	[-0.84]	[-0.48]	[-0.51]
Foreign holdings x		0.0443*		0.0318*		0.0126
Change in US corp. spread		[2.02]		[2.08]		[0.52]
N	4640	4640	4640	4640	4640	4640
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Included	Included	Included	Included	Included	Included
Within R-squared	0.2411	0.2417	0.0914	0.092	0.2009	0.2010
Overall R-squared	0.3115	0.3127	0.1852	0.1866	0.2282	0.2282

Note: The dependent variables are the nominal LC yield spread, the swap rate (currency risk) and the DS spread (credit risk). The risk factor is the US corporate spread. The control variables are not reported for simplicity, which include change in LC bond bid-ask spread, change in CCS bid-ask spread, inflation and real GDP growth. All regressions are estimated at the weekly frequency with country fixed effect using the Huber-White robust standard error. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

5.2 IMPOSING TIME LAG TO FOREIGN HOLDINGS

Similar to risk reversal, the level of foreign holdings might also be subject to the problem of endogeneity when the yield spread is regressed. Higher foreign holdings may have conditional effect on the yield spread on any changes in the FX expectation or global shock. Nevertheless, the reverse relationship might also be true in the sense that a change in the yield spread could cause a change in the level of foreign holdings. This issue is not easy to address as the yield spread data and the foreign holding data are in different frequencies. Still, Equation (1) can be re-estimated by lagging the foreign holdings by one quarter, to at least explore causality in the Granger sense.

Table 5 reports the results of the estimations using lagged foreign holdings. The risk factors in columns (A)-(B) and (C)-(D) are lagged risk reversal and VIX respectively. The results are highly consistent with the main results that only the interaction terms are positively significant, hence the key findings are robust to the lagging foreign holdings.

Table 5. Robustness using lagged foreign holdings

	(A)	(B)	(C)	(D)
	Yield spread	Yield spread	Yield spread	Yield spread
Lagged foreign holdings	-0.0098	-0.0098	-0.0097	-0.0097
	[-0.26]	[-0.26]	[-0.26]	[-0.26]
Change lagged in risk rev.	0.0488	-0.0426		
	[0.83]	[-1.39]		
Lagged Foreign holdings x		0.0087***		
Change in lagged risk rev.		[6.54]		
Change in VIX			-0.0014	-0.0071
			[-0.39]	[-1.39]
Lagged foreign holdings x				0.0006*
Change in VIX				[2.13]
N	4592	4592	4592	4592
Fixed effect	Yes	Yes	Yes	Yes
Control variables	Included	Included	Included	Included
Within R-squared	0.2256	0.2263	0.2254	0.2255
Overall R-squared	0.3187	0.3189	0.3193	0.3194

Note: The dependent variable is the nominal LC yield spread. The risk factors are the lagged risk reversal and VIX respectively. The level of foreign holdings is lagged by one quarter in this specification. Control variables are not reported for simplicity, which include a change in the LC bond bid-ask spread, change in CCS bid-ask spread, inflation and real GDP growth. All regressions are estimated at the weekly frequency with country fixed effect using the Huber-White robust standard error. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

5.3 ADJUSTING THE SAMPLE PERIOD TO POST-GCF

To examine whether the key results are robust to different sample period, Equation (1) is re-estimated by using the post-GFC data only.

Table 6 reports the regression results using the sample from July 2009 to June 2018. The risk factors in column (A)-(B) and (C)-(D) are lagged risk reversal and VIX respectively. The results in column (A)-(B) are consistent with the main results, indicating that the interaction effect between the level of foreign holdings and the change in the lagged risk reversal holds well in the post-GFC period. The interaction term of the level of foreign holdings and the change in VIX in column (D) is, however, insignificant. The results imply that, in the post-GFC period, there is no statistical evidence on the feedback loop effect of a global negative shock exerted on yield spread via foreign holdings. That said, the insignificance may only reflect that Asian EMEs have not experienced any substantial negative feedback loop effect in the post GFC period.

Table 6. Robustness of post-GFC sample period

	(A)	(B)	(C)	(D)
	Yield spread	Yield spread	Yield spread	Yield spread
Foreign holdings	-0.0579	-0.0579	-0.0579	-0.0579
	[-0.96]	[-0.96]	[-0.96]	[-0.96]
Change in lagged risk rev.	0.0292	-0.0439		
	[1.01]	[-1.22]		
Foreign holdings x		0.0044**		
Change in lagged risk rev.		[3.07]		
Change in VIX			0.0044	-0.0005
			[1.56]	[-0.10]
Foreign holdings x				0.0004
Change in VIX				[1.54]
N	3003	3003	3003	3003
Fixed effect	Yes	Yes	Yes	Yes
Control variables	Included	Included	Included	Included
Within R-squared	0.1481	0.1483	0.1481	0.1482
Overall R-squared	0.1011	0.1014	0.1012	0.1012

Note: The sample period covers from July 2009 to June 2018. The dependent variable is the yield spread and the risk factors are the lagged risk reversal and VIX. Control variables are not reported for simplicity, which include change in the LC bond bid-ask spread, change in the CCS bid-ask spread, inflation and real GDP growth. All regressions are estimated at the weekly frequency with country fixed effect using the Huber-White robust standard error. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

5.4 TACKLING THE NON-STATIONARITY OF FOREIGN HOLDINGS

The non-stationarity of level of foreign holdings is expected to have no effect on our key results as the estimated coefficient of the individual term of the level of foreign holdings is insignificant in all estimations. To check the robustness of our results on to this assumption, we re-estimate all regression models without the individual term of foreign holdings.

Table 7 reports the estimations without the individual term of level of foreign holdings. According to the panel unit root tests, all variables in these specifications are stationary (refer to table A3 for details). The risk factors of columns (A)-(C) and (D)-(F) are lagged risk reversal and also the VIX respectively. All coefficients are consistent with the main results, verifying that the empirical findings are not affected by the non-stationarity of the level of foreign holdings.

Table 7. Alternative specifications without the individual term of foreign holdings

	(A)	(B)	(C)	(D)	(E)	(F)
	Yield spread	Swap	DS	Yield spread	Swap	DS
Change in lagged risk rev.	-0.0381	-0.0164	-0.0218			
	[-1.12]	[-0.32]	[-0.65]			
Foreign holdings x	0.0086***	0.0079***	0.0006			
Change in lagged risk rev.	[6.20]	[3.99]	[0.43]			
Change in VIX				-0.0076	-0.0046	-0.003
				[-1.33]	[-1.19]	[-0.52]
foreign holdings x				0.0006*	0.0001*	0.0004
Change in VIX				[2.25]	[2.01]	[1.59]
N	4636	4636	4636	4640	4640	4640
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Included	Included	Included	Included	Included	Included
Within R-squared	0.2157	0.0533	0.1808	0.2143	0.0516	0.1812
Overall R-squared	0.3328	0.0939	0.1223	0.3325	0.0944	0.1225

Note: The individual term of foreign holdings is excluded such that all variables are stationary in these estimations. The dependent variables are the nominal LC yield spread, swap rate (currency risk) and DS spread (credit risk). The risk factors are the lagged risk reversal and VIX respectively. Control variables are not reported for simplicity, which include change in the LC bond bid-ask spread, change in CCS bid-ask spread, inflation and real GDP growth. All regressions are estimated in the weekly frequency with country fixed effect using the Huber-White robust standard error. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

6. CONCLUSION AND POLICY IMPLICATIONS

Our empirical results show that foreign participation in Asian EMEs' LC government bond markets reveal a "double-edged sword" effect on the yield spread. In good times—when there are expectations of the local currency strengthening—foreign participation helps reduce yield spreads, likely through increasing bond demand and providing liquidity. However, in times of market distress with a strong depreciation expectation of the currency or a large global negative shock, large foreign holdings will further widen the LC bond yield spread, raising borrowing costs and eroding liquidity. We further provide evidence that this "double-edged sword" effect is mainly reflected in the currency risk component of the nominal LC bond yield spread, but not in the credit risk component.

Our results suggest that the development of LC bond markets *alone* might have overcome the "original sin" in emerging Asia, but it is not a panacea for improving financial stability in the region. A large LC bond market could facilitate domestic investors to borrow abroad in local currency, but foreign investors will flee the region in the event of a currency crisis, or when there is another global financial shock, even if the source of the crisis is not relevant to the fiscal conditions or external positions of the bond issuing economy.

As a result, our findings lead to two important policy implications. First, as the currency risk is the key driver of the region's financial vulnerability, it is crucial for Asian EMEs to develop or deepen their foreign exchange derivatives markets to facilitate currency risk hedging. A reduction in currency risk exposure to foreign investor could help stabilise foreign exchange volatility and smooth financial investment flows, thereby mitigating the region's risk of capital flight (See Appendix B for the case study).[12]

Second, as domestic investors are less sensitive to the currency risk, broadening the domestic investor base will help contain the impact of FX risk in Asian EMEs' markets. This could be achieved through policy incentives, such as encouraging the region's rising middle class to invest in domestic pension plans for their future retirement plan or by investment education. A change in policy, such as the implementation of mandatory provident funds, could also help.

[12] Some studies associate the increase in turnover of FX hedging instruments with the rising investment in LC bonds, such as Mihaljek and Packer (2010) and McCauley el al. (2014).

Appendix A

Table A1. Data description and source

Variable	Description	Source
Nominal LC yield spread	Unhedged 5-year zero-coupon LC government yield over US Treasury yield.	Bloomberg
Swap rate (Currency risk component)	5-year implicit long-term forward premium of LC. Calculated by spot rate from fixed LC for USD Libor cross currency swap less spot rate from fixed USD for Libor interest rate swap.	Bloomberg
Du-Schreger (DS) spread (Credit risk component)	Swapped 5-year zero-coupon LC government yield over US Treasury yield. Calculated by nominal LC yield spread less swap rate.	Author's calculation
Level of foreign holdings	Share of foreign investors' outstanding in LC government bonds as a percentage of total outstanding LC government bonds.	Arslanalp and Tsuda (2014)^ and Asian Bonds Online#
Risk reversal	USD/LC option volatility of 3-month 25-delta call less put.	JP Morgan
VIX	Chicago Board Options Exchange Volatility Index.	Bloomberg
LC bond bid-ask spread	Bid-ask spread of LC government bond.	Bloomberg
CCS bid-ask spread	Bid-ask spread of cross currency swap.	Bloomberg
Inflation	Percentage change in CPI corresponding to the month of previous year.	IMF International Financial Statistics
Real GDP growth	Percentage change in Real GDP corresponding to the quarter of previous year.	IMF International Financial Statistics
Current account to GDP ratio	Current account balance as a percentage of nominal GDP.	IMF International Financial Statistics
FX reserves to GDP ratio	FX reserves as a percentage of nominal GDP.	IMF International Financial Statistics

Note: All variables are in the unit of percentage.

^: China, Indonesia, India, Malaysia, the Philippines and Thailand.

#: South Korea.

Table A2. Descriptive statistics of variables

Variable	N	Mean	SD	p1	p25	p50	p75	p99
Nominal LC Yield spread	5261	2.95	2.80	-1.98	0.96	2.25	4.81	10.43
Swap rate	5119	1.80	2.51	-3.12	0.15	1.30	3.41	8.43
DS spread	5102	1.24	1.43	-1.52	0.39	0.92	1.83	7.35
Foreign holdings	5278	10.05	11.02	0.00	1.23	7.29	14.60	39.31
Risk Reversal	5278	1.50	2.23	-2.00	0.48	1.25	2.17	9.87
VIX	5278	18.36	9.01	9.59	12.86	15.55	20.95	56.10
LC bond bid-ask spread	5182	0.06	0.07	0.00	0.02	0.03	0.07	0.37
CCS bid-ask spread	5119	0.40	0.41	0.01	0.14	0.30	0.50	1.25
Inflation	5269	3.92	3.00	-1.41	1.94	3.28	5.22	14.90
Real GDP growth	4901	5.63	2.99	-3.74	4.27	5.59	6.97	14.21
Current account to GDP	5122	3.01	5.05	-4.94	-0.68	2.33	5.40	18.17
FX reserves to GDP	5174	111.5	46.5	41.4	70.1	104.9	152.0	212.5

Source: Author's calculation.

Table A3. Stationarity tests

	Inverse chi-squared		Inverse normal		Inverse logit t	
Variable	Statistic	p-value	Statistic	p-value	Statistic	p-value
Nominal LC yield spread	21.9376	0.080*	-1.8093	0.035**	-1.7641	0.043**
Swap rate	46.5484	0.000***	-4.3639	0.000***	-4.7245	0.000***
DS spread	75.4619	0.000***	-6.5153	0.000***	-7.9134	0.000***
Foreign holdings	5.8184	0.971	1.9144	0.972	1.9765	0.972
Risk Reversal	95.4144	0.000***	-8.0157	0.000***	-10.0704	0.000***
VIX	128.1739	0.000***	-9.8027	0.000***	-13.5337	0.000***
LC bond bid-ask spread	432.0496	0.000***	-19.5265	0.000***	-45.6201	0.000***
CCS bid-ask spread	417.6081	0.000***	-19.1398	0.000***	-44.0952	0.000***
Inflation	19.3335	0.153	-1.6083	0.054*	-1.501	0.071*
Real GDP growth	45.5397	0.000***	-4.2963	0.000***	-4.6037	0.000***
Current account to GDP	55.246	0.000***	-4.8801	0.000***	-5.6322	0.000***
FX reserves to GDP	29.0234	0.010**	-2.3513	0.009***	-2.4889	0.009***

Note: Fisher-type unit-root test based on augmented Dickey-Fuller tests. All variables are in weekly frequency. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

Appendix B: A case study on the yield spread and FX derivatives market development during the taper tantrum

This case study serves as a piece of evidence to the stabilisation effect of the development of a foreign exchange derivatives market. The taper tantrum example in Figure 2 is revisited in this coarse and simple study.

The vertical axis of Figure A1 is the residual of the simple linear regression in Figure 2, which measures the portion of change in the LC yield spread that remains unexplained by the level of foreign holdings. A positive (negative) residual means the yield spread is wider (narrower) than expected. The horizontal axis is the indicator of the development of the FX derivatives market which is constructed by the ratio of OTC turnover of FX derivatives to FX spot.[13]

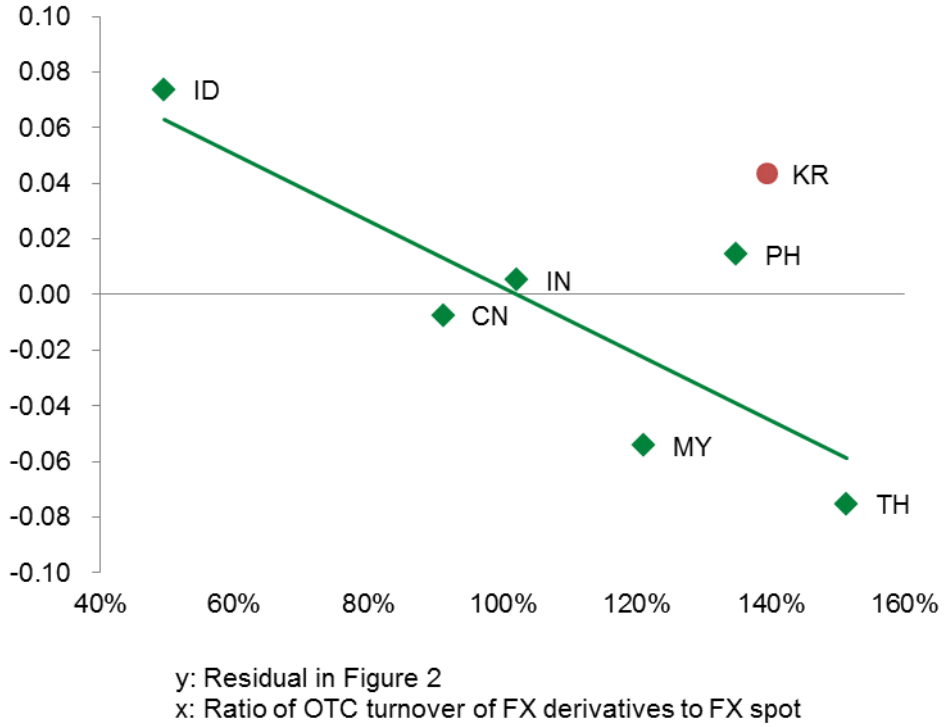
Considering South Korea as an outliner[14], the figure reveals a remarkable negative relationship between the change in yield spread controlled for foreign holdings and the development of a foreign exchange derivatives market. It hints that in a sudden external shock, the risk of capital outflow due to foreign holdings could be mitigated if the Asian EME has a relatively well developed foreign exchange derivatives market. Such findings are consistent with the hypothesis of this study that foreign investors may not sell off LC government bonds if a hedging instrument against currency risk is readily available.

This case study is very preliminary and coarse, largely constrained by data availability. We hope that future studies could provide further insight into this topic.

[13] FX derivatives refer to the outright forwards, FX swaps, currency swaps and options.

[14] There are several possible explanations for South Korea being an outliner among the Asian EMEs. South Korea is one of the most developed economies in the sample in terms of both the industrial sector and financial sector. Some literatures (e.g. Andritzky, 2012) consider South Korea as an advanced economy. In addition, its LC bond market is, unlike other Asian EMEs in the sample, dominated by corporate bonds. Further studies on this issue are needed to fill in the gap.

Figure A1. Weekly change in LC yield spread (controlled for foreign holdings) after taper tantrum against development of FX derivatives market



Note: y-axis is the residual of the simple linear regression in Figure 2. x-axis is the ratio of OTC turnover of FX derivatives to FX spot in daily average in April 2013. The green line is the simple linear regression line without South Korea, in which R-squared is 0.66 (0.35 if South Korea is included).
Source: BIS Triennial Survey and Author's estimation.

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