Determinants of Asia-Pacific government bond yields

By Mikhail Chernov, Drew Creal and Peter Hördahl[1]

Abstract

This paper examines the dynamic properties of Asia-Pacific local currency sovereign bond yields and risk premiums. We focus, in particular, on the properties and interactions of components of bond risk premiums that are due to credit spreads and exchange rates. We find that local variables are significant in explaining the dynamics of these components. In particular, the credit risk premium component is, unsurprisingly, mostly affected by a factor that reflects local sovereign credit risk, while the currency risk premium component is affected by the credit factor as well as by the difference in the interest rate level between the local and US yield curves. Moreover, we find that, quantitatively, local variables play a large role in explaining the variation in the credit and currency risk premium components.

JEL classification: F30, G12, G15

Keywords: emerging market bonds, bond risk premia, currency risk, credit risk

1 Affiliations: Chernov: Anderson School of Management, UCLA, NBER, and CEPR (email: mikhail.chernov@anderson.ucla.edu); Creal: Notre Dame University (email: dcreal@nd.edu); Hördahl: Bank for International Settlements (email: peter.hoerdahl@bis.org).

This note summarises the results and discussions in the full version of the paper, which will appear in the *BIS Working Papers* series. We thank Ran Li and Amanda Liu for excellent research assistance. We also thank conference participants at the Bank of Korea-BIS conference on "Asia-Pacific fixed income markets: evolving structure, participation and pricing" for comments and, in particular, our discussant Min Wei. Any remaining errors are our own. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank for International Settlements.

1. Introduction

We study the determinants of sovereign bond yields in emerging market economies (EMEs), focusing on common features of local determinants within a region and global ones. Two natural drivers of bond yields in this context are credit and currency risks, which we label as the Twin Cs. A changing likelihood of sovereign default is likely to affect the exchange rate. A weakening exchange rate could be a precursor of fiscal stress and higher credit risk. Our focus on the Twin Cs is related to the literature on the so-called Twin Ds (default and devaluation), eg Na et al (2018) and Reinhart (2002). Since we do not observe any defaults in our sample, we emphasise the Cs rather than the Ds.

When studying EME bond markets, it is particularly relevant to examine potential spillovers from the US bond market. We test whether factors driving EME bond yields contain information about future local interest rates and macro variables, beyond what is contained in the factors that drive US yields. Here, we consider US and local versions of factors constructed from yields, specifically principal components of yields and macro factors (inflation, output, exchange rates), as well as local credit factors. We also study the impact of these local and US factors on bond risk premiums and assess their relative importance for risk premia.

In order to identify the Twin Cs separately, we need data on bonds denominated in local currency (LC) in addition to bonds denominated in US dollars. This prompts us to study sovereign bonds from Asia-Pacific (AP) countries. AP local currency government bond markets have been characterised by rapid growth in recent years. Partly as a result of policy initiatives in response to the 1997-98 Asian crisis, these markets have grown from less than a quarter of a trillion USD in 1995 (or 10% of GDP) to USD 10.1 trillion in 2018 (48.5% of GDP).[2] This rapid growth stands in contrast to other EME bond markets. For example, the amount of outstanding Latin American LC bonds has barely increased over the past decade, in part due to insufficient macroeconomic stability.

When studying EME bond markets, the literature has thus far largely focused on the role of only one of the Cs, namely credit risks (eg Hilscher and Nosebusch (2010) and Longstaff et al (2011)). Data limitations have also led most researchers to use the EMBI index that aggregates across different maturities of US dollar-denominated bonds, or to study credit default swap (CDS) contracts for one single maturity. Regarding the second C, currency risk, little work has been carried out on understanding the connection between currency risk and cross-country differences in bond yields, in particular for EMEs. Hofmann et al (2017) document that movements in the dollar exchange rate of EMEs affect local government bond yields through changes in the sovereign credit risk. While they emphasise this interaction between currency and credit risk, they do not formally jointly model bond yields, exchange rates and credit risk or their drivers.

We address the questions raised above by studying the behaviour of LC bond yields of China, Indonesia, Korea, and Singapore. Despite relative macroeconomic stability, these countries vary in terms of monetary policy, exchange rate stabilisation

[2] This includes LC government bonds of China, Hong Kong SAR, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand and Vietnam; source: Asian Development Bank and Reserve Bank of India.

policy, credit quality and tightness of capital controls. This is in contrast to the traditional analysis of bond markets in G7 countries, which share a lot of similarities across all of these dimensions. The significant cross-country differences among AP countries complicate the analysis of the factors driving bond yields in these countries. Another complication arises from the relatively short time span of most AP bond markets. We address both complications through the use of panel regressions with fixed effects, which allows us to identify commonalities across countries while at the same time establishing predictability patterns in the data. Using this approach, we study both the lead-lag relations between US and local yield and macro factors and how such factors affect bond risk premiums.

We find that US variables matter for both local yield factors and local macro factors, as well as for the credit factor. Importantly, we also find that local factors themselves matter for the future evolution of local variables. In particular, the local credit factor predicts all other local variables with the exception of output and credit. The local credit factor is predictable by the depreciation rate (the Twin Cs effect) and by the cross-country differences in the levels of the interest rates and term spreads. The fact that the credit factor and the depreciation rate predict each other highlights the interaction between the Twin Cs.

For local excess bond returns, US macro variables are important across all return horizons. Among local factors, the depreciation rate and the credit factor are significant for the component reflecting compensations for credit risk. Regarding compensation for currency risk, the depreciation rate is significant at short horizons and the credit factor is significant at long horizons. Moreover, we find that local variables play a major quantitative role in both time-series of depreciation rates and credit spreads, and bond risk premiums associated with the Twin Cs.

2. Data

For our analysis, we require data on bond yields and macroeconomic factors for the Asian countries we study, as well as for the United States. We also need exchange rates between the currencies of the AP countries in our sample and the US dollar, as well as data on the credit risk of individual sovereigns.

For the macroeconomic data, we rely on inflation (the monthly log-difference of the consumer price index) and a measure of economic activity (the monthly growth rate of industrial production (IP)). The exchange rate data consists of end-of-month quotes of the Chinese yuan, the Indonesian rupiah, the Korean won, and the Singapore dollar, against the US dollar.[3]

As for the bond market data, we use zero-coupon government bond yields. For the four AP economies we study (China, Indonesia, Korea and Singapore), we rely on Bloomberg zero-coupon yields, which are estimated using a spline approach on available prices of individual bonds in domestic markets. For the United States, we use the standard dataset from the Federal Reserve, as constructed by Gürkaynak et al (2007). The zero-coupon yield series available for our four AP countries are relatively short compared to US data. Specifically, yield data is available as of September 2003

[3] The source of the macro and FX data is Bloomberg, except for Chinese IP data, which comes from China's National Bureau of Statistics.

for China, from October 2003 for Indonesia, from September 1999 for Korea and as of June 1998 for Singapore.

In order to allow us to separately identify default and currency risks, we need US dollar-denominated bond yields for the AP countries in our sample. Singapore is an exception, as we consider Singaporean bonds as credit risk-free due to their AAA-status. In the case of Korea, we again rely on Bloomberg zero-coupon yields, which are available for US dollar-denominated bonds. For China, no data on US dollar-denominated zero-coupon yields exist, whereas Indonesian data are available only as of very recently. For these two countries, we therefore instead construct synthetic US dollar yields by adding Chinese or Indonesian sovereign CDS spreads to US Treasury par yields and estimating zero-coupon yields. We take the difference between the one-year US dollar-denominated AP yield and the corresponding US Treasury yield as our credit risk factor. Table 1 reports summary statistics for our data.

Macro and yield variables: summary statistics

Table 1

Variable	Statistic	Country China	Indonesia	Korea	Singapore	US
Depr rate	mean	–0.14	0.28	–0.05	–0.10	-
	st dev	0.66	2.80	3.08	1.68	-
	serial corr	0.28	0.09	0.01	–0.05	-
Inflation	mean	0.23	0.53	0.21	0.13	0.29
	st dev	0.59	0.80	0.36	0.49	0.37
	serial corr	0.09	0.21	0.26	–0.16	0.62
IP growth	mean	0.93	0.28	0.40	0.47	0.17
	st dev	0.63	3.86	2.21	7.10	0.68
	serial corr	0.31	–0.48	–0.02	–0.37	0.28
1-year yield	mean	0.22	0.65	0.33	0.10	0.42
	st dev	0.06	0.20	0.14	0.07	0.31
	serial corr	0.94	0.94	0.99	0.98	0.99
3-year yield	mean	0.25	0.72	0.36	0.14	0.46
	st dev	0.06	0.21	0.15	0.09	0.30
	serial corr	0.94	0.94	0.99	0.98	0.99
10-year yield	mean	0.31	0.81	0.40	0.25	0.54
	st dev	0.05	0.21	0.16	0.07	0.26
	serial corr	0.94	0.95	0.99	0.96	0.99
Credit	mean	0.02	0.07	0.11	-	-
	st dev	0.02	0.10	0.08	-	-
	serial corr	0.85	0.92	0.96	-	-

Sample statistics of macroeconomic factors and selected yields. "Depr rate" refers to the deprecation rate of the local currency relative to the US dollar. The depreciation rate, inflation and IP growth are measured as monthly log-differences, scaled up by 100. The yields and the credit factor are zero-coupon based and expressed in monthly continuously compounded terms. All series end in December 2017; series for China start in September 2003, for Indonesia October 2003, for Korea September 1999, for Singapore June 1998 and for the United States February 1977.

3. Econometric approach

While our dataset features yields across a large number of maturities, we reduce the dimension of the yield data by extracting principal components (PCs). Our analysis shows that the first 10 PCs explain 99.6% of the joint variation in 35 yields across the five different countries in our sample. However, in contrast to a traditional PC analysis on yields for a specific single country, these PCs are difficult to interpret. Therefore, we construct a different set of 10 factors from our yield data. Specifically, we take the first two PCs constructed using yield data for each country separately. As shown in numerous studies, these first two PCs largely represent the level of yields (PC1) and the slope of the yield curve (PC2). Since there is a lot of commonality between the US PCs and their AP counterparts, our final set of yield variables uses the differences between the US PCs and the corresponding local ones, $\Delta PC1_{i,t}$ and $\Delta PC2_{i,t}$ for country i, in addition to the US PCs themselves, $PC1_{US,t}$ and $PC2_{US,t}$.

All in all, we have four US variables and six local variables that we will use to try to explain AP government bond yield dynamics. The US variables are US inflation (π_t), US IP growth (g_t), and the two yield PCs, $PC1_{US,t}$ and $PC2_{US,t}$. The local variables are (for country i) domestic inflation ($\hat{\pi}_{i,t}$), IP growth ($\hat{g}_{i,t}$), the two local PC differentials ($\Delta PC1_{i,t}$ and $\Delta PC2_{i,t}$), the nominal exchange rate depreciation rate ($\Delta s_{i,t}$), and the local credit factor ($\hat{c}_{i,t}$).

We model the joint dynamics of all these variables via a first-order vector autoregression, VAR(1). The VAR can provide some insights on whether local or global (US) factors are the main drivers of local bond yields, but it can also tell us something about the relative importance of macro variables vs financial variables for local yields. With four AP countries and the United States, we have a total of 27 variables (Singapore does not have a credit factor). This implies $27+27^2+27\cdot28/2 = 1134$ identified parameters that need to be estimated. This is a daunting challenge in any situation, which is further complicated by relatively short samples.

To overcome these challenges, we pool data from different countries. This approach imposes the constraint that the underlying structure is the same for each country. We make one exception, namely that US variables respond to US variables only, and their responses are allowed to be different from the responses of non-US variables to non-US variables of the same type.

4. Results

4.1 The dynamics of macro and yield variables

As a first step, we estimate a regression with fixed effects that correspond to the predictable component of our macro and yield variables. Table 2 displays the estimated coefficients of the VAR, with the above-mentioned restrictions imposed (we also use the Akaike information criterion (AIC) to select individual parameters that we can set to zero)). Our results show that the cross-country differential in the interest rate slope (PC2) predicts the depreciation rate, so uncovered interest parity (UIP) is violated but not via the traditional interest level differential channel (see related evidence in Bansal and Dahlquist (2000)). An increase in the US minus local yield slope implies a depreciation of the LC against the US dollar the next period. The LC also tends to depreciate if US economic activity (IP) falls.

The effects of the interest rate differential on the exchange rate are intuitive. To the extent that changes in yield slopes reflect changes in investors' perceptions of monetary policy, this suggests that LCs tend to depreciate against the dollar when the US monetary policy outlook becomes more hawkish, or when the local policy outlook turns more dovish. Of course, changes in term premia may also contribute to this result. We discuss risk premia considerations in the next section.

Macro and yield variable dynamics: panel VAR parameter estimates

Table 2

Variable	π_{t-1}	g_{t-1}	$PC1_{US,t-1}$	$PC2_{US,t-1}$	$\Delta s_{i,t-1}$	$\hat{\pi}_{i,t-1}$	$\hat{g}_{i,t-1}$	$\Delta PC1_{i,t-1}$	$\Delta PC2_{i,t-1}$	$\hat{c}_{i,t-1}$
π_t	0.488		0.318							
	(0.057)		(0.086)							
g_t	0.327	0.220								
	(0.102)	(0.062)								
$PC1_{US,t}$	0.009		0.987							
	(0.003)		(0.004)							
$PC2_{US,t}$		–0.007		0.994						
		(0.002)		(0.009)						
$\Delta s_{i,t}$		–0.486		–3.398	0.030			1.180	6.112	–1.098
		(0.122)		(2.125)	(0.035)			(0.974)	(2.549)	(1.616)
$\hat{\pi}_{i,t}$			0.588			0.081		–0.817		–0.921
			(0.170)			(0.035)		(0.223)		(0.355)
$\hat{g}_{i,t}$	0.724					–0.419	–0.361			
	(0.375)					(0.259)	(0.033)			
$\Delta PC1_{i,t}$		0.006				–0.007		0.949	–0.053	0.056
		(0.002)				(0.002)		(0.015)	(0.024)	(0.023)
$\Delta PC2_{i,t}$		–0.007	–0.042	0.101	–0.0005			–0.033	0.745	–0.078
		(0.001)	(0.008)	(0.020)	(0.0003)			(0.009)	(0.026)	(0.015)
$\hat{c}_{i,t}$	–0.004	–0.007	0.029		0.0024			–0.019	0.039	0.883
	(0.002)	(0.001)	(0.008)		(0.0003)			(0.009)	(0.019)	(0.015)

The table reports parameter estimates of the persistence matrix in the panel VAR with fixed effects for the state vector consisting of the variables listed in the table. Out of those, the US variables are autonomous. The reported coefficients are chosen by AIC. Figures in parentheses are standard errors.

The fact that the LC depreciates in response to increases in the credit risk reflects the Twin Cs. Further, the difference between US and AP interest rate levels affects the local inflation rate and the local credit factor, in addition to the US interest rate level. As for the remaining local macro variable, IP, the regression provides no evidence that either local or global yield factors matter. Instead, its own lag is important, but the serial correlation is negative, reflecting much higher variability in the production growth of EMEs as compared to the United States. US inflation also seems to matter, and enters marginally significantly for local IP growth.

With respect to drivers of local bond yields, our regression results suggest that AP yields are driven by both local and global macro and yield factors. Among local factors, domestic inflation enters significantly for the level, with higher inflation implying a higher interest rate level compared to that of the United States (thus resulting in a negative response of the US-local differential). Local yield factors naturally also play an important role: both local level and slope (in deviation from the US level and slope) matter for both variables.

Interestingly, the global/US yield level does not seem to influence the local level (beyond what is accounted for by the difference to the US level). However, it does play a significant role for the local slope differential. When the US yield level rises, or when the US slope falls, the difference between the US and the local slope falls. This suggests that local short-term yields rise when the US interest rate level rises, and that the local slope reacts less than one-to-one to changes in the US slope.

Another factor that enters significantly for local yield factors is the sovereign credit factor. As the credit risk goes up, the local interest rate level tends to fall relative to that of the United States, perhaps due to a monetary policy response. At the same time, the local yield curve tends to steepen (because long-term yields rise), reducing the difference between US and local slopes. Furthermore, the results show that a higher US interest rate level tends to raise the local credit risk. Hence, down the line there is an indirect effect from rising US interest rates to a steeper local yield curve via higher credit risk. An appreciating LC also raises the local credit risk, another manifestation of the Twin Cs.

Excess return regressions — Table 3

Variable	2 years	3 years	5 years	10 years
	Maturities			
π_{t-1}	−0.226	−0.361	−0.626	−1.187
	(0.076)	(0.113)	(0.187)	(0.382)
g_{t-1}	0.173	0.263	0.433	0.815
	(0.044)	(0.065)	(0.107)	(0.218)
$PC1_{US,t-1}$	0.830	0.992	0.865	−0.589
	(0.308)	(0.457)	(0.753)	(1.541)
$\Delta PC1_{i,t-1}$	−1.216	−1.053	0.670	7.975
	(0.763)	(1.135)	(1.868)	(3.825)
$\Delta PC2_{i,t-1}$	−0.066	−0.109	−0.212	−0.585
	(0.052)	(0.077)	(0.126)	(0.258)
$\hat{c}_{i,t-1}$	−0.226	−0.361	−0.626	−1.187
	(0.076)	(0.113)	(0.187)	(0.382)

The table reports exposures of excess returns on AP LC bonds to the variables listed in the table, obtained through fixed-effects OLS regressions. We omit variables that do not result in significant parameter values in any of the columns. Figures in parentheses are standard errors.

4.2 Bond risk premia

In order to get a sense of determinants of the bond risk premiums, we run several regressions of bond excess returns on our set of macro and yield factors. We implement regressions with fixed effects for the same reasons as when we estimated the dynamics of the variables themselves.

We define LC excess returns on AP bonds as the log-price change earned from purchasing a bond and selling it one month later, less the one-month interest rate prevailing at the time of the bond purchase. In the regressions that we implement, we consider bonds of maturities ranging from two to 10 years. Table 3 reports the results. We see that the global factors play a big role. Both US macro variables are highly significant for local excess returns. Higher US inflation has a negative impact on excess returns, whereas higher US IP growth has the opposite effect. The US level factor is important for short-horizon excess returns, with a higher US level tending to lift such returns.

Among local variables, the yield level differential stands out as particularly important. A higher (lower) US-local yield differential implies lower (higher) excess returns across all maturities. In other words, when local yields rise more than US ones, this tends to result in higher excess returns. The yield slope differential has a similar effect on excess returns, although it is statistically significant only for long-maturity returns. Finally, higher local credit risk, as captured by the credit factor, raises excess returns significantly up to five years.

In principle, LC excess returns reflect not only compensation for the local interest rate risk, but currency and credit risks as well. To demonstrate this, we decompose our excess returns into a part that reflects the currency risk and another part that reflects credit risk. Specifically, by taking the difference between excess returns on LC bonds and USD bonds issued by the same country, we cancel out the sovereign credit risk and isolate the currency risk component. And by taking the difference between excess returns on an Asia-Pacific bond issued in USD and the corresponding excess return on US Treasuries, we are able to cancel out the currency risk component and isolate the credit risk. We then simply run regressions of these excess return differentials on our set of macro and yield variables to examine the determinants of the two bond risk premium components.

Excess return spread regressions

Panel A. Excess returns reflecting currency risk — Table 4

	Maturities			
Variable	2 years	3 years	5 years	10 years
π_{t-1}	–0.261	–0.436	–0.816	–1.514
	(0.096)	(0.142)	(0.238)	(0.496)
g_{t-1}	0.027	–0.050	–0.339	–1.377
	(0.055)	(0.082)	(0.137)	(0.285)
$PC1_{US,t-1}$	–2.638	–2.741	–0.440	12.365
	(1.006)	(1.489)	(2.492)	(5.195)
$\Delta s_{i,t-1}$	0.043	0.049	0.057	0.112
	(0.015)	(0.022)	(0.036)	(0.075)
$\Delta PC1_{i,t-1}$	–1.128	–2.039	–4.279	–10.368
	(0.407)	(0.602)	(1.008)	(2.101)
$\Delta PC2_{i,t-1}$	2.169	0.665	–6.199	–29.942
	(1.271)	(1.882)	(3.149)	(6.563)
$\hat{c}_{i,t-1}$	–0.635	–1.526	–5.224	–20.172
	(0.678)	(1.004)	(1.680)	(3.502)

Panel B. Excess returns reflecting credit risk

	Maturities			
Variable	2 years	3 years	5 years	10 years
g_{t-1}	–0.249	–0.402	–0.662	–1.159
	(0.036)	(0.055)	(0.091)	(0.205)
$\Delta s_{i,t-1}$	0.060	0.082	0.122	0.222
	(0.010)	(0.015)	(0.025)	(0.055)
$\hat{g}_{i,t-1}$	–0.013	–0.022	–0.049	–0.137
	(0.010)	(0.015)	(0.025)	(0.057)
$\hat{c}_{i,t-1}$	–3.691	–5.051	–7.407	–13.954
	(0.339)	(0.515)	(0.859)	(1.933)

The table reports exposures of spreads of excess returns on AP LC bonds over USD bonds (Panel A) and of excess returns on US Treasury bonds over AP USD bonds (Panel B) to the variables listed in the table, obtained through fixed-effects OLS regressions. We omit variables that do not result in significant parameter values in any of the columns. Figures in parentheses are standard errors.

Table 4 reports the results. Panel A controls for credit risk and focuses on the currency risk, assuming no selective defaults. Not surprisingly, the depreciation rate is significant, although only for the shorter maturities. A depreciation of the LC tends to raise excess returns on short-term local bonds relative to US dollar-denominated bonds. The credit factor is significant at intermediate and long maturities, driving up US dollar excess returns more than local returns, reflecting the Twin Cs. US inflation is significant across the board as well, consistent with evidence on US bond risk premiums.

As for yield factors, Panel A also shows that both global and local yield variables matter for the excess return differentials. An increase in the US slope increases excess returns on dollar bonds, while it has little effect on local excess returns (see Table 3). The result is a decline in the difference between LC and USD excess returns. A similar effect is produced by increases in the level differential factor. This time, the effect is due to lower LC excess returns, in line with the results in Table 3. The same goes for the slope differential for the longest maturity.

Panel B controls for currency risk and focuses on the credit risk, which is what most studies on EMEs have concentrated on. As expected, the credit factor enters highly significantly. Higher credit risk raises excess returns on Asia-Pacific dollar bonds, resulting in a decline in the return difference between Treasuries and Asia-Pacific bonds. The depreciation rate also appears as a predictive variable, another manifestation of the Twin Cs. The cross-horizon average coefficient of 0.12 implies an increase in the credit risk premium component of at least 8 basis points for a one-standard-deviation increase in the depreciation rate (decrease in LC value). A depreciating LC lowers the expected return on dollar bonds, perhaps reflecting shifts by investors from LC to USD bonds.

There are other significant variables here as well. We see an important role for US IP. The fact that higher US IP implies higher risk premia on Asia-Pacific bonds may reflect compensation for a greater risk of a policy response in the form of rising US interest rates.

4.3 Variance decomposition analysis

Finally, we would like to be able to quantify the contribution of the various factors in explaining the overall variation in the variables of interest. To this end, we implement a variance decomposition analysis, which allows us to measure the percentage contribution of a shock to a particular variable to the variation in some other variable.[4] As is usually the case, the variance decomposition could be sensitive to the ordering of variables. Therefore, instead of focusing on the impact of individual variables, we distinguish between the US and local variables only. We stack the odds in favour of the US variables by ordering them first.

The first part of Table 5, labelled "factors", displays the results. We find that a lot of variables are primarily impacted by the local shocks: output growth in all countries, inflation in Indonesia and Korea, and the difference between the interest rate levels everywhere except for Singapore. For the Twin Cs, credit is impacted more by local variables across all countries. This conclusion is in contrast to most existing studies on the determinants of sovereign credit spreads. Currencies, in general, are mostly driven by their own shocks, the other local shocks contribute more in Indonesia and Korea. The difference in term spread is the only variable that is primarily driven by the US variables (for Indonesia the impacts of local and US variables are similar).

[4] In order to implement the variance decomposition analysis, we first need to estimate the conditional covariance matrix. To handle the unbalanced panel data at our disposal, we therefore reestimate the VAR using MLE and the Kalman filter. This results in slightly different parameter estimates than those reported in Table 2. See the full paper for further details.

Next, we evaluate the impact of shocks on the variation on expected differences in excess returns that are reported in Table 3.[5] The second part of Table 5, labelled "risk premiums", displays the results. The currency risk premiums are primarily affected by the shocks to US factors with the exception of Indonesia. The conclusion is reversed for credit risk premiums. Interestingly, local factors dominate for credit risk premia. What does that mean for the Twin Cs? Out of the local variables, the currency premium is primarily affected by the difference in PC1 (interest rate level), consistent with UIP violations and, to a much larger degree, by the credit factor, despite being ordered to be last. The major US variable affecting the currency component is the term spread variable (PC2). The credit risk premium is, unsurprisingly, overwhelmingly driven by the credit factor itself.

Variance decompositions

Panel A. Factor variance decompositions

Table 5

	China		Indonesia		Korea		Singapore	
Factors	US	local	US	local	US	local	US	local
$\Delta s_{i,t}$	5.72	4.35	0.37	1.51	0.24	0.50	0.77	0.04
$\hat{\pi}_{i,t}$	4.08	2.88	2.12	12.13	7.89	14.43	4.28	1.19
$\hat{g}_{i,t}$	5.45	39.22	0.54	10.75	0.97	13.90	0.14	1.42
$\Delta PC1_{i,t-1}$	21.77	25.88	2.58	16.45	11.33	43.69	34.26	5.11
$\Delta PC2_{i,t-1}$	66.32	11.83	32.81	34.95	57.81	31.02	79.95	2.18
$\hat{c}_{i,t-1}$	2.53	4.66	0.45	10.65	0.83	8.71	-	-

Panel B. Excess return variance decompositions

Type /	China		Indonesia		Korea		Singapore	
maturity	US	local	US	local	US	local	US	local
Currency								
2-year	82.84	17.16	42.14	57.86	65.90	34.10	89.85	10.15
3-year	72.96	27.04	28.90	71.10	49.74	50.26	88.73	11.27
5-year	79.57	20.43	42.29	57.71	59.05	40.95	96.56	3.44
10-year	77.49	22.51	40.95	59.05	56.35	43.65	97.59	2.41
Credit								
2-year	20.09	79.91	4.42	95.58	7.91	92.09	-	-
3-year	21.22	78.78	4.72	95.28	8.43	91.57	-	-
5-year	22.30	77.70	5.01	94.99	8.93	91.07	-	-
10-year	21.80	78.20	4.87	95.13	8.70	91.30	-	-

The table reports contributions, in per cent, of shocks to the state variables to the unconditional variance of the state variables themselves or to the currency and credit components of bond risk premiums corresponding to Table 3. Our factor order is such that US variables are given a first chance to explain the relevant variation with a residual attributed to the local factors. We report cumulative contribution of US vs local variables and do not distinguish between the shocks to individual elements of the state vector. Because many of the state variables are persistent, we exclude the impact of its own shock on a variable in Panel A. As a result, the US and local columns do not add up to 100.

[5] The excess returns can be written as combinations of the state variables in the VAR, allowing us to obtain variance decompositions of excess returns.

5. Conclusions

We study the interaction between the credit and currency risks, the Twin Cs, reflected in LC bonds issued by sovereigns in AP. Our particular focus is on the impact of local vs US variables on the dynamics of these risks and their risk premiums. We adopt a panel VAR with a fixed effects approach to address relatively short samples available, political and economic differences between the countries, and parameter proliferation. We document an important role of local variables in driving the Twin Cs.

We find that local variables play a significant role in both factor dynamics and risk premiums. Although there is a natural separation between macro and yield-based variables, depreciation rates and credit spreads are affected by both types of variables. In particular, past declines in the value of the local currency is highly significant in predicting increased credit spreads (the Twin Cs effect). Bond risk premiums due to currency risk are affected, in particular, by depreciation rates at short horizons and by credit spreads at long horizons. Bond premiums due to credit risk are affected by both variables at all horizons.

Variance decompositions reveal that time-series variation in credit and currency risks is primarily affected by local variables. The credit risk premium is mostly affected by the (local) credit factor. The currency risk premium, meanwhile, is affected by the credit factor as well as by the interest rate differential.

References

Bansal, R and M Dahlquist (2000): "The forward premium puzzle: different tales from developed and emerging economies", *Journal of International Economics*, vol 51, pp 115–44.

Gürkaynak, R, B Sack and J Wright (2007): "The US treasury yield curve: 1961 to the present", *Journal of Monetary Economics*, vol 54, pp 2291–304.

Hilscher, J and Y Nosebusch (2010): "Determinants of sovereign risk: Macroeconomic fundamentals and the pricing of sovereign debt", *Review of Finance*, vol 14, pp 235–62.

Hofmann, B, I Shim and H S Shin (2017): "Sovereign yields and the risk-taking channel of currency appreciation", *BIS Working Papers*, no 538.

Longstaff, F, J Pan, L Pedersen and K Singleton (2011): "How sovereign is sovereign credit risk?" *American Economic Journal: Macroeconomics*, vol 3, pp 75–103.

Na, S, S Schmitt-Grohe, M Uribe and V Yue (2018): "The twin Ds: optimal default and devaluation", *American Economic Review*, vol 108, pp 1773–819.

Reinhart, C (2002): "Default, currency crises, and sovereign credit ratings", *World Bank Economic Review*, vol 16, pp 151–70.