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THE DEVELOPMENT OF LOCAL CURRENCY BOND MARKETS AND UNCOVERED INTEREST RATE PARITY

Cyn-Young Park and Kwanho Shin

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ABSTRACT

This paper investigates whether the uncovered interest parity (UIP) will hold more firmly if the local currency bond markets (LCBMs) are more developed, and the presence of nonbank financial institutions (NBFIs) is expanded. Deviations in UIP decrease as LCBMs develop, while the patterns of the UIP premium in emerging markets increasingly resemble patterns in advanced economies. Capital flows respond more sensitively to the UIP premium for emerging markets when LCBMs are more developed. These suggest the development of LCBMs and NBFIs might induce more active cross-border carry trades and reduce UIP deviations. However, greater carry trade positions may increase a country's exposure to market disruptions and exchange rate volatility. Empirical results show that gross portfolio debt inflows increase (decrease) when the exchange rate appreciates (depreciates). While LCBMs becoming more developed can mitigate the negative effect of the original sin redux hypothesis in advanced economies, this aggravates the impact of exchange rate depreciation in emerging markets.

Keywords: uncovered interest parity, local currency bond markets, emerging economies, nonbank financial institutions, capital inflows

JEL codes: E44, F34, F62, G12, G21, G23

1. INTRODUCTION

The United States (US) Federal Reserve raised its policy rates in March 2022 for the first time since 2018. The pace of interest rate hikes has accelerated since then and will likely push the US interest rate higher than in most advanced economies and some emerging market economies. A rise in the US interest rate (which, all things equal, increases interest rate differentials between the domestic and foreign interest rates) attracts capital to the US and leads to concurrent depreciation pressure on the local currency exchanged for US dollars (and therefore an expectation of future appreciation). This positive comovement between the interest rate differential and the exchange rate can be explained by the uncovered interest parity (UIP).¹

An interest rate differential between two countries must be offset by a change in the expected exchange rate in conditions where the UIP condition prevails. This is because excess returns cannot be gained by shifting one's investment from a low-yielding currency to a high-yielding currency if markets are efficient and investors are risk-neutral. That said, while the UIP condition is theoretically sound, it does not hold well empirically. An influential paper from Fama in 1984 found a negative relationship between interest rate differentials and exchange rate movements, contrary to the theoretical prediction. Since then, a large body of financial literature has empirically tested the UIP hypothesis and reached similar conclusions that the UIP fails to hold.² The rejection of the UIP condition has been dubbed either the Fama puzzle or the UIP puzzle. As this also implies that forward rates do not provide an unbiased predictor of the future spot rates, creating forward premium, it has also been called the forward premium puzzle or the unbiasedness puzzle.

The empirical failure of the UIP casts doubt on the efficient market hypothesis, which is a cornerstone of the modern financial theory and asset pricing models. That is, the UIP condition should hold in an efficient market that reflects all available information based on the fundamental assumption that investors are risk-neutral and act in line with rational expectations (Taylor 1995). Thus, the UIP condition is a joint hypothesis and a rejection of it would imply either market participants are irrational in expectation or risk-averse (requiring a risk premium), or both. Other studies have attributed the failure of the UIP to market shocks, market inefficiency, time-varying volatility, and various other risks. Bacchetta (2013) provides a review of the theoretical explanations of the forward premium puzzle.

¹ This statement is confirmed by Figure 1 that will be explained in Section 2.

² See Engle (2014) for a comprehensive literature survey.

Carry trade is a trading strategy to take advantage of such UIP deviations by borrowing in lower-yielding currencies to lend in higher-yielding currencies. Carry trade will be profitable as long as the higher-yielding currency does not depreciate as much as interest rate differential, thereby generating excess return. As the volume of carry trade increases, the arbitrage opportunity disappears and the UIP condition should hold. However, earlier studies noted that the opportunity for exchange-rate speculation with the carry trade is infrequent due to transaction costs or market frictions, and even when it does happen, the volume of speculative funds may not be sufficient to ensure the UIP condition (Froot and Thaler 1990; Bacchetta and van Wincoop 2007, 2010). Bacchetta and van Wincoop (2010) show that infrequent portfolio decisions lead to a delayed impact of interest rate shocks on exchange rates, allowing UIP deviations to persist. Others suggest that forecast errors generate UIP deviations (Gourinchas and Tornell 2004; Bacchetta, Mertens, and van Wincoop 2009; Burnside, Eichenbaum, and Rebelo 2011). Imperfect information and learning would produce gradual or delayed adjustments in exchange rates in response to monetary shocks.

However, more recent studies show evidence supporting the UIP condition. In particular, a number of studies find that the UIP holds among advanced economies when forecasts are used for future expected exchange rates (Kalemli-Özcan and Varela 2021). On the other hand, UIP deviations often remain significant and persistent for emerging market economies.

What has changed? As discussed in the earlier literature on the UIP and carry trade, factors affecting market efficiency and risk premium could provide explanations. First, frictions in the foreign exchange market may have lessened, improving market efficiency in advanced economies. Second, investors may have learned about their trading environment and other market conditions, with their knowledge reducing the risk premiums they require. Third, the profitability of the carry trade may have decreased over time, as more investors enter the market and reduce the excess returns that used to prevail. The development of financial markets and institutions may have contributed to such improvements in market efficiency and reduction in risk premiums in many ways.

In this context, we would like to test if the rise of local currency bond markets (LCBMs) and nonbank financial institutions (NBFIs) in advanced and emerging market economies influences the UIP condition. While LCBMs are less developed in emerging market economies, the size of LCBMs has been increasing rapidly, reaching 72% of gross domestic product (GDP) in 2020 (Park 2016, Park et al. 2021). LCBMs offer more carry trade opportunities for foreign investors in emerging economies. The participation of NBFIs in carry trade can also reduce risk premium, inducing UIP to hold more firmly.

We find that as the LCBMs develop and the NBFIs expand, the UIP condition holds more tightly even in emerging economies. We also find that the dynamics of the UIP premium in emerging economy LCBMs now show similar patterns to those of developed countries. In addition, deviation of the UIP condition decreases as LCBMs develop. Since the UIP premium implies that investing in the local currency produces an excess return, capital flows should respond. We find that capital inflows increase as the UIP premium rises in advanced economies. However, in emerging economies, only when the size of the LCBMs is large, does the UIP premium have a positive effect on capital inflows.

These findings, however, do not necessarily imply that emerging market economies with more developed LCBMs are less vulnerable to large depreciations of the local currency. We find strong evidence of the so-called original sin redux, as described by Carstens and Shin (2019), in both advanced and emerging economies. In other words, we find that capital outflows increase from countries whose currency depreciations are larger. While a larger size of LCBMs mitigates the negative effects of the original sin redux hypothesis in advanced economies, it aggravates the impact of actual exchange rate depreciation in emerging economies.

The rest of the paper is organized as follows. Section 2 explains the data we use in the paper. Section 3 reports our main empirical findings. Section 4 concludes.

2. DATA

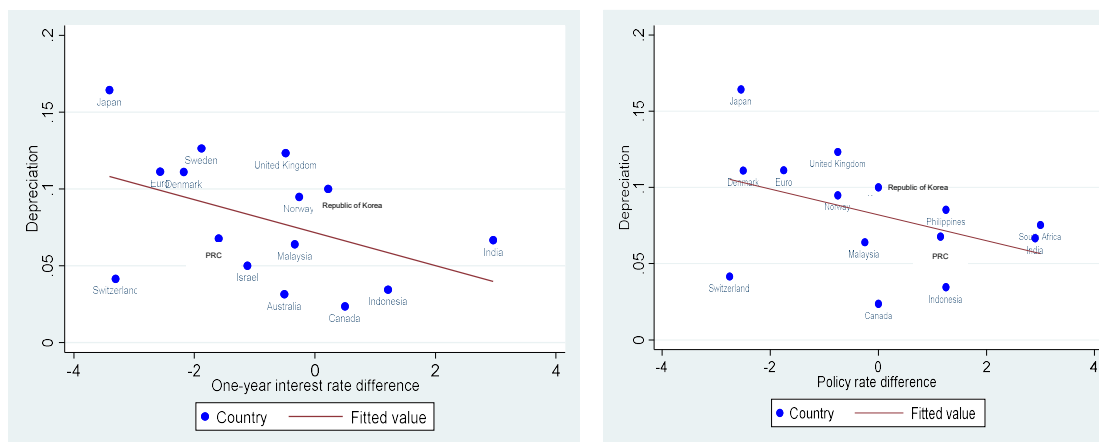
We collect monthly data for 11 advanced economies and 8 emerging market economies.³ The advanced economies include the euro area as a whole and Australia, Canada, Denmark, Israel, Japan, New Zealand, Norway, Sweden, Switzerland, and the United Kingdom. The emerging market economies include India, Indonesia, Malaysia, the People's Republic of China (PRC), the Philippines, the Republic of Korea, South Africa, and Thailand. The sample period is from January 1996 to April 2022 for monthly data and first quarter (Q1) of 1996 to Q1 2022 for quarterly data. The starting date, which is the same as used in Kalemli-Özcan and Varela (2021), is chosen because interest rates are available around that time for most countries. For the interest rates, we use 1-year treasury bill rates if they are available. Otherwise, we collect deposit rates of the same maturity.

Figure 1 shows the relationship between the interest rate differential and the exchange

³ The definition and sources of data are explained in Appendix Table A1.

rate adjustment. The exchange rate depreciation from January 2022 to August 2022 is represented by the vertical axis. In the upper panel, the horizontal axis represents the interest rate differential between each country and the US. In the lower panel, the horizontal axis is the same interest rate differential based on policy rates. In both panels, we clearly see the negative relationship between the interest rate differential and the exchange rate depreciation. In other words, the lower the interest rate of the currency compared to the US interest rate, the more depreciated the currency. Note that Japanese yen is most depreciated during the period, even though it is sometimes considered as a safe haven. Emerging market economies such as India and Indonesia have among the least depreciated currencies because they maintain high interest rates. This figure clearly shows a possibility that the UIP condition may explain well the recent changes in exchange rates even when emerging market economies are included.

Figure 1. Interest Rate Differentials and Exchange Rate Depreciations, January–August 2022



PRC = People's Republic of China.

Note: The x-axis represents the difference in 1-year interest rates of treasury bills (upper pane) and policy rates (lower panel) between each country and the United States in August 2022. For Switzerland, we use the policy rate in July since the August value is not available. The y-axis is the depreciation rate of the exchange rate from January 2022 to August 2022. We use monthly average values.

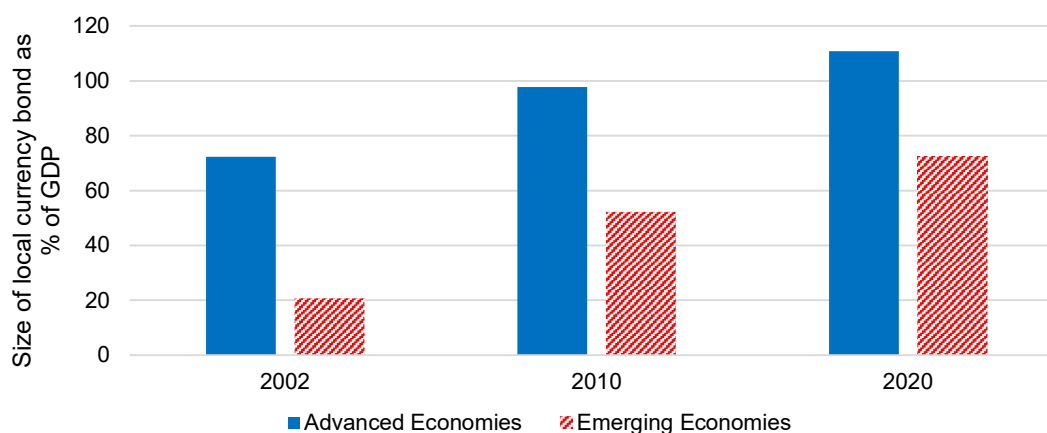
Source: Authors' calculations.

Following the recent studies, we use the exchange rate forecasts rather than the realized exchange rates and test if the Fama puzzle still exists. The exchange rate forecasts are collected from Consensus Economics. The survey is conducted monthly to provide information

on the exchange rate forecasts at 3 months, 12 months, and 24 months horizons.⁴ The survey interviews most global banks and investors that participate in the foreign exchange trade. For example, the global agents include Barclays, Bank of America, Citigroup, Deutsche Bank, Fitch Ratings, HSBC, JP Morgan, Moody's Analytics, and Standard and Poor's (S&P) Global Ratings for forecasts of the pound sterling. For advanced economies, on average, more than 50 global agents are interviewed.

The size of LCBMs is calculated by the sum of domestic debt securities and international debt securities denominated in local currency. This approach is also used among others, by Bae (2012), Burger and Francis (2006) and Park et al. (2021). Figure 2 presents the size of LCBMs as a percentage of GDP for advanced and emerging market economies in 2002, 2010, and 2020. In 2002, the size of LCBMs in advanced economies (72.4%) is three times larger than that of emerging market economies (20.8%). However, by 2020, the gap has narrowed to less than double (110.9% vs. 72.3%). The reason for the smaller gap is that emerging market countries have made great efforts to develop their LCBMs. In Figure 3, we present the size of NBFIs in both advanced and emerging markets economies in the same years. While not as dramatic as the LCBMs, we can see that NBFIs in emerging economies have also grown rapidly.

Figure 2. Growth of Local Currency Bond Markets in Advanced and Emerging Economies



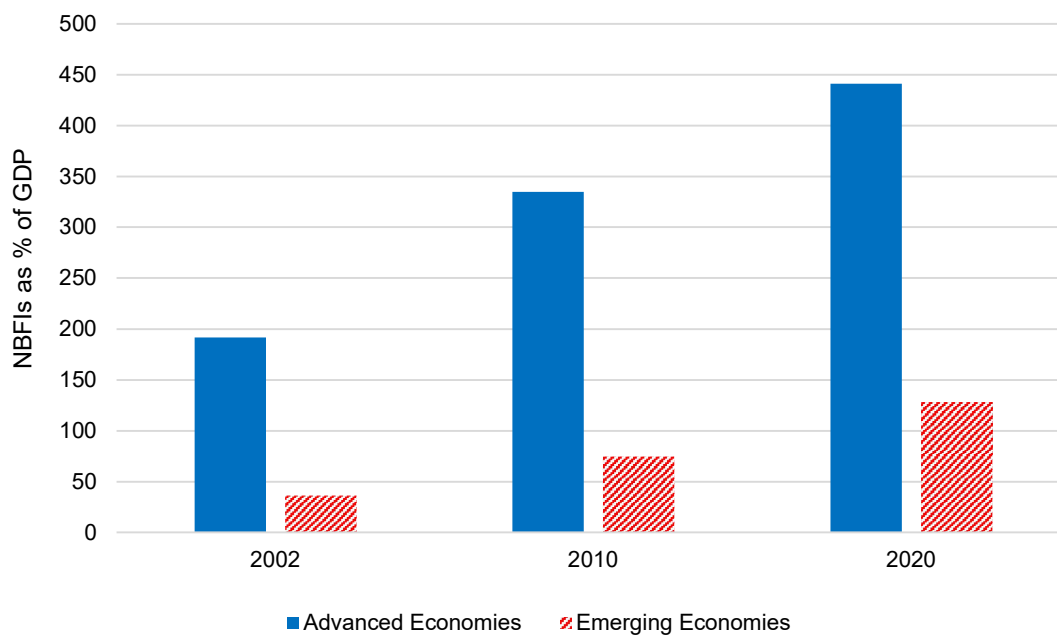
GDP = gross domestic product.

Note: The size of local currency bond market is calculated by the sum of domestic debt securities and international debt securities denominated in local currency, collected from the Bank for International Settlements debt securities database. Advanced economies include Australia, Canada, Denmark, the euro area, Israel, Japan, New Zealand, Norway, Sweden, Switzerland, and the United Kingdom. Emerging economies include India, Indonesia, Malaysia, the People's Republic of China, the Philippines, the Republic of Korea, South Africa, and Thailand.

Source: Authors' calculations.

⁴ While our study uses forecasts at 12-month horizon, our results are qualitatively the same if the 3-month horizon is used.

**Figure 3. Growth of Nonbank Financial Institutions
in Advanced and Emerging Economies**



GDP = gross domestic product, NBFi = nonbank financial institution.

Note: NBFIs is measured as total assets of nonbank financial intermediation, collected from Global Monitoring Report on nonbank financial intermediation. Advanced economies include Australia, Canada, Denmark, Israel, Japan, euro area, New Zealand, Norway, Sweden, Switzerland, and the United Kingdom and emerging economies include India, Indonesia, Malaysia, the People's Republic of China, the Philippines, the Republic of Korea, South Africa, and Thailand.

Source: Authors' calculations.

Capital flows are collected from the balance of payments of the International Monetary Fund (IMF). Total gross capital inflows are categorized into gross foreign direct investments (FDIs), gross portfolio equity inflows, gross portfolio debt inflows, and other capital flows. FDIs are excluded because they are known to be stable regardless of financial conditions. In many countries, since other capital flows mostly capture bank borrowings, we will refer to them as bank borrowings.

3. EMPIRICAL FINDINGS

The UIP condition between a country and the US is represented as follows:

$$E_t(S_{t+h})(1 + i_t^{US}) = S_t(1 + i_t) \quad (1)$$

where S_t is the exchange rate in units of local currency per US dollar at time t , and i_t and i_t^{US} are the interest rate of the country concerned and the US at time t , respectively. E_t denotes expectations over the horizon h conditional on the information at time t . Equation (1) is converted in log terms with lower cases as follows:

$$s_{t+h}^e - s_t = i_t - i_t^{US} \quad (2)$$

where the superscript e denotes expectations. Equation (2) indicates that if we regress changes in exchange rate, $s_{t+h}^e - s_t$, on the interest rate differential, $i_t - i_t^{US}$, the coefficient should be equal to 1. In other words, the interest rate differential should be exactly offset by depreciation of the local currency. Assuming rational expectations, Fama (1984) and Hansen and Hodrick (1980) use the realized exchange rate at $t + h$ as s_{t+h}^e and find that the coefficient is even negative. The local currency appreciates rather than depreciates, further reinforcing the excess return caused by the interest rate differential—hence the Fama puzzle.

Table 1 reports the Fama regression results using the realized values of the future exchange rate for the whole sample, the advanced economies sample, and the emerging economies sample. We use monthly data, and the horizon of the expectations is 12 months. All regressions include a constant term and time dummies for which the coefficients are not reported. For the panel regression, we include country fixed effects. The upper panel reports the results for the whole sample period from first month (m1) of 1996 to m4 2022. Interestingly, at least for the ordinary least squares (OLS) regression results, the Fama puzzle disappears in the sense that the coefficients are positive and statistically significant. The panel regression results generate a negative coefficient for the whole country sample, consistent with the Fama puzzle—but it is not statistically significant. For the sample of advanced economies, both OLS and panel regression results show that the coefficient is positive and statistically significant. While the Fama puzzle disappears in the sense that the coefficient is positive, it is different from 1 with statistical significance in both OLS and panel regressions. On the other hand, for the emerging market economies sample, the coefficient of the panel regression is negative, large, and statistically significant. Hence the Fama puzzle is more severe in emerging economies.

Table 1. Fama Regression Using the Realized Values**Panel A: Whole sample period from m1 1996 to m4 2022**

	Whole economies		Advanced economies		Emerging economies	
	OLS	Panel	OLS	Panel	OLS	Panel
Interest rate differential	0.34*** (0.10)	-0.18 (0.18)	0.28*** (0.08)	0.44*** (0.11)	0.22* (0.12)	-0.52* (0.25)
Time dummies	YES	YES	YES	YES	YES	YES
R-squared	0.43	0.44	0.63	0.63	0.46	0.48
Observations	5,410	5,410	3,137	3,137	2,273	2,273

Panel B: Sample period 1 from m1 1996 to m12 2007

	Whole economies		Advanced economies		Emerging economies	
	OLS	Panel	OLS	Panel	OLS	Panel
Interest rate differential	0.34** (0.14)	-0.61*** (0.19)	0.22** (0.09)	0.01 (0.21)	0.17 (0.15)	-1.00*** (0.25)
Time dummies	YES	YES	YES	YES	YES	YES
R-squared	0.38	0.40	0.62	0.62	0.45	0.49
Observations	2,375	2,375	1,382	1,382	993	993

Panel C: Sample period 2 from m1 2013 to m12 2019

	Whole economies		Advanced economies		Emerging economies	
	OLS	Panel	OLS	Panel	OLS	Panel
Interest rate differential	0.28*** (0.07)	-1.96*** (0.60)	0.72*** (0.18)	1.06 (1.55)	0.45*** (0.09)	-2.76*** (0.69)
Time dummies	YES	YES	YES	YES	YES	YES
R-squared	0.45	0.50	0.62	0.65	0.43	0.52
Observations	3,035	3,035	1,755	1,755	1,280	1,280

OLS = ordinary least square.

Note: The dependent variable is 1-year change in the exchange rate. Following Fama (1984) and Hansen and Hodrick (1980), we use the realized value for future exchange rate. For panel regression, we add country fixed effects. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are robust (OLS) and cluster-robust (Panel) standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively. Removing the period of the global financial crisis (Q1 2008 to Q4 2008) from sample period 2 generates qualitatively similar results.

Source: Authors' calculations.

We divide the whole sample into two subperiods: sample period 1 (m1 1996 to m12 2007) and sample period 2 (m1 2013 to m12 2019).⁵ In the middle panel, we report the regression results for period 1. For the whole economies, while the OLS results are similar to those for the whole sample period, the coefficient of the panel regression is negative and highly statistically significant, confirming the Fama puzzle. If we restrict the country sample to advanced economies, again the OLS results are similar, but the estimated coefficient of the

⁵ We remove the period of the global financial crisis (m1 2008 to m12 2012) and the pandemic period (m1 2020 to m4 2022) from sample period 2.

panel regression is positive and statistically insignificant. For the emerging countries sample, while the estimated coefficient of the OLS regression is not statistically significant, the coefficient of the panel regression is negative, large, and highly statistically significant. Again, in sample period 1, the Fama puzzle is more severe in emerging economies. In the lower panel, we report the regression results for sample period 2. For this period, the coefficient of the advanced economies is very large and the hypothesis that it is equal to 1 is not rejected in both OLS and panel regressions. However, the evidence is mixed in emerging economies. While the coefficient from the OLS regression is larger and statistically significant, the coefficient from the panel regression is negative, even larger, and statistically significant. Hence in period 2, while the Fama puzzle disappears in advanced economies, it is almost as severe as before in emerging economies.

Following the recent literature that uses forecasts of the future exchange rates, we report the same Fama regression results, but with forecasts, in Table 2.⁶ The forecasts of the exchange rate 12-months ahead is collected from the consensus economics. The upper panel shows that, confirming the recent literature, at least for the advanced economies, the coefficient of the panel regression is close to 1, consistent with the UIP condition. For the panel regression, the hypothesis that it is equal to 1 is not rejected. Even the coefficient of the OLS regression is 0.69, not very far from 1. On the other hand, for emerging economies, the coefficient is close to zero, rejecting the UIP condition. If we divide the sample period, for the advanced economies, as far as the panel regression is concerned, the hypothesis that it is equal to 1 is not rejected in both periods 1 and 2. On the other hand, for emerging economies, while not precisely estimated, the coefficient from the panel regression is much larger in period 2 than in period 1, suggesting that the Fama puzzle may be less severe in period 2.

Table 2. Fama Regression Using Forecast Values

Panel A. Whole sample period from m1 1996 to m4 2022

	Whole economies		Advanced economies		Emerging economies	
	OLS	Panel	OLS	Panel	OLS	Panel
Interest rate differential	0.21*** (0.03)	0.24 (0.16)	0.68*** (0.05)	1.07*** (0.23)	0.10** (0.04)	-0.06 (0.07)
Time dummies	YES	YES	YES	YES	YES	YES
R-squared	0.26	0.28	0.53	0.61	0.31	0.34
Observations	5611	5611	3248	3248	2363	2363

⁶ Following the seminal paper of Frankel and Froot (1989), Bussiere et al. (2018) and Kalemli-Özcan and Varela (2021) use forecasts of the exchange rate from survey data to test the Fama puzzle. While forecasts of exchange rate changes are regressed on the forward premium in the first paper, they are regressed on the interest rate differential in the last two papers. If covered interest differentials are zero, the two approaches are identical. These papers generally find that unlike the realized exchange rates, the forecasts behave quite consistently with the UIP.

Panel B. Sample period 1 from m1 1996 to m12 2007

	Whole economies		Advanced economies		Emerging economies	
	OLS	Panel	OLS	Panel	OLS	Panel
Interest rate differential	0.30*** (0.04)	0.15 (0.12)	0.75*** (0.06)	0.93** (0.38)	0.08* (0.05)	-0.01 (0.07)
Time dummies	YES	YES	YES	YES	YES	YES
R-squared	0.24	0.24	0.44	0.47	0.19	0.24
Observations	2,356	2,356	1,363	1,363	993	993

Panel C. Sample period 2 from m1 2013 to m12 2019

	Whole economies		Advanced economies		Emerging economies	
	OLS	Panel	OLS	Panel	OLS	Panel
Interest rate differential	0.09*** (0.03)	0.70 (0.55)	0.78*** (0.08)	1.28** (0.55)	0.00 (0.04)	0.37 (0.24)
Time dummies	YES	YES	YES	YES	YES	YES
R-squared	0.32	0.42	0.54	0.70	0.54	0.57
Observations	1,596	1,596	924	924	672	672

OLS = ordinary least square.

Note: The dependent variable is 1-year change in the exchange rate. For the future exchange rate, we use the expected exchange rate from Consensus Forecast surveys. For panel regression, we add country fixed effects. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are robust (OLS) and cluster-robust (Panel) standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively. Removing the period of the global financial crisis (m1 2008 to m12 2009) from sample period 2 generates qualitatively similar results.

Source: Authors' calculations.

In order to investigate further differences between advanced and emerging economies, Kalemli-Özcan and Varela (2021) decompose the UIP premium into two components and how their relationships with the UIP premium differ across advanced and emerging economies. The UIP premium, λ_{t+h}^e over the expectation horizon of h , is defined as a deviation of the UIP condition in logs, as follows:

$$\lambda_{t+h}^e = (i_t - i_t^{US}) + (s_t - s_{t+h}^e) \quad (3)$$

The first term is the interest rate (IR) differential, and the second term is the exchange rate (ER) adjustment. If the UIP condition holds, then the UIP premium is zero, i.e., $\lambda_{t+h}^e = 0$. If $\lambda_{t+h}^e > 0$, investing in the country concerned generates excess returns. Kalemli-Özcan and Varela (2021) argue that while the comovement of the UIP premium and global risk perception (VIX) is explained by the comovement of the VIX with the IR differential in emerging economies, this comovement is explained by the comovement of the VIX with the ER adjustment in

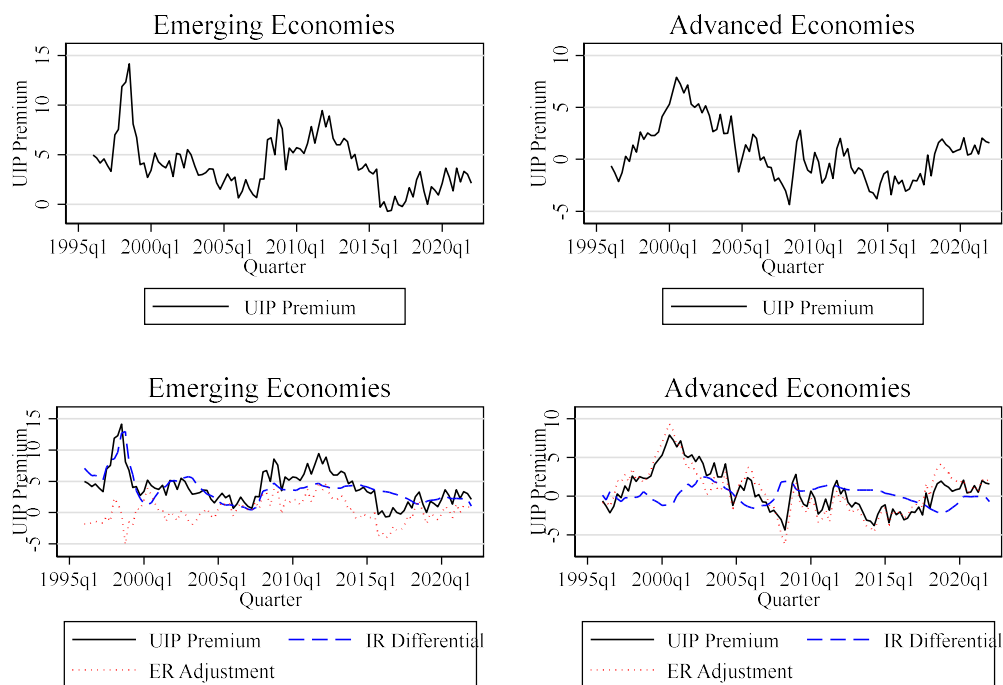
advanced economies. This makes the correlation between the UIP premium and the ER adjustment is higher in advanced economies than in emerging economies. On the other hand, the opposite is true for the correlation between the UIP premium and the IR differential.

Figure 4 is a replication of Figure 1 in Kalemli-Özcan and Varela (2021). While they use monthly data, we convert monthly data into quarterly data by taking quarterly averages. The reason for using quarterly data is that capital flows and the size of local currency bond markets that will be used as main explanatory variables later are available only at the quarterly frequency.⁷ In the upper panel, we present the UIP premium in emerging market and advanced economies. In emerging market economies, it mostly moves in the range greater than zero, which suggests that the UIP condition does not hold. However, a negative trend is observed, and the UIP premium is getting closer to zero over the recent period. On the other hand, in advanced economies, it fluctuates around zero (especially since the mid-1990s), indicating that the UIP condition holds on average.

In the lower panel, we present the movement of the UIP premium along with its two components. As stressed by Kalemli-Özcan and Varela (2021), in advanced economies, the UIP premium comoves closely with the ER adjustment. Even at the quarterly frequency, the correlation is also quite high at 0.92. On the other hand, the movements in the IR differential contribute little to the movement of the UIP premium. The correlation between them is -0.01 . This relationship is reversed in emerging economies. While not as dramatic as in Kalemli-Özcan and Varela (2021), the movement of the UIP premium is better explained by that of the IR differential. While the correlation between the UIP premium with the IR differential is 0.70, its correlation with the ER adjustment is 0.53. Again, however, we notice that this correlation pattern changes over time in emerging market economies: while the UIP premium moves very closely with the IR difference in the earlier period, it moves more closely with the ER adjustment in the latter period. Confirming the eyeballing econometric observation, in emerging market economies, the correlation between the UIP premium and the IR difference (0.84) is much larger than that between the UIP premium and the ER adjustment (-0.04) in period 1 (Q1 1996 to Q4 2007), but the former (0.53) is lower than the latter (0.88) in period 2 (Q1 2013 to Q4 2019). This finding suggests that the movement of the UIP premium in emerging market economies has become more similar to that for advanced economies in recent periods.

⁷ Kalemli-Özcan and Varela (2021) interpolate quarterly capital flows to get monthly flows using a cubic spline built in Stata. This methodology imports quarterly flows into the median month of the corresponding quarter (for example, the first quarter value is imported into February, the second quarter into May and so on), and the interpolation fills remaining empty months. At the same time, they use one month lagged value when capital flows are used as an explanatory variable. However, this procedure does not resolve the endogeneity issue, because the generated monthly values are likely to be highly serially correlated at least in the quarterly window.

Figure 4. Evolution of the Uncovered Interest Parity Premium in Advanced and Emerging Economies



ER = exchange rate, IR = interest rate = UIP = uncovered interest parity.

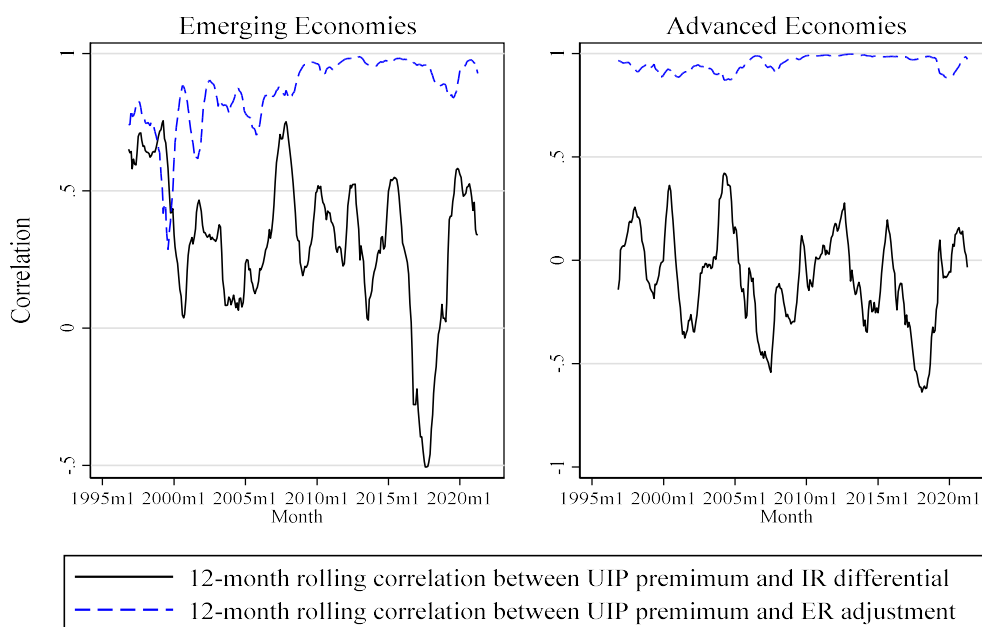
Note: Following Kalemli-Özcan and Varela (2021), the UIP premium in logs is defined as the sum of the IR differential and the expected ER adjustment measured by using expected exchange rate changes from Consensus Forecast surveys. The figures show the evolution of these three variables for 8 emerging countries and 11 advanced economies over Q1 1996 to Q1 2022. We calculated the UIP premium, the IR differential and the ER adjustment in monthly frequency and used quarterly averages.

Source: Authors' calculations.

In order to track this changing pattern of the correlation, in Figure 5, we present 12-month rolling correlations between the UIP premium and the IR differential/the ER adjustment in emerging market economies (left) and in advanced economies (right). For the figure, we use monthly data to increase the number of observations and calculate, for each month, the correlation from $t - 6$ to $t + 6$. In advanced economies, over the entire period, the rolling correlation between the UIP premium and the IR differential is on average zero and much lower than that between the UIP premium and the ER adjustment. In emerging market economies, the correlation between the UIP premium and the IR differential is close to that between the UIP premium and the ER adjustment in the early period, but the gap widens over time. The rolling correlation between the UIP premium and the IR differential is still on average positive but lower than that between the UIP premium and the ER adjustment in the latter period. Again, this changing pattern of the rolling correlation shows that over time, movement

of the UIP premium in emerging economies increasingly resembles that in advanced economies.

Figure 5. Twelve-month Rolling Correlation between the Uncovered Interest Parity Premium and Interest Rate Differential or Expected Exchange Rate Adjustment



ER = exchange rate, IR = interest rate, UIP = uncovered interest parity.

Note: The UIP premium in logs is defined as the sum of the IR differential and the expected ER adjustment. Using monthly data from m1 1996 to m4 2022, we calculate 12-month rolling correlation between the UIP premium and the IR differential or the ER adjustment for each country and calculate the average across emerging economies (left panel) and advanced economies (right panel).

Source: Authors' calculations.

So far, we have seen that the correlations of the UIP premium with its two components, the IR differential and the ER adjustment, are evolving over time, and their features in emerging economies become similar to those in advanced economies. This is especially true when we remove the two crisis periods of the global financial crisis and the COVID-19 pandemic. If this is true, it is worth examining what changes in emerging market economies are driving such changing patterns. One possibility is that these changes are associated with the fast development of LCBM in emerging market economies.⁸ Emerging market economies' efforts to develop LCBMs stem from the lessons learned from the foreign exchange crisis in 1997. As emphasized by Eichengreen and Hausman (1999), emerging market economies could not borrow in their local currencies over the long term. This so-called original sin is widely

⁸ See Park (2016) and Park, Shin, and Tian (2021).

considered as one of the most important sources of financial vulnerability in emerging market economies. If a country's external liabilities are largely denominated in a foreign currency, a sudden depreciation of the local currency will rapidly deteriorate the financial position on the balance sheet, contributing to financial vulnerabilities. In the aftermath of the 1997 crisis, ASEAN+3 countries made efforts to develop LCBMs a top priority. Since these countries' financial systems depend on bank finance, developing LCBMs require a more balanced financial system that expands capital markets and the role of NBFIs. Similar changes have been also made in Latin America and can be seen as a common development in emerging market economies.⁹

Table 3 shows that the development of LCBMs is also closely associated with the expansion of NBFIs. The dependent variable is the size of LCBMs as a percentage of GDP. The size of LCBMs is calculated as the sum of domestic debt securities and international debt securities denominated in local currency. The explanatory variable is total assets of NBFIs as a percentage of GDP. For the panel regression, we add country fixed effects. All regressions include a constant term for which the coefficient is not reported. In parentheses, we report Huber-White robust standard errors for the OLS regression and cluster-robust standard errors for the panel regression. In the OLS regression, the coefficient of NBFIs is all positive and statistically significant at the 1% level. In the panel regression, the coefficient of NBFIs is all positive. Without time dummies, it is statistically significant at the 5% level, but is not precisely estimated if time dummies are added.

Table 3. Local Currency Bond Markets and Nonbank Financial Institutions

	OLS		Panel	
	(1)	(2)	(3)	(4)
NBFI as % of GDP	0.14*** (0.01)	0.12*** (0.01)	0.21** (0.07)	0.05 (0.08)
Time dummies	NO	YES	NO	YES
R-squared	0.15	0.19	0.40	0.67
Observations	736	736	736	736

GDP = gross domestic product, NBFI = non-bank financial institution, OLS = ordinary least square.

Note: The dependent variable is the size of local currency bond markets as % of GDP. The size of a local currency bond market is the sum of domestic debt securities and international debt securities denominated in local currency. NBFI refers to nonbank financial institutions. For panel regression, we add country fixed effects. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are robust (OLS) and cluster-robust (Panel) standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively.

Source: Authors' calculations.

⁹ See Jeanneau and Tovar (2008) for the development of local currency bond markets in Latin America.

As LCBMs develop, above all, emerging market economies offer better markets for investors to take advantage of arbitrage opportunities arising from IR difference than before, thereby exhibiting more similar dynamics of the UIP premium to that of advanced economies. In Table 4, we test the implication of how the development of LCBMs affects the dynamics of the UIP premium. In Panel A, the dependent variable is the rolling correlation between the UIP premium and the IR differential (columns 1–4) and that between the UIP premium and the ER adjustment (columns 5–8). Since the regression is run with quarterly data, we calculate the quarterly average of the monthly rolling correlations for each quarter. In columns 1 and 2, the OLS regression shows the coefficient of the size of LCBMs is negative and statistically significant. Note that, as emphasized in Figures 4 and 5, a high correlation between the UIP premium and the IR differential is characteristic of emerging market economies.

The regression results show that the more developed LCBMs are, the less is the correlation between the UIP and the IR differential. In column 2, the development of NBFIs also contributes similarly to the low correlation between the UIP premium and the IR differential. However, in the panel regression, both coefficients of LCBMs and NBFIs are not precisely estimated. In all columns (1)–(4), a rise in VIX increases the correlation, which is also a feature in emerging economies, emphasized in Kalemli-Özcan and Varela (2021). In columns (5)–(8), the dependent variable is the correlation between the UIP premium and the ER adjustment. In both OLS and panel regressions, the coefficient of the LCBMs is positive and highly statistically significant. Again, a rise in this correlation is a feature of advanced economies, and our results confirm that the development of LCBMs contributes to the high correlation between the UIP premium and the ER adjustment. In column 2, we also find that the coefficient of NBFIs is positive and statistically significant, which is consistent with our interpretation. Interestingly, the coefficient of the VIX is mostly statistically insignificant, which is also consistent with Kalemli-Özcan and Varela (2021) that shows that a rise in the VIX is not related with the correlation between the UIP premium and the ER adjustment in both advanced and emerging economies.

In Panel B, instead of the UIP premium, we use the VIX and its correlations with the IR differential and the ER adjustment as dependent variables. Kalemli-Özcan and Varela (2021) emphasize that while the high correlation between the UIP premium and the ER adjustment is explained by the high correlation between the UIP premium and global risk perception (VIX) in advanced economies, the high correlation between the UIP premium and the IR differential reflects that VIX closely correlates with the IR differential in emerging economies. In columns (1)–(4), we report the same regression results as in Panel A, but the dependent variable is the rolling correlation of the VIX and the IR differential.

Table 4. The UIP Premium Dynamics and the Role of LCBMs and NBFIs

Panel A. UIP Premium

	Correlation between UIP premium and IR differential				Correlation between UIP premium and ER adjustment			
	OLS		Panel		OLS		Panel	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LCBM as % of GDP	-0.20*** (0.02)	-0.13*** (0.03)	0.02 (0.10)	-0.07 (0.12)	0.06*** (0.01)	0.03*** (0.00)	0.12** (0.05)	0.11** (0.04)
VIX index	18.19*** (3.47)	22.21*** (4.73)	22.12*** (6.73)	24.31** (10.22)	-1.29 (0.84)	2.16** (1.08)	-0.68 (1.42)	2.16 (2.36)
NBFI as % of GDP		-0.07*** (0.01)		0.03 (0.03)		0.01*** (0.00)		-0.01 (0.01)
R-squared	0.07	0.16	0.03	0.04	0.07	0.11	0.04	0.04
Observations	1,572	736	1,572	736	1,572	736	1,572	736

Panel B. Log VIX

	Correlation between log VIX and IR differential				Correlation between log VIX and ER adjustment			
	OLS		Panel		OLS		Panel	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LCBM as % of GDP	-0.05** (0.02)	-0.06** (0.03)	-0.42*** (0.10)	-0.30 (0.20)	-0.06*** (0.02)	-0.12*** (0.03)	0.35*** (0.11)	0.32** (0.13)
VIX index	21.88*** (3.30)	10.64** (4.86)	18.72*** (5.82)	8.85 (9.89)	-2.02 (3.09)	13.35*** (4.17)	1.53 (5.57)	15.92* (7.38)
NBFI as % of GDP		-0.02** (0.01)		-0.04 (0.06)		0.02** (0.01)		0.03 (0.04)
R-squared	0.03	0.02	0.06	0.03	0.01	0.04	0.04	0.06
Observations	1572	736	1572	736	1572	736	1572	736

ER = exchange rate, GDP = gross domestic product, IR = interest rate, LCBM = local currency bond market, NBFI = non-bank financial institution, OLS = ordinary least square, VIX = Chicago Board Options Exchange's CBOE Volatility Index.

Note: The dependent variable is presented in the first row in each panel. For panel regression, we add country fixed effects. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are robust (OLS) and cluster-robust (Panel) standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively.

Source: Authors' calculations.

Again, we find that the coefficient of LCBMs is all negative, and statistically significant in columns (1)–(3), which shows that the correlation between the VIX and the IR differential becomes less pronounced as LCBMs develop, similar to the feature of advanced economies. The coefficient of NBFIs is negative both in columns (2) and (4) and statistically significant in column (4). In columns (5)–(8), we report the regression results when the dependent variable is the correlation between the VIX and the ER adjustment. The results are mixed in the sense that the coefficient of LCBMs is negative and statistically significant in columns (5)–(6), and positive and statistically significant in columns (7)–(8). Hence only the panel regression results are consistent with our interpretation that LCBMs contribute to the efficiency of the financial markets. On the other hand, the coefficient of NBFIs is positive both in columns (6) and (8), and statistically significant in column (6), consistent with our interpretation.

Another important feature of emerging economies, pointed out in the literature, is that the UIP condition does not hold and the UIP premium is on average positive. In Table 5. We test whether the development of LCBMs contributes to lowering the deviation of the UIP condition. The deviation of the UIP condition is measured by the absolute value of the UIP premium and used as a dependent variable.¹¹ In the OLS regression, as explanatory variables, we use LCBMs only in column (1) and both LCBMs and NBFIs in column (2). The coefficient of LCBMs is negative and highly statistically significant in both columns and the coefficient of NBFIs is also negative and highly statistically significant in column (2), which implies that as LCBMs develop and NBFIs expand, the deviation of the UIP condition shrinks.

In the panel regression, the coefficient of LCBMs is negative and statistically significant only when it is included as an explanatory variable, in column (3). However, if LCBMs and NBFIs are simultaneously used as explanatory variables, both coefficients are imprecisely estimated. In columns (1)–(4), the coefficient of the VIX is positive and statistically significant, implying that as global risk increases, the deviation of the UIP condition widens.

¹¹ The UIP premium is almost always positive in emerging economies, but sometimes negative in advanced economies. Since a negative value of the UIP premium also implies a deviation of the UIP condition, we use its absolute value as a dependent variable.

Table 5. The Deviation of the UIP Condition and the Development of LCBMs and NBFIs

	OLS		Panel	
	(1)	(2)	(3)	(4)
LCBM as % of GDP	-0.01*** (0.00)	-0.01*** (0.00)	-0.02* (0.01)	0.00 (0.01)
NBFI as % of GDP		-0.01*** (0.00)		-0.00 (0.00)
VIX index	2.45*** (0.30)	1.82*** (0.39)	2.37*** (0.68)	1.90** (0.66)
R-squared	0.09	0.21	0.07	0.07
Observations	1,617	736	1,617	736

GDP = gross domestic product, LCBM = local currency bond market, NBFI = non-bank financial institution, OLS = ordinary least square, UIP = uncovered interest parity, VIX = Chicago Board Options Exchange's CBOE Volatility Index.

Note: The dependent variable is the absolute value of the UIP premium. VIX and NBFI refer to (stock market) volatility index and total assets of nonbank financial institutions. For panel regression, we add country fixed effects. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are robust (OLS) and cluster-robust (Panel) standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively.

Source: Authors' calculations.

Under normal circumstances, capital flows move to a country where the UIP premium increases. In Table 6, we test this implication for the whole sample in columns (1)–(4), for advanced economies in columns (5)–(8) and for emerging market economies in columns (9)–(12). We divide total gross capital inflows into gross portfolio equity inflows, gross portfolio debt inflows, and gross bank borrowings.¹² In the upper panel (Panel A) of Table 6, we use the UIP premium and the VIX as explanatory variables for which we use one-period lagged values. The dependent variable is capital inflows: gross portfolio equity inflows in columns (1), (5), and (9); gross portfolio debt inflows in columns (2), (6), and (10); gross bank borrowings in columns (3), (7), and (11); and total gross inflows in columns (4), (8), and (12). We report panel regression with country fixed effects only. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets in Table 6 are cluster-robust standard errors.

¹² Since it is well known that capital flows associated with foreign direct investments are not much affected by financial conditions, we did not use them as a dependent variable. Bank borrowings are not separately reported and included in other capital flows. However, since a significant portion of other capital flows is borrowed from banks, in this study, other capital flows will be referred to as bank borrowings.

Table 6. The Impact of the Uncovered Interest Parity Premium on Capital Inflows

Panel A.

	Whole economies				Advanced economies				Emerging economies			
	(1) Equity	(2) Debt	(3) Bank	(4) Total	(5) Equity	(6) Debt	(7) Bank	(8) Total	(9) Equity	(10) Debt	(11) Bank	(12) Total
L.UIP premium	0.00 (0.02)	0.01 (0.02)	0.31** (0.13)	0.41** (0.16)	-0.02 (0.03)	0.00 (0.04)	0.48** (0.20)	0.58** (0.24)	0.04 (0.03)	0.03 (0.02)	0.03 (0.02)	0.12 (0.07)
L.VIX index	0.34 (0.36)	0.01 (0.48)	-5.87*** (1.97)	-6.00*** (2.08)	0.64 (0.55)	-0.03 (0.76)	-8.09** (3.06)	-8.06** (3.22)	-0.17 (0.28)	0.08 (0.34)	-2.19** (0.67)	-2.49*** (0.68)
R-squared	0.00	0.00	0.02	0.02	0.01	0.00	0.03	0.02	0.00	0.00	0.04	0.02
Observations	1715	1696	1725	1696	1053	1053	1059	1053	662	643	666	643

Panel B.

	Whole economies				Advanced economies				Emerging economies			
	(1) Equity	(2) Debt	(3) Bank	(4) Total	(5) Equity	(6) Debt	(7) Bank	(8) Total	(9) Equity	(10) Debt	(11) Bank	(12) Total
L.UIP premium	-0.01 (0.03)	-0.05 (0.04)	0.37 (0.22)	0.26 (0.29)	-0.03 (0.04)	-0.06 (0.06)	0.63* (0.33)	0.51 (0.45)	-0.07* (0.03)	-0.07 (0.04)	0.03 (0.07)	-0.09 (0.08)
L.UIP premium*L.LCBM	0.00 (0.00)	0.001* (0.00)	-0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	0.001*** (0.00)	0.001** (0.00)	0.00 (0.00)	0.003** (0.00)
L. LCBM	-0.01 (0.01)	-0.01 (0.01)	-0.05 (0.04)	-0.09 (0.06)	0.00 (0.01)	-0.01 (0.02)	-0.07 (0.06)	-0.11 (0.08)	-0.03 (0.02)	-0.00 (0.01)	0.00 (0.01)	-0.04** (0.01)
L.VIX index	0.46 (0.40)	0.17 (0.57)	-6.50** (2.52)	-6.80** (2.81)	0.88 (0.57)	-0.05 (0.89)	-9.64** (3.93)	-10.03** (4.40)	-0.12 (0.37)	0.47 (0.49)	-1.61*** (0.30)	-1.63** (0.56)
R-squared	0.01	0.00	0.02	0.03	0.01	0.00	0.03	0.04	0.04	0.01	0.03	0.03
Observations	1496	1477	1498	1477	940	940	942	940	556	537	556	537

Panel C.

	Whole economies				Advanced economies				Emerging economies			
	(1) Equity	(2) Debt	(3) Bank	(4) Total	(5) Equity	(6) Debt	(7) Bank	(8) Total	(9) Equity	(10) Debt	(11) Bank	(12) Total
L.UIP premium	-0.00 (0.05)	-0.02 (0.05)	0.02 (0.15)	0.16 (0.14)	0.05 (0.14)	0.06 (0.11)	-0.74 (0.61)	-0.48 (0.61)	-0.02 (0.05)	0.02 (0.03)	0.15** (0.04)	0.26* (0.10)
L.UIP premium × L.NBFI	-0.00 (0.00)	0.00 (0.00)	0.001* (0.00)	0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)	0.003** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.001*** (0.00)	-0.00 (0.00)
L.NBFI	-0.00 (0.00)	-0.01 (0.01)	-0.04 (0.03)	-0.07* (0.03)	-0.00 (0.00)	-0.01 (0.01)	-0.04 (0.03)	-0.07 (0.04)	-0.01** (0.00)	0.01** (0.00)	0.00 (0.01)	-0.01 (0.01)
L.VIX index	0.27 (0.52)	-0.39 (0.41)	-8.63* (3.91)	-9.93** (4.14)	0.63 (0.72)	-0.41 (0.56)	-13.53* (6.05)	-14.75* (6.28)	-0.24 (0.64)	-0.11 (0.37)	-1.79** (0.46)	-2.36* (1.10)
R-squared	0.01	0.04	0.06	0.09	0.01	0.04	0.07	0.10	0.02	0.03	0.07	0.06
Observations	767	748	767	748	453	453	453	453	314	295	314	295

GDP = gross domestic product, L. = log, LCBM = local currency bond market, NBFI = non-bank financial institution, OLS = ordinary least square, UIP = uncovered interest parity, VIX = Chicago Board Options Exchange's CBOE Volatility Index.

Note: We report panel regression with country fixed effects. The dependent variable is capital inflows: gross portfolio equity inflows in columns (1), (5), and (9); gross portfolio debt inflows in columns (2), (6), and (10); gross bank borrowings in columns (3), (7), and (11) and total gross inflows in columns (4), (8), and (12). UIP refers to uncovered interest parity and VIX to the (stock market) volatility index. LCBM and NBFI refer to the size of local currency bond markets and total assets of nonbank financial institutions as % of GDP. The prefix L denotes that the variable is one period lagged. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are cluster-robust standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively.

Source: Authors' calculations.

For the whole sample, we find that a rise in the UIP premium increases gross bank borrowings in column (3) and total gross capital inflows in column (4), with statistical significance. This is also true for advanced economies in columns (7) and (8). While the coefficient of the UIP premium in columns (2) and (6) are positive but not statistically significant.

Our finding that the coefficient of the UIP premium is statistically significant for bank borrowings but not for gross portfolio debt inflows seems to be closely related to bank borrowings being largely short-term, and therefore more sensitive to a change in the UIP premium. However, a rise in the UIP premium does not induce any type of capital inflows in emerging markets. This may be because an increase in the UIP premium in an emerging economy reflects elevated risk premium in response to a global or domestic shock, discouraging capital from flowing into the country. The coefficient of the VIX is, however, always negative and statistically significant for bank borrowings and total gross capital inflows regardless of whether the economy is advanced or emerging, reflecting that global liquidity shrinks as the VIX increases.

In the middle panel (Panel B), by including the interaction term between the UIP premium and the size of LCBMs as an additional explanatory variable, we investigate if the size of LCBMs affects the relationship between capital inflows and the UIP premium. As expected, the size of LCBMs affects the relationship mainly through gross portfolio debt inflows. For the whole country sample, the coefficient of the interaction term is positive and statistically significant only in column (2), suggesting that the larger the size of the LCBMs, the positive effect of the UIP premium on gross portfolio debt inflows is larger. Interestingly, this effect is driven mostly by emerging market economies. The coefficient is positive for both advanced economies and emerging market economies, but statistically significant only for the latter. In fact, the coefficient of the interaction term is positive and statistically significant in columns (9) and (12). In the lower panel (Panel C), we test the effect of the NBFIs—but the evidence is mixed. The effect of the NBFIs also works mainly through bank borrowings. However, the coefficient of the interaction term between the UIP premium and the NBFIs is positive and statistically significant in column (3) while it is negative and statistically significant in column (11).

As noted, the development of LCBMs was intended to alleviate financial vulnerability from emerging economies' reliance on overseas borrowing. However, increased foreign participation in LCBMs can be another source of financial vulnerability. The high volume of foreign portfolio investment in LCBMs without currency hedging shifts the risk of currency mismatches in emerging markets to the balance sheet risk of global investment firms during

financial turbulence. In the face of high-risk perception, a massive unwinding of carry trades by global portfolio investment firms can trigger a sudden reversal of capital flows from emerging market economies; which Carstens and Shin (2019) dubbed “the original sin redux”. An example is where a sudden currency depreciation lowers the value of assets denominated in local currency on the balance sheets of global investors, pressuring the value-at-risk constraints and thereby driving a flight to safety away from emerging markets.¹³

In Table 7, we test the idea of the original sin redux, by regressing capital inflows on the ER adjustment and the VIX. Note that the ER adjustment is defined in equation (3) using forecasts of the future exchange rate and henceforth can be interpreted as expected adjustment of the exchange rate. Table 7 is organized exactly the same way as in Table 6. In Table 7, we do not find any supporting evidence of the original sin redux in the sense that the coefficient of the expected ER adjustment is mostly statistically insignificant.¹⁴

In Table 8, instead of using the ER adjustment, $s_t - s_{t+h}^e$, we use its one period lagged value which we call the actual ER adjustment, $s_{t-h} - s_t$, as an explanatory variable. Since the original sin redux assumes a situation where a sudden depreciation of the local currency lowers the dollar value of assets in investors’ balance sheets, tightening the value-at-risk constraints, the actual exchange rate changes may be more relevant in testing this. Note that, according to our definition, the actual ER adjustment refers to an appreciation rate of the exchange rate from $t - h$ to t . We set $h = 4$, so that the appreciation rate is the value for four quarters.

Unlike in Table 7, we find strong evidence of the original sin redux in Table 8. In the upper panel (Panel A), the coefficient of the actual ER adjustment in columns (2), (6), and (10), all of which are for gross portfolio debt inflows, is positive and statistically significant at the 1% or 5% level. The positive sign suggests that gross portfolio debt inflows increase (decrease) when the exchange rate appreciates (depreciates), consistent with the implication of the original sin redux. While the coefficient value of advanced economies is larger than that of emerging economies, the implication of the two values is comparable in that exchange rate fluctuations are higher in emerging economies.¹⁵ In emerging economies, the coefficient of the actual ER adjustment is positive and statistically significant even for total gross capital

¹³ The supporting evidence of the original sin redux is found, among others, in Bertaut, Bruno, and Shin (2021) and Park and Shin (2021).

¹⁴ The only exception is that the coefficient of the expected ER adjustment is marginally significant in column (2). However, as explained later, the sign is the opposite to support the original sin redux.

¹⁵ The standard deviation of the actual ER adjustment is 9.86% in advanced economies and 14.3% in emerging economies.

inflows in column (12). The coefficient for bank borrowings is also positive in columns (3), (7), and (11), but statistically insignificant. The coefficient of the VIX is negative and statistically significant in columns (3), (4), (7), (8), (11), and (12).

In the middle panel (Panel B), by including the interaction term between the actual ER adjustment and the size of LCBMs as an additional explanatory variable, we examine if the size of LCBMs affects the degree to which the original sin redux holds. In advanced economies, the coefficient of the interaction term is negative and statistically significant in column (6), suggesting a larger LCBM mitigates the negative effects of the original sin redux. However, the coefficient is positive and statistically significant in columns (9) and (11), raising a possibility that the larger the LCBMs, the stronger the effect of the actual exchange rate in emerging economies.

In addition, we investigate the role of the NBFIs in the lower panel (Panel C). The coefficient of the interaction term between the actual ER adjustment and the NBFIs is positive and statistically significant in columns (7) and (8). This suggests that a large presence of NBFIs aggravates capital outflows from advanced economies when there is a large ER adjustment. The result is supportive of the original sin redux hypothesis. That is, increased participation of NBFIs in cross-border carry trade activities encourages excessive risk-taking and heightens their currency exposures (Eren and Wooldridge 2021). At the time of financial turbulence, NBFIs will attempt to unwind carry trades, which aggravates liquidity shortages and disruptions in dollar funding markets. On the other hand, the coefficient of the interaction term is statistically insignificant in emerging economies. This may be due to the smaller size of NBFIs in emerging economies, implying that their participation in carry trades may still be limited.

Finally, we investigate the role of foreign investors in LCBMs. Since the hypothesis of the original sin redux relies on the change in the balance sheet of foreign investors, we can expect that capital flows are more sensitive to the change in the exchange rate if more foreign investors participate in LCBMs. We can further expect the global shock to have increasing impact as the share of foreign investors in LCBMs rises.

Table 7. The Impact of Expected Exchange Rate Adjustment on Capital Inflows

	Whole economies				Advanced economies				Emerging economies			
	(1) Equity	(2) Debt	(3) Bank	(4) Total	(5) Equity	(6) Debt	(7) Bank	(8) Total	(9) Equity	(10) Debt	(11) Bank	(12) Total
ER adjustment	-0.01 (0.02)	-0.08* (0.04)	0.30 (0.17)	0.31 (0.20)	-0.00 (0.02)	-0.10 (0.06)	0.39 (0.23)	0.40 (0.26)	-0.02 (0.03)	-0.05 (0.04)	0.05 (0.04)	0.05 (0.11)
L.VIX	0.35 (0.33)	0.21 (0.44)	-5.22*** (1.74)	-5.00** (1.90)	0.56 (0.50)	0.20 (0.71)	-7.02** (2.72)	-6.62* (3.00)	0.04 (0.30)	0.19 (0.34)	-2.28** (0.73)	-2.24** (0.79)
R-squared	0.00	0.00	0.02	0.02	0.00	0.00	0.02	0.02	0.00	0.00	0.05	0.02
Observations	1754	1738	1771	1735	1072	1075	1085	1072	682	663	686	663

ER = exchange rate, L. = log, VIX = Chicago Board Options Exchange's CBOE Volatility Index.

Note: We report panel regression with country fixed effects. The dependent variable is capital inflows: gross portfolio equity inflows in columns (1), (5), and (9); gross portfolio debt inflows in columns (2), (6), and (10); gross bank borrowings in columns (3), (7), and (11) and total gross inflows in columns (4), (8), and (12). VIX refers to (stock market) volatility index, respectively. The prefix L denotes that the variable is one period lagged. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are cluster-robust standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively.

Source: Authors' calculations.

Table 8. The Impact of Actual Exchange Rate Adjustment on Capital Inflows**Panel A**

	Whole economies				Advanced economies				Emerging economies			
	(1) Equity	(2) Debt	(3) Bank	(4) Total	(5) Equity	(6) Debt	(7) Bank	(8) Total	(9) Equity	(10) Debt	(11) Bank	(12) Total
Actual ER	0.02 (0.02)	0.21*** (0.07)	0.12 (0.14)	0.29* (0.14)	-0.00 (0.03)	0.26** (0.11)	0.15 (0.26)	0.31 (0.25)	0.05* (0.02)	0.14** (0.05)	0.10 (0.06)	0.28** (0.10)
L.VIX	0.33 (0.33)	-0.06 (0.49)	-4.79** (1.70)	-4.67** (1.89)	0.56 (0.50)	-0.22 (0.81)	-6.50** (2.78)	-6.25* (3.07)	0.01 (0.34)	0.10 (0.38)	-2.21** (0.71)	-2.19** (0.81)
R-squared	0.00	0.04	0.02	0.02	0.00	0.04	0.02	0.02	0.01	0.05	0.06	0.08
Observations	1761	1745	1778	1742	1079	1082	1092	1079	682	663	686	663

Panel B

	Whole economies				Advanced economies				Emerging economies			
	(1) Equity	(2) Debt	(3) Bank	(4) Total	(5) Equity	(6) Debt	(7) Bank	(8) Total	(9) Equity	(10) Debt	(11) Bank	(12) Total
Actual ER	0.06 (0.04)	0.37** (0.16)	0.06 (0.17)	0.46* (0.24)	0.03 (0.06)	0.53** (0.22)	0.11 (0.32)	0.59 (0.39)	-0.01 (0.08)	0.00 (0.12)	-0.03 (0.08)	-0.08 (0.19)
Actual ER × L. LCBM	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.003* (0.00)	0.00 (0.00)	-0.00 (0.00)	0.002* (0.00)	0.00 (0.00)	0.002*** (0.00)	0.01 (0.00)
L.LCBM	-0.01 (0.01)	-0.01 (0.01)	-0.05 (0.04)	-0.09 (0.06)	0.00 (0.01)	-0.01 (0.02)	-0.07 (0.06)	-0.12 (0.08)	-0.02 (0.02)	0.00 (0.00)	0.00 (0.01)	-0.03** (0.01)
L.VIX	0.41 (0.36)	-0.05 (0.59)	-5.63** (2.34)	-6.11** (2.60)	0.81 (0.53)	-0.33 (0.92)	-8.41* (3.75)	-8.95* (4.07)	-0.13 (0.36)	0.42 (0.49)	-1.49*** (0.36)	-1.55* (0.71)
R-squared	0.01	0.05	0.02	0.03	0.01	0.06	0.03	0.04	0.08	0.08	0.06	0.13
Observations	1507	1488	1509	1488	951	951	953	951	556	537	556	537

Panel C

	Whole economies				Advanced economies				Emerging economies			
	(1) Equity	(2) Debt	(3) Bank	(4) Total	(5) Equity	(6) Debt	(7) Bank	(8) Total	(9) Equity	(10) Debt	(11) Bank	(12) Total
Actual ER	0.08 (0.05)	0.12* (0.06)	-0.70 (0.40)	-0.38 (0.40)	-0.07 (0.10)	0.22 (0.22)	-1.60** (0.58)	-1.18 (0.64)	0.12 (0.07)	0.08 (0.04)	0.10 (0.11)	0.27 (0.16)
Actual ER × L.NBFI	-0.001* (0.00)	0.00 (0.00)	0.005* (0.00)	0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	0.01** (0.00)	0.01* (0.00)	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
L.NBFI	-0.00 (0.00)	-0.01 (0.01)	-0.04 (0.03)	-0.06* (0.03)	-0.00 (0.00)	-0.01 (0.01)	-0.05 (0.03)	-0.07* (0.03)	-0.01 (0.00)	0.01** (0.00)	-0.00 (0.01)	-0.01 (0.02)
L.VIX	0.17 (0.47)	-0.42 (0.45)	-8.35** (3.56)	-9.93** (3.97)	0.60 (0.69)	-0.53 (0.73)	-12.42* (5.15)	-14.35* (5.63)	-0.37 (0.62)	-0.05 (0.48)	-1.55** (0.43)	-2.06 (1.18)
R-squared	0.01	0.05	0.09	0.11	0.01	0.06	0.11	0.13	0.11	0.08	0.07	0.13
Observations	770	751	770	751	456	456	456	456	314	295	314	295

ER = exchange rate, L. = log, LCBM = local currency bond market, NBFI = non-bank financial institution, VIX = Chicago Board Options Exchange's CBOE Volatility Index.

Note: We report panel regression with country fixed effects. The dependent variable is capital inflows: gross portfolio equity inflows in columns (1), (5), and (9); gross portfolio debt inflows in columns (2), (6), and (10); gross bank borrowings in columns (3), (7), and (11) and total gross inflows in columns (4), (8), and (12). VIX refers to the (stock market) volatility index. LCBM and NBFI refer to the size of local currency bond markets and total assets of nonbank financial institutions as % of GDP. The prefix L denotes that the variable is one period lagged. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are cluster-robust standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively.

Source: Authors' calculations.

In Table 9, we add two interaction terms between the share of foreign holdings in LCBMs and (i) the actual exchange rate and (ii) the VIX, as explanatory variables.¹⁶ We find that the first interaction term between the foreign share and the actual exchange rate is not statistically significant. However, the second interaction term is statistically significant for bond flows in column (2) and for total gross capital flows in column (4). Our findings suggest that while the original sin redux is not reinforced by the size of the foreign investment share, the effect of the global shock on capital flows increases as the foreign investment share rises.

Table 9. Foreign Shares in Local Currency Bond Markets and Capital Flows

	(1)	(2)	(3)	(4)
Actual ER	0.033 (0.111)	0.046 (0.076)	0.299*** (0.073)	0.393 (0.238)
Actual ER × L.Foreign share of LCBMs	0.003 (0.005)	0.008 (0.008)	-0.006 (0.005)	0.005 (0.018)
L.Foreign share of LCBMs	0.094 (0.100)	-0.486 (0.267)	-0.110 (0.162)	-0.505** (0.194)
L.VIX × L.Foreign share of LCBMs	-0.060 (0.045)	0.194* (0.094)	0.058 (0.056)	0.184* (0.081)
L.VIX	-0.076 (0.631)	-1.014 (0.845)	-2.667* (1.195)	-4.274* (2.011)
R-squared	0.074	0.141	0.072	0.126
Observations	402	402	402	402

ER = exchange rate, L. = log, LCBM = local currency bond market, VIX = Chicago Board Options Exchange's CBOE Volatility Index

Note: We report panel regression with country fixed effects. The dependent variable is capital inflows: gross portfolio equity inflows in column (1); gross portfolio debt inflows in column (2); gross bank borrowings in column (3); and total gross inflows in column (4). VIX refers to the (stock market) volatility index. Foreign share of LCBM refers to the share of foreign investment in local currency bond markets. The prefix L denotes that the variable is one period lagged. All regressions include a constant term for which the coefficient is not reported. Numbers in brackets are cluster-robust standard errors, and ***, ** and * denote the significance levels of 1%, 5%, and 10%, respectively.

Source: Authors' calculations.

¹⁶ The share of foreign holdings in the LCBMs is collected from the Asian Bonds Online. Only the share of foreign holdings in government bonds is available for six Asian countries in our sample and it is used as a proxy for the share of foreign holdings in the LCBMs. Given the importance of government bonds in the LCBMs, the use of this proxy is not expected to generate a large bias.

4. CONCLUSION

The empirical validity of the UIP condition remains a subject of continued research. Earlier studies have attributed the empirical failure of the UIP to a peso problem, self-fulfilling prophecy, and learning under incomplete information. Recent literature, however, noted the profitability of the carry trade isn't well related to conventional risks and can be attributed to market frictions such as bid-ask spreads, price pressure, and time-varying adverse selection (Burnside et al. 2011; Brunnermeier, Nagel, and Pedersen 2008; Burnside, Eichenbaum, and Rebelo 2011). Brunnermeier, Nagel, and Pedersen (2008) also suggest that inadequate carry trade activities might be a reason to reject the UIP condition.

This paper investigates whether the UIP condition will hold more firmly if LCBMs are more developed and NBFIs expanded, both of which would contribute to cross-border carry trade activities. We compare the dynamics of the UIP premium and its two components in advanced and emerging market economies. We find the patterns of the UIP premium in emerging market economies become assimilated with those in advanced economies, as the LCBMs develop. A UIP deviation also decreases as the LCBMs develop. Capital flows to emerging economies respond more sensitively to the UIP premium when their LCBMs are more developed. In emerging economies, a positive effect of the UIP premium on gross portfolio debt inflows increase as the size of the LCBMs increases. Overall, our findings suggest the development of the LCBMs and NBFIs might induce more active cross-border carry trades and lessen UIP deviations.

However, increased carry trades might make advanced and emerging market economies more vulnerable to currency market volatility and disruptions in dollar funding markets. We find strong evidence of the original sin redux in both advanced and emerging economies. Empirical results show that gross portfolio debt inflows increase (decrease) when the exchange rate appreciates (depreciates), consistent with the implication of the original sin redux.

In addition, while a larger size of the LCBMs mitigates the negative effects of the original sin redux hypothesis in advanced economies, it aggravates the impact of actual exchange rate depreciation in emerging market economies. One possible interpretation is that a larger LCBM with perhaps high foreign participation in an emerging market economy further increases the effect of the actual exchange rate on capital outflows from these countries during financial turbulence. Finally, our findings also suggest that a larger NBFIs sector induces larger capital outflows from advanced economies when there is a large ER adjustment, which is supportive of the original sin redux hypothesis.

APPENDIX

Table A1. Definitions of Variables and Data Sources

Variables	Description and Construction	Frequency	Data Source
Spot exchange rate, 1996–2022	USD to local currency; end of period and average	month, quarter, year	IMF IFS
Treasury bill rate, 1996–2022	Annual percentage rate; maturity: 12 months; end of period and average	month, quarter, year	Bloomberg, IMF IFS
Deposit rate, 1996–2022	Annual percentage rate; end of period and average	month, quarter, year	Bloomberg, IMF IFS
Exchange rate forecast, 1996–2022	USD to local currency; forecast horizon: 12 months; end of period	month, quarter, year	Consensus Economics
VIX, 1996–2022	Chicago Board Options Exchange volatility index	month, quarter, year	FRED
GDP, 1996–2022	Local currency, nominal, seasonally-adjusted and non-seasonally-adjusted	quarter, year	IMF IFS
Size of local currency bond market 1996–2022	Size of local currency bond market as % of GDP	quarter, year	BIS debt securities
NBFI, 1996–2022	Total assets of NBFI as % of GDP	year	Global Monitoring Report on Non-Bank Financial Intermediation 2021
Capital inflows by type 1996–2022	Capital accounts by type	quarter, year	IMF IFS
Foreign share	Share of foreign holdings in local currency government bonds	quarter, year	Asian Bonds Online

BIS = Bank for International Settlements, FRED = Federal Reserve Economic Data, GDP = gross domestic product, IFS = International Financial Statistics, IMF = International Monetary Fund, NBFI = nonbank financial intermediation, USD = United States dollar, VIX = Chicago Board Options Exchange's CBOE Volatility Index.

Source: Authors' compilation.

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The Development of Local Currency Bond Markets and Uncovered Interest Rate Parity

The authors conclude that deviations in uncovered interest parity (UIP) decrease as local currency bond markets (LCBMs) develop, while the patterns of the UIP premium in emerging market economies merge with patterns in advanced economies. The paper also finds that while LCBMs becoming more developed can mitigate the negative effect of the original sin redux hypothesis in advanced economies, this aggravates the impact of actual exchange rate depreciation in emerging market economies.

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