

The markets for non-deliverable forwards in Asian currencies¹

Trading in non-deliverable forwards on Asian currencies has grown in recent years. The offshore interest rates implied by these contracts differ significantly from onshore interest rates and suggest upward pressure on most Asian currencies.

JEL classification: F310, G150, G180, N250.

Active, large and growing non-deliverable forward (NDF) markets trade six Asian currencies. These offshore markets form an important part of the global and Asian foreign exchange markets, equilibrating market demand and supply in the presence of capital controls (Ishii et al (2001), Watanabe et al (2002)).

While the NDF markets have at times presented challenges to policymakers, the rise of NDF trading could nevertheless prove beneficial to the development of local currency bond markets in Asia. Monetary authorities naturally regard these offshore speculative trades and their possible cross-border spillovers with suspicion, and the general trend since the 1997–98 crisis has been to further restrict onshore-offshore interactions. However, liquid NDF markets could serve international portfolio investors by affording them an otherwise unavailable means to hedge foreign exchange risk. An ability to hedge currency risk is particularly important for offshore bond investors. Consequently, NDF markets could potentially facilitate foreign investment in Asia's expanding local currency bond markets and thereby add diversity and liquidity to them (Jiang and McCauley (2004)).

This special feature sketches the characteristics of NDF markets in Asia and analyses the market segmentation between onshore interest rates and offshore interest rates implied by NDFs. Characteristics considered include market turnover, liquidity, volatility, market participants and interactions among the Asian NDFs. The analysis focuses on the implications of the changing spread between the onshore interest rate of the home currency and its NDF-implied interest rate offshore.

¹ The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.

Characteristics of Asian NDFs

NDFs are foreign exchange derivative products traded over the counter. The parties of the NDF contract settle the transaction, not by delivering the underlying pair of currencies, but by making a net payment in a convertible currency (typically the US dollar) proportional to the difference between the agreed forward exchange rate and the subsequently realised spot fixing. NDFs are also distinct from deliverable forwards in that NDFs trade outside the direct jurisdiction of the authorities of the corresponding currencies and their pricing need not be constrained by domestic interest rates.

What is an NDF ...

The NDF market offers an alternative hedging tool for foreign investors with local currency exposure or a speculative instrument for them to take positions offshore in the local currency. The use of Asian NDF markets by non-residents in part reflects restrictions on their access to domestic forward markets (Table 1). However, in some cases, such as Korea, onshore players are also important counterparties in the NDF market of the home currency (Hohensee and Lee (2004)). The NDF markets for some Asian currencies have existed at least since the mid-1990s. Tightening of controls after the Asian crisis may have boosted their growth in some cases.

... and what are its uses?

Why these offshore instruments have emerged in the first place can be illustrated by the birth of the Indonesian rupiah NDF in early 2001 (Goeltom (2002), Watanabe et al (2002)). Before January 2001, *deliverable* rupiah forwards were actively traded offshore, mostly in Singapore, and non-residents enjoyed easy access to rupiah funding. To reduce speculative pressure on the rupiah, rupiah loans and transfers by banks to non-residents and related derivative transactions were prohibited or restricted by Bank Indonesia in January 2001. This effectively limited the offshore deliverability of the rupiah and dried up trading in offshore *deliverable* rupiah forwards. To meet the offshore hedging or speculative demand, an offshore market in rupiah NDFs gradually developed over the following months.²

NDFs arise in response to cross-border restrictions

Access to onshore forward markets by non-residents	
Chinese renminbi	No offshore entities participate in onshore markets
Indian rupee	Allowed but subject to underlying transactions requirement
Indonesian rupiah	Allowed but restricted and limited
Korean won	Allowed but subject to underlying transactions requirement
Philippine peso	Allowed but restricted and limited
New Taiwan dollar	Only onshore entities have access to onshore market
Sources: HSBC (2003); national data.	
Table 1	

² A more actively traded Thai baht NDF market could emerge in the future in response to the recent Bank of Thailand measures to limit non-resident holdings of Thai baht bank accounts. There is effectively no Malaysian ringgit NDF market at the moment, despite restrictions on access by foreign investors to the onshore forward market, possibly because of market-makers' concerns over their onshore banking licences. In Asia, there are also non-deliverable options (NDO) markets that trade off the NDFs.

Average daily NDF turnover in Asia					
In millions of US dollars					
Sources of estimates	HSBC (mid-2003)	Deutsche Bank (2003–04)	EMTA (1st quarter 2003)	Lehman Brothers (June 2001)	April 2001 forwards and FX swaps ¹
Chinese renminbi	1,000	50	150	50	55
Indian rupee	100	20–50	38	35	1,628
Indonesian rupiah	100	50	65	50	301
Korean won	500	700–1,000	1,350	500	4,025
Philippine peso	50	20–30	38	35	301
New Taiwan dollar	500	300–500	250	250	922
Asian six total	2,250	1,140–1,680	1,890	920	7,232
<i>As a percentage of April 2001 forwards, FX swaps and NDFs¹</i>	25.1	13–19	20.7	11.3	

¹ Daily turnover of the forwards and FX swaps is based on BIS (2002).

Sources: Leven (2001); HSBC (2003); Emerging Markets Traders Association (2003); Deutsche Bank (2003); Hohensee and Lee (2004); BIS (2002). Table 2

Turnover

Predominance of Asian NDFs globally

Asia's NDF turnover accounts for the overwhelming majority of global NDF turnover. In particular, NDFs in the Korean won, the New Taiwan dollar, the Chinese renminbi, the Indian rupee, the Indonesian rupiah and the Philippine peso amount to some 70% of the emerging market NDF turnover globally, as measured by an Emerging Markets Traders Association survey in early 2003 (EMTA (2003)).³

Korean won NDFs most actively traded

Turnover in the Asian NDF markets varies a great deal across currencies. While reliable, comparable and consistent statistics on NDF turnover are hard to come by, the available survey evidence and estimates by market-makers allow a rough ranking (Table 2). The Korean won NDF market has been the deepest NDF market in Asia as well as globally, with average daily trading volume in excess of \$500 million and representing nearly half of the global emerging market NDF turnover. Turnover in the New Taiwan dollar NDF market has been the second most active in Asia. Given the relatively small amount of foreign investment in local currency bond markets, the high turnover in won and New Taiwan dollar NDFs may reflect the active participation of international investors in the Korean and Taiwanese stock markets, though currency hedging is more characteristic of international bond investors.

Rapid growth in Asian NDF markets

Market participants report that the shallower NDF markets in Asia have generally deepened over the past few years. As recently as three years ago, daily NDF turnover in the Chinese renminbi, Indian rupee, Indonesian rupiah and Philippine peso, respectively, was thought to be less than \$100 million per day on average. The turnover in the renminbi NDF market has been rising

³ The major remaining NDF markets are those in Latin American currencies (mainly the Brazilian real and Chilean peso) and the Russian rouble, according to the same survey.

Bid-ask spreads for Asian NDFs			
In per cent			
	Deutsche Bank estimates ¹	Indicated (6 April 2004) ²	
		One-month contract	One-year contract
Chinese renminbi	–	0.05–0.07	0.12–0.18
Indian rupee	0.11–0.43	0.23	0.46
Indonesian rupiah	1 mth: 0.24; 1 yr: 1.2	0.35	0.82
Korean won	0.25–0.84	0.09–0.12	0.17–0.21
Philippine peso	–	0.18–0.25	0.53–0.60
New Taiwan dollar	0.08–0.14	0.03	0.06

¹ Based on average US dollar spot rates in June 2003. ² Based on NDF bid-ask spreads and spot rates as indicated on Reuters.

Sources: Deutsche Bank (2003); Reuters; authors' estimates. Table 3

rapidly since, to about \$200 million in early 2003. Estimates of renminbi NDF turnover in 2003 vary, and indeed turnover is said to fluctuate a lot from day to day, but it seems to have doubled over the year. Turnover in the rupiah NDF market seems to have increased substantially from the first months of NDF trading in 2001, with increased non-resident investment in local currency bonds, equities and other assets. Indian rupee and Philippine peso NDF trading seems to have gained depth as well.

NDFs form an important part of overall forward trading in regional currencies. For the six Asian currencies being discussed, the reported NDF turnover represents some 10 to 20% of the combined trading volume of the onshore outright forwards, foreign exchange swaps and NDFs.⁴ In the case of China, since domestic trading of outright forwards has only recently begun, and

A substantial part of forward trading in Asia

Volatility of spot, NDF and onshore forward markets			
In per cent			
	Spot	Three-month NDF	12-month NDF
Chinese renminbi	0.04	1.35	2.75
Indian rupee	1.62	3.28	4.07
Indonesian rupiah	13.89	15.10	15.60
Korean won	6.84	6.90	7.06
Philippine peso	5.02	6.87	8.95
New Taiwan dollar	3.11	4.19	4.76
<i>Memo:</i> ¹			
<i>Japanese yen</i>	9.41	9.52	9.23
<i>Euro</i>	10.55	10.54	10.50
<i>Hong Kong dollar</i>	0.01	0.64	0.93

¹ Three- or 12-month deliverable outright forwards. Annualised standard deviation of daily percentage changes. All of the spot rates, forwards and NDFs are those against the US dollar. The data range is from March 2001 to February 2004.

Sources: Bloomberg; CEIC; authors' estimates. Table 4

⁴ The turnover data for outright forwards and foreign exchange swaps are from BIS (2002), while NDF trading volumes are estimates by market-makers (Table 2).

an onshore swap market does not yet exist, renminbi NDFs amount to some 90% of the estimated combined turnover of onshore deliverable forwards and offshore NDFs. Therefore, the importance of NDF markets should not be underestimated, for policymakers and market participants alike.

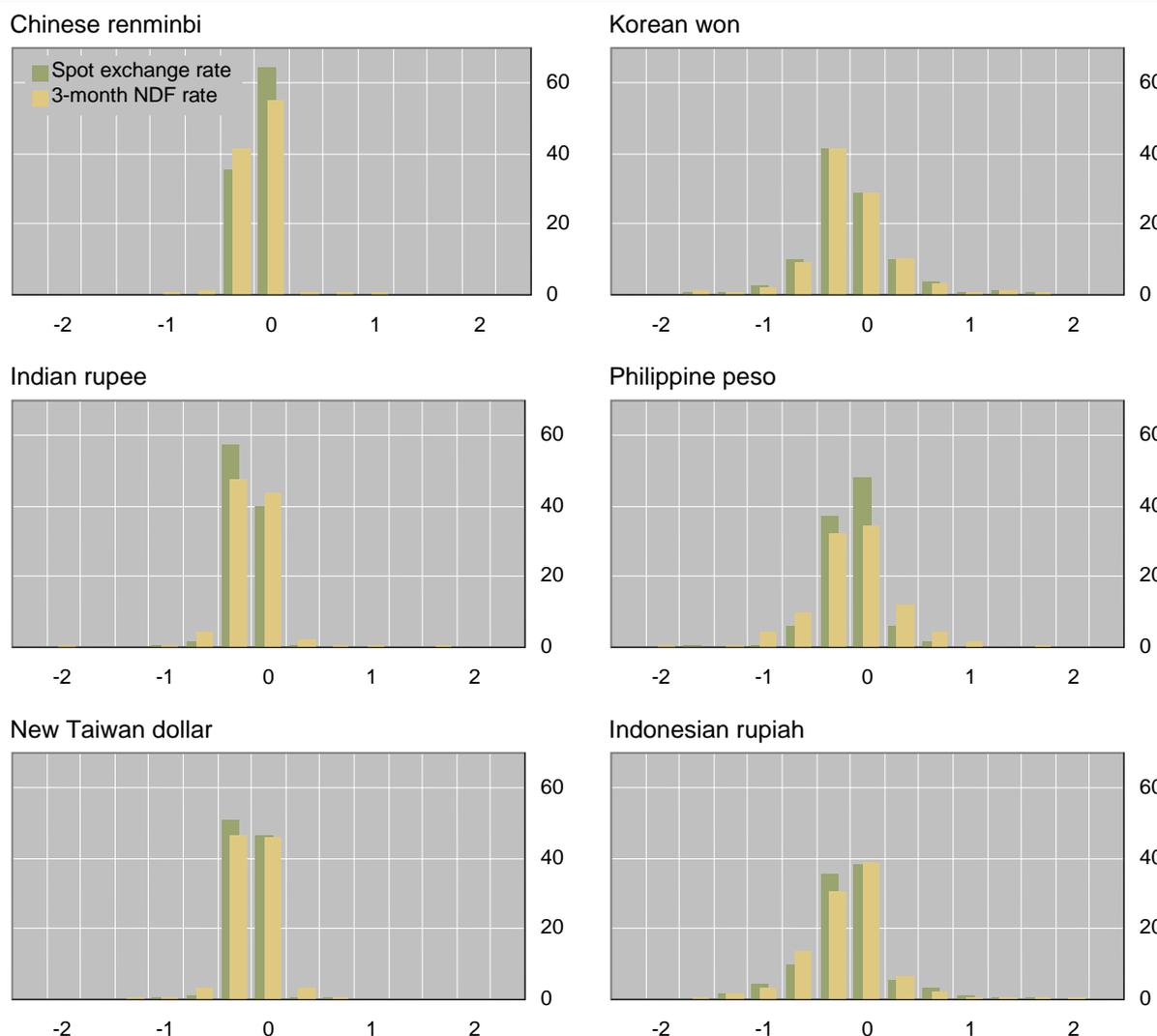
Liquidity

Better liquidity at longer maturities

Liquidity varies with turnover across currencies as well as across maturities (Table 3). Judging by reported bid-ask spreads, the larger and more active NDF markets in Asia – those of the won, the New Taiwan dollar and the renminbi – are comparatively more liquid. The most liquid maturities of the Asian NDFs seem to be much longer than those of the main currency pairs

Frequency distribution of daily percentage changes in spot and three-month NDF-implied US dollar exchange rates

Number of days, January–December 2003



Note: All rates are expressed as domestic currency per US dollar; consequently, positive percentage changes on the horizontal axis denote a depreciation against the dollar.

Sources: Bloomberg; BIS estimates.

Graph 1

globally, where the overwhelming majority of forward transactions span three months or less. In Asian NDF markets, most inter-dealer transactions are concentrated in the two- to six-month maturities, while some bank-customer trades even extend out to two to five years, in part due to the importance of foreign direct investment (FDI) in Asia.

Volatility

For the period under consideration, NDF volatilities have been consistently higher than their spot counterparts for all six Asian currencies covered (Table 4 and Graph 1). This may be due to official intervention in the respective spot markets. Market participants rank the frequency of official spot market intervention as the highest for China and India, followed by the Philippines and Taiwan (China),⁵ and the lowest for Korea and Indonesia. Furthermore, the volatility of the Asian NDFs typically increases with maturity. By contrast, the spot and forward volatilities of the major currency pairs tend to be much more similar.

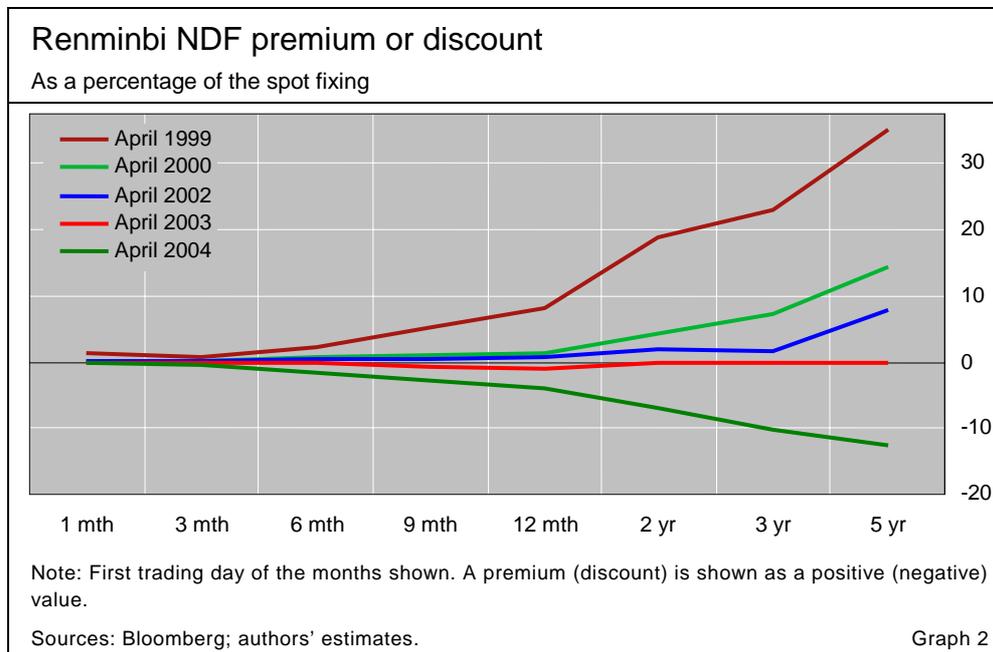
More volatile than spot rates ...

... and at longer maturities

Market participants

The investor base for the Asian NDF markets is generally thought to have become broader compared with five years ago. This base mainly comprises multinational corporations, portfolio investors, hedge funds and proprietary foreign exchange accounts of commercial and investment banks.⁶ Both hedging demand and speculative demand are present in Asian NDF markets.

A broadening investor base



⁵ Hereinafter Taiwan.

⁶ The net NDF positions of the main market participants in Asia vary over time. Market-makers reported that, as of early 2004, non-resident portfolio investors tended to be most short regional currencies while offshore hedge funds were most long regional currencies. In between, multinationals were somewhat short regional currencies, while offshore market-makers and commercial banks took limited open positions. In the case of the won, where local

Correlation matrix for Asian spots and NDFs						
	CNY	INR	IDR	KRW	PHP	TWD
CNY	1	0.061	0.028	0.079	0.016	0.089
INR	<i>0.006</i>	1	0.120	0.162	0.103	0.085
IDR	<i>-0.033</i>	<i>0.068</i>	1	0.216	0.242	0.149
KRW	<i>-0.001</i>	<i>0.131</i>	<i>0.160</i>	1	0.399	0.421
PHP	<i>0.039</i>	<i>0.057</i>	<i>0.203</i>	<i>0.324</i>	1	0.254
TWD	<i>-0.010</i>	<i>0.127</i>	<i>0.170</i>	<i>0.518</i>	<i>0.301</i>	1

Note: CNY = Chinese renminbi; IDR = Indonesian rupiah; INR = Indian rupee; KRW = Korean won; PHP = Philippine peso; TWD = New Taiwan dollar. Correlations for the daily percentage changes of the three-month NDF (upper right-hand side of the matrix) and spot (lower left-hand side of the matrix in italics). March 2001 to February 2004.

Sources: Bloomberg; authors' estimates. Table 5

In the case of the won and the New Taiwan dollar, portfolio investors and hedge funds are probably the most important players. In contrast, in the case of the renminbi, multinationals (given large FDI inflows into China in recent years) and more recently hedge funds (owing to heightened market speculation) probably play a greater role.

Renminbi NDF premia (discounts) larger at longer maturities

Differences in the offshore renminbi forward rates across maturities are said to reflect differences in the preferred maturity habitats of various market participants. The observation is that longer maturities show larger renminbi NDF premia (in the late 1990s) or discounts (recently) (Graph 2). Multinational corporate players probably trade along both short and long maturities, owing to their diverse needs. In contrast, hedge funds' bets reflect market analysts' often refreshed calls for an exchange rate policy change at a horizon of nine months or more. Hence the premia or discounts in the renminbi NDFs have tended to be larger at longer maturities, as speculative players positioned themselves for a possible renminbi devaluation during and after the Asian crisis or a possible revaluation after late 2002.

Correlations between Asian NDFs and major forwards					
	Japanese yen		Euro		
	Three-month	12-month	Three-month	12-month	
CNY	0.059	0.076	-0.062	-0.032	
INR	0.092	0.063	-0.098	-0.097	
IDR	0.120	0.128	-0.011	-0.028	
KRW	0.495	0.506	-0.182	-0.018	
PHP	0.305	0.268	-0.167	-0.150	
TWD	0.347	0.312	-0.260	-0.290	

Note: See Table 5 for an explanation of the currency codes. The correlation of daily percentage changes of the Asian NDF and bilateral dollar forward of the yen (or euro) against the US dollar of the same tenor. March 2001 to February 2004.

Sources: Bloomberg; authors' estimates. Table 6

banks are important counterparties, onshore banks were found to be overwhelmingly long won in the NDF market, accommodating offshore short positions.

Within the Asia-Pacific region, the principal trading locations for Asian NDFs are in Hong Kong SAR, Singapore, Korea, Taiwan and Japan. Singapore is often thought to be the largest hub, according to the incomplete information available in the central bank 2001 triennial global foreign exchange market survey. Outside the region, New York and London are the principal locations for trading Asian NDFs.

NDF trading hubs

Interactions among Asian NDF markets and with other forward markets

The NDFs of the six Asian currencies under consideration have displayed closer co-movements than their spot counterparts (Table 5). In particular, daily percentage changes of the three-month Asian NDFs are all positively correlated with each other and, except for the New Taiwan dollar, exhibit stronger correlations than the respective pairs of spot exchange rates. While the spot correlations between the renminbi and the other five currencies are near zero, their NDF correlations are somewhat higher.

Higher positive correlations among NDFs than among spot rates

A possible common influence underlying the above positive correlations among most Asian NDFs is the yen (Table 6). The euro may also play a role, albeit to a lesser extent, for all but the Indian rupee. All six Asian NDFs have generally strengthened against the US dollar in response to an appreciating yen or euro. The won, Philippine peso and New Taiwan dollar NDFs have shown the greatest co-movement with the yen forwards.

The yen is a possible common influence

Market participants harbour changing notions about the relationship between the renminbi and the Hong Kong dollar, as seen in the time-varying correlations between the respective NDFs and forwards. During and after the 1997-98 Asian crisis, many viewed the liquid Hong Kong dollar as an imperfect proxy for the renminbi, which was still illiquid in NDF trading at the time, on the assumption that a depreciation of the latter would unpeg the former. In 2002 and early 2003, the theme of convergence between a rapidly growing mainland and a mature and deflationary Hong Kong SAR led some to take positions short the Hong Kong dollar forward and long the renminbi NDF, contributing to a negative correlation. All changed in September 2003, however, when the market's interpretation of the call for exchange rate flexibility in the G7 communiqué exerted appreciation pressure on not only the renminbi but also the Hong Kong dollar, resulting in a positive correlation. For the period 2001–04 as a whole, the correlation of the pair is 0.28 for 12-month contracts.

Renminbi NDFs and Hong Kong dollar forwards

Onshore/offshore interest rate spreads

Large and persistent spreads between the onshore yield on the home currency and its NDF-implied offshore yield are found for five of the six Asian currencies covered. Wide spreads suggest that capital controls effectively segment the onshore and offshore markets.⁷ The Korean won stands out as an exception, probably owing to active if not completely unconstrained arbitrage by onshore participants in the offshore won NDF market. Furthermore, the signs of these

⁷ For a review of the literature on cross-border mobility and capital controls, see Frankel (1992).

spreads may also reflect the direction of the underlying market pressure on these currencies in the presence of capital controls. Finally, these spreads have narrowed and become less volatile over recent years.

Construction, interpretation and limitation of onshore spreads

Size of spread
measures
segmentation ...

One way to measure the degree of cross-border market segmentation caused by capital controls is the spread between the onshore interest rate and the NDF-implied offshore interest rate on the home currency (Box 1). Using US dollar Libor, the NDF rate and the bilateral dollar spot rate (of the same maturity and annualised), one may derive the offshore interest rate on the home currency as implied by covered interest parity. This NDF-implied offshore yield on the home currency could be substantially negative, as it is not constrained by the zero lower bound for nominal interest rates. A substantial onshore/offshore yield gap would suggest that capital controls effectively segment onshore and offshore markets.

... and its sign
signals market
pressure

Further, the sign of the onshore/offshore yield spread can signal underlying market pressure on the currency. An onshore interest rate above its offshore NDF-implied counterpart would indicate underlying appreciation pressure on the home currency but effective capital controls limiting capital inflows into the home currency. An onshore rate below its offshore counterpart would indicate depreciation pressure but effective stemming of capital outflows.⁸ Finally, the volatility of the spread may also contain information

Box 1: The spread between onshore yields and NDF-implied offshore yields

In the absence of capital controls, the forward exchange rate of the home currency is linked by arbitrage to its spot rate and the interest rate differential between the home currency and the US dollar through the covered interest parity condition

$$F = S(1+r)/(1+r^{\$})$$

where F is the forward rate, S the spot rate, r the interest rate on the home currency and $r^{\$}$ the US dollar interest rate. When there are no cross-border restrictions, borrowing and lending ensure that the above holds.

However, when capital controls bind, non-residents may not have full access to onshore credit or placements, giving rise to NDFs.

$$NDF = S(1+i)/(1+r^{\$})$$

where i is the NDF-implied yield on the home currency offshore. To the extent that the arbitrage between the onshore money market and offshore NDF market is effectively constrained by capital controls, the NDF-implied offshore interest rate, i , can differ considerably from the interest rate prevailing in the onshore money market, r . A large and persistent onshore/offshore spread ($r - i$) indicates the presence of effective cross-border restrictions.

Another, in principle equivalent, approach is to estimate the implied onshore yield on the home currency using the onshore deliverable forwards and then to compare it to the NDF-implied offshore yield. Alternatively, one may directly compare the onshore deliverable forwards with their NDF counterparts to derive a forward premium spread. The merits of these different approaches depend in part on data availability and market liquidity.

⁸ A zero spread may suggest the absence of effective capital controls, or the absence of market pressure on the home currency, or both.

about the depth of the spot, NDF and onshore money markets, and the ease of transacting across them.

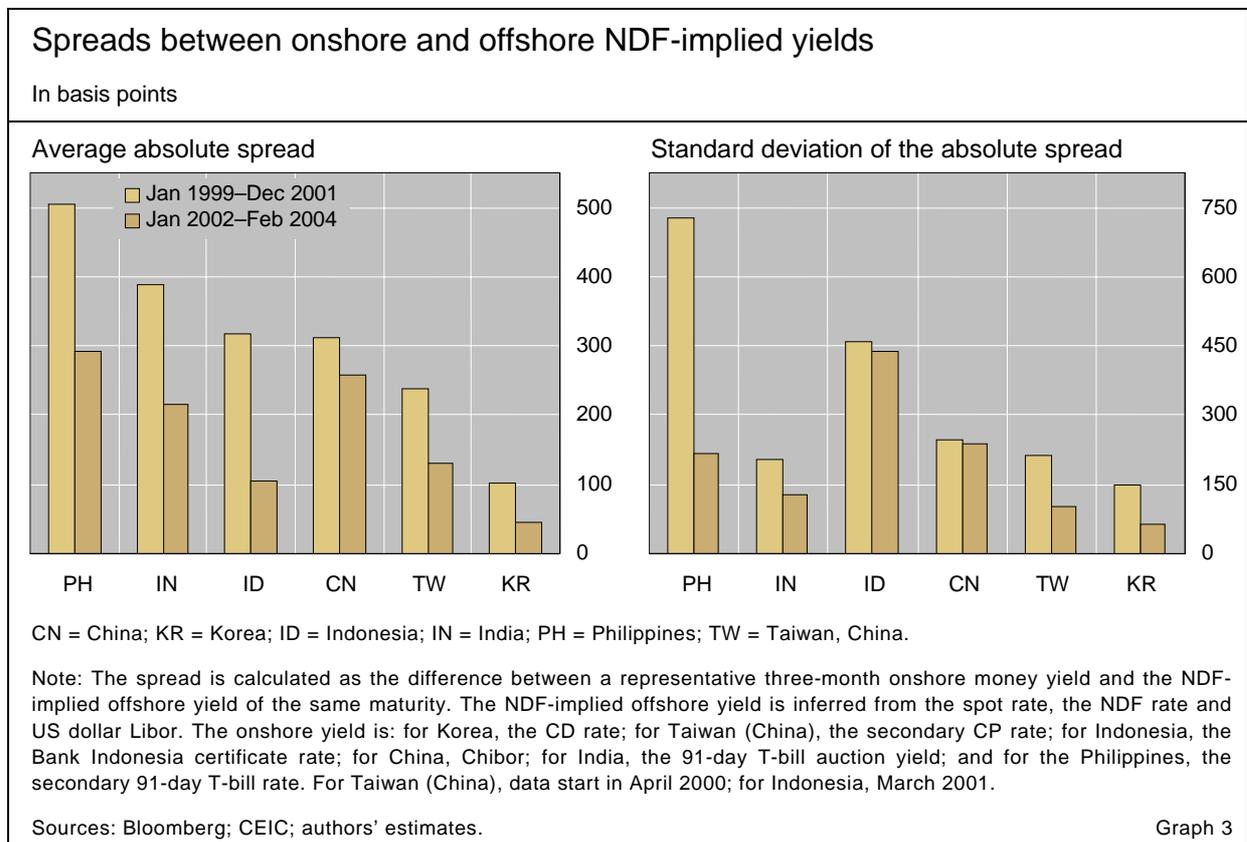
Interpretations of onshore/offshore interest spreads are qualified, however, by a number of limitations. Ideally, the comparison should be between a liquid onshore bank interest rate and a similarly liquid offshore implied rate. But the fact that the domestic money market is most liquid at short maturities, while NDF markets tend to be more liquid at medium to long maturities, makes it hard to find good liquidity at matching maturities. In the case of India, Indonesia and the Philippines, public sector interest rates rather than bank interest rates are used. Since NDFs involve global banks with a higher credit rating than onshore banks or even sovereigns, and in any case start out with only potential credit risk, onshore yields could exceed offshore implied yields even with full capital mobility. This implies that evolving credit and country risk premia may complicate the interpretation of variations in the onshore/offshore interest spreads.

Some qualifications

Findings

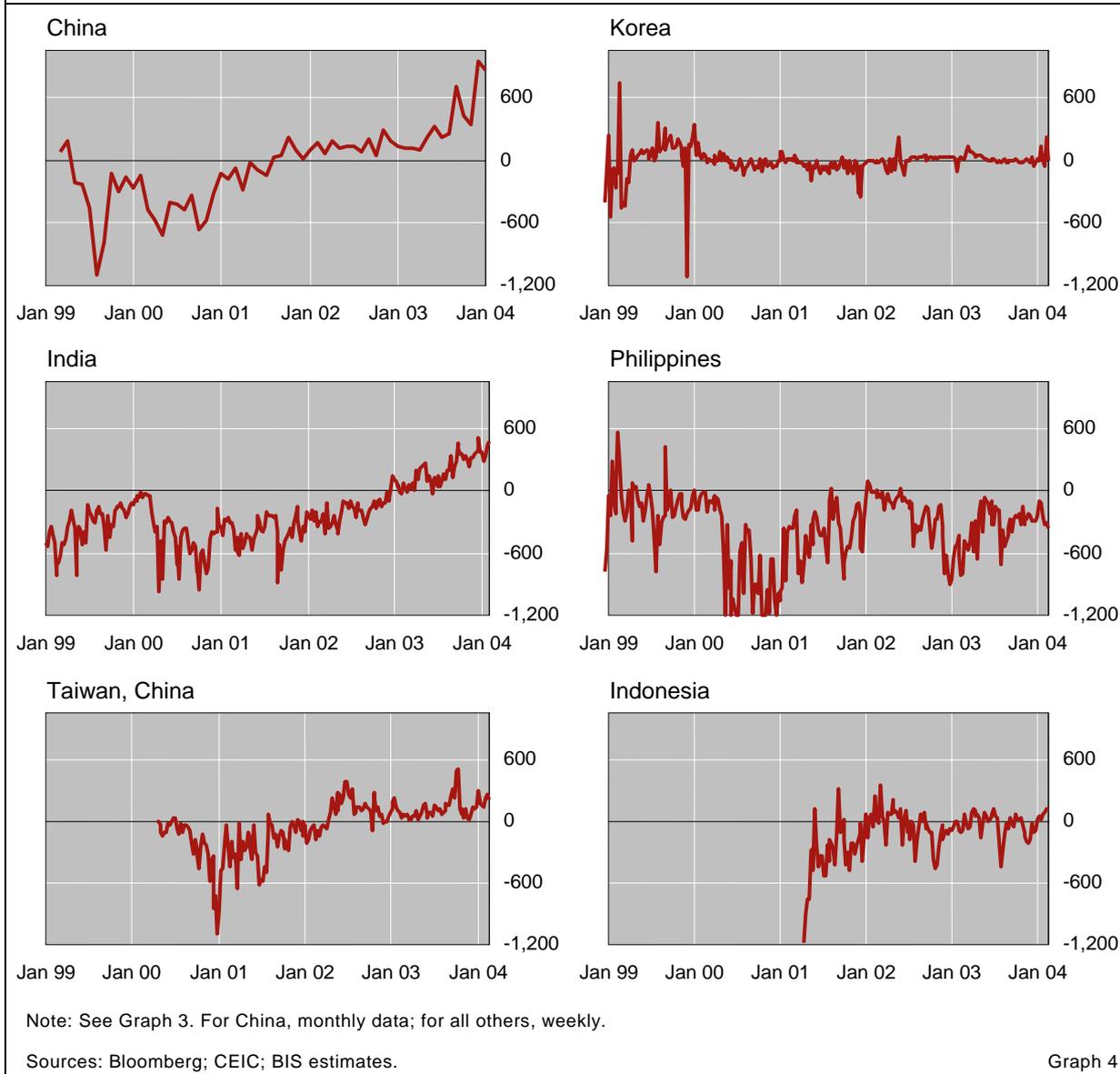
Our estimates of the three-month onshore/offshore interest spread for the six Asian currencies actively traded in NDF markets suggest that capital controls in Asia are binding to varying degrees, weakening or even preventing cross-border arbitrage (Graph 3). The main exception is the case of the Korean won (Box 2). The estimated spreads for the other five Asian currencies appear to be mostly larger than what could be accounted for by other factors (such as transaction costs).

Capital controls bind to varying degrees



Onshore less offshore NDF-implied yields

Three-month rates, in basis points



Wide swings in underlying market pressure

The relationship between the onshore and NDF-implied offshore yields also seems to reflect the swings in the underlying market pressure on the currencies in question (Graph 4). In the wake of the Asian crisis, offshore implied interest rates were higher than onshore rates, reflecting ongoing depreciation pressure in the offshore trading at the time. Since 2001–02, however, offshore positioning on further Asian currency appreciation has driven offshore implied interest rates below onshore rates for some Asian currencies.

This development is most obvious in the case of the Chinese renminbi and the Indian rupee, where the estimated onshore/offshore interest rate spreads swung widely from a negative 400–1,000 basis points in 1999–2001 to a positive 400–1,000 basis points by late 2003. The New Taiwan dollar and the

Box 2: The Korean won NDF market

The Korean won NDF market, the largest and most liquid NDF market globally, continues to thrive offshore alongside a large and active onshore forward market. This is in spite of its effective integration with the onshore money market as measured by the very small spread between onshore and offshore yields (see Box 1). Why? There are three possible explanations.

The first explanation is the residual exchange regulations in Korea, where underlying cross-border transactions (trade or investment) and documentation requirements apply to onshore forward trading. Thus, pure speculative demand for won has to be met offshore. Moreover, in order to reduce pressure for depreciation, the authorities have limited the Korean banking system's ability to provide credit to offshore entities. In particular, won lending by local banks to non-residents required case by case approval before April 1999. Thereafter, the system shifted to a rule-based regime of a won lending quota that was raised from KRW 100 million by one domestic bank to a single non-resident to KRW 1 billion after January 2001. In the face of pressure for appreciation, the authorities introduced new restrictions on the net won NDF positions taken by onshore banks in January 2004, only to partially ease them in February 2004 (Hohensee and Lee (2004)).

These evolving regulations may give rise to an asymmetry of the onshore/offshore spreads (see the table in this box). Before April 1999, the average absolute size of the yield spread when the offshore yield exceeded the onshore yield is larger than when the offshore yield was less than the onshore yield. This was consistent with the policy bias against won outflows at the time. The rule-based won lending quota lessened such a bias, resulting in similar average sizes of the negative and positive spreads for the 1999–2003 period. The latest measure in early 2004 was intended to discourage offshore investors' speculative won demand and to limit onshore banks' arbitraging between the domestic market and NDFs. This has indeed led to larger absolute spreads when onshore yields are below offshore yields.

A second and alternative hypothesis is that the offshore NDF market allows foreign investors to limit taking on credit risk in currency trading. The observation that onshore rates rose relative to offshore rates in early 2003 at a time of heightened concerns over bank credit may be relevant. This observation suggests that the onshore yields embody more credit risk than do their offshore counterparts, both because of the nature of the contract (offshore, only differences are at risk to counterparty failure, not the full amount invested in a domestic certificate of deposit) and because of the credit ratings of market participants (a larger share of foreign banks offshore).

A third view is that a thriving offshore NDF market benefits from the inertia of liquidity, so that trade remains in the offshore Korean won NDF market because it is liquid. This perspective is associated with the notion that liquidity begets liquidity in financial markets, consistent with the tight bid-ask spreads in the won NDF market.

Absolute size of onshore/offshore¹ yield spreads

In basis points

	Onshore yield above offshore yield	Onshore yield below offshore yield
Nov 1998–Mar 1999	106.6	281.6
Apr 1999–Dec 2003	69.4	67.1
<i>Apr 1999–Dec 2000</i>	<i>109.4</i>	<i>81.4</i>
<i>Jan 2001–Dec 2003</i>	<i>39.3</i>	<i>60.8</i>
Jan 2004 to date	143.5	75.3

¹ Three-month NDF.

Sources: Bloomberg; authors' estimates.

rupiah also show similar but less pronounced trends. The market's interpretation of the G7 communiqué on exchange rate flexibility in September 2003 looks to have manifested itself as a spike in the onshore/offshore yield spreads for China, India and Taiwan.

A notable exception to the above trend is the Philippine peso. Just as it alone weakened vis-à-vis the US dollar in the spot market, it showed consistently higher offshore NDF-implied interest rates.⁹

Spreads have
narrowed over time

Over time, however, the estimated absolute spreads for all six Asian currencies have narrowed considerably, sometimes by as much as two thirds, and the variability of the estimated spreads has also diminished noticeably (Graph 3). In addition to the possibility that pressure for appreciation is weaker or more consistent than the depreciation pressure in previous years, two possible reasons for these observations can be offered. First, liquidity in the NDF markets and the quality of data on them may have improved. For example, the initial large onshore/offshore yield spread for the Indonesian rupiah briefly seen around early 2001 may be due to a lack of liquidity in the nascent rupiah NDF market. Second, controls on capital flows may have diminished or may be consistently less effective against the recent incipient inflows. For instance, until recently, most regulations on cross-border transactions in China and Korea had been biased against capital outflows.

Conclusion

Six Asian currencies trade actively in NDF markets. Their turnover represents the bulk of global trading in NDFs and amounts to a substantial fraction of onshore outright forward and foreign exchange swap turnover in the same currencies. Aggregate turnover in regional NDFs has risen, particularly in the renminbi. The Asian NDF volatility is typically larger than the spot counterpart, owing in part to official intervention in the spot market. Asian NDFs tend to correlate more positively with each other than do their spot counterparts and respond similarly to movements in the forwards of major currencies.

The wide spreads between onshore interest rates and NDF-implied offshore interest rates suggest effective segmentation of onshore and offshore markets in Asia, with the exception of Korea. The recent upward pressure on most Asian currencies is evident in the low and even negative NDF-implied offshore interest rates. One implication of the large negative implied offshore yields is that competing firms with or without offshore operations may face rather different funding costs. However, both the size and volatility of such spreads have diminished in recent years for all six Asian currencies covered.

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⁹ The large negative spread briefly observed around late 2000 and early 2001 was consistent with the political instability at the time.

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