Social Finance

A Primer on Currency Risk Management for Microfinance Institutions

J.P.Morgan

Stefano Diamantini
Stefano.f.diamantini@jpmorgan.com
+44 207 777 3687

This work is an outgrowth of two J.P. Morgan projects with Grameen Foundation's Bankers without Borders® program, which connects private sector volunteers with microfinance and technology-for-development initiatives that help break the cycle of poverty. A J.P. Morgan team evaluated the FX risk management practices of MBK Ventura (a leading Indonesian microfinance institution) and recommended measures that enabled MBK Ventura to develop a more robust FX risk management framework and take actions to reduce overall risk. The J.P. Morgan team also provided Grameen Foundation with recommendations to manage FX risk related to its existing loan portfolio and its new Pioneer Fund, a local currency financing facility for MFIs and related entities.

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AGENDA

ANNEX

>> SECTION 1

Microfinance and FX Risk

It is widely acknowledged that microfinance – loans, savings and other financial services specially tailored to meet the needs of low-income clients – has enabled numerous families to lift themselves out of poverty. Yet, the promise of microfinance remains unrealized for most of the world's poor. Global market demand for microfinance services is estimated at roughly 250 billion USD, while the aggregate estimated loan portfolios of microfinance institutions (MFIs) worldwide amount to 44 billion USD as of 2009.[1,2] Domestic financing, the primary source of funding for microfinance to date, has not been sufficient to meet demand. As of 2008, an estimated 4 billion USD of hard currency debt funding was outstanding on MFI balance sheets, compared to 700 million USD in 2004.[3]

If MFIs are to close the significant supply-demand gap, external financing sources will continue to be tapped for the foreseeable future, making currency risk management an important priority for MFIs and their investors.

Currency risk arises from the mismatch between the assets held by an MFI (denominated in the local currency of the MFI's country of operation) and the loans that fund its balance sheet (often denominated in USD). An unexpected depreciation of the local currency against the USD can dramatically increase the cost of servicing debt relative to revenues. It can also negatively affect the creditworthiness of the MFI (hence the ability to raise new funds) and even generate a negative net income, with serious consequences for the long-term financial stability of the MFI.

MFIs are particularly vulnerable to foreign exchange rate risk, since they operate in developing countries where the risk of currency depreciation is high. Furthermore, extreme currency depreciation tends to be highly correlated with a general deterioration of local economic conditions, which can cause higher loan delinquencies and a reduction in profitability of financial activities.

Currency risk also affects the institutions that provide funding for MFIs. Organizations like Grameen Foundation USA raise their own funding in USD while extending loans to MFIs around the world in their respective local currencies. Generally, these organizations have some protection from currency risk due to the diversification of the currencies in their portfolios. Past experience, however, suggests that a financial crisis originating in one emerging market country or region often spreads across borders through what is known as the contagion (or spillover) effect. Contagion is the cross-country transmission of negative shocks occurring when instability is not limited to the country (or countries) of origin, but quickly transmits to other markets. In 1998, for example, the Russian financial crisis was followed by increased volatility in the global securities markets. The reassessment of credit and sovereign risks that took place during this period led to large jumps in credit and liquidity spreads in both emerging and advanced

[1] Symbiotics at www.symbiotics.ch.
[2] Microfinance Information Exchange at www.themix.org.
[3] CGAP Brief, "MIV Performance and Prospects: Highlights from the CGAP 2009 MIV Benchmark Survey," September 2009.

economies. As a result of the crisis, the financial stability of countries whose economies did not appear particularly interconnected with Russia was badly compromised. The risk of contagion means that currency diversification alone is not enough to shield MFIs that borrow in foreign currencies from serious losses on their portfolios. A more sophisticated currency risk management policy is needed.

MFIs participate in the FX market due to their funding needs, not as their core activity. They lack the resources and experience to engage in a process of making profits from short-term trading of currencies. Engaging in currency trading without the support of appropriate investments in terms of people and technology increases the risk of failure. Hence, currency risk management for MFIs should mainly revolve around reducing the risk associated with currency fluctuations through FX hedging rather than improving firm profitability through currency speculation.

Advantages of Currency Hedging for Microfinance Institutions

Hedging can contribute greatly to an MFI's success and stability. Through an appropriate hedging policy, the MFI can reduce or even eliminate the uncertainty of mismatches between local currency receivables and foreign currency repayments. This will bring several benefits to the MFI. First, minimizing deviations in forecasted cash flows leads to more seamless communication between various departments (namely, sourcing and lending). Improved internal communication helps to define business strategies more effectively through:

- >> better pricing of loans being disbursed;
- >> better planning of when and how to grow business (increase size of loan books).

Secondly, reduced uncertainty helps in providing firm and clear balance sheet figures to external stakeholders (including investors and rating agencies). Improved external communication strengthens the business model through:

- >> helping to secure steady sources of funding;
- >> decreasing the chances of breaching debt/equity covenants.

As a result, credit rating agencies also find it easier to analyze the MFI and are more satisfied with predicted balance sheet performance:

- >> Better ratings improve investor faith and would most likely reduce cost of funding of the institution.

To summarize, hedging supports long-term business sustainability and protects the MFI from financial distress in case of volatility in the financial markets.

Determining how to hedge, however, is not easy. Going forward, we discuss how to devise an effective FX hedging strategy that is aligned with the business requirements and ultimately creates value for the MFI.

>> SECTION 2

Currency Hedging Policy for MFIs

Introduction

Currency risk management is complex and requires a thorough understanding of the MFI's business needs, its internal and external environment and exposures to the financial markets. Currency hedging needs to be tailored around the MFI mission and vision statements, operational infrastructure, risk exposure and risk appetite. Consequently, there are no 'one size fits all' solutions.

As seen in the previous section, hedging can add value to an MFI's business. However, an ill-designed hedging policy has the potential to undermine the effectiveness of an MFI's core business. For example, hedging a foreign currency loan with a short-dated contract creates a cash flow event when the contract is settled and needs to be re-extended. Such maturity mismatches need to be carefully managed to avoid facing financial payment demands when available liquidity may be inadequate to meet them. In addition, using long-dated hedging contracts that perfectly match the expiry of the underlying exposure can expose the MFI to pay substantial premiums as the liquidity of the FX market can dry up beyond given tenors.

When engaging in hedging activities, MFIs also need to consider the choices of their competitors (if there are any). This would help MFIs to benchmark their risk policy with the practices followed by other peers in the industry.

The above examples are put forth not to discourage the use of hedging solutions, but to point out that such strategies should not be employed blindly—instead, an informed, logical step-by-step process should be employed. When it comes to an MFI, this process can take the form of the following three steps:

1. Define the long-term objectives of the MFI and its operating constraints.
2. Identify and quantify currency risk exposures.
3. Elaborate the hedging policy (long-term optimal strategy and short-term deviation parameters).

1) Defining the Long-Term Objectives of the MFI

The first step in formulating an optimal risk policy is to define "optimality" for the concerned entity. In other words, designing an appropriate risk management policy for an organization requires a thorough understanding of its business model.

If we look at the mission statements of different MFIs globally, their main objective can be summarized as:

- >> providing financial relief for a significant proportion of the poverty-ridden population in the region in which the MFI operates;
- >> maintaining financial self-sufficiency in order to provide sustained and efficient services for clients.

The two statements are equally important in defining how an MFI functions. Most MFIs—whether organized as non-profits or for-profit financial institutions—have

a social mission as well as a financial return objective. This "double bottom-line" profile creates a tension between the returns awarded to the MFI's shareholders and the pricing of credit for the MFI's clients. The MFI needs to generate adequate revenue to continue to invest in and grow the business as well as, in the case of commercial MFIs, to attract more capital. At the same time, it wants to provide the most useful services to its clients at the most reasonable cost. It is exactly this delicate balance between a social mandate and financial equilibrium that differentiates most MFIs from either traditional charities or fully commercial financial institutions.

The dual objectives of an MFI create tension when determining the appropriate lending rate:

- >> Minimize the lending rate (or "active rate") to avoid excessive financial cost to clients; or
- >> Keep the lending rate high enough to finance growth and investments.

The best way to overcome this tension is to consider the growth objective as a boundary operative condition to the minimal lending rate. More specifically, the MFI should aim to minimize its lending rate subject to its baseline operating costs, cost of funding, and minimum return expectations of its shareholders (if any).

To simplify, the aim of an MFI's currency policy should be to stabilize the margin between the active rate and the cost of funding. In other words, an appropriate hedge should prevent the cost of funding from rising to disproportionate levels and should keep it in line with some sort of benchmark passive rate. But what is an appropriate equilibrium funding rate? In order to answer this question, we need to look at situations where the MFI faces no currency risk. This occurs when funding is in local currency.

In the absence of any currency risk, the cost of funding for an MFI (which we define as "passive rate domestic") is the sum of the local currency reference interest rate plus any credit spread required by its lending institution. Sometimes an MFI could also be asked to provide a third-party guarantee in order to access funding resources. This will come with a cost, which adds on to the funding rate. The Passive Rate under domestic financing can thus be summarized by the following equation:

$$\text{[1.1] Passive Rate Domestic} = \text{Interest Rate}_{\text{Local Currency}} + \text{Credit Charge} + \text{Cost of Guarantee}$$

To illustrate this concept with an example, let's consider an MFI with operations in Brazil. If the MFI wants to borrow locally, it will be requested to pay the base interest rate of Brazilian real (for example, 9.00% per annum) plus an extra charge based on the credit rating of the institution (assumed to be 4.00% per annum). The local bank might also ask for a guarantor on behalf of the MFI. We assume the MFI is required to get a bank guarantee from a foreign bank at 1.50% per annum. With this information we can calculate the Passive Rate Domestic, which is equal to 14.50% per annum (9.00%+4.00%+1.50%). Should the MFI decide to raise funding in the international financial markets and face FX risk, the aim of the currency policy is to keep the cost of funding close to 14.50% per annum.

2) Identifying Currency Exposures

Having clarified the long-term objectives and operating constraints of an MFI, the second step toward an optimal risk management policy is to assess the sources of currency risk and to quantify their impact in terms of funding cost. As explained before, MFIs mainly run a domestic business and should naturally look at local funding avenues as a first channel for raising capital. However, more often than not, borrowing in local markets is insufficient to satisfy the entire funding requirement due to underdeveloped local market conditions and restrictive regulations. As MFIs tap international financial markets, their passive rate becomes a stochastic (random) variable and the equation (in section [1.1] above) no longer holds. Assuming the MFI is able to obtain funding without the burden of a standby letter of credit (which is normally the case when financing is in hard currencies), the correct Passive Rate under international financing is:

$$[1.2]\ \text{Passive Rate International} = \text{Interest Rate}_{\text{Foreign Currency}} + \text{Credit Charge} + \text{Currency Return}$$

The last component of this equation, which is a key element of funding in foreign currency, is often disregarded by MFIs. Nevertheless, it is fundamental to understanding the intrinsic nature of the funding cost under hard currency borrowing. Disregarding the currency impact is both a quantitative and qualitative mistake. It is "quantitative" in the sense that the cost associated with foreign currency funding is systematically underestimated, tempting the MFI to finance itself in hard currency even when a valid local currency alternative is available. It is "qualitative" in the sense that the uncertainty surrounding the realized cost is taken out of the equation; ignoring Currency Return means ignoring the uncertainty associated with foreign currency borrowing. Taking again the example of a Brazilian MFI, we assume the institution decides to fund itself in USD instead of borrowing in the local market. It will pay the USD interest rate (for example 2.50% per annum) and it will also be charged 4.00% for credit risk. The resulting rate (6.50%) seems quite attractive compared with local borrowing. However, as explained above, this number is misleading, as it does not incorporate the risk of future fluctuations in the USD/BRL rate.

When funding costs are uncertain, MFIs will find it hard to define the optimal lending rate in line with the operative boundary condition described in the previous paragraph. To overcome this situation, MFIs have two possible choices:

1. Eliminate the uncertainty through currency hedging.
2. Leave the exposure unhedged but try to quantify the expected future cost of funding (i.e., the future exchange rate) and the probability associated with some extreme unfavorable currency movements.

Under the first option, the MFI is able to measure the local currency equivalent of its foreign currency loans. However, by hedging, MFIs face an extra cost (or sometimes extra return) associated with the difference between the forward and spot exchange rates. Hedging costs need to be taken into account in the calculation of the Passive Rate. A way to approximate this cost is to use the interest rate differential between the local currency and the borrowed currency (usually USD). A positive differential (i.e., local currency interest rate higher than USD interest rate) means hedging cost (i.e., Passive Rate increases); a negative differential (i.e., local currency interest rate lower than USD interest rate) means hedging

benefit (i.e., Passive Rate decreases). Under a full currency hedge, the Passive Rate becomes:

$$[1.3]\ \text{Passive Rate Hedged} = \text{Interest Rate}_{\text{Foreign Currency}} + \text{Credit Charge} + \text{Cost of Hedging}$$

This equation is directly comparable to [1.1], as both rates are deterministic. Furthermore, in the absence of restrictions on cross-border capital flows, and under the same credit charges, the two rates should be very similar (or even identical). In reality, this is not always the case.

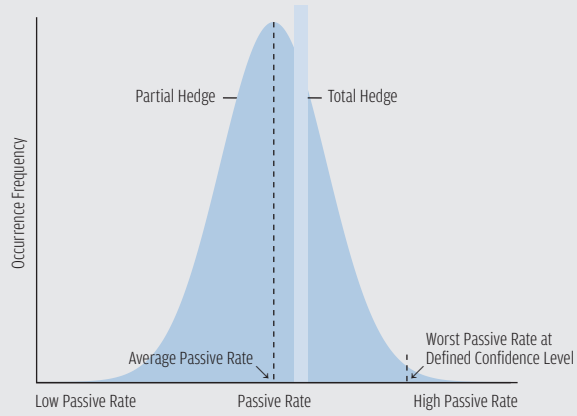
When the MFI leaves its entire portfolio unhedged, the cost of hedging is not known with certainty and is estimated. The typical way of measuring uncertainty is to create a model that replicates the behavior of the exchange rate over time. Academics and market professionals have suggested alternative statistical techniques, and the literature around forecasting models is very comprehensive. Without entering into too much detail, the common denominator in these models is to rely on some sort of distribution that associates alternative future spot values with a given probability. The basic (and most commonly used) model is to assume that currency returns follow a normal distribution, i.e., a bell-shaped curve with the two following properties:

- >> The curve is concentrated in the center and decreases on either side.
- >> The curve is symmetric (the probability of deviations from the mean are comparable in either direction).

The main advantage of normal distributions is that they can be described by specifying two parameters: mean (average outcome or expected value) and standard deviation (average deviation around the mean). When modeling currencies, the mean return can be set at the forward differential, at some sort of estimated historical drift, or even at zero. The difference between the three methodologies is reflected by the expected (most likely to occur) future exchange rate implied under the three assumptions: expected future exchange rate equal to current forward, expected future exchange rate consistent with historical trend, and expected future exchange rate equal to current spot rate. Regarding the standard deviation of returns, the usual choices are the realized standard deviation (actual volatility) over past data or the implied volatility quoted by option traders in option markets (when this is available for the currency pair in question). For the purposes of this article, we have selected the mean to be zero (in line with the assumption of zero long-term currency returns) and the standard deviation to be the implied volatility quoted on the option market (with tenor equal to the average life of the portfolio).

To better understand the difference between a stochastic Passive Rate and a deterministic one, let us consider the graph below.

CHART 1 – Stochastic Passive Rate



The light blue column in the graph represents the Passive Rate under the Total Hedge scenario. The rate is well defined and hence the MFI eliminates the uncertainty around future local currency commitments.

The blue-colored region defines the probability density (distribution) of the Passive Rate in a situation where the MFI is unhedged (or only partially hedged). The dotted line in the graph represents the average Passive Rate (expected value) in the unhedged situation. Following our assumptions, this value is lower than the hedged Passive Rate (i.e., currency hedging involves a cost).[4] However, the average passive rate is only one of several possible outcomes, so its relevance is limited. In fact, in the case of exposures to floating currencies, it is not possible to identify a unique future domestic currency commitment. It is only possible to calculate the probability associated with different levels of the Passive Rate in given intervals (given by the area underneath the distribution).

When facing exchange rate risk, the MFI should not limit the analysis to estimate a single value for the Passive Rate. On the contrary, it should identify the probability associated with different levels of the cost of funding, especially for those levels that are a potential threat to the financial equilibrium of the institution. Those worst-case scenarios can be assessed using Value at Risk (VaR) methodology.

VaR is defined as the largest loss (in this case, associated with the worst Passive Rate) likely to be suffered with a defined probability (confidence level) in a given time horizon. In the case of normal distributions, VaR numbers can be easily calculated as the multiple of the distribution's standard deviation. For example, the 95.00% confidence level VaR is approximately equivalent to 1.65 standard deviations. Calculating the 95.00% VaR in the graph above means identifying the Passive Rate that leaves only 5.00% of the distribution on the right (therefore 95.00% of the area lies on the left). In other words, 95.00% of the time the realized future Passive Rate would not be worse than the level identified by the VaR.

[4] We assume future spot rate equal to current spot rate and unfavorable interest rate differential between the local and funding currencies.

VaR analysis gives good indications on the level of risk associated with an unhedged foreign currency policy. However, even this measure has its limitations. Models approximate the real world and require some simplifying assumptions about the behavior of financial prices. In this case, the main assumption used is the normality of returns. Normal distributions have convenient statistical properties, since they only require estimating expected return and volatility. However, the normality assumption implies that successive price changes are independent of each other and that there is as much probability of an upward movement as there is of a downward one. Financial time-series often contradict these two assumptions: returns can be serially correlated (i.e., the price change of a given date is dependent on the previous day's/days' change) and returns can be skewed toward one direction (i.e., distributions are not symmetrical around the mean). These two types of behavior are respectively known as kurtosis and skew.

Kurtosis describes the extent to which distributions are taller and have "fatter tails" than a normal distribution. When the actual distribution has high kurtosis, approximating it with a normal distribution underestimates the probability of extreme events. Skew describes the extent to which a distribution leans to one side. When the distribution in the real world is highly skewed in one direction, using a normal distribution to approximate it means ignoring an underlying price trend that is likely to persist. As a result, the VaR number that is derived under the normality assumption can be misleading. The MFI that decides to leave its currency exposure unhedged cannot rely only on VaR. A second, complementary layer of analysis is required: stress testing.

Stress testing seeks to identify and quantify the effect of extreme (non-normal) price changes (in our case, of extreme exchange rate movements). In summary, stress testing requires creating several scenarios of future outcomes to investigate the effects that extreme events in the financial markets can have on the MFI's risk profile.

Stress testing can be used as a complement to VaR when measuring the probability of an extreme event. For example, if the 95.00% VaR estimated under the normality assumption corresponds to a 15% devaluation of the local currency, the MFI can verify the occurrence of this event by looking at past price history to assess if actual currency behavior is consistent with stochastic analysis. Back-test analysis also helps the MFI verify the frequency and extent of extreme currency devaluations.

More importantly, stress testing should be used to create extreme, yet realistic, downside scenarios that, starting from a single event (i.e., currency devaluation), would encompass all financial and commercial aspects of the MFI. In fact, proper currency stress testing needs to be assessed in conjunction with assumptions about availability of contingent funding sources, cost of funding and client delinquency rate. Based on the outcome of such analysis, the MFI's management can design appropriate contingency plans meant to avoid severe losses.

By running VaR analysis in conjunction with stress testing scenarios, the MFI will have the necessary quantifiable data to define a risk management strategy.

3a) Defining the Hedging Policy: Benchmark

Having identified the currency exposure, the final step in creating an optimal risk management policy is to design the benchmark hedging strategy and to define the corridor of leeway in which discretionary tactical decisions can be made.

A benchmark is essentially a policy for managing exposures that are optimal in relation to the MFI's long-term objectives. The benchmark sets the strategic direction for exposure management by defining the target long-term strategy, which is then used as the reference point for short-term tactical deviation.

Designing a benchmark policy involves taking decisions around three dimensions:

- >> the hedging horizon
- >> the hedging ratio
- >> the hedging instrument

Defining the hedging horizon means selecting the expiry dates of the mix of hedging instruments that better offset the underlying currency exposure. Usually, the longer the duration of the hedge, the higher the impact of the interest rate differential (hence the higher the cost or benefit of the hedging instrument). If an MFI hedges its FX portfolio with instruments whose expiry dates match the underlying exposures, then uncertainty around currency and interest rate risk is fully removed. However, long hedging horizons are usually associated with higher hedging cost in terms of a higher interest rate differential (due to lower market liquidity), higher charges and higher credit costs. On the contrary, using a shorter hedging horizon can be cost effective but it creates cash flow events when the hedge is due to be extended. Furthermore, a shorter currency hedging horizon leaves the MFI exposed to movements in the interest rate differential.

Defining the hedging ratio means quantifying a currency exposure that balances risk and return (or cash flow for a borrower). For example, an MFI might consider an acceptable policy to be at least 50% hedged at all times. The quantification of a hedging ratio is a well-known topic among the investor community and there is ample literature covering the subject. In general, investors will look to be fully hedged if they can get superior risk-adjusted returns compared to the unhedged portfolio. While this seems to be the case for a portfolio invested in G10 currencies, the same does not always apply in the emerging currencies space. Unlike G10 currencies, emerging market currencies can offer positive persistent returns over the long run, due to a faster rate of productivity growth.[5] As a result, the MFI that borrows in USD can achieve a better performance leaving its hard currency exposure underhedged rather than running a fully-hedged policy. At the same time, however, we believe that situations of fully-unhedged exposures should be avoided altogether. Setting the hedging ratio to 0% leaves the MFI highly exposed to situations of stress in the financial markets. Under those circumstances (which can be triggered by restrictions in the global flow of credit or by a general rise in risk aversion among investors), illiquid currencies tend to depreciate very quickly and well below their long-term equilibrium fair value. By the time that confidence is restored, the MFI running a fully-unhedged exposure can find itself out of business. A fully unhedged benchmark could be introduced only in conjunction with clear procedures and stop-loss strategies. Stop-losses are used by professional traders to avoid incurring unlimited losses should the underlying financial exposure move in an unfavorable way. Usually stop-losses are orders placed in the market to unwind an exposure when a predefined loss limit is breached (determined by the difference between the price at trading inception and the stop-loss price). For an MFI, a currency stop-loss means automatically hedging the exposure if the foreign currency appreciates beyond a given threshold. Since an MFI may have neither the required technology nor the financial skills to manage the risk of complex

[5] John Normand, Gabriel de Kock, Matthew Franklin-Lyons, Arindam Sandilya "Managing FX hedge ratios," J.P. Morgan Global FX Strategy, 26 May 2010

positions continuously, we believe that the benchmark hedge ratio should be somewhere between 50% and 75%. Currency risk should be eliminated whenever possible, since it is an exogenous factor rather than an endogenous one related to the MFI's core business and mission.

Finally, the MFI has to decide on the hedging instrument it wants to use. The MFI could also make a choice on the kind of tools it wants to use for hedging. Using forwards is perhaps the simplest way to hedge, but not always the most effective. Depending on the economic situation, and provided that local regulations permit, it could make sense to employ options as hedging tools, though it could be more costly than the forward at inception.[6] However, strategies involving rolling vanilla options can be a more cost-effective hedge than a simple forward when interest rate differentials are extremely adverse. This is because the local currency may appreciate or depreciate less than implied by forward points.[7] So while a forward contract will force the user to lock in the negative differential in full, an option contract will not (the worst negative event is limited to the initial premium). Furthermore, the option premium doesn't necessarily need to be paid at inception, as it can also be netted with the payout at expiry.

Having decided the hedging horizon, the hedging ratio and the instrument to be used, the MFI should employ further flexibility in its benchmark policy. Instead of hedging the full exposure with a single contract, the MFI should break the same into smaller amounts and hedge each of them in sequence at fixed time intervals until the full notional is covered. This technique would allow the MFI to average out its protection rate at hedge inception. How many such contracts the MFI enters into should be decided taking into consideration maintenance hassles and transaction costs.

The benchmark policy described above would be unique for each MFI. It would depend on its short-term and long-term goals and would also take into consideration the MFI's present situation—the growth considerations, the state of its balance sheet, and any macroeconomic conditions that would influence future business.

3b) Defining the Hedging Policy: Tactical Deviations

A benchmark hedging policy sets the basis on which an MFI can operate safely. It eliminates risks to acceptable levels but could sometimes be too rigid to be practical. Tactical deviations should be made to instill some flexibility into the hedging policy. However, they should not become a justification to introduce speculative behaviors. There is a very thin line separating policy optimization from currency speculation, and the MFI managers need to handle any deviation very carefully. For this reason, it is important to state explicitly what is allowed and what is not in the risk management policy. Tactical deviations should only be introduced to allow the MFI to react to some structural changes in the economic environment. Fully-hedged policies, where currency fluctuations are always completely eliminated, might not be optimal when the environment changes rapidly, especially if the hedging horizon chosen is very long. Introducing tactical deviations can help the MFI to fine-tune its hedging policy in line with the forecasted evolution of economic conditions.

By marginally tweaking the benchmark it has set up for itself, the MFI can also respond to contingent situations of increased competition either by local government initiatives or by other MFIs. This is especially true when those

[6] See Annex for more information on forwards.
[7] Forward point equals the difference between the forward rate and the spot rate.

competitors are limiting currency hedging or avoiding it altogether. However, as already stressed before, this situation should not create a justification for the MFI to move too far away from the risk limits with which it is comfortable.

Tactical deviations can also be very useful when the funding cost achieved under a fully-hedged policy turns out to be much higher than the domestic funding rate (or higher than that implied by the interest rate differential). A situation like this might occur when the hedging instrument is a non-deliverable contract whose price implies a risk premium due to the fact that the local currency is expected to depreciate. Hedging at these levels would mean facing a funding cost much more adverse than the prevailing domestic interest rate. If the MFI believes that the non-deliverable forward (NDF) levels are not representative of the true economic situation, it could decide to hedge a lower portion of the exposures, such that the passive rate achieved is around the local currency funding rate.[8] When the situation improves or the market changes its expectations, the MFI can then hedge the remaining exposure at more neutral NDF levels.

Tactical deviations can be introduced in any of the three dimensions of the benchmark.

- For the hedging ratio, tactical deviations should be subject to predefined levels for the lowest and the highest hedging percentages allowed. To define the upper and lower limit of this "comfort zone," the MFI could use scenario analysis, for example, to ascertain what VaR and the associated expected hedging cost would be under different hedging percentages. The table below gives an example based on Case Study 1 – Single Currency Exposure, which follows later.

Table 1

Percentage of USD Loan Hedged	50%	60%	70%	80%	90%	100%
Expected Funding Cost (p.a.)	11.37%	11.60%	11.84%	12.07%	12.31%	12.54%
Worst Case Funding Cost (p.a.) (95.00% VaR)	19.19%	17.86%	16.53%	15.20%	13.87%	12.54%

Source: J.P. Morgan

- For the hedging horizon, tactical deviations should be subject to predefined levels for the shortest and longest possible hedging tenor. The decision regarding the tenor to use should balance the advantages of liquidity and transparency of short-term hedges with the burden of transaction and administrative costs of too-frequent trades.

- For the hedging instrument, tactical deviations should be subject to a range of feasible and available hedging instruments (forward, option, zero-cost combination) and a maximum percentage of overall hedging that can be allocated to any given product category. A tactical decision around the hedging instrument is basically a decision on the sophistication of the hedging strategy – moving from the use of forward contracts to the use of options. For example, boundaries should be set around how much exposure should be hedged by forwards and how much by more complex products.

Whether the MFI should position itself on the lower or higher tactical band will be based on contingent market situations (on exchange rate or interest rate levels, for example) and on MFI risk aversion and preferences.

[8] See Annex for more details on non-deliverable forwards.

>> SECTION 3

Case Study 1 – Single Currency Exposure

Exposure Description

We present here a hypothetical situation of an MFI with single currency exposure. The MFI has operations in Indonesia, with limited local funding availability but with access to international financial markets (either directly or through specialized institutions). The MFI, experiencing a period of fast growth, is financing itself in USD. More precisely, since November 2007, it has raised five loans of 1 million USD each, with a tenor of two years and interest rate of 8.50% per annum.[9] Alternative local funding could have been used at 13.50% per annum on IDR loans.[10] However, due to bureaucratic difficulties and the higher nominal rate associated with this solution, the MFI decided against it.

The table below summarizes the outstanding loan portfolio as of October 1, 2009 (which we assume to be the valuation date of this case study):

Table 2

Funding Start Date	Repayment Date	Tenor (Years)	Funding Amount (USD)	Cost of Funding *(Nominal Rate + Credit Charge)*	USD/IDR Rate on Start Date[11]	USD/IDR NDF on Start Date[12]
15-Nov-07	15-Nov-09	2.00	1,000,000	8.50%	9,300	10,083
15-Jan-08	15-Jan-10	2.00	1,000,000	8.50%	9,434	10,411
30-Mar-08	30-Mar-10	2.00	1,000,000	8.50%	9,204	10,272
30-Jun-08	30-Jun-10	2.00	1,000,000	8.50%	9,224	10,599
30-Sep-08	30-Sep-10	2.00	1,000,000	8.50%	9,435	10,706

Source: J.P. Morgan

At each loan inception, the MFI converted the entire USD amount into local IDR at the prevailing USD/IDR spot rate. The resulting IDR funds were used to disburse micro-loans.

Given the availability of non-deliverable forwards in USD/IDR, the MFI could have decided to fix the IDR value of future USD commitments through these contracts. However, the forward rate (reported in the table above) was perceived to be very unfavorable, so the risk management approach chosen was to keep the repayment of USD loans unhedged. In other words, the MFI was planning to use future receivables in Indonesian rupiah to repay the USD commitments (principal plus periodic interests) using the prevailing USD/IDR spot rate.

The MFI ran its unhedged policy without serious problems until late 2008, when the financial crisis prompted a sudden depreciation of the IDR. A few months later, the MFI questioned its hedging policy and tried to assess if hedging the USD/IDR risk would have been a more appropriate solution. We will try to answer this question in the next two sections, where we focus first on quantifying the risk of the unhedged policy and then suggest some FX policy recommendations.

[9] This is calculated as the sum of the average two-year USD swap rate (3.5% per annum) plus a credit charge of 5% per annum.

[10] This is calculated as the sum of the average two-year IDR swap rate (8.5% per annum) plus a credit charge of 5% per annum.

[11] Source: J.P. Morgan.

[12] Source: J.P. Morgan.

Assessing the Risks of the Unhedged Policy

Since the first USD loan was raised, the USD/IDR spot rate has experienced considerable variations.

CHART 2 – USD/IDR Spot Rate

Source: J.P. Morgan

However, on the valuation date used in this case study (October 1, 2009), the USD/IDR exchange rate (9615 IDR per 1 USD) is only marginally higher than the average rate calculated from Table 2 (9320 IDR per 1 USD). This means that the USD obligations have become slightly more expensive in IDR terms. The extra cost is approximately equivalent to 1.60% per annum over a two-year loan tenor.[13] Given that none of the loans have been redeemed yet, the IDR depreciation is still unrealized: it is affecting the mark-to-market value of the USD loans but it has not been translated yet into actual negative cash flows. Furthermore the MFI has enjoyed paying a lower nominal interest rate (for the time already elapsed) than it would have paid had the loans been denominated in IDR.

That said, the 1.60% of extra cost per annum is an imperfect measure of the risk of running an unhedged position. The MFI has to use the statistical techniques highlighted in the previous sections to identify the expected cost of funding and, more importantly, the probability of that cost remaining below some critical level.

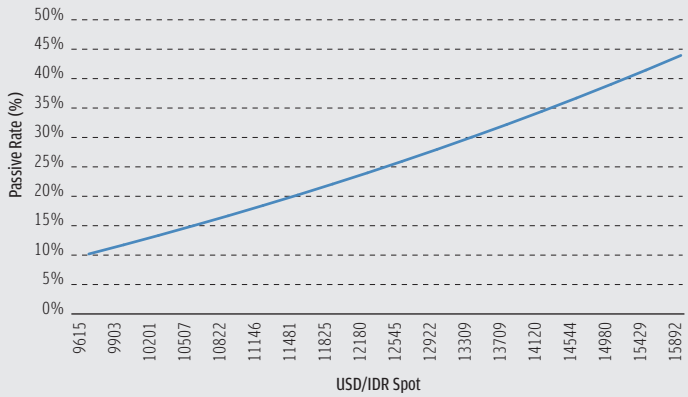
Assuming that the current spot can be used as an unbiased predictor of future expected spot, the expected passive rate is calculated as:

8.50% *(nominal USD rate)* + 1.60% *(IDR depreciation from loan inception)* = 10.10%

As we said, this number is fairly useless for risk management decisions, as it is simply resulting from the assumptions used in the model (i.e., future spot in line with current spot rate). Furthermore, it keeps changing on a daily basis with changes in the USD/IDR spot rate. The following graph shows, for example, that a 30% increase in the spot level would increase the expected passive rate to almost three times the current value.

[13] 1.60% = (9615-9320)/9320 over two years or (9615-9320)/9320 *1/2 per annum.

CHART 3 – Passive Rate Unhedged



Source: J.P. Morgan

As uncertainty is not eliminated, it becomes necessary to assess some sort of worst-case scenario.

The concepts of VaR and stress testing introduced before would help in this task. VaR can be used to assess the probability of different spot levels and associated passive rates. Calculation of VaR requires defining a given confidence level and a selected time horizon (holding period). The combination of these two parameters can be varied. In this case, we decided to use a holding period equivalent to the remaining average life of the loan portfolio (around 0.6 years) and a confidence level of 95.00%: the resulting VaR can be interpreted as the worst funding cost that the MFI will face over the remaining average life of the loans, with 95.00% probability.

VaR can be estimated using different techniques. In this case, we used a simulation-based approach with a proprietary J.P. Morgan Monte Carlo model, which is more sophisticated than the normal distribution approach described before. Based on market conditions prevailing on the valuation date (USD interest rate at 0.43% per annum, IDR interest rate at 6.54% per annum and USD/IDR implied volatility at 17.00%), the model forecasted the 95.00% worst-case spot rate at 12,523 IDR per USD (over the horizon under consideration).[14] Using the graph above, this number translates into a Passive Rate of 25.70%.

The 95.00% VaR resulting from the Monte Carlo simulation turns out to be consistent with the weakest exchange rate against the USD during the IDR depreciation in the fall of 2008. Given that a similar IDR depreciation has occurred in the recent past, it would be imprudent to rely only on this VaR number as a conservative risk estimate. Some sort of stress testing is also needed. In this case, we decided to repeat the same Monte Carlo simulation using "stressed" market parameters: we set volatility at 35.00% and the IDR interest rate at 26.00%, the levels reached during the currency crisis.[15, 16] The resulting cost of funding was 40.20% per annum.

[14] Interest rates are 6-month Libor rates and volatility is the 6-month at-the-money forward-implied volatility.

[15] 6-month at-the-money forward-implied volatility as per J.P. Morgan proprietary database.

[16] 6-month IDR interest rate as per J.P. Morgan proprietary database.

Should spot ever reach those levels, the institution would most likely breach contractual covenants (equity/debt, etc.) attached to its financing, and the very existence of the MFI could be at stake.

Currency Policy Suggestions

The VaR and stress testing scenario analysis clearly show that leaving currency exposure completely unhedged is a gamble rather than a strategy, and that the risks far outweigh the advantages. A lack of strategy in dealing with exchange rate risk leaves an MFI vulnerable to situations of market stress, whereas a well-designed hedging policy can make the difference between failing and surviving. Only with a risk management policy in place can the MFI keep operational costs under control in any situation.

Let's consider again the credit crisis of late 2008. With the IDR depreciating against the USD 30.00% in just three months and the interest rate differential at historic highs, the repayment of USD loans could have become seriously problematic. Although no repayment was due in that period, the strain on the MFI's financial position would have been reflected in the mark-to-market of its USD loans against IDR assets and, consequently, on its financial statements. With the possibility of several covenants on the brink of being breached, the MFI could have decided to hedge completely its USD exposure at prohibitively expensive rates. This would have prevented the MFI from benefiting from the subsequent economic improvement and IDR appreciation. Furthermore, had the MFI needed to raise new loans, they would have only been available at much higher rates than previously assumed. With the passive rate spiraling upward, the MFI would have been forced either to take losses on its books or pass on the extra burden to its clients, who already would have been hard hit by the economic crisis. Delinquencies could have increased at an alarming rate, further stressing the financial equilibrium of the MFI.

Having been able to survive the incredible turmoil of late 2008, the MFI cannot afford any more risk management mistakes. The best course of action is to create a benchmark risk management policy that defines the guidelines for dealing with currency risk. As discussed before, the benchmark policy involves taking decisions over three aspects of currency risk management: the hedging ratio, the hedging tenor and the hedging instrument.

Regarding the hedging ratio, we believe the MFI should simply hedge 100.00% of its exposure. This MFI cannot afford the risk of a spiraling cost of funding. The level of 25.70% per annum identified by the VaR is definitively not a sustainable level. With current spot (USD/IDR 9,615) and interest rates (USD 6-month rate at 0.50% and IDR 6-month rate at 4.40%), the MFI could in effect buy USD forward with NDF contracts without being particularly penalized.[17] The cost of hedging would only be 2.80% for the remaining tenor.[18] The resulting passive rate on hedged USD loans would then be 11.30% per annum (even lower than the 13.50% available at inception on domestic IDR loans).

[17] The NDF rate for the average remaining life of the loans is USD/IDR 9,840.

[18] In reality, hedging cost relative to the interest rate differential is only 1.20%. The remaining 1.60% is due to the depreciation of IDR from loan inception (9,320) to valuation date (9,615). Hedging in fact will force the MFI to realize any currency appreciation/depreciation that occurred from loan inception to date.

Regarding the hedging tenor, we believe the MFI should be hedged close to the full expiry, given that NDFs on IDR are quite liquid up to two years. However if the MFI changes its funding policy, by raising loans with increased tenors (say 5 or 10 years), those considerations would change. Liquidity of available hedging instruments in fact dries up for longer tenors, making them more expensive to use. The MFI should thus target a rolling strategy using instruments with a shorter horizon.

Regarding the hedging instrument, we would suggest that this MFI use just NDF contracts. USD/IDR NDFs are easily available from a variety of financial institutions. Given that the MFI lacks experience in hedging, the use of the most vanilla product seems the most appropriate decision. Simple products are easy to manage on an ongoing basis.

>> SECTION 4

Case Study 2 – Multi-Currency Exposure

Geographically Diversified Funds

In the second case study, we shift our attention to managing multi-currency exposures. This situation is relevant for microfinance investment funds and organizations (such as Grameen Foundation) that lend to and invest in MFIs across multiple countries and regions. These organizations are usually based in developed countries, so their funding is in hard currency (mainly USD, EUR and CHF). Their portfolios of loan receivables, however, are sometimes denominated in the domestic currencies of the borrowing entity (usually emerging market currencies). In this situation, the borrower (local MFI) is protected from exchange rate risk, which is borne by the lender. The risk for the latter is to receive, at redemption, amounts in local currencies that are less than the hard currency amount initially disbursed.

Multi-Currency Exposure: Description

A multi-currency exposure introduces a new level of complexity, as well as some potential benefits, in the risk management process. In this case, we assume a lending institution which funds itself in USD, while providing local currency loans to MFIs operating in India, Mexico, South Africa and Indonesia.

The table below summarizes the institution's funding base and loan disbursements as of October 1, 2009 (the selected valuation date for this case study).

Table 3

Funding Start Date	Tenor (Years)	Local Currency	Equity (USD)	Spot Rate on Start Date	Loan Receivable (In Local Currency)
15-Jan-08	2	INR	5,000,000	39.27	196,350,000
30-Mar-08	2	MXN	5,000,000	10.6367	53,183,500
30-Jun-08	2	ZAR	5,000,000	7.8196	39,098,000
30-Sep-08	2	IDR	5,000,000	9,435	47,175,000,000

Source: J.P. Morgan

The institution has never employed a hedging policy. However, due to increased currency volatility, its management would like to revisit its risk management practices to introduce hedging. In fact, the institution has already experienced an (unrealized) currency loss, given that the value of foreign currency receivables has fallen below the original USD equity funding amount when converted at prevailing spot levels. If spot rates remain constant until final redemption date, the institution would suffer a write-down of 2 million USD in just two years (10% of its equity). But the situation could worsen in the event currencies depreciate further over the next five months (which is the average remaining loan tenor).

By hedging 100% of each exposure, the institution would eliminate any uncertainty but it would also incur an extra loss of approximately 700,000 USD due to an adverse interest rate differential (as shown in Table 4 below).

Table 4

Local Currency	Remaining Tenor (Years)	Current Spot	Loan Amount at Current Spot (USD)	Current Forward	Loan Amount at Current Forward (USD)
INR	0.25	47.78	4,109,460	47.98	4,092,330
MXN	0.45	13.7173	3,877,111	14.0567	3,783,498
ZAR	0.71	7.6744	5,094,600	8.0637	4,848,643
IDR	0.96	9,615	4,906,396	10,288	4,585,439
		Net cost due to hedging (USD)			-677,657

Source: J.P. Morgan

Not willing to pay this extra cost in full and hoping for a recovery of local currencies, the institution would prefer to pursue a partial hedging strategy. Management would like to identify the combination of hedges that would provide good downside protection at a fraction of the cost of a fully-hedged position.

Correlations in Multi-Currency Exposures

Before comparing different hedging combinations, some theoretical concepts specific to multi-currency exposures are useful. A multi-currency basket can, in a way, be regarded as a single new currency with its own interest rate and volatility. The interest rate of the basket (which ultimately defines the cost of funding of the basket) is nothing other than the weighted average of the interest rates of each basket component. When it comes to the basket volatility, the same does not hold true: the interdependence of currency fluctuations must be taken into account. This co-movement can be estimated by a statistical measure called correlation. When two currencies move in tandem (i.e., they both appreciate at the same time or depreciate at the same time with respect to the home currency), we say that they are highly correlated. Conversely, we define currencies that move in opposite directions to be inversely correlated. When no strong co-behavior can be identified, we say that currencies are uncorrelated. Mathematically, correlation ranges from 1 (perfectly correlated) to -1 (perfectly inversely correlated). A value of correlation equal to zero means that currencies are uncorrelated.

Correlation determines the level of diversification in a portfolio of currencies. A highly diversified basket (when currencies are negatively correlated) is less risky than a poorly diversified one because the loss due to depreciation of one currency could be offset by the gain in another. The expression used to calculate the volatility of a multi-currency basket clearly shows the impact of correlation:

$$Volatility_{basket} = \sqrt{\sum_{i=1}^{n} w_i^2 \sigma_i^2 + 2\sum_{i=1}^{n}\sum_{j=i+1}^{n} w_i w_j \sigma_i \sigma_j \rho_{ij}}$$

This formula defines the volatility of a basket of "*n*" components, where "*w*" is the weight of each component in the basket, σ represents the volatility of each such component and ρ the correlation between a pair of components. For an equally-weighted basket of two currency pairs, with volatilities σ_A and σ_B, respectively, and correlation of ρ, the basket volatility is:

$$\sigma_{basket} = \frac{1}{2} \times \sqrt{\sigma_A^2 + \sigma_B^2 + 2\sigma_A \sigma_B \rho}$$

If the two currency pairs are completely correlated (ρ=1), then the basket volatility is the average of the individual volatilities. However if they are inversely correlated (ρ=-1), then the basket volatility is half the difference of the individual volatilities. The lower the correlation, the higher the benefit, because volatility of the basket is reduced.

For this case study, we decided to estimate correlations by using the option market. This value, called implied correlation, can be considered the co-movement between two currency pairs "expected" by market participants over the horizon under consideration. Market makers (usually large banks) quote implied volatilities and implied correlations for various currency pairs. All the currency pairs used in this case study are traded in the option market and the values we used for volatility and correlations are summarized in the table below.[19] The six-month implied volatilities (as of October 1, 2009) are in the tan diagonal of the table. The six-month implied correlations are in the blue body of the table.

Table 5

	INR	MXN	ZAR	IDR
INR	10.27%	49.07%	62.28%	47.56%
MXN		15.68%	47.67%	54.75%
ZAR			19.02%	39.19%
IDR				13.35%

Implied Correlation USD/IDR vs USD/INR

Implied Volatility USD/IDR

Source: J.P. Morgan

The lowest correlation is between USD/IDR and USD/ZAR, at 39%. Although no currency pair is negatively correlated, the volatility of this currency portfolio (derived from the correlations and volatilities above) is still lower than the average of the individual volatilities. The annualized volatility of the currency basket is in fact 11.74%.[20]

Having defined the basket volatility, it is now possible to apply the same Monte Carlo technique to estimate the 95.00% VaR for the fully-unhedged portfolio over the remaining average tenor of loan receivables. This number, at 3.5 million USD, shows that the risk of leaving the exposure unhedged is still too high and that correlation alone is not enough to protect the USD value of this portfolio of loan receivables.[21] The MFI needs to hedge with some combination of forward (or NDF) contracts.

[19] Source: J.P. Morgan.
[20] Source: J.P. Morgan.
[21] Source: J.P. Morgan.

Comparing Different Hedging Combinations

To select the combination of hedging ratios that best suits the MFI objectives, it is necessary to define a framework that supports the decision process. One way to do that is to combine the underlying exposure with different hedging portfolios and to rank each combination on a defined metric.

A simple approach is to use a bi-dimensional space:

- >> On the "x" axis, we assess the "Risk" of the combination of exposure and relative hedges.
- >> On the "y" axis, we assess the "Hedging Cost" of the combination of exposure and relative hedges.

CHART 4 – Risk vs. Hedging Cost Analysis

The selected measure for Risk is the 95.00% confidence VaR (expressed in total USD), while for the Hedging Cost, it is the ratio between the expected future value of the portfolio minus the current value divided by the current USD value.

The first step of this analysis is to identify the two boundary situations:

On one side, the fully-hedged strategy; at the opposite end of the spectrum, the fully-unhedged solution.

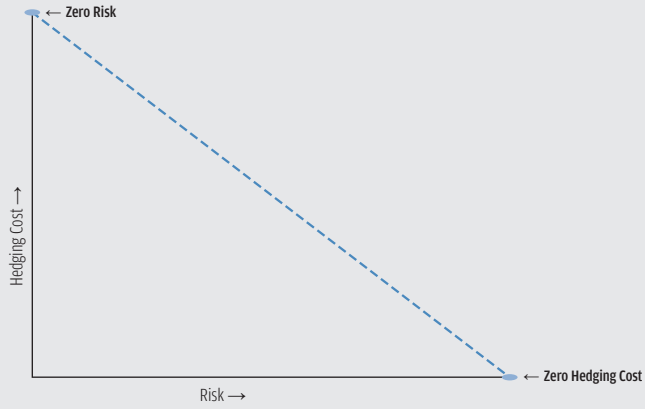
The fully-hedged strategy is the one with the highest hedging cost and lowest (zero) VaR. By hedging, in fact, the distribution of future outcomes collapses into a single value: the future value of the portfolio is simply obtained by converting each receivable into USD at the respective forward rate.

On the contrary, the fully-unhedged strategy is the one with the lowest (zero) hedging cost and highest VaR. In this case, in fact, the MFI is exposed to the full volatility of the currency basket. However, the expected value of the portfolio is (by construction) equal to current spot value.[22] Consequently, the hedging cost of this strategy is equal to zero.

[22] This is a consequence of the assumption that expected future spot rates are equal to current spot rates.

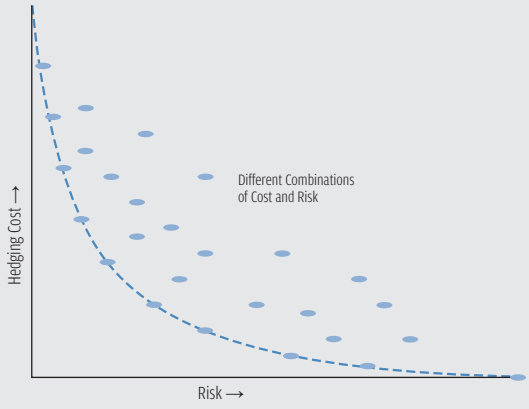
In the previous paragraph, we estimated the hedging cost of the fully-hedged strategy (677,657 USD or 3.77% of current portfolio value) and the VaR of the unhedged strategy (approximately 3.5 million USD). With this information, it is possible to identify the two combinations in the space above.

CHART 5 – Risk vs. Hedging Cost Analysis



The second step of this analysis is to identify all other combinations of exposures that lie between these two solutions. The hedging cost and VaR related to these exposures define the coordinates that enable us to position different hedging solutions in bi-dimensional space.

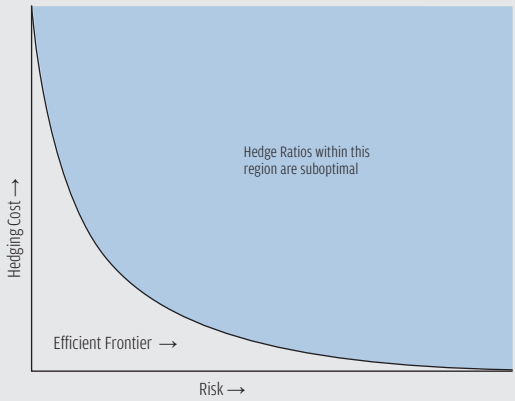
CHART 6 – Risk vs. Hedging Cost Analysis



With the scatter plot in mind, we can now take the final step of identifying the hedging combination superior to others in terms of lower risk and lower cost: any combination that achieves a lower risk reduction at the same cost as another combination is deemed inefficient and should not be considered as a hedging solution. The hedging solutions with the best cost/risk profile define the

"Efficient Frontier." The fully-hedged solution and fully-unhedged solution will lie on that frontier on the extreme left and extreme right, respectively. Points in the gray region are suboptimal because for each point therein, we can find a point on the efficient frontier where either risk is lower for the same cost or cost is lower for the same risk. The limit of this analysis is that it will not be possible to identify a single hedging solution that is always superior to all others, as all solutions that lie on the frontier are considered equivalent. The choice of hedging combination will depend on the MFI's risk aversion and cost preferences.

CHART 7 – Efficient Frontier



The Efficient Hedging Frontier – Monte Carlo Experiment

The theoretical concepts previously discussed about volatility, correlations and interest rate differentials provide some initial guidelines that should help to assess which combination is likely to lie on the efficient frontier. The lending institution's main aim is to decrease the volatility of the portfolio without entailing a high cost due to adverse interest rate differentials.

In order to minimize the volatility of the currency mix:

1. High hedging ratios should be allocated to currencies with the highest volatility.
2. Currencies left unhedged (or partially hedged) should be those which are negatively correlated (in USD terms).

In order to minimize the impact of negative carry:

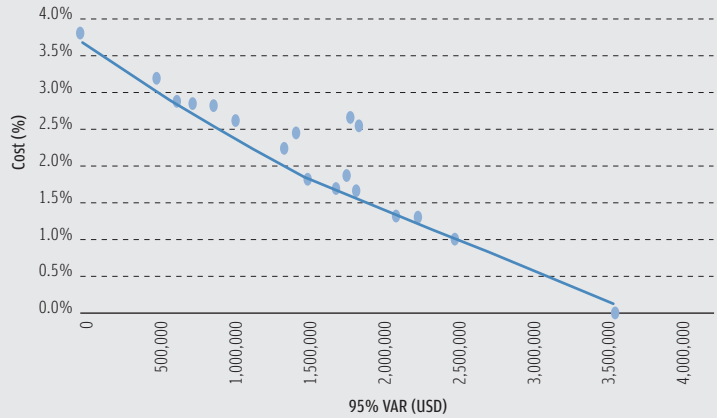
1. Currencies with less adverse carry will have less opportunity cost and can be hedged almost in full.
2. Currencies with high adverse carry can be hedged until the reduction in portfolio volatility justifies the high opportunity cost.

To confirm these intuitions, we need to run a scenario analysis by repeating the same Monte Carlo simulation several times, using different hedging ratios in order to create the scatter plot described above. The time horizon chosen for each simulation is the remaining average tenor of loan receivables (approximately six months from valuation date). We also use the usual assumptions that expected

future exchange rates are equal to current spot rates and that implied volatilities and correlations can be used to estimate future realized volatilities and correlations.

In the following example, we moved the hedge ratio for each currency pair between 0 and 100%, one currency at a time. Some of the results are shown in the graph below.

CHART 8 – Efficient Frontier



Source: J.P. Morgan

A more micro-sectional look at the graph provides the following combination of hedging ratios, which are the most effective:

Table 6

Currency	Hedging Ratio Combinations									Average
INR	0%	100%	100%	100%	100%	75%	50%	25%	50%	67%
MXN	0%	100%	50%	100%	50%	25%	13%	15%	0%	39%
ZAR	0%	100%	100%	100%	75%	50%	50%	25%	50%	61%
IDR	0%	100%	100%	50%	25%	25%	13%	15%	0%	36%
95% VAR	3,415,404	0	163,527	623,235	1,453,382	2,023,960	2,390,684	2,696,456	3,093,096	
Cost	0.00%	3.77%	3.54%	2.88%	1.82%	1.33%	1.02%	0.75%	0.47%	

Source: J.P. Morgan

The conclusions that we draw from this experiment are in line with our initial assumptions.

The first thing we notice is that in all efficient combinations, India is always extensively hedged. This is not surprising as the INR interest rate is the lowest among the four currencies, so hedging the INR is relatively "cheap."

Secondly, we note that the next most hedged exposure is the ZAR. ZAR rates are the highest in the currencies under consideration. This would definitely make it a costly exposure to hedge. But USD/ZAR volatility is also the highest. It perhaps then makes more sense to pay for the hedge and reduce the high uncertainty introduced by the ZAR exposure in the portfolio.

So the currencies that yield better results when only partially hedged are the MXN and IDR. Between the two, the IDR is clearly the currency that can be left mostly unhedged, due to its lower implied volatility and lower correlations than the MXN.

With the analysis above, the institution can now estimate the costs associated with a fully-hedged strategy compared with a completely unhedged one. Furthermore, it has valuable indications about which currency should be hedged first and in what percentage, thus providing very useful directions in formulating an effective risk management strategy.

Basket Options

Another way to look at hedging solutions is through options. The advantage of using options over forwards is the ability to profit from any recovery in the value of foreign currency receivables that might occur before redemption date. So, if the lending institution had missed the opportunity to hedge at inception and the foreign currency had depreciated in the meantime, using options would be one way to cover FX risk without locking in the currency loss. Unfortunately, options require the payment of an upfront premium, and a portfolio of four options (one for each individual currency) would likely be very costly. A more efficient alternative could be a basket option.

With a basket option, the lending institution could define a protection target for the value of the entire portfolio instead of protecting each individual foreign currency receivable. To understand this concept, let's consider a simplified version of the case study above, where the institution has four foreign currency loan receivables whose redemption date is two years.[23] The currencies of denomination are the same of the case study: IDR, MXN, ZAR and INR. The receivables are 5 million USD equivalent per currency (the value for the full portfolio is hence 20 million USD). The institution can protect this portfolio either by buying four at-the-money spot options (strike 5 million USD for each option) or by using a single basket option strike at 20 million USD. The individual options will pay at expiry if the foreign currency receivable is less than 5 million USD. Conversely, the basket option will only pay at expiry if the combined portfolio value drops below 20 million USD (independently from individual currencies' performances).

Let's assume that, at expiry, the IDR receivable has decreased by 1 million USD (due to IDR depreciation), the MXN receivable increases by 1 million USD (due to MXN appreciation) and the other two currencies are unchanged. So the final portfolio value is, in fact, unchanged (20 million USD). As a result, the basket option would expire worthless. The hedging portfolio made up of four individual options would instead pay 1 million USD (as the foundation would exercise the IDR option, while the other three options would expire worthless). Because hedging with individual options is always more expensive than buying the basket option, the latter is a more efficient way to hedge multi-currency portfolio exposure: the MFI would only pay for the protection it effectively needs.

[23] We could alternatively consider two years to be the hedging horizon of longer-dated receivables to relax this assumption.

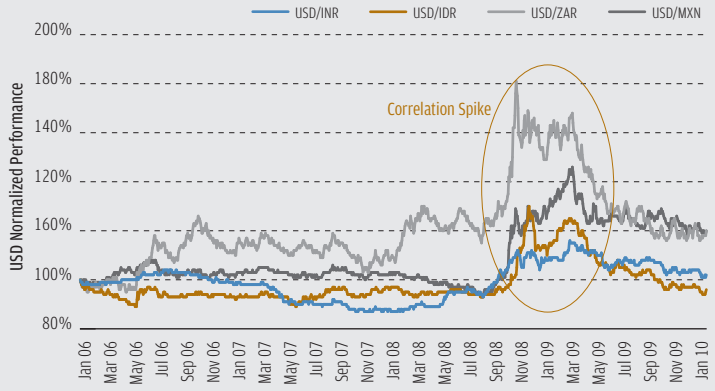
When Diversification Breaks Down

If we had to single out one concept from the case study discussed above, it would be that of correlation. We have seen that correlation plays an important role in multi-currency hedging and it works to the advantage of the hedging entity by reducing the overall currency risk. In this case study, the currencies under consideration were mildly correlated, thus providing only a limited reduction in volatility (and VaR). Other times, there could be situations wherein the currencies are so negatively correlated that portfolio volatility is reduced considerably. This provides a kind of natural protection, thus theoretically reducing the need to hedge the exposure. Nevertheless, the MFI that relies only on correlation as a way to eliminate currency risk can become vulnerable to changing market conditions.

It is possible that, over time, correlations become unstable. This happens especially when global economic conditions deteriorate. Due to "contagion effect," previously uncorrelated emerging market currencies start behaving similarly, rapidly losing value against the USD or other "hard" currencies.

The graph below provides the normalized performances of the USD against the four currencies used in this case study over the last three years.

CHART 9 – EM Currencies vs. USD



Source: J.P. Morgan

Between October 2007 and October 2008, the four currencies had very mixed performances against the USD, with the MXN stable, the IDR and INR appreciating, and the ZAR depreciating. At that time, correlation between those currency pairs would have been low. However during the credit crunch of November 2008, all currencies experienced a sharp depreciation against the USD, showing a quite "correlated" behavior. Institutions relying only on correlation to protect the value of their portfolios would have found themselves suddenly unhedged when hedging was most needed. During the crisis in fact, when delinquencies were on the rise, refinancing the portfolio would have been difficult, so it would be critical to have effective protection in place. For this reason, diversification should not be considered as the one and only answer to managing currency risk. VaR, scenario analysis, and, not least, some common sense should always be considered fundamental ingredients of a well-defined risk management policy.

Annex

Currency Risk

Before an MFI engages in any currency activity, the first step is to understand the nature of currency risk and the value of currency risk management, and then to define an appropriate risk management policy.

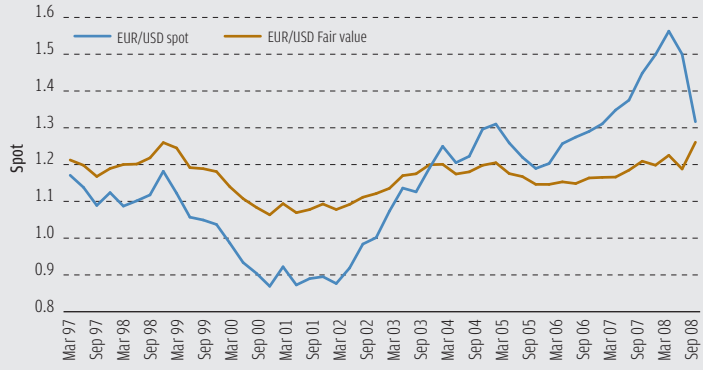
Nature of Currency Risk

Currencies are a means of exchange. They provide a utility (enabling the exchange of goods and services) but their usefulness is a function of the price of the currency itself in the domestic market (determined through inflation/deflation) or in the international markets (determined through appreciation/ depreciation). Currencies differ from other strategic assets (e.g., bonds or equities) in that their mere possession does not necessarily provide a positive long-term return. Theoretical studies and empirical research seem to confirm this point. It has become more widely accepted that exchange rate returns wash out over a sufficiently large investment horizon (8 to 10 years). In other words, exchange rates tend to revert over time towards some kind of long-term equilibrium level (mean reversion). This fair value level is usually estimated by comparing macroeconomic indicators of the economies under consideration.

In light of this, it is appropriate to question the value of currency risk management: if periods of currency losses will be compensated by similar periods of currency gains, then managing currency risk should be redundant.

This conclusion, though a theoretical truth, is a practical mistake. Although currency movements average out in the long term, there are still plenty of short-term fluctuations and trends. In other words, currency pairs can deviate considerably from their long-term equilibrium value and the adjustment process might take longer than what many anticipate. The following graph gives an idea of how long it could take for the effect of currency fluctuations to average out. J.P. Morgan has an internal trade-adjusted model to estimate the fair value of a currency—this fair value could be considered to be a long-term average. From the graph, it can be concluded that an EUR/USD exposure, if left unhedged, would balance out eventually, but only over a period of 5 years. However, the short-term deviations are very large, and if an entity finds itself on the wrong side of the exchange rate movement, bankruptcy risks could arise due to potentially huge negative cash flow events.

CHART 10 – Fair Value Comparison



Source: J.P. Morgan

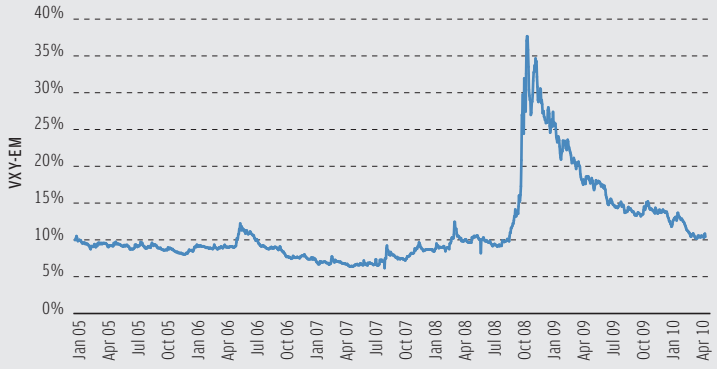
The crisis that financial markets experienced in 2008 has brought even more uncertainty to currency markets by ending a period of relatively low volatility. Exchange rates that used to move in narrow ranges have become unpredictable, with violent trends in one direction followed by abrupt reversals. The graph below shows the value of implied volatilities of G7 currencies between January 2005 and April 2010 as summarized by the J.P. Morgan VXY Index.

CHART 11 – JPM VXY Index

Source: J.P. Morgan

The situation has been even worse for emerging market currencies (as summarized by the J.P. Morgan VXY-EM Index shown in the graph below).

CHART 12 – JPM VXY-EM Index



Source: J.P. Morgan

Although volatility has come down substantially since the crisis, the uncertainty about future global economic growth and inflation pressures is likely to keep the level of volatility quite high for some time to come.

Higher volatility means greater uncertainty related to currency movements, hence greater deviations from long-term macroeconomic equilibrium values. Equilibrium values themselves are difficult to estimate and are subject to changes (regime shifts) over time. For these reasons, any enterprise caught on the wrong side of such moves could face substantial losses and even fall into bankruptcy before the currency goes back to a more sustainable level. We can thus confidently say that managing FX risk is a prudent activity that improves business efficiency through:

- >> improving return and/or
- >> reducing volatility of foreign-currency-denominated commitments.

Financial institutions and money managers (mutual funds, pension funds and hedge funds) increasingly recognize the advantages of currency risk management as a means of generating extra return (alpha). They have created a variety of quantitative algorithmic strategies (carry-based strategies, momentum-based strategies, and mean reverting rules, to name a few) to make the best out of currency fluctuations. Sometimes, asset managers even outsource foreign currency management to specialized firms whose aim is to optimize currency exposure with respect to the underlying mix of assets. The activities whereby currency risk is managed separately from the underlying investment are usually referred as currency overlay.

Foreign Exchange Market

Market and Market Participants

The foreign exchange market – better known as FOREX – is a worldwide market for buying and selling currencies. It handles a huge volume of transactions 24 hours a day, 5 days a week. Daily exchanges are worth approximately 1.5 trillion USD. In comparison, the United States Treasury bond market averages 300 billion USD a day and American stock markets exchange about 100 billion USD a day.

Currencies are always traded in pairs – the US dollar against the Japanese yen, or the English pound against the euro. Every transaction involves selling one currency and buying another, so if an investor believes the euro will gain against the dollar, he will sell dollars and buy euros. The foreign exchange rate is the price of a currency expressed in terms of another currency. The exchange rates make the monetary value of goods, services, capital spending and investments comparable all over the world. For example the notation USD/CHF = 1.1000 expresses the price of one US dollar in terms of Swiss francs. This notation is the system used by traders and market makers and it is a simple market convention (mathematically it would be correct to express this exchange rate as CHF/USD, as it represents how many Swiss francs are needed to get one US dollar).

The exchange rate may be fixed or floating, depending upon the exchange rate regime. These regimes are agreements, treaties or practices that govern the setting of exchange rates between two (or more) countries. When exchange rates are fixed, the countries involved guarantee that their central banks will exchange one currency for another at a fixed level. In the case of floating rates, the exchange rates are set flexibly on the market by supply and demand. It is also possible that countries choose regimes that are a mixture of the two. This was the case of the old European Monetary System, where exchange rates could fluctuate by some percentage around a central value (or central parity). In this regime, central banks were obliged to intervene in the market when the currency reached the upper or lower limit of the bands set.

The "modern" foreign exchange market was established in 1971 with the partial abolishment of fixed currency exchanges in many countries. Many currencies became valued at 'floating' rates determined by supply and demand. The FOREX grew steadily throughout the 1970s, but with the technological advances of the 1980s, FOREX grew from trading levels of 70 billion USD a day to the current level of 1.5 trillion USD.

Anyone who trades in the foreign exchange market faces a financial risk. Foreign exchange rate risk is the risk of exchange rate translation losses (or gains) associated with any economic interest that is denominated in a foreign currency.[24] This risk is not related only to currencies that evolve in floating exchange rate regimes. In this case, the increase in value of one currency is said to be appreciation, while the decrease in value is said to be depreciation. Currencies whose values are fixed are always threatened by the risk of devaluation (revaluation): the central banks might not be able to guarantee the fixed rate and might be forced to revise the peg (or the central parity in a "target zone" regime) or even leave the regime.

[24] DeRosa D. F. (1996), "Managing Foreign Exchange Risk," Irwin Professional Publishing.

The main categories of market participants are: market makers, brokers, funds (mutual funds, pension funds and hedge funds), non-financial institutions (corporations, private or government agencies) and central banks. Market makers are major financial institutions (investment banks and global commercial banks). Their function is to create an over-the-counter (OTC) market for all foreign exchange products by showing a bid and an offer price for spot exchange rates, forward contracts, currency swaps and options. When a client "hits" the market maker price, the latter becomes the legal counterpart of a foreign exchange rate contract. The market maker assumes a financial exposure that mirrors the one of the client. MFIs and organizations that provide funding for MFIs may access the foreign exchange market to hedge the risks that occur due to mismatches in the currency denomination of their liabilities and assets.

FX Hedging Instruments

In this section we define the most popular hedging tools available in the market to manage currency exposures. However, not all the solutions defined are universally applicable. Foreign exchange exposures in major economies can be addressed using mainstream risk management instruments and techniques, which are not always applicable in the case of emerging market currencies. In particular, some emerging market currencies have unique characteristics that impede "orthodox" approaches to controlling FX risk.

In addition, given specific operational constraints in running a microfinance business, it might not always be possible to implement derivative solutions to mitigate currency risk. In this case, an MFI can only rely on non-derivative solutions (like standby letters of credit), which are not discussed here.

Mainstream Instruments

Forwards

An FX forward is an agreement to purchase or sell a set amount of a foreign currency at a specified price for settlement at a predetermined future date, or within a predetermined window of time. FX forwards help investors manage the risk inherent in currency markets by predetermining the rate and date on which they will purchase or sell a given amount of foreign exchange. The portfolio is thus protected against a possible negative currency move and there are no additional price complications in execution from doing a spot trade. Deliverable forwards are contracts that will be settled with the physical delivery of the foreign currency. Non-deliverable forwards are cash-settled for the gain or loss on the value of the contract.

Cross-Currency Swaps

A cross-currency swap is generally used at the start of a loan period. Cross-currency swaps allow two counterparties to exchange specific amounts of two different currencies at the outset and to make repayments over time. In a currency swap, interest payments in two currencies are exchanged over the life of the contract, and the principal amounts are repaid either at maturity or according to a predetermined amortization schedule.

These instruments can be used to synthetically convert debt (or another asset) from one currency to another.

Options

An option is a unique financial instrument or contract that confers upon the holder or the buyer thereof the right, but not an obligation, to buy or sell an underlying asset, at a specified price, on or up to a specified date. In short, the option buyer can simply let the right lapse by not exercising it. On the other hand, if the option buyer chooses to exercise the right, the seller of the option has an obligation to perform the contract according to the agreed terms. The asset underlying a currency option can be a spot currency or a futures contract on a currency. An option on a spot currency gives the option buyer the right to buy or sell the said currency against another currency, while an option on a currency futures contract gives the option buyer the right to establish a long or short position in the relevant currency futures contract. Options on spot currencies are commonly available in the interbank over-the-counter markets, while those on currency futures are traded on exchanges.

Emerging Market Solutions

Emerging market economies and their currencies are commonly characterized by low levels of transaction activity, dramatic fluctuations (often depreciations) in their currency exchange rates, central bank restrictions and less developed financial markets in general. All of the aforementioned factors ultimately create conditions of elevated risk. Fortunately, there are hedging tools and methods that are available to mitigate FX exposure in many emerging markets. Given the liquidity, depth and sophistication of currency markets, MFIs in South America and Asia can rely on a range of instruments to eliminate the uncertainty surrounding the domestic currency value of foreign currency commitments. However, the number of instruments available for African currencies remains quite limited.

The principal derivative of choice in this arena is the **non-deliverable forward** (NDF). An NDF is considered a synthetic instrument in that it is a "cash settled" contract in a major base currency, i.e., USD, EUR, etc. It is used as a proxy hedge in a situation in which an exotic currency is not actively traded in the forward market. Primary examples of these currencies include the Korean won (KRW), Brazilian real (BRL), Philippine peso (PHP), Chilean peso (CLP), Taiwan dollar (TWD), Chinese renminbi (CNY) and Indian rupee (INR). On settlement, as NDF contracts are "cash settled," there is no actual exchange of the underlying currencies. Settlement simply reflects the difference between the pre-agreed NDF rate and the existing spot rate at time of fixing. This difference should approximately offset what occurred over the same time with respect to the underlying exotic currency relative to the base currency.

Often, offshore non-deliverable forwards trade in tandem with deliverable contracts, and like their on-shore siblings, they enable multinational firms and international investors to manage exposure to emerging market currencies. In several key respects, however, NDFs differ from deliverable forwards. Typically, the extent of these differences depends on the narrowness and degree of underdevelopment of local financial markets, as well as the severity and effectiveness of controls segmenting onshore and offshore markets. Because NDFs represent a market response to underdeveloped and restricted financial

markets, their pricing tends to vary from that of onshore deliverable forwards (which reflects spot and relevant interest rates). The extent of any discrepancy in pricing, however, depends on the stringency of regulations impeding flows between the markets: the less restrictive the controls, the tighter the link between offshore and onshore prices (and, hence, the greater the extent to which NDF prices reflect spot and interest rates). However, the more restrictive the regulations, the weaker is the link between onshore and offshore prices. In this case, NDF prices reflect the expectations of market participants about future prices more than the differential in interest rates.

An option can also be structured as a non-deliverable contract. These **non-deliverable option** contracts (NDOs) extend to the buyer the right, but not the obligation, to buy (via a call option) or sell (via a put option) a set amount of foreign currency at a specified rate, or strike price, on a predetermined future date in exchange for an initial premium. Instead of physical delivery of currencies, those contracts are cash settled in hard currency.

List of NDFs

Region	Currency	Code	Name	Currency Type	Deliverable or NDF	Max Tenor
Asia	Philippines	PHP	Philippine Peso	Free Floating	NDF	5 years
	Indonesia	IDR	Indonesia Rupiah	Free Floating	NDF	5 years
	Vietnam	VND	Vietnamese Dong	Managed Floating	NDF	1 years
	China	CNY	China Yuan	Pegged	NDF	5 years
	India	INR	Indian Rupee	Managed Floating	NDF	5 years
Africa	Ghana	GHS	Ghanaian Cedi	Free Floating	Deliverable	1 year
	Kenya	KES	Kenyan Shilling	Managed Floating	Deliverable	1 year
	Tanzania	TZS	Tanzanian Shilling	Free Floating	Deliverable	1 year
	Uganda	UGX	Ugandan Shilling	Free Floating	Deliverable	1 year
	Ethiopia	ETB	Ethiopian Birr	Managed Floating	No Market	NA
	Nigeria	NGN	Nigeria Naira	Managed Floating	NDF	1 year
	Cameroon	XAF	Central African CFA Franc	Pegged	Deliverable	NA
	Rwanda	RWF	Rwanda Franc	Free Floating	No Market	NA
Latin America	Peru	PEN	Peruvian Sol	Free Floating	NDF	5 years
	Bolivia	BOB	Bolivian Boliviano	Free Floating	No Market	NA
	Brazil	BRL	Brazilian Real	Free Floating	NDF	5 years
	Columbia	COP	Columbian Peso	Free Floating	NDF	5 years
	Mexico	MXN	Mexican Peso	Managed Floating	Deliverable	10 years
Others	Morocco	MAD	Moroccan Dhiram	Pegged	Deliverable	1 year
	Egypt	EGP	Egyptian Pound	Free Floating	NDF	1 year
	Yemen	YER	Yemeni Rial	Free Floating	No Market	NA
	Lebanon	LBP	Lebanese Pound	Managed Floating	No Market	NA
	Haiti	HTG	Haiti Gourde	Free Floating	No Market	NA
	Honduras	HNL	Honduras Lempira	Managed Floating	No Market	NA
	Dominican Republic	DOP	Dominican Republic Peso	Managed Floating	No Market	NA
	Bangladesh	BDT	Bangladesh Taka	Pegged	No Market	NA
	Pakistan	PKR	Pakistani Rupee	Managed Floating	NDF	1 year

Glossary of Terms

Terms	Definition
BRL	Brazilian real, official currency of Brazil
Carry	Interest rate differential of two countries
CCS	Cross-currency swaps
CHF	Swiss franc, official currency of Switzerland
CLP	Chilean peso, official currency of Chile
CNY	Chinese yuan, official currency of China
Contagion effect	Transmission of a financial shock in one entity to other interdependent entities
Correlation	In the financial world, the statistical measure of the relationship between two securities
Cross-currency swap	A swap that involves the exchange of principal and interest in one currency for the same in another currency
Emerging markets	Nations with social or business activity in the process of rapid growth and industrialization. Currently, there are 28 emerging markets in the world, with the economies of China and India considered to be by far the two largest
EUR	Euro, official currency of the European Union
Exchange rate	The value of a particular currency denominated in terms of another currency
Exchange rate regime	The method that is employed by governments in order to administer their respective currencies in the context of the other major currencies of the world
Fixed rate regime	An exchange rate regime under which the government or central bank ties the official exchange rate to another country's currency (or the price of gold). The purpose of a fixed exchange rate system is to maintain a country's currency value within a very narrow band. Also known as pegged exchange rate
Floating rate regime	An exchange rate regime where the values of the currencies are influenced by the movements in the financial market
FOREX	Foreign exchange market
FX	Foreign exchange
G7	Group of seven industrialized nations formed in 1976 (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States)
Hard currency	Refers to a globally traded currency that can serve as a reliable and stable store of value (usually United States dollar, euro, Swiss franc, British pound sterling, Norwegian krone, Swedish krona, Canadian dollar, Japanese yen, and Australian dollar)
Hedging	The implementation of a set of strategies, instruments and processes used by an organization with the explicit aim of limiting or eliminating the effect of fluctuations in the price of interest rates, foreign exchange or commodities
IDR	Indonesian rupiah, official currency of Indonesia

Terms	Definition
INR	Indian rupee, official currency of India
Interest rate swap	A swap agreement where interest payments on a certain amount of principal are exchanged between two parties on a specified date. One of the payment streams involved is usually based on a fixed interest rate, while the other is based on a floating rate
Libor	The London Interbank Offered Rate is a daily reference rate based on the interest rates at which banks borrow unsecured funds from other banks in the London wholesale money market (or interbank market)
Mark-to-market	The practice of revaluing securities and financial instruments using current market prices
MFI	Microfinance institution
Monte Carlo analysis	Class of computational algorithms that rely on repeated random sampling to compute their results
MXN	Mexican peso, official currency of Mexico
NDF	Non-deliverable forward
NDO	Non-deliverable option
Option	Financial instrument providing the holder the right and not the obligation to buy or sell financial assets at a pre-specified price
OTC	Over-the-counter
PHP	Philippine peso, official currency of Philippines
Swap rate	The fixed interest rate (or yield) required to be exchanged for a series of cash flow payments, based on floating interest rates, for a particular length of time (term to maturity of the swap)
TWD	Taiwanese dollar, official currency of Taiwan
USD	US dollar
VaR	Value at Risk, VaR is expressed as the worst-case loss that could be expected to be incurred from a given portfolio as a result of movements in identified risk parameters, over a nominated time period within a specified level of probability
Volatility	Standard deviation of the rate or price of financial instruments and assets
VXY	J.P. Morgan volatility index of G7 currencies
VXY-EM	J.P. Morgan volatility index of emerging market currencies
Yield curve	The line that results from plotting, at a certain time, the market interest rates of a financial instrument (for instance a bond) over a range of maturity dates
ZAR	South African rand, official currency of South Africa
ρ	Correlation coefficient (ranges from -1 to 1)
σ	Volatility

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