

IMF Working Paper

Monetary Implications of Cross-Border Derivatives for Emerging Economies

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Monetary and Exchange Affairs Department

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Abstract

<p>The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.</p>
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This paper surveys concepts, practices and analytical literature to assess benefits and risks for monetary stability of cross-border currency and interest rate derivative operations in calm and turbulent periods, with a view of extracting implications for emerging economies. Monetary authorities must prevent one-sided positions in the currency, favor asset substitutability, and incorporate the enriched information set provided by derivative-based transactions into monetary policy design. In some circumstances, the use of derivatives by monetary authorities may help fulfill this role. By contrast, surcharges to compensate for a downward impact of derivatives on the cost of capital appear neither advisable nor necessary.

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I. INTRODUCTION

The substantial growth of derivative activities in the last couple of decades has made monetary policy design and short-term exchange rate management increasingly dependent on the interaction between domestic financial systems and foreign counterparties in the derivative market and on the combined behavior of the spot exchange rate and that of foreign exchange forwards, swaps and options. Derivatives may facilitate the continuity of financial inflows by allowing the adaptation of risk exposures to the investors' preferences, and they may also facilitate a less costly exposure to riskier high-yield investments by speculators in particular periods.

The Bank for International Settlements (BIS) defines a financial derivative as "a contract whose value depends on the prices of underlying assets, but which does not require any investment of principal in those assets. As a contract between two counterparts to exchange payments based on underlying prices or yields, any transfer of ownership of the underlying asset and cash flows becomes unnecessary."² This relates to the fact that a financial derivative could be replicated by conventional financial instruments.³ They are however preferred over an equivalent combination of financial instruments because of lower transaction costs resulting from the unification of separable tradable contracts and their dynamic and transparent revaluation resulting from the difference between the reference contract price of the underlying security and the prevailing or expected market price, appropriately discounted.⁴ The price of derivatives captures automatically the continuous changes in risk conditions, while the continuous resetting of an equivalent position would entail larger transaction costs.

² BIS (1995). This definition excludes fixed price contracts and delayed transactions within the normal course of business that do not result on a separate contract; insurance and contingencies such as guarantees and letters of credit that depend on the occurrence of additional events that sometimes are not even market related; and embedded derivative-like features as they are not separable from contracts on the underlying assets.

³ Parallel contracts with different maturities, actual exchanges of assets and/or liabilities, and combinations of borrowing/depositing and purchasing/selling of financial assets are substituted by forwards, swaps and options respectively. In the absence of derivatives, investors would need to rebalance these positions continuously to achieve the same results.

⁴ This definition corresponds to the intrinsic value of derivatives. For derivatives with an expiration date, such as options, additional time value is associated with waiting for expiration. Time value comprises basis value, related to imperfect risk offsetting, and volatility value, which is the value of a derivative instrument when it is out of the money (zero intrinsic value).

Derivatives impact emerging markets by enhancing liquidity in financial markets; lowering the cost of incorporating new information into prices (thus accelerating the speed of transactions); and favoring increased asset substitutability at the domestic and international levels (favored by more transparent risk pricing).⁵ From a policy-making perspective, issues related to the key features of OTC derivatives activities that are relevant for emerging economies are:⁶

- The domestic impact of systemic risks, in relation to credit exposure and leverage implicit in derivative transactions through the interbank market; and
- The capacity of the domestic financial system to adapt to the transformation of financial risks through derivatives, including availability of market liquidity and changes in market conditions to bear risk and intermediate capital.

This paper deals mainly with the second set of issues, from the perspective of central banks,⁷ analyzing benefits as well as risks of cross-border currency and interest rate derivative operations in calm and turbulent periods. Of particular importance is the analysis of combinations of cross-border investors' positions and strategies in alternative monetary-stance settings. Section II outlines a framework to analyze cross-border transactions in connection with currency holdings with an embedded convertibility option. Section III reports on recent evidence of unstable financial inflows and destabilizing strategies. Section IV analyzes the implications for monetary transmission, differentiating money and credit channels. Section V includes a note on the use of derivatives by central banks within this analytical framework. Section VI summarizes and concludes.⁸

II. DERIVATIVES, CURRENCY HOLDINGS AND CROSS-BORDER POSITIONS

A. Convertibility Option Embedded in Domestic Currency Holdings

Merton's representation of a company's assets and liabilities could be extended to analyze domestic currency holdings as a liability with option-like features. In Merton's scheme, equity and debt are considered options on the value of a company's assets. To the extent that the value of equity tends to zero if liabilities exceed assets but increases indefinitely as assets

⁵ Based on Bank for International Settlements (1994).

⁶ Based on Schinasi et al. (2000).

⁷ The paper addresses cross-border interest and exchange rate derivatives in general. Wherever the differentiation becomes relevant, it refers to over-the-counter (OTC) rather than exchange-traded derivatives, as they are even more dominant in emerging markets.

⁸ Appendix I includes the description of basic derivatives referred to in the paper.

exceed liabilities, the value of equity would resemble that of a purchase of a call option (to be exercised by the equity holder). Analogously, to the extent that a lender could not recover the full value of liabilities when liabilities exceed assets, the value of liabilities would resemble that of writing (selling) a put option (to be exercised by the company) (Figure 1), in the manner of an American option with an expiration date well into the future.⁹ Also, equities and liabilities are a sui-generis type of options as they can be partly exercised, do not have a clearly defined exercise date or a contractual strike price, and their value is affected by the counterparty decisions (in this case the company).

To extend these characteristics to domestic currency holdings, one must take into account their special features as a central bank liability.¹⁰ Holding domestic currency provides intrinsic benefits to currency holders, for which they are willing to pay (through seignorage). In Merton's example, it is the company who exercises the option to repay debt with the residual value of assets (as liability holders sold a put option in exchange for a regular payment of interest rates). In the case of currency, the option on the company's assets (in this case the central bank) is to be exercised by currency holders.

However, domestic currency holders do not have direct access to central bank assets (except for the case when currency is automatically exchanged for central bank international reserves in fixed exchange rate regimes). Therefore, it is more appropriate to characterize the rights of domestic currency holders as an embedded convertibility option to dispose of currency holdings in exchange for goods and services or foreign exchange. Part of seignorage pays for the right to "exercise" this option. If exercised, the central bank must react by reducing its assets in proportion to the reduction of domestic currency holdings (by reducing credit, international reserves, or tolerating higher inflation and/or devaluation).

Considering the characteristics of currency from the perspective of a central bank balance sheet, the following additional features would apply to the embedded convertibility option described above:

- The value of this option is given by the negative difference between the present economic value of the flow of services provided by domestic currency relative to holding goods or foreign currency. The holder of domestic currency would have a long position in this put option.¹¹ That means that the option is not exercised as long

⁹ American options can be exercised at any time before maturity, while European options are exercised only at the time of the specified exercise date.

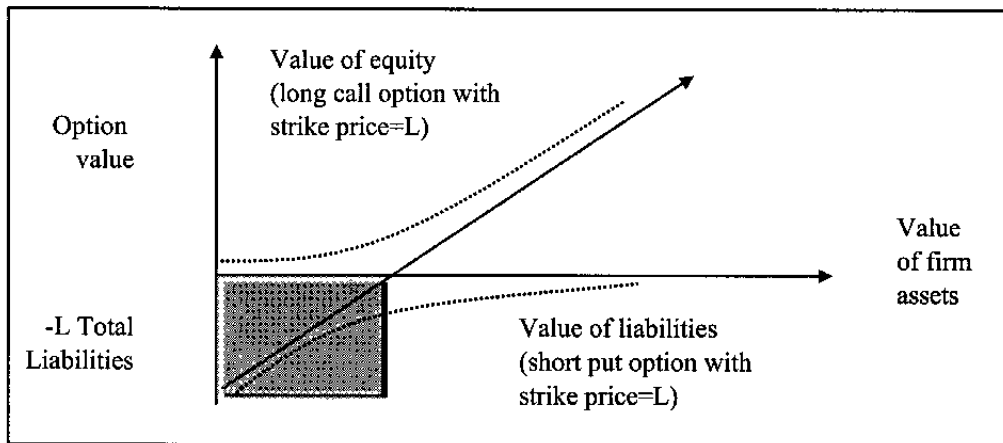
¹⁰ See Blejer and Schumacher (1999) for other works that analyze monetary policy aspects based on the overall central bank balance sheet.

¹¹ A long position implies that losses are limited, unlike short positions that could lead to unlimited losses.

as the present economic value of currency services is perceived as larger than the alternative of holding goods or foreign currency.

- The present economic value of domestic currency services would depend on the ability of the central bank to defend its value over time, which in turn is mainly correlated with the availability of central bank international reserves (positively) and the level of interest rates and inflation (negatively).
- This convertibility option would be exercised when the present value of currency services decline as to justify its exchange for goods or foreign exchange. This means that the aggregate demand for currency will decline,¹² to which the central bank would react based on the monetary policy framework.

Figure 1. Merton's Option-based Model for Valuing Debt and Equity



This “convertibility option” is also comparable to an American put option (as opposed to a European put option, that must be exercised at maturity). The concept of maturity is of course also irrelevant in the case of currencies. A representation of domestic currency as an American option whose expiration date is far into the future is however useful, as this implies that this option will be exercised sooner rather than later: American put options show a bias to be exercised early if sufficiently in the money,¹³ as the prospect of potential profits arising

¹² As in Merton's example, this option is exercised partially, as the demand for currency does not decline to zero.

¹³ Options are in the money when its exercise is advantageous for those holding a long position, at the money when it is neutral and out of the money when it is disadvantageous.

from further losses in value of the underlying asset decline.¹⁴ For domestic currency holdings, the bias to early exercise is reinforced by the prospects of depreciation of the exchange rate and/or inflation.

This characteristic entails a prompt reduction of domestic currency holdings when monetary conditions deteriorate. Figure 2 represents the corresponding pattern of the value of these options at exercise. No exact analytical formula is available to determine the value of an American put option (comparable to Black-Scholes for European options).¹⁵ Domestic currency holdings can be formulated as a portfolio, as follows:¹⁶

$$\text{Portfolio A: } c, \text{ PEV}_{dc} \\ \text{PEV}_{dc} = \int_0^z X_t e^{-rt} dt$$

Where c denotes the value at exercise of the convertibility option, PEV_{dc} the present economic value of domestic currency, r the discount rate, t time (from 0 to z) and X the flow of services per unit of time. In equilibrium, this portfolio should be equivalent in the initial period to the value of potential services provided by alternative uses of domestic currency:¹⁷

$$\text{Portfolio B: } \text{PEV}_{au} \\ \text{PEV}_{au} = \int_0^z Y_t e^{-rt} dt$$

Where PEV_{au} denotes the present economic value of the alternative use of domestic currency and Y the corresponding value of its flow of services per unit of time.

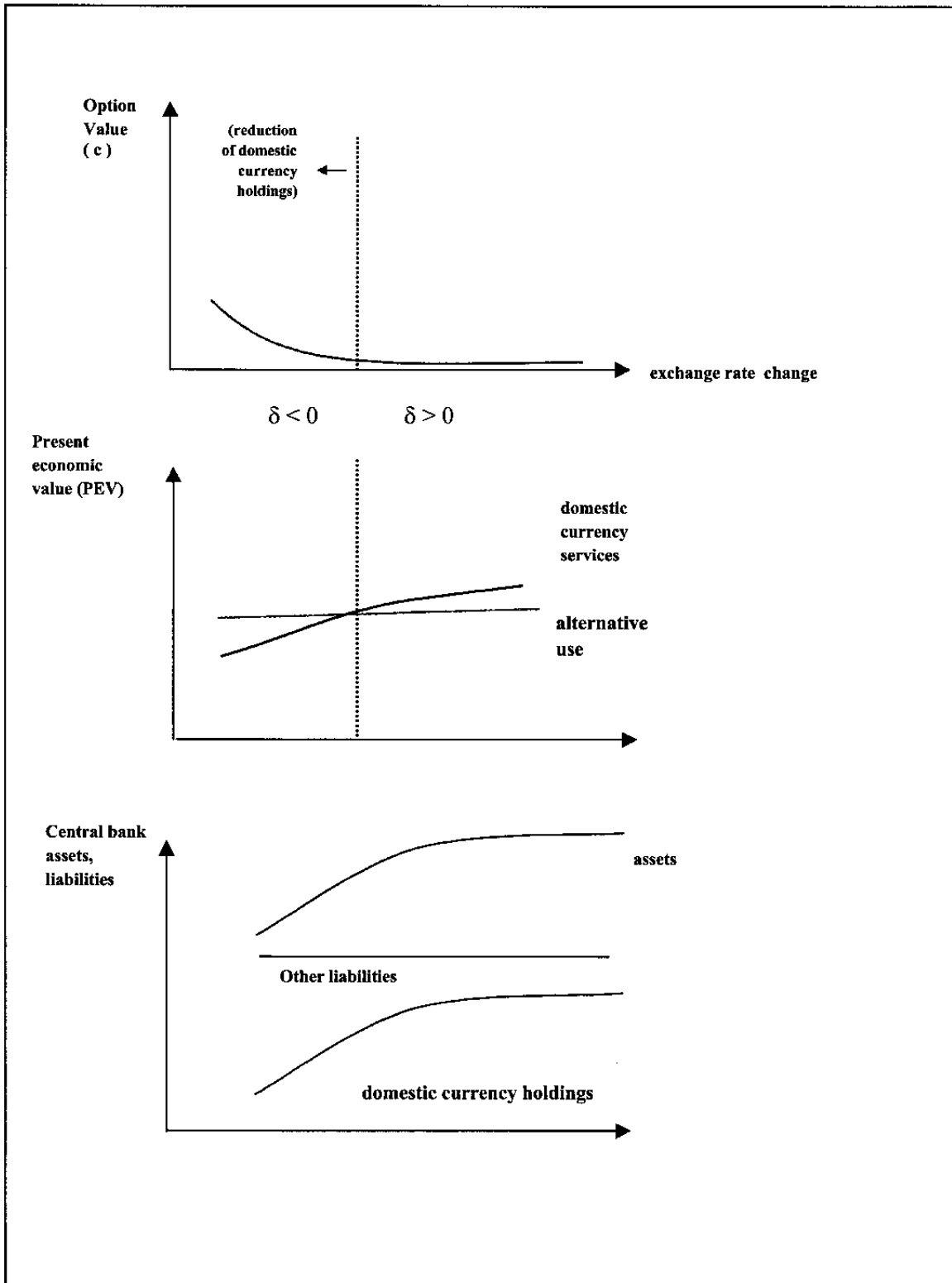
¹⁴ In general, the early exercise of an American put option is more attractive as the value of the underlying asset decreases, the interest rate increases and volatility decreases. See Hull (1997).

¹⁵ Numerical procedures and analytic approximations could be applied, but that goes beyond the purpose of this paper.

¹⁶ The example can be followed considering the most simple case of a fixed exchange rate regime where the domestic currency holder lays a claim directly on central bank international assets. In this case, the alternative use of domestic currency is to be substituted by foreign currency.

¹⁷ For the part that is being converted.

Figure 2: Put Option Embedded in Domestic Currency Holdings



In this representation, the “option” will turn “in the money” when the following events take place:

$$\begin{aligned}\delta &< 0 \\ \Delta PEV_{dc} &< 0 \\ PEV_{dc} &< PEV_{au}\end{aligned}$$

At any point of time, the value of Portfolio A would be:

$$\text{Max}(PEV_{au}, PEV_{dc})$$

When PEV_{dc} declines (meaning that the option is “in the money”), the value of portfolio A becomes the present economic value of the alternative use of domestic currency. This value is always maximized through an early exercise for the same discount factor:

$$\int_n^z Y_t e^{-rt} dt > \int_{n+1}^z Y_t e^{-rt} dt$$

In addition, as $\delta < 0$, the domestic currency holder would lose in the exchange as PEV_{dc} keeps declining.

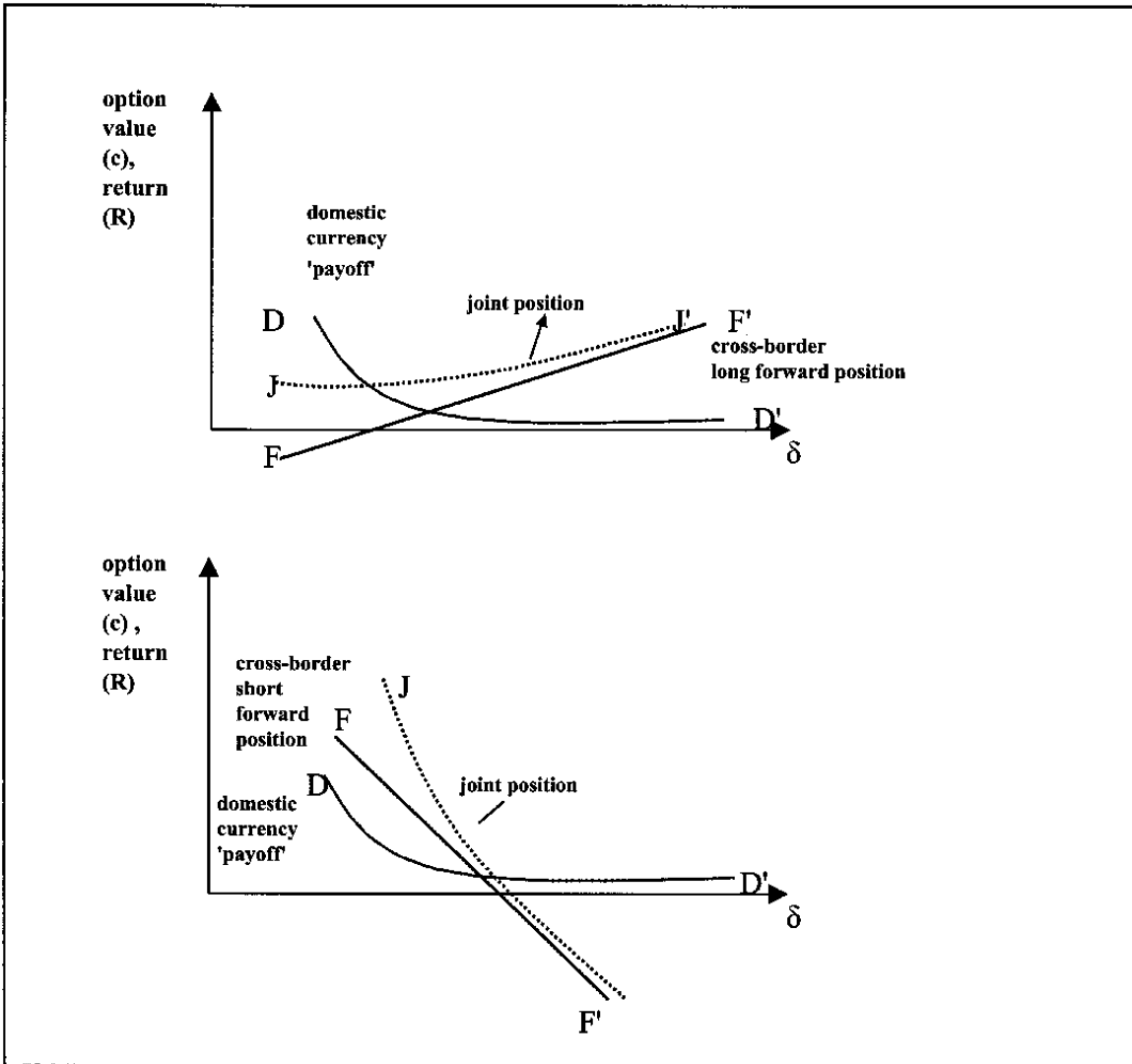
The reduction of domestic currency holdings must be addressed by the central bank through an active policy (for example, the placement of bonds in exchange for the released domestic currency holdings), a passive rule (the sale of foreign exchange to preserve the exchange rate), or through higher devaluation and/or inflation.

B. Cross-Border Positions and Domestic Currency Holdings

Forward positions in the domestic currency are incorporated into the analysis to introduce the role of cross-border investors. These investors would only hold the domestic currency as long as it offers profitable returns (R), positive in case of prospects of exchange rate appreciation for long positions and of exchange rate depreciation for short positions (FF' in Figure 3).

If the position of the domestic currency holder and the long position of the cross-border investor are combined with equal weights (line JJ', top graph in Figure 3), the pattern of the joint position would resemble that of a call option on central bank assets (to be exercised when the value of the domestic currency appreciates sufficiently by the cross-border investor); i.e., it would be equivalent to the pattern for an equity holder in Merton's example. The build-up of long positions over time would likely coincide with a sizable excess of central bank foreign assets over liabilities. This could be seen as another representation of the stabilizing speculator.

Figure 3. Cross-border Forward Positions



In the case of a short forward position, the corresponding pattern of the short position with domestic currency holdings would result in a steeper slope than the original domestic currency holding position (line JJ', bottom graph in Figure 3). The magnified impact in times of currency depreciation illustrates the destabilizing effect of short positions by cross-border speculators. A short cross-border position against the currency would magnify the reduction in domestic currency holdings when economic conditions deteriorate. This has been the argument favored by those who advocate measures to limit speculative capital inflows through controls.

However, unstable situations (roughly represented by the height of the curve JJ') would not only result from short speculative cross-border positions. The following scenarios illustrate the main alternative possibilities (see Figure 4):

Scenario A : Even in an economy where “fundamentals are right” (moving from left to right along the domestic payoff curve DD’ in Figure 4), at a given return $R(0)$ ‘profit-taking’ sales of domestic currency will be induced. This would not lead to turmoil only if the central bank has a comfortable availability of assets.

Scenario B : However, a long position by cross-border investors could still become destabilizing if there is an unexpected shock affecting domestic monetary conditions. This would be equivalent to a shift of the domestic payoff curve DD’ to the right (and a related shift upwards of JJ’). Holders of a long position would unwind their positions in times of turmoil coming from a deterioration of domestic monetary conditions.

Scenario C: Variables affecting FF’ and DD’ may not be independent. For example, if interest rates increase in a comparable foreign market and cross-border investors reduce their positions, that may in turn prompt domestic currency holders to reduce their domestic currency holdings (a shift of DD’ to the right).

Prior to the widespread use of derivatives, one-sided positions resulting from financial flows were more likely, and therefore a higher risk of exacerbating currency risk resulted from all or nothing positions by investors not being able to isolate their portfolios from specific risks. Still, instability in periods of turmoil may become potentially more damaging with derivatives. A country may be subject to compounded negative effects, as illustrated by the case of Hong Kong in 1998, where massive short positions in the currency combined with short positions in the stock exchange were addressed by large emergency purchase of stocks by the Hong Kong authorities.

Introducing derivatives into the framework developed above allows for the differentiation of alternative effects on monetary stability. The following scenarios illustrate the main possibilities:

Scenario D: Derivatives lead to a reduction in the elasticity of returns to changes in the value of the currency as a result of hedging (a flattening of FF’). This implies more neutral positions of cross-border investors relative to domestic monetary conditions.

Scenario E: The financial exposure of economic agents may also be modified more easily.¹⁸ Agents could switch more rapidly to an alternative portfolio allocation in the face of exchange and interest rate movements, even if “fundamentals were right.” FF’ would become unstable.

Scenario F: Short positions could also intersect the flat segment of the DD’ curve (“right fundamentals”), when it is compatible with dynamic strategies favored by derivatives.

¹⁸ Bank for International Settlements (1994)

The net impact of derivatives on domestic monetary conditions would then depend on the relative intensity in the use of derivatives for hedging, position-taking or destabilizing strategies. In principle, there are reasons to expect a more intensive use of derivatives for hedging purposes:

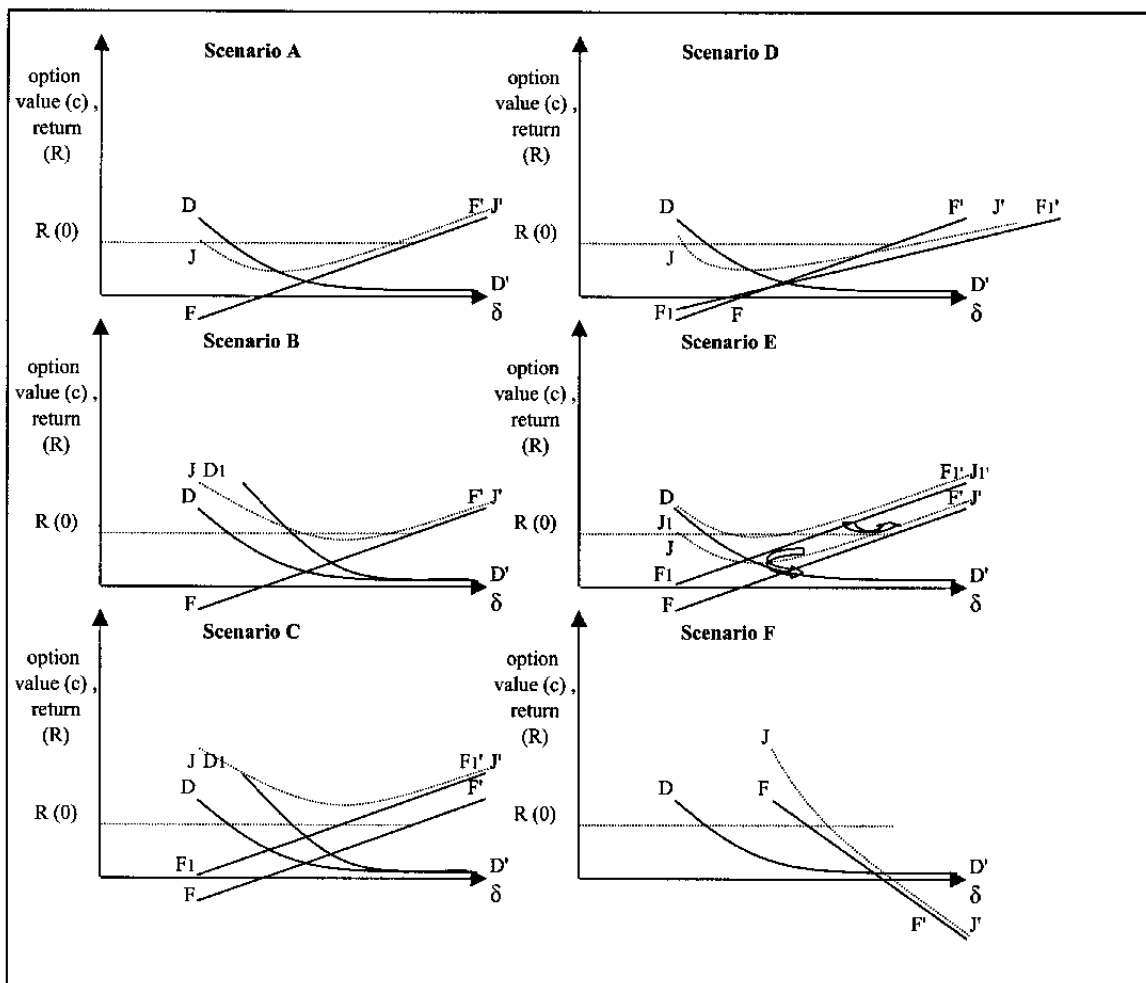
- Empirical evidence shows that the use of derivatives has been widely focused on risk management and hedging. A recent survey conducted by the U.S. Treasury Management Association found that 86 percent of treasurers in the U.S. use derivatives for that purpose. A similar survey by Treasury and Risk Management Magazine in 1999 shows that between 50 and 60 percent of Treasurers use derivatives to hedge foreign currency exposure, with 20 percent or less reporting the use for the creation of synthetic products to take positions of different forms.
- However, unhedged positions are not uncommon for large banks, particularly for transactions with foreign countries economies. This could nonetheless be related to the likely more intensive resort to risk diversification benefits for these banks, and also to higher hedging costs in emerging markets that make hedging uneconomic.¹⁹
- Speculative operations are components of the high yield end of a portfolio. Consequently, they would only become sizable for a specific market if returns more than justify the exposure to higher risk (to divert resources from other alternatives). An additional consideration is the lack of evidence of a proliferation of short positions (between 1 and 2 percent of notional value according to BIS surveys). Investors search for overvalued currencies against which to go short at least as much as for currencies that are trading at attractive prices.²⁰

Still, even with strong fundamentals, instability could potentially cause massive damage if a proliferation of adverse positions affect an emerging market currency within a short time period. Before analyzing the connection between derivatives and monetary transmission, the following section presents recent evidence on unstable financial flows associated with derivatives (scenario E) and the importance of destabilizing strategies (scenario F).

¹⁹ Gorton and Rosen (1995). In a study of the U.S. swap market, they found that large banks tend to be long (pay fixed interest rates) at short maturities and short (pay floating interest rates) at long maturities.

²⁰ Eichengreen and Mathieson (1998).

Figure 4. Alternative Scenarios



III. RECENT EVIDENCE OF UNSTABLE FINANCIAL INFLOWS AND DESTABILIZING STRATEGIES RELATED TO DERIVATIVES

Following the U.S. stock market crash of October 1987, literature on derivatives focused on the analysis of the potential threat to the stability of cash markets resulting from concentration of short-term speculative transactions facilitated by their impact on the reduction of the cost of capital.²¹ In addition to the consequences of short-term swings on the

²¹ Consistent with that view, the 1993 recommendations for the classification of derivatives in the National Accounts considered derivative-linked cash flows as an inherent component of the cost of capital. More recently, there is increasing consensus to view derivatives as financial assets in their own right that do not affect the cost of capital directly given that a direct provision of capital is not involved, and, consequently, net cash settlement payments associated with derivatives are classified as part of the financial accounts (Heath 1998).

availability of foreign exchange, the inability to prevent the impact on domestic markets of sudden financial inflows and outflows has been a source of concern.

Derivatives could reduce the cost of speculative capital flows by expanding leverage and, in the case of banks, avoiding the use of bank reserves by reducing the need for on-balance sheet transactions.²² Specifically, short forward positions, short sales, synthetic repurchase agreements or the purchase of put options allow short positions against a currency. Market makers add to pressures in the currency when they cover their corresponding counterparty long positions through sales of domestic currency assets in the spot market (compensating the maturity mismatch with a foreign exchange swap).

A. Financial Flows Instability

If cross-border derivatives were intrinsically prone to instability, this should be reflected in the rise of instability at the initial stages of cross-border derivative operations. This may be a result of uninformed traders migrating to derivative markets to benefit from lower transaction costs, higher leverage-induced volatility in the derivative markets spilling over spot market rates, and market makers setting larger spreads in the spot market to compensate for the higher cost of dealing with informed investors.

For emerging economies, volatility spillovers from the introduction of derivative operations do not appear to have been a problem for underlying spot markets.²³ Studies confirm the two-way connection between derivatives and spot markets, but volatility does not appear to have increased. On the contrary, derivative markets seem to incorporate information faster than the spot market.²⁴ Some studies go further to conclude that volatility is reduced as options contracts complete the market, stabilizing the behavior of the underlying instrument.²⁵ Surprisingly, the little evidence supporting the hypothesis that an increase in volatility follows the introduction of derivatives comes from industrial economies.²⁶

²² See Lall, Subir (1997) and Garber-Spencer (1995).

²³ See Jochum and Kodres (1998)

²⁴ See Scott (1993) and Morales (2000)

²⁵ See Shastri, Sultan, and Tandon (1996)

²⁶ Chatrah, Ramchander and Song (1993), for the British pound, Canadian dollar, Japanese yen, Swiss franc and Deutsche mark. However, they attribute these volatility swings to more efficient pricing in the futures market.

B. Destabilizing Strategies

Positive feedback

Through positive feedback trading, currency and security purchases reinforce price increases and sales reinforce price declines. Consequently, in the absence of offsetting forces, prices will tend to overshoot. The prompt purchase of cheap put options on the Thai baht by cross-border investors left domestic dealers without the possibility of sufficient coverage of their short positions, which may have led to further sale of bahts in the spot market.²⁷ Positive feedback trading includes dynamic hedging, stop loss orders and margin calls.

- Dynamic hedging relies on liquid and reasonably continuous markets with low to moderate transaction costs. As portfolio insurance is expected to increase when the price of underlying assets increase and vice-versa, demand from dynamic hedgers will add to underlying upward and downward price pressures.
- When stop-loss orders are triggered (sell stop-loss orders when prices decline and buy stop-loss orders when prices increase), pressures from these operations will add to market pressures in the same direction.
- Margin calls imply that when domestic assets used as a collateral experience a decline in prices, foreign investors will require offsetting deposits to cover the increased exposure.

Recent studies show weak evidence that positive-feedback strategies have been exercised consistently to the point of leading the markets toward instability, and no evidence in the case of emerging markets. Where these strategies have been consistently exercised, it appears that market players' profits do not increase during periods where positive feedback was a priori considered profitable, indicating that positive feedback may not have been as intensely used as was believed and/or that profits from that strategy may not have been as high once all costs are considered.²⁸ There is some evidence that most periods of market instability have occurred as a result of the unwinding of long positions, particularly carry trades, which points at one-sided positions as the source of risk rather than at the proliferation of destabilizing

²⁷ See Eichengreen and Mathieson (1998).

²⁸ Kim and Wei (1999) show similar results concerning profitability of positive feedback trading in Korea.

strategies.²⁹ There is also some evidence that positive feedback trading (associated with some herding behavior) may have intensified during crises (i.e., after the crises had erupted).

Cross hedging

Within one-sided positions in general, cross-hedges to limit liquidity and convertibility restrictions in countries with high yield securities, are more appropriately of concern in terms of unforeseeable impacts. In cross-hedge operations long positions in a high yield market will be hedged through short positions in currencies highly correlated with the country where the investor holds securities, but that show larger availability of liquidity and lower convertibility risks. If this leads to a large net short position against a currency, the central bank would be less able to exercise an interest rate defense of the currency when needed, as it would need to commit more international reserves to this purpose. If instead the central bank increases interest rates, this may lead to sizable sales of the currency based on dynamic hedging, if an expectation of exchange rate depreciation is incorporated into hedging.³⁰

C. Consequences of Compensatory Surcharges to the Cost of Capital

Even in apparently justified cases, surcharges (normally in the form of administrative measures) may lead to undesired consequences and side effects. First, these measures to artificially raise the cost of related financial flows entail the caveats associated with capital controls. Second, for derivative markets, other undesired impacts result from the shift of portfolio transactions offshore.³¹ For example, swaps and repurchase agreements could help to circumvent limits on domestic financial operations to operate on margin, as illustrated by the well-known example of Mexican Tesobono swaps in the collapse of the Mexican peso in 1994.³² The following considerations apply:

- The perception of country risks may be distorted following the imposition of limitations.

²⁹ See Hsie (1999), for an analysis of the behavior of hedge funds. He analyzes profitable opportunities during the stock market crash of 1987, the ERM crisis of 1992, the world bond market rally of 1993, the Mexican Peso crisis of 1994, and the Asian currency crisis of 1997.

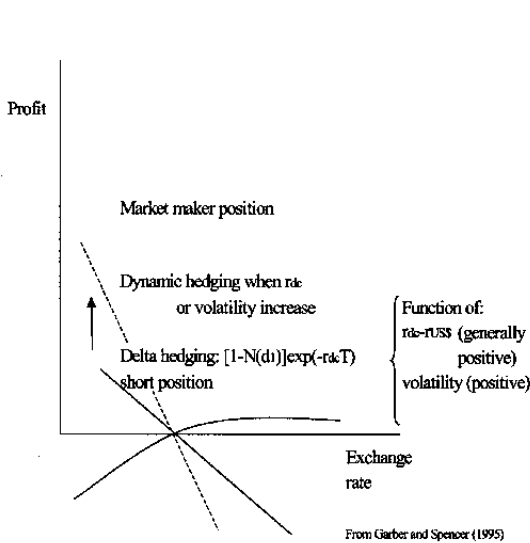
³⁰ See Garber and Spencer (1995)

³¹ For an analysis of limits on the offshore use of currencies, see forthcoming IMF Working Paper by Ishii, Ötoker-Robe and Cui.

³² See Folkerts-Landau- Garber (1997).

- By driving operations offshore, the economy may be still exposed to instability in ways that may be less apparent, as the higher cost of pure offshore transactions would induce foreign investors to look for indirect access to domestic alternatives through structured instruments that circumvent domestic legal restrictions.

Figure 5. Destabilizing Strategies

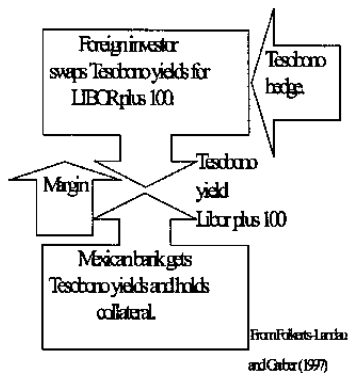


Dynamic hedging

Short spot or forward domestic currency market makers' positions to hedge net sale of exchange rate protection is updated (higher when domestic interest rates or volatility increase).

Tesobono swap

Agreement between foreign and Mexican banks, by which the foreign bank pays Tesobono yields (hedge by Tesobono holdings) and receives LIBOR plus and collateral (subject to margin calls).



- As convertibility risk is not completely eliminated,³³ investors would look for coverage of the risk of an interruption of convertibility that may lead to the proliferation of illiquid accounts.
- More stable investors would prefer a country where the cost of hedging is lower, and therefore, may be discouraged to undertake operations in a country where hedging must take place in less liquid offshore markets.³⁴

IV. CROSS-BORDER DERIVATIVES AND MONETARY TRANSMISSION

A. Derivatives and Monetary Transmission

The pure money channel of monetary transmission works through the liability side of the banks' balance sheet: A decrease in reserve money reduces the banking sector's ability to issue demand deposits. The banking sector must then hold fewer bonds, which for equilibrium to be maintained requires that the real interest rate increases. As this affects the cost of capital, the demand for durable goods, such as fixed investment, housing, inventories and consumer durables declines, and aggregate demand would affect the level of production.³⁵

For emerging markets, the impact of derivatives on the money channel of monetary transmission is ambiguous, because of the following factors:

- Derivatives may increase the speed and the extent of the transmission of monetary policy as yields would adjust faster to changes in the money market rate.
- On the other hand, derivatives may make financial inflows more independent of central bank decisions reflected in the money market rate.

³³ Offshore banks may book these transactions as domestic currency local transactions and hedge domestically through a branch in the domestic currency country.

³⁴ Practitioners report that lack of liquidity has been a recurrent problem in NDF markets. Non-deliverable forwards may also be subject to manipulation by official agencies like in Russia prior to the crisis of August 1998. Sudden closures of some operations left markets without price references, at the time of the imposition of capital controls in Malaysia in 1998. In Thailand and Malaysia, two-tier foreign exchange forward markets resulted from caps on onshore transactions.

³⁵ Bernanke and Gertler (1995) and Kashyap and Stein (1994)

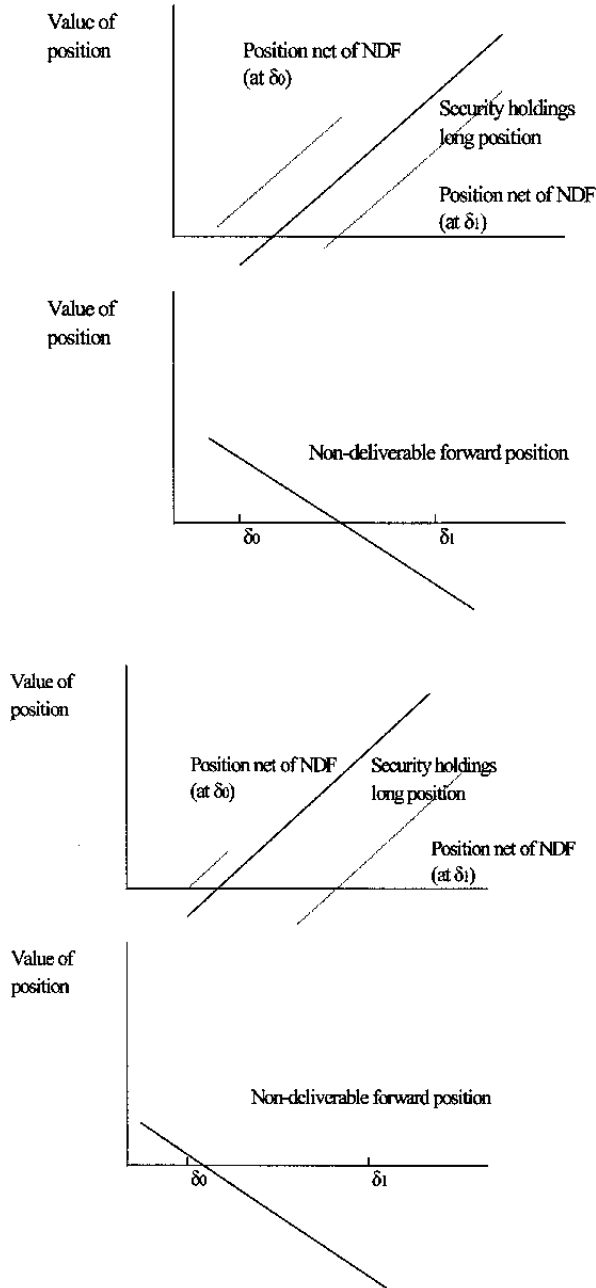
The credit channel of monetary transmission leads to the amplification of the direct effects of monetary policy on interest rates, as the difference in cost between funds raised by issuing equity or debt and funds generated internally increases. This reflects imperfections in credit markets that explain transitory increases in interest rates leading to sustained declines in real GDP, aggregate demand declining ahead of supply, and expenditure on long term assets declining more significantly than other expenditure categories. The credit channel in turn shows two subordinated channels:

- The balance sheet channel, or the impact of monetary policy on borrowers' balance sheets and income statements, that stresses the impact of monetary policy on borrowers' net worth, cash flow and liquid assets.
- The bank lending channel that affects the supply of loans. For the bank lending channel to exist, intermediated loans and open-market bonds must not be perfect substitutes (for example, because banks have limited access to bond financing), the central bank must affect the supply of loans (because firms are basically bank loan dependent) and price frictions must prevail (for example, because of imperfect information or costly enforcement of contracts).

Derivatives affect the credit channel through their impact on the degree of asset substitutability. A diminishing role of the credit channel in emerging markets could be expected from the following factors:

- A reduction of balance sheet effects may result from the isolation of cash flows from changes in the money market interest rate, at least for a segment of economic agents.
- Domestic portfolio assets would become more comparable with foreign portfolio assets by hedging interest rate and exchange rate risks. Specifically, by hedging the currency risk, a foreign investor may invest in a domestic security denominated in the domestic currency as if it were denominated in a foreign currency. This reduces price frictions in the financial market. (See Figure 6)
- Increased portfolio investment in domestic portfolio assets facilitated by derivatives may lead to increased arbitrage between domestic assets. Swapping away interest rate risk would increase the possibility to shift among competitive domestic portfolio assets. This facilitates access to other sources of financing for both banks and firms.

Figure 6: Currency-Hedged Positions



Currency neutral position

A long position in a security is hedged through short NDFs. Protection from exchange rate depreciation implies surrendering the currency element of price gains.

Uneconomic hedging

Little protection from exchange rate depreciation and/or large surrender of currency gains results from forward exchange rates inconsistent with market expectations.

B. Cross-Border Derivatives and Asset Substitutability

The introduction of derivatives could potentially reduce the importance of the credit channel relative to the money channel, which may result in faster and more durable responses to monetary decisions. But because increased asset substitutability may partially reduce the extent of frictions in the domestic market, responses may be less significant in magnitude.³⁶ For example, in a more derivative-intensive economy, sterilization policy may more quickly influence the yield curve by incorporating the expectation of declining inflation with less need of arbitraging financial flows across maturities. Empirical work to identify these effects is made difficult given the multiplicity of operations, the dynamic nature of cross-border positions, the specialization of market participants and the relatively limited net positions of any sign during normal times.³⁷

Increased asset substitutability also entails increased dependence of monetary policy on events in comparable countries, because of a larger risk correlation with countries with similar risk profile (even from different geographic jurisdictions) and with related economies to which fundamentals are expected to converge. This increases the possibility of unstable financial flows affecting the money channel of transmission, and of destabilizing strategies across different markets. However, evidence of this being a major factor is not strong (as seen in Section III).

The net benefits from asset substitutability would be greater if participation of domestic agents in the derivatives market increases as a consequence of derivatives leading the way in the development of underlying asset markets, through the development of reference pricing and setting up of standardized transactions. The incorporation of domestic players into the derivatives market would constitute a sign in itself of the degree of advance of the financial system and would favor enhanced asset substitutability. However, this process could take some time as market players may experience disadvantages in pricing volatility against experienced investors that have the advantage of larger availability of liquidity and a wider range of investment opportunities.

Authorities should support the development of derivative markets to favor asset substitutability to reduce the risk of one-sided positions, to favor more stable financial inflows, and limit the extent of the credit channel to facilitate transmission of monetary policy through prices rather than through quantities. Emerging economies normally show more significant effects through the credit channel, specifically the lending channel: loans are clearly imperfect substitutes for other forms of financing, the central bank affects the supply of loans, and price frictions abound. To the extent that the credit channel relies on market imperfections, the growth of derivative activities diminishes its importance by allowing

³⁶ Vrolijk (1997)

³⁷ Negligible and indeterminate effects have been found in most studies.

expanded leverage and hedging and enhanced information symmetry. Overall increase in substitutability would allow for the isolation of some of the risks entailed in lending, mainly market risks embedded in lending activities. This may also have an important indirect effect by increasing efficiency in domestic financial markets.

Conditions for enhanced asset substitutability

Generally, the benefits from enlarged asset substitutability relate to the concept of complete markets. A complete system of markets is one in which there is a market for every good, and investors have the greatest range of opportunities to bet on a particular outcome. Derivatives are of value because they provide investors with flexibility in deciding on the risks to be incorporated in their portfolio.³⁸ Therefore, their use is consistent with a preference for more predictable and liquid markets over the long run, which explains why the largest share of derivative operations remains concentrated in developed countries and mature financial markets.

Still, emerging economies have been making progress in recent years to provide an attractive destination of these operations: The share of non-core currencies in the total turnover has increased from 10 percent in April 1995 to 15 percent in April 1998.³⁹ However, increased reluctance to carry large inventory positions in emerging currencies by market makers, as a result of substantial losses following episodes of volatility jumps, limits the magnitude of resources that individual institutions would allocate to certain high yield plays in these markets.

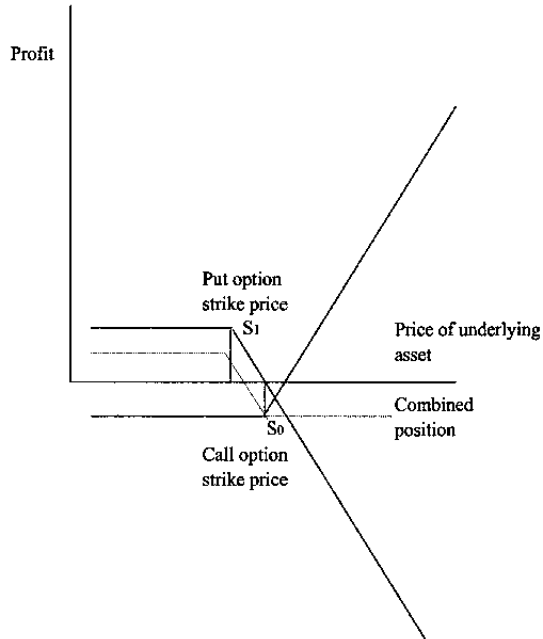
Enhanced scope for asset substitutability would be possible in emerging markets that attract a critical mass of cross-border investors. Emerging markets perceived as attractive to conduct these operations would be those that show higher financial development, policy credibility and adequate infrastructure similar to those in mature financial markets. Among the main features related to this perception are the following:⁴⁰

³⁸ Eisenberg and Jarrow (1991).

³⁹ Currencies different than the U.S. dollar, the Dmark, the Yen, the Pound sterling, the Franc, the Swiss franc, the Canadian Dollar, the Australian Dollar and the ECU and other EMS currencies.

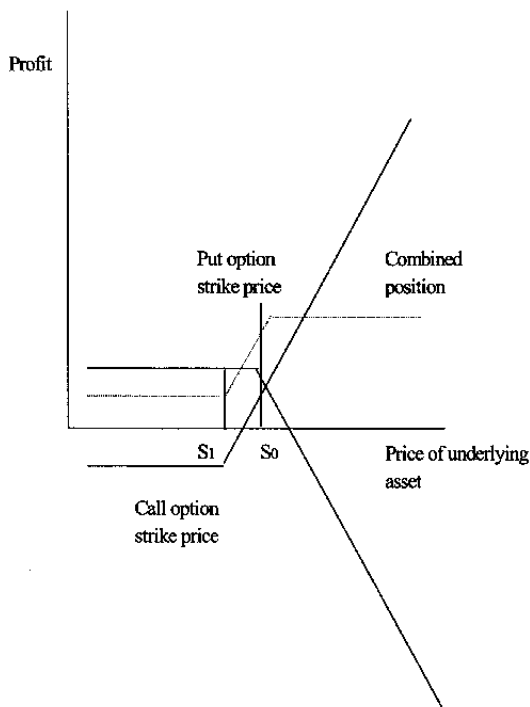
⁴⁰ For examples of typical cross-border derivatives, see Figure 6.

Figure 7: Cross-Border Transactions Involving Derivatives



Bear call spread

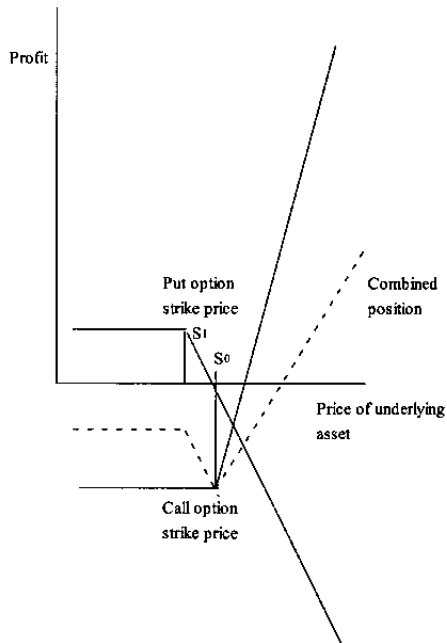
Combined position resulting from buying a call option at a high strike price and selling another call at a lower strike price in that expectation the security price would decline



Bull call spread

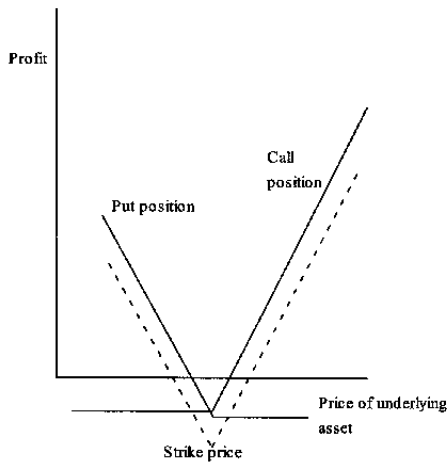
Combined position resulting from buying a call option at a low strike price and selling another call at a high strike price in the expectation that the security price would increase.

(Fig. 7, cont.)



Call ratio back spread

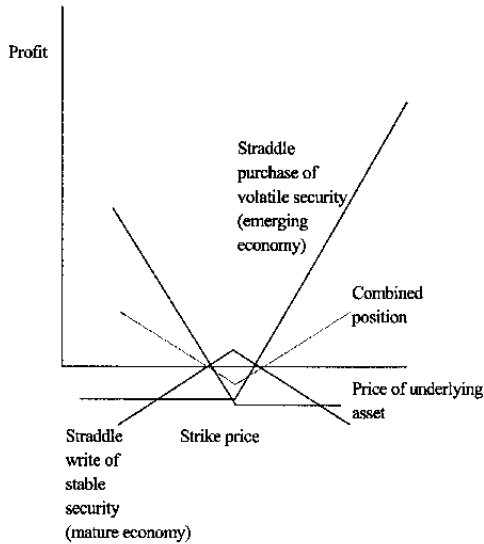
Combined position resulting from buying a large number of call options at a high strike price and selling a call option at a lower strike price in the expectation that the security price would increase substantially.



Straddle purchase

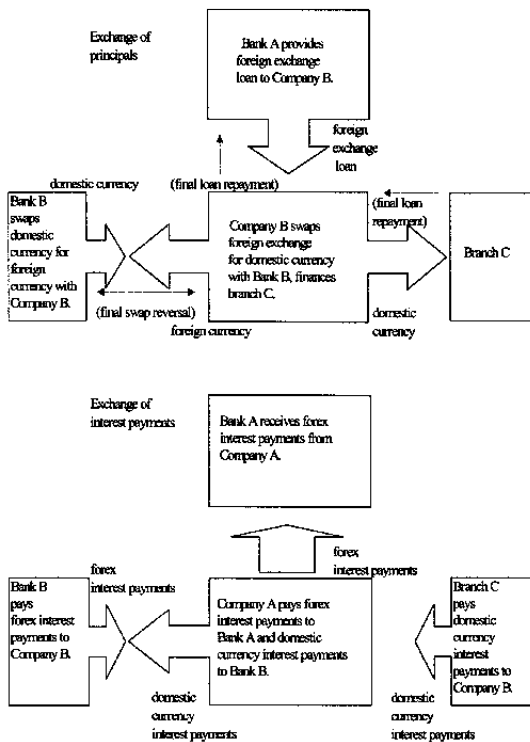
Combined position resulting from buying a call and a put option at the same strike price in the expectation that the security price volatility would increase.

(Fig. 7, cont.)



Option convexity trade

Combined position resulting from a straddle purchase on a volatile security and a straddle write on a related less volatile security in the expectation that the same shock would lead to a net profit



Currency swap

Exchange of principal amount of two currencies at the spot exchange rate to be reversed at a predetermined exchange rate, exchanging interest payments in swapped currencies.

Financial development

- Adequate risk pricing related to the possibility of separating risk effectively among its main components (convertibility risk, default risk, foreign exchange risk, settlement risk). In the Tesobonos example (Figure 5), a magnifying factor was the joint default and market risk embedded in margin calls. These risks are always difficult to quantify, especially in countries with illiquid markets, larger correlation of risk factors, imperfect markets resulting in discontinuous price movements and 'volatile volatility'. A rapid incorporation of market expectations into risk pricing would allow for reasonable hedging costs. For example, a depreciated domestic currency in the forward foreign exchange market while the market actually expects an exchange rate appreciation would discourage hedging by those with long positions in the currency, by making it unduly expensive. By contrast, appropriate pricing translated into yield curves reflecting market expectations would help developing the currency swap market.
- Duration, defined as how long, on average, the holder of a security has to wait before receiving cash payments. Yield-curve and relative value plays would take place in financial markets showing longer duration. Transactions may involve relative value plays (funding investment on long- term bonds by a short position on shorter dated bonds) or spread trades (bets for/against volatility). Liquidity should allow for different strike prices and premia to make these transactions economically justifiable, even for different price ranges as for a call-ratio back-spread. On the other extreme, before an array of prices is available to investors, volatility plays would allow other alternatives such as a straddle purchase if an investor perceives that market volatility is 'cheap,' until the market finally incorporates all relevant information into volatility pricing.

Policy credibility

- Strong track record of policy making, which could be reinforced by strong policy commitments such as the adoption of a currency board or a complete reliance on inflation targeting, as they reduce uncertainty. By contrast, loss of credibility in these commitments would be related to short positions (as in the top graph in Figure 2). A particular case is that of countries where the government is in a delicate position to sacrifice credibility without incurring substantial costs. This explains the relatively quick return of short-term capital to Mexico, Southeast Asia and Russia shortly after their corresponding currency collapses. This reflected the investors' perception of higher credibility costs after the collapse. Therefore short-term bets were worth exercising if compensated by high profitability.
- Convergence expectations. Convergence plays take place in emerging economies whose yield patterns are expected to meet those of mature markets within a

reasonable period for an investor, normally following international agreements like the EMU, the incorporation to the EU by smaller European economies, or the adoption of a foreign currency as a legal tender. For example, if fundamentals in a developing country show a high correlation with a mature economy an investor could conduct option convexity trades by buying an interest rate option straddle on a security from the developing country (simultaneous call and put options on fixed income instruments at the same strike price) and selling an equivalent option straddle on a security from the mature economy. In this way, it may benefit from the larger impact on volatility of the emerging market security for a given shock in the mature economy.⁴¹

Adequate infrastructure

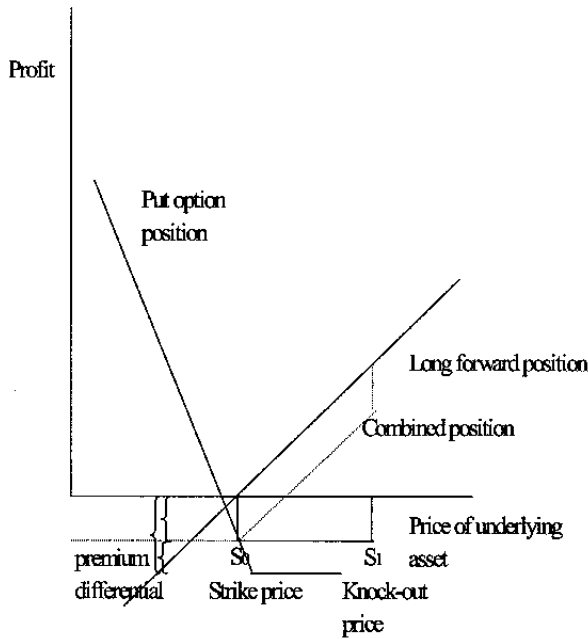
- Transparent regulations, including on convertibility, foreigners' access to money markets and treasury securities, transparent market pricing, smooth settlement system, clear and unambiguous tax legislation, and availability of custody accounts, among others, that should keep up with product innovation. Available funding alternatives in the local money market; including available assets such as government debt and liquid foreign exchange forwards, and the participation of all relevant domestic participants such as pension funds and small investors. Development of appropriate standards may allow for more sophisticated instruments such as barrier options, that require an array of knock-in/knock-out prices in addition to different strike prices (See Figure 8). Hedging through long knock-out put options would allow cross-border investors to benefit from exchange rate returns for a range of exchange rates for which profits are higher. For these transactions, settlement procedures and clarity in the definition of time limits become crucial.⁴²
- Adoption of generally accepted standards in risk control, accounting, auditing, and supervision to discourage inadequate risk taking or selective information disclosure for end-users of derivatives. Regulators in financial centers are becoming increasingly aware of differences in the legal and regulatory environments in developing economies.⁴³

⁴¹ See Kodres, Laura 'Hedge Fund Investment Strategies', in Eichengreen and Mathieson (1998).

⁴² Even in emerging markets where these operations are more commonly used, some pressure in the spot market has resulted from investors unease about exchange rates to close to the point where options may cease to exist.

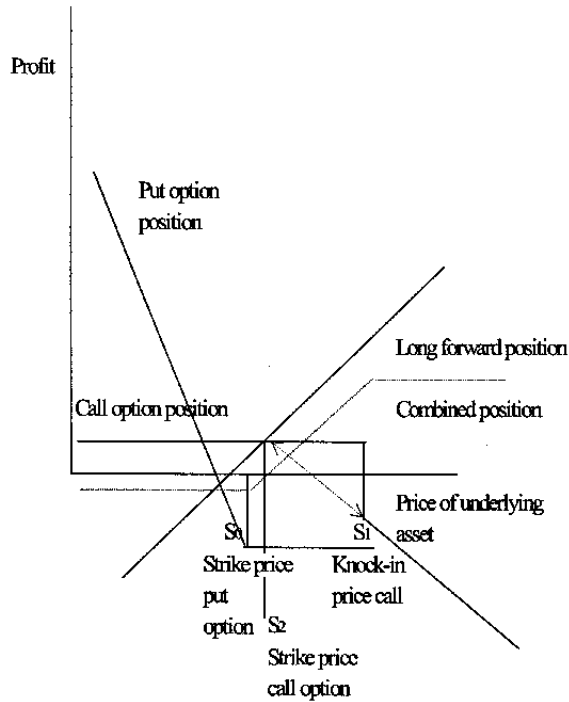
⁴³ See Schinasi G. et al. (2000).

Figure 8: Barrier Options



Knock-out put hedging

Combined position from a long forward and the purchase of a knock-out put option in the expectation that large spot price gains would not reverse below the strike price, while reducing the premium.



Knock-in call hedging

Combined position from a long forward, the purchase of a put option and the sale of a knock-in call option in the expectation that gains would remain within a certain range, while reducing the premium.

Central bank role

In addition to promoting policy credibility and financial development and to contributing to an adequate infrastructure, the central bank could encourage asset substitutability further by becoming active in incorporating signals from the derivative markets into monetary management, which would reinforce consistency between monetary policy and market expectations, without compromising the achievement of the central bank main targets. Continuous follow-up of these variables would also reduce the risk of uncertainty about central bank decisions in the face of turmoil. Examples of information already available for some emerging economies include:

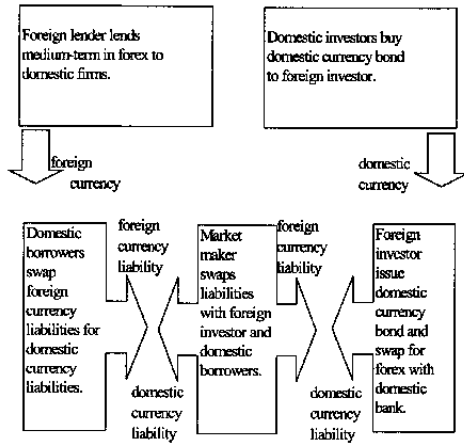
- The magnitude of risk pricing reaction to central bank decisions, as they reveal to what extent the market had anticipated them, as a measure to gauge the sensitivity of the market to alternative policies.
- Market valuation of options at different strike prices and for different maturities reflect the perception of the possibility and sign of risk reversals and the distribution of expected volatility for a range of security prices, exchange rates and time horizon. Yield curves based on implied forward rates normally relate to the time distribution of interest rate, inflation and exchange rate expectations.⁴⁴

Other actions may include measures at the micro level. Some examples are:

- The Monetary Authority of Singapore removed a prohibition on foreigners to issue Singapore dollar liabilities, and now encourages this practice to the point that it is treated as a favorable factor for approval of the setting up of new regional offices. As foreign companies would need to swap these liabilities into foreign currency, market makers offer swaps in the other direction to domestic companies with medium-term obligations in foreign currency. This helps the development of the domestic bond market and allows for an expanded availability of hedging for domestic companies and the development of alternatives of medium-term financing in domestic currency.
- Other alternatives may compensate for the lack of domestic assets. For example, in some emerging markets there are not sufficient long-maturity bonds available long-term investors such as pension funds and insurance companies in order to compensate interest rate risk. The appropriate design of inverse floaters (with investors paying par in return for coupons that pay a fixed percentage minus a leverage factor times a floating rate index), would allow investors to protect themselves from duration gaps in the event of declining interest rates.

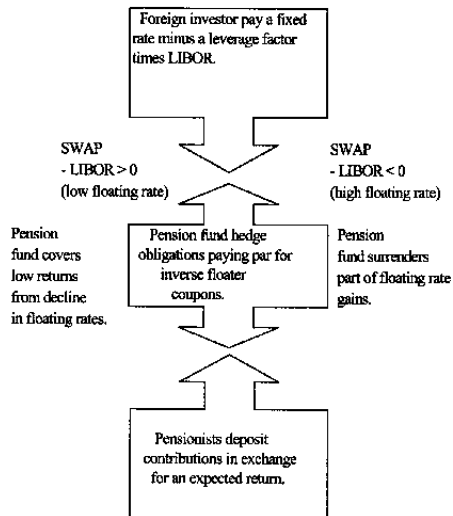
⁴⁴ However, this may be affected by lack of liquidity and varying risk premia. The U.S. Federal Reserve bank only uses information from yield curves in the context of other supporting or contradicting information.

Figure 9: Derivatives for Market Development



Liability swap

Issue of domestic currency bond by foreign investor, swapping the liabilities with market maker who in turn swaps obligations with domestic firm indebted in forex.



Inverse floaters

Pension funds pay par in exchange for coupons negatively related with a floating interest rate, to hedge its investments at floating rates.

V. A NOTE ON THE USE OF DERIVATIVES BY MONETARY AUTHORITIES

The use of derivatives by central banks has been increasing, and its expanded use has been strongly related to cross-border transactions, both to limit the possibility of the central bank leaning against the market and to counteract short-term positions by cross-border financial investors and financial flows instability. In the latter case, the use of central bank derivatives appears more justified in cases of once-and-for-all events (Y2K, Euro). Moreover, a more systematic use should follow a thorough examination of market conditions, availability of liquidity, likely market position, central bank tolerance for losses, and the proper evaluation of market signals. Decisions taken ex-ante would facilitate a passive fulfillment of central bank objectives with the lowest degree of noise introduced into the market, which would increase transparency, and a proper valuation of risks would ensure central bank caution.⁴⁵ Special care should be taken in countries with thin derivative markets and few market players, where potential moral hazard risks must be identified.

A. Central Bank Derivatives to Promote Asset Substitutability

In a successful innovation that has attracted the attention of neighbor countries (Colombia), the central bank of Mexico established in 1996 an option mechanism, with the explicit intention of passively accumulating net international reserves at times of foreign exchange selling pressures, in this way accommodating to demand-supply imbalances rather than leaning against the market. The scheme consists of auction sales of one-day put option portfolios to sell foreign exchange at the exchange rate of the previous day, if this does not exceed the average for the previous 20 working days. The exchange rate of the previous day is advantageous for the sale of foreign exchange to the central bank if the Mexican peso is appreciating. In this way, the central bank accumulates reserves at times of appreciation, and avoids adding to buying pressures at times of exchange rate depreciation. By smoothing exchange rate fluctuations, this central bank policy promotes asset substitutability of foreign-exchange denominated instruments.⁴⁶

Derivatives may also be used to affect expectations. Tinsley (1998) argues that central banks could counteract the weak impact on monetary policy transmission on long-term rates, which limits the effectiveness of central bank interest rate policy to money market rates. As term premiums are generally countercyclical, this delays the effect of expansionary policies. By selling bond puts in coordination with the central bank, the government would make implicit its views of how much interest rates could decrease given its policy preferences (or how much bond prices are expected to increase). In case bond prices decline and the option price

⁴⁵ See Blejer M. and Schumacher (2000).

⁴⁶ Its success is related to the willingness of Mexican authorities to refrain from any other form of intervention in the foreign exchange market, which may not be consistent with alternative monetary frameworks.

is in the money, option holders would need to buy bonds to hedge their position, which would have stabilizing effects on the relevant bond prices. An important caveat is that Tinsley proposal could lead to distort the information content of long-term interest rates, and may require large volumes of intervention in the bond market.

B. Central Bank Derivatives to Counteract Short-Term Positions

The most notorious case of this type of intervention was the use by the Bank of Thailand of forward swaps to defend the baht in 1996-1997 to postpone the impact of defending the currency in central bank reserves in the expectation that depreciating pressures on the currency would mitigate. However, this implicitly added to domestic currency liquidity, which made one-sided bets profitable to the extent that by mid 1997 net international reserves were basically exhausted. Similar instruments to dilute exchange rate pressures have been used by other central banks, with more success as the market regarded the central bank as capable to defend the currency. In the case of South Africa the spot market seems to reflect a premium in the currency that depends on the outstanding forward position of the central bank. However, the intrinsic large possibility of market reversals makes these operations risky, beyond considerations of time-distribution of net foreign exchange earnings.

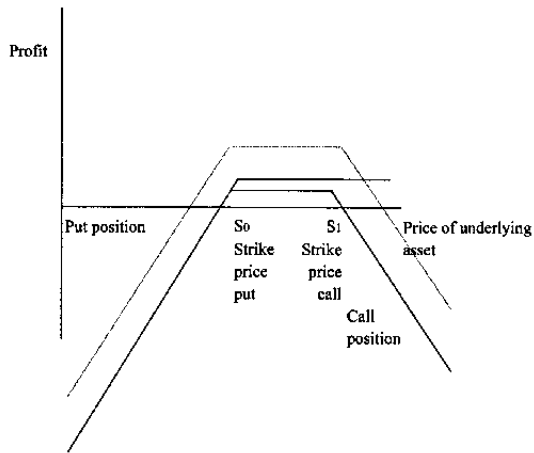
Concerning the possibilities of central banks to counteract short positions, Breuer (1999) makes a comprehensive proposal, considering expectations as the main channel through which the central bank affects volatility. Consistent with findings that market makers normally have a small net short position consistent with dynamic hedging, central banks could sell options to counteract this position, preferably a domestic currency call option or a strangle (put and call options at different strike prices), implicitly creating a target band for the exchange rate. As this strategy reduces the short-option positions by market makers, it also reduces destabilizing delta hedging by these agents. However, it risks unlimited losses for the central bank outside the exchange rate target range (as the central bank has to sell at out-of-market exchange rates).

In this vein, several other alternatives may be explored. By combining long and short positions (all call or all put) through a butterfly position, the central bank could eliminate the possibility of unlimited losses associated with Breuer's proposal.⁴⁷ However, financial markets should be mature enough to provide liquidity for these operations at all times.⁴⁸ Other topics that would merit analysis based on central bank preferences are the convenience of setting specific volumes to be transacted through the options market, or to set the premium and let the market reflect their preferences at a given price.

⁴⁷ Butterfly spreads were intensively used to protect investors from the risk of eventual Y2K volatility problems.

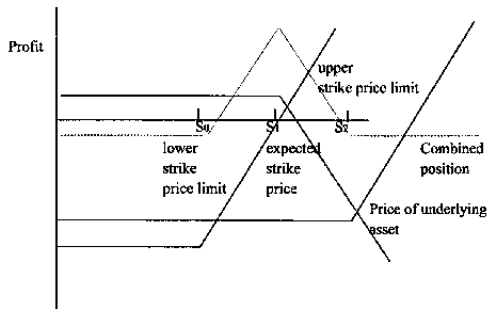
⁴⁸ Also, this alternative does not address Breuer's main concern, which is the need to counteract short positions. But instead, it eliminates the possibility of indefinite losses.

Figure 10. Central Bank Use of Derivatives



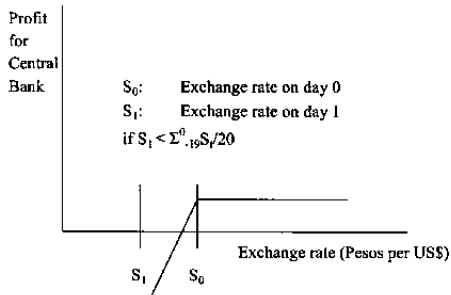
Strangle sale

Combined position resulting from selling a call at a high strike price and a put at a lower strike price in the expectation that volatility would remain low.



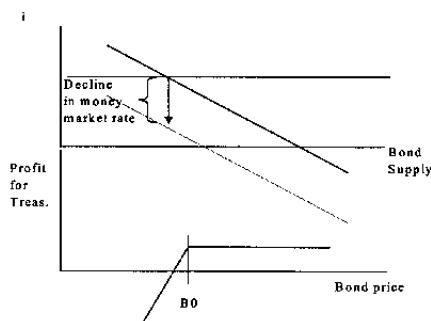
Butterfly spread

Combined position from selling a put at an expected strike price and buying two calls at lower and upper limit strike prices in the expectation that the price would lie in that range.



Central bank forex put sales

Central bank sale of a currency put in foreign exchange, with the strike price equal to the exchange rate of the day before, if the price is lower than the arithmetic average of the 20 previous days.



Government sale of bond puts

The government treasurer sells bond puts that will be activated if the bond price declines (interest rate increases), decreasing the supply of bonds to flatten the yield curve.

C. Exceptional Uses of Central Bank Derivatives

Derivatives have also been used on ad-hoc basis to address specific once-and-for-all problems. To prevent Y2K problems, the New York Federal Reserve sold about US\$370 billions in liquidity options, valid for five days, giving the holder the right to access cash from the Fed at a strike price of 150 basis points over the Fed funds rate, ensuring the availability of liquidity during this period. In the transition to the EMU, the Central Bank of Ireland entered into substantial foreign exchange swaps to ensure credibility in the forthcoming conversion rate.

VI. CONCLUSIONS

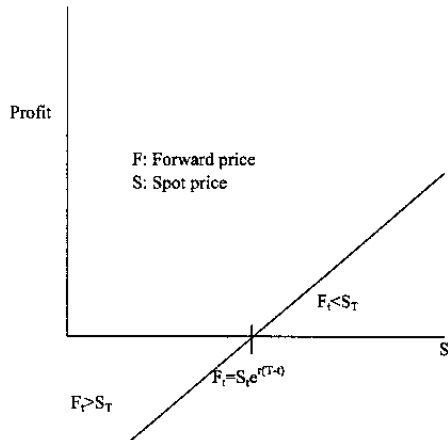
The impact of derivatives on emerging markets' ability to bear risk and intermediate capital would depend on the capacity of the domestic financial system to adapt to the transformation of financial risks, including availability of market liquidity and changes in market conditions. Instability may result from cross-border one-sided financial positions (more likely before the introduction of derivatives) and also from financial flows instability and destabilizing strategies brought about by derivatives, potentially more damaging as a country may be subject to compounded negative effects.

Available information does not support the hypothesis of a proliferation of short positions following the introduction of derivative operations. Volatility spillovers from the introduction of derivative operations do not appear to have been a problem for underlying spot markets and there is evidence that positive feedback strategies have not been exercised consistently to the point of leading the markets toward instability. By contrast, unwinding of long positions and cross hedging may have played a role in financial instability. However, administrative measures may lead to undesired consequences related to the caveats associated with capital controls and the shift of portfolio transactions offshore: the perception of country risks may be distorted, the economy's exposure to instability may be less apparent, and long-term investors would prefer alternatives showing a lower cost of hedging.

For monetary transmission in emerging markets, the impact of derivatives on the money channel is ambiguous because of the effect on the higher speed of transmission offset by the greater possibility of unstable financial inflows independent of the central bank monetary stance. A diminishing role of the credit channel would result from a reduction of balance sheet effects coming from the isolation of cash flows from changes in the money market interest rate, more comparable domestic and foreign portfolio assets and increased arbitrage between domestic assets.

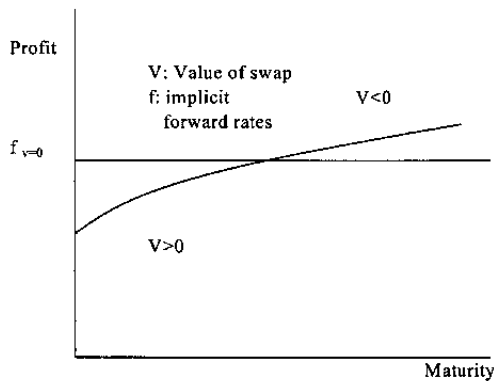
Monetary authorities should facilitate the benign impact of derivatives on asset substitutability by promoting an adequate risk pricing and expanded duration, establishing a credibility record and provide an adequate infrastructure. In addition, the central bank could become active in incorporating signals from the derivative markets into monetary management to reinforce consistency between monetary policy and market expectations.

BASIC DERIVATIVE INSTRUMENTS



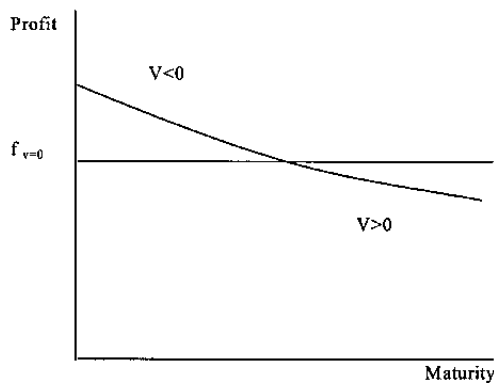
Forward contracts

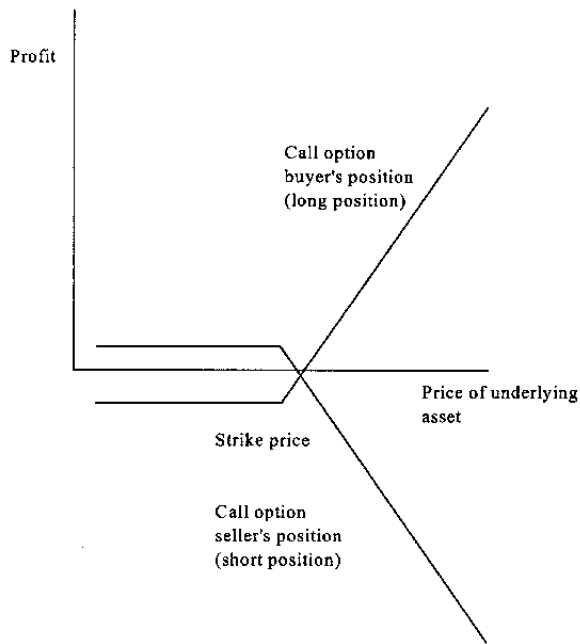
Agreement to buy or sell an asset at a certain future time for a certain price (delivery price). The party assuming a long position agrees to buy the underlying asset on a certain specified date.



Swaps

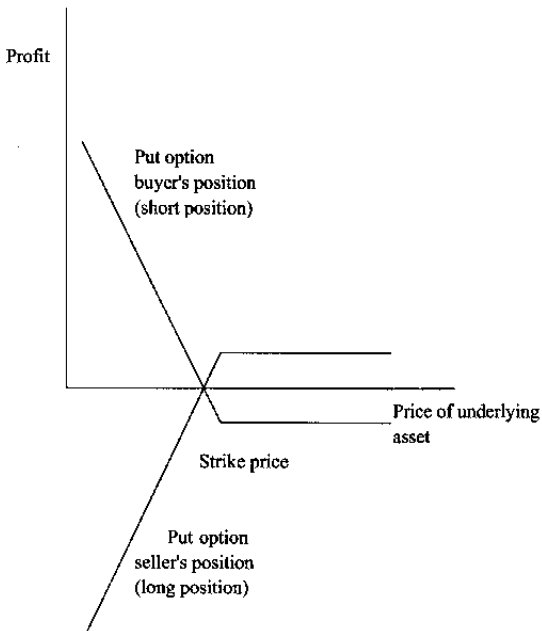
Agreement to exchange cash flows in the future according to a prearranged formula. They can be regarded as portfolios of forward contracts





Call option

A call option gives the holder the right to buy the underlying asset by a certain date (expiration date, exercise date, or maturity) for a certain price (exercise price or strike price)



Put option

A put option gives the holder the right to sell the underlying asset by a certain date (expiration date, exercise date, or maturity) for a certain price (exercise price or strike price).

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