BANK FOR INTERNATIONAL SETTLEMENTS

RECENT INNOVATIONS IN INTERNATIONAL BANKING

APRIL 1986

Prepared by a Study Group established by the Central Banks of the Group of Ten Countries

Second impression

Preface

At the request of central-bank Governors of the Group of Ten countries a Study Group was established in early 1985 to examine recent innovations in, or affecting, the conduct of international banking.

The Study Group carried out extensive discussions with international commercial and investment banks that are most active in the market for the main new financial instruments. The purposes were both to improve central-bank knowledge of those instruments and their markets as the situation existed in the second half of 1985, and to provide a foundation for considering their implications for the stability and functioning of international financial institutions and markets, for monetary policy, and for banks' financial reporting and the statistical reporting of international financial developments. Alongside this work the Basle Supervisors' Committee has undertaken a study of the prudential aspects of banking innovations and a report on the management of banks' off-balance-sheet exposures and their supervisory implications was published by that Committee in March 1986.

The Study Group's aim was not to recommend detailed policy changes but rather to develop a general framework in which the Group of Ten central banks and the BIS could consider their implications for the evolution of the structure and functioning of the international banking system. While the main purpose of the report is to raise issues for internal discussion it is being published in the hope that the general framework offered may contribute to what is likely to be a continuing public debate, both internationally and within countries, on these issues.

The report should be considered solely as the product of the Study Group's work and not as necessarily representing the views of either the central banks of the Group of Ten countries or the BIS. The members of the Study Group were:

Chairman:	Mr. Sam Y. Cross - Federal Reserve Bank of New York
Belgium:	M. Jean-Jacques Rey - National Bank of Belgium
Canada:	Mr. William E. Alexander - Bank of Canada
France:	M. Jean-Paul Redouin - Bank of France
Germany:	Mr. Gerhard Laske - Deutsche Bundesbank
Italy:	Dr. Giovanni Cristini - Bank of Italy
Japan:	Mr. Keiji Matsuda - The Bank of Japan
Luxembourg:	Mme Andrée Billon - Luxembourg Monetary Institute
Netherlands:	Mr. Wouter L. Benard - Netherlands Bank
Sweden:	Mr. Ake Törnqvist - Bank of Sweden
Switzerland:	Dr. Bruno Müller - Swiss National Bank
United Kingdom:	Mr. Lionel D.D. Price - Bank of England
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Part I

Recent Innovations in International Banking
Summary of Study Group Report

A sharp acceleration in the pace of innovation, deregulation and structural change in recent years has transformed the international financial system in important ways. Major new financial instruments - mostly taking the form of off-balance-sheet commitments - have either been created or have dramatically increased their rôle in the financial structure; international credit flows have shifted away from loans through large international banks into direct credit markets; the volume of daily transactions has multiplied; financial markets have become far more closely integrated worldwide; capital has become much more mobile.

In many respects, innovation has improved the efficiency of international financial markets, mainly by offering a broader and more flexible range of instruments both for borrowing and for hedging interest and exchange rate exposures. These changes have clearly aided banks and their customers to cope with stresses associated with the greater volatility of exchange and interest rates in recent years. These beneficial effects are noted in the Report which follows and have been widely discussed elsewhere.

The Study Group sought to examine in detail whether these trends at the same time either increase risks within the financial structure or alter the functioning of the financial system over the longer term, in ways which suggest the need for central banks to adjust their approaches to monetary or macro-prudential policy. The group also considered whether these developments alter the usefulness or content of statistical data.

To varying degrees both the banks and their customers from all industrial countries are active in innovative business in the international markets. Although the new instruments are traded to some degree in most financial centres, the international market-places are principally located in the United States and the United Kingdom. In the United States particularly there has been active cross-fertilisation of domestic and international financial markets. The domestic markets of other countries are also increasingly affected by these international developments, and these influences are likely to strengthen as present trends, especially deregulation, continue and their effects spread.

The stimulus for financial innovation is strong, arising from the interaction of a changing regulatory environment, expanding technology, volatile markets, shifting current-account balances, and growing competition among financial institutions. We cannot predict whether the momentum of this process will advance further or wane. But it is clear that a number of the forces supporting it are unlikely to recede soon. Moreover, even if the pace of innovation were to slow substantially, the cumulative effect of changes already introduced will impinge on the broad categories of policy for which central banks are responsible.

Innovation is changing both the specific problems central banks face and affecting the tools they customarily employ. The policy responses required under present circumstances may need to be more rapid than in the past and may call for closer co-operation between banking authorities and those responsible

for capital-market regulation at national and international levels. Because of the market's ability to innovate rapidly and flexibly, it can be more difficult than in the past to design policy changes and be confident that those changes will for long achieve desired results, without unwanted side effects.

The Basle Supervisors' Committee has recently examined one aspect of these trends, the rapid growth in off-balance-sheet activity of banks, and concluded that it poses urgent challenges to supervisory authorities. The study presented here concludes that central banks must in addition be concerned with other far-reaching policy issues that arise from the process of innovation and structural change. Issues in the fields of macro-prudential policy (that is, the safety and soundness of the broad financial system and payments mechanism), monetary policy, and financial reporting and statistics are examined in Part V of the Report and summarised in the paragraphs below.

A. Macro-prudential policy

For a variety of reasons, the large international banks appear to have lost comparative advantage to international securities markets as a channel for credit intermediation with respect to large high-grade borrowers, and in response have themselves moved heavily into certain capital-market (largely off-balance-sheet) activities.

These developments have had their main impact on international credit flows and in markets used by large corporations. If these trends continue - and have a more pervasive influence on domestic markets - there could be important consequences for the banking and financial systems:

- with the highest quality borrowers increasingly turning to direct credit markets, the average quality of banks' loan assets may gradually decline by comparison;

- in view of its narrower base, the international banking system might become less responsive to sudden liquidity needs or other shocks in the corporate or other borrowing sectors;

- a greater share of credit is likely to flow through capital-market (rather than bank) channels, which may be characterised by less supervision, by less complete information on which to base credit decisions, and by more distant business relationships between debtor and creditor, perhaps complicating the task of arranging rescheduling or financing packages for those with debt servicing problems;

- both bank and non-bank financial institutions are relying more on income from off-balance-sheet business;

- the distinctions between banks and other financial institutions are becoming progressively blurred.

These trends, taken together, may require the authorities to consider substantial adjustments and adaptations with respect to financial regulation and other policies.

The above considerations all, to a greater or lesser extent, reflect concern that innovation may heighten vulnerabilities in various ways, even as certain benefits clearly accrue to financial and non-financial users of the new instruments. The rapid innovation currently taking place in international banking and financial markets - and also in some nations' domestic markets - enables consumers to choose among many new products and to benefit from the reduced costs and enhanced protection those products bring. From the perspective of the individual buyer there are improvements in efficiency. But, in a world financial system with many imperfections, there can be no guarantee that increased efficiency of financial intermediation at the individual firm level will necessarily improve economic welfare overall. Many innovations have been designed to exploit existing imperfections in the financial system. Some of the "imperfections" around which innovations are manoeuvering their way represent official measures, such as capital adequacy requirements imposed in the interest of safety and soundness of the financial structure, or measures to deal with liquidity problems or to promote market stability. Others constitute regulations designed to meet the needs of domestic monetary and credit policy objectives; and still others are meant to serve investor protection needs.

A major source of concern derives from the difficulties in pricing new instruments and the possibility that many new instruments appear to be, at least to some degree, underpriced, that is, that gross income from the transactions is insufficient, on average, to compensate fully for their inherent risks. Since it may be necessary to accumulate experience over a variety of circumstances and cyclical conditions in order for market participants fully to understand and assess all elements of risk, this problem may appear especially before the market for a new product has reached maturity. Underpricing may also be resulting from intense competitive pressures, as individual institutions struggle to hold market share in changing markets, or from inability to predict longer-run swings in economic circumstances.

There are several other ways in which innovation may contribute to systemic vulnerabilities. The presumed superior liquidity of securitised assets over conventional bank loans may turn out to be a mirage if a substantial number of the creditors of a single debtor attempt to liquidate their holdings simultaneously, or nearly so. That is, the risk that the liquidity of these assets will disappear is likely to be greatest when it is most needed. At such times, banks may be exposed to liquidity pressure from drawdowns on commitments which backstop many securitised assets. Moreover, the general trend toward increased off-balance-sheet activity and "unbundling" (which involves separating market risk from credit risk), as well as the complexity of multiple linked transactions, can mask the interlocking of risks, for bank management, regulators and market participants alike. Indeed, in any corporation using the new instruments there is an important need for all levels of management to acquire knowledge and understanding of the risks inherent in them, and to adapt internal accounting systems sufficiently to ensure adequate control. Because of the pace of innovation, use of the new instruments may be running ahead of these necessary changes. A further point is that the new instruments transfer price or market risk from one economic agent to another, but do not eliminate that risk. And, in the process, they create new credit exposures, and thereby increase the ways in which the default of one borrower can adversely affect others. This problem may be exacerbated by the hitherto untested legal status of many of the new financial instruments. Moreover, since the growth of these transactions on the part of a relatively few large financial intermediaries has been very rapid, there is some possibility that,

in the aggregate, credit risk is becoming more concentrated within the financial structure, even as exposure to price or market risk may be more widely distributed.

The rapid growth in the volume of transactions being settled through the payment system can also contribute to potential systemic risks. An important feature of innovation has been the huge reduction in transactions costs - some estimates are that costs of many transactions have fallen by more than 90 per cent. in the past two decades because of major technological improvements. As a result, financial institutions find it possible, and profitable, to undertake a much larger number of transactions. There is a risk of overloading or congestive interruption of the payment system.

An important question is whether innovation has added to, or subtracted from, the degree of volatility in financial markets. Theoretical reasoning alone cannot resolve the issues, and market participants are divided in their views. Where there are empirical studies examining the impact of futures and options markets on the underlying cash markets, those studies suggest that prices in cash markets were subject to no more, and often less, fluctuation after the introduction of futures markets. At the same time, there are particular day-to-day situations in which the hedging activities of market participants, especially in options, do seem to increase the volatility of the price of the underlying asset. It is possible that the new instruments tend to cause short-term volatility in certain circumstances but longer-term stability, particularly if the market is a broad one with a large number of participants.

A further question is whether financial innovation leads to growth in overall debt. All in all, there are indications that global integration and innovation have contributed at the margin to credit growth, particularly in the United States, whose markets and institutions have played a pioneering rôle in most of the innovations and where, because of the rôle of the dollar, the links with international markets are close. Nonetheless, looking at the record of the major Group of Ten nations, individually or on an aggregated basis, it is difficult to establish any clear causal nexus from financial innovation to aggregate credit flows in most countries.

B. Monetary policy

Monetary policy is being influenced - in some countries more than others - by the effects of innovation, deregulation and structural change:

- the scope for monetary policy to operate via changes in the availability of credit is being reduced relative to the rôle of prices (that is, interest rates and exchange rates);

- the rise in the international mobility of capital has resulted in some countries in the exchange rate increasing in importance as a channel of monetary policy;

- the many new instruments and hedging techniques available to market participants and the shift to variable rate financing can make the timing and incidence of monetary policy less certain; and

- innovation is changing and may erode the meaning and usefulness of the monetary and credit aggregates as indicators of monetary policy.

These developments may have several important implications for the conduct of monetary policy.

The external sector has become a relatively more important restraint on the conduct of an independent monetary policy in some countries, as the relative importance of the exchange rate as a channel through which monetary policy has its effect on the economy has risen along with the increasing degree of international capital mobility. For the smaller members of the EMS as well as other countries whose economies are particularly open, developments in the external sector have long been an important consideration when formulating policy. For some larger countries, the change has been more noticeable. It has become necessary in recent years in formulating policy to recognise the increasing degree of macro-economic interdependence among the industrial countries.

Moreover, the developments noted above have combined in the larger economies particularly to shift the sectoral incidence of the effects of a change in monetary policy. Although the situation varies from country to country, the rising importance of the price channel accompanied by the declining significance of credit allocation techniques means that it is no longer true that the incidence of monetary policy changes falls mainly on the housing and business fixed-investment sectors of the economy. In contrast, monetary policy increasingly has its effects on the competitive position of the export and import competing industries, with a potentially damaging effect on investment decisions in those sectors.

This is not to imply that the exchange rate has replaced interest rates as the principal channel of monetary policy in a significant number of countries or that there has been a widespread move towards exchange rate targeting. With respect to the effect of interest rates, the increased use of variable rate financing and interest rate hedging techniques can have an important influence on the working of monetary policy. Once the fear of being locked into higher interest rates is removed, the incentive to delay spending is reduced, particularly when tighter monetary policy is expected to be temporary. In addition, monetary authorities, when considering interest rate increases, must take account of the fact that under today's circumstances such increases can have more important cash-flow implications than before and may give rise to potential solvency problems over a broader component of the domestic and perhaps the international economy.

Finally, new instruments may shift the incidence of monetary policy among sectors of the economy in ways that are not easily predictable. The new instruments may concentrate risk in the financial sector, which can make it more vulnerable to large, unexpected changes in the macro-economic environment.

These various considerations will have to be taken into account and will certainly influence the way in which central banks make discretionary changes in monetary policy.

C. Financial reporting and statistics

The growth of off-balance-sheet transactions and the unbundling of different types of risks have rendered the analysis of financial statements more complex in several ways:

- for a bank's management, there are important questions about how best to account for, monitor and manage a bank's risk exposure, and how to fold in off-balance-sheet activities with its other exposure;

- counterparties and shareholders of banks and other institutions face similar problems of understanding the full scope of the institutions' activities since conventional financial statements are often not complete and are clouded by the growth of off-balance-sheet transactions;

- supervisory and regulatory measurement of risk exposure can also be significantly affected by off-balance-sheet transactions, and the authorities have taken major steps to determine how to treat them for measures of liquidity and capital adequacy, specific loan concentration limits, and for assessing the overall health of banks;

- in addition, the absence of accepted accounting techniques with respect to off-balance-sheet items allows leeway in the presentation of financial accounts that may have encouraged firms to assume more risks.

With respect to the monitoring of international capital flows, the usefulness of our international statistics has been impaired by financial innovation and structural change:

- "securitisation", that is, an increasing tendency for credit to take the form of negotiable instruments, and the expanding rôle of contingent commitments have reduced the content of available information on international exposures by taking a growing proportion of credit transactions off banks' balance sheets;

- institutions outside the present reporting systems have played an increasing rôle in credit intermediation;

- the negotiability of assets makes it more difficult to keep track of their ownership; in particular because of asset trading, changes in reporting banks' assets may not necessarily accurately reflect changes in borrowers' liabilities;

- since many off-balance-sheet transactions are of a complex nature, detailed data would be required to permit the kind of analysis that has been possible with conventional on-balance-sheet positions.

In view of these problems, consideration should be given to broadening the coverage of the data on international capital flows and, in particular, to obtaining:

- fuller and more detailed information on banks' involvement in the securities markets;

- information on the arrangements and use of NIFs and other back-up facilities;

- information from outside the banking sector on outstanding bond indebtedness and short-term securities, using where possible data from trade associations and other sources;

- information on banks' off-balance-sheet business, arranging when possible for data to be collected by supervisory authorities in a manner useful for macro-analysis.

* * *

The foregoing discussion summarises the Study Group's findings with respect to the policy implications of innovation and structural change in the international financial markets. The following paragraphs outline the factual material gathered with respect to the main new instruments actively traded in international markets, as well as the analysis of the driving forces behind the process of financial innovation and structural change generally.

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Forces stimulating financial innovation

The stimulus behind financial innovation arises from the confluence of a series of disparate trends during the 1970s and 1980s. For one thing, macro-economic trends have helped to foster stuctural change and innovation. Most important are the sharp rise in inflation and the increased volatility of interest rates and exchange rates. Higher volatility has generated an increase in the risk exposure of those financial intermediaries which fail to maintain a strict match in the term structure of their assets and liabilities. There has been a need on the part of both financial intermediaries and non-financial institutions to develop effective hedging devices and strategies to deal with the increased risks related to volatility, and there has been an incentive to develop new financial instruments which can be used to transform and shift the burden of risk. We have seen a proliferation of new financial instruments and techniques with the capability of meeting these needs.

A sharp shift during the 1980s in the geographic pattern of net flows of international savings and investment, as reflected in the distribution of current-account imbalances, has also been a contributing factor. To the extent that this shift has interacted with the distinct preferences of investors and borrowers in different geographic areas for particular forms of financial assets and liabilities, it can be held at least partly accountable for the changes in the structure of international financial intermediation and the development of new financial instruments. Thus, the sharp fall in OPEC investible surpluses and the reduced access to credit by the major LDC borrowing countries after the onset of the international debt crisis are consistent with a reduced supply of bank deposits and a matching reduction in syndicated bank credits. Similarly the switch in the rôle of the United

States from large net provider to large net taker of funds, combined with the growth of current-account surpluses in Europe and Japan, is consistent with the increased use of marketable debt instruments in international financial markets.

Another important trend has been the changing regulatory environment affecting national financial markets. There have been two aspects to this. One has been the growing worldwide tendency to deregulate and to reduce structural rigidities and barriers to competition in domestic financial markets. The moves toward deregulation (as well as the extent of previous regulation) have varied substantially from country to country, and include such measures as the abolition of exchange controls, the phasing-out of interest rate ceilings on deposit and lending activities of key financial intermediaries, the opening of domestic markets to foreign financial institutions, tax reductions and the relaxation of certain traditional boundaries limiting the types of financial activity in which particular financial institutions may engage. The other aspect of the regulatory environment fostering innovation has been the increased attention which supervisory authorities have begun to pay to the adequacy of financial institutions' capital ratios, particularly as the quality of some international and domestic assets have come into question. The effect has been to create an incentive for banks to increase their activity in business subject to less stringent capital requirements - a powerful motivation to shift to off-balance-sheet products.

Another trend which has spurred innovation and structural change is the recent widespread application of new communications and computer technology to financial markets and financial transactions. This encompasses the expansion of worldwide information and new service companies, and improvements in accounting and information-processing systems in financial institutions. Similarly the application of advanced computer technology to the international payment systems and to transactions processing generally has acted as a stimulus to innovation and structural change. The lowering of transactions costs to a fraction of earlier levels has given a powerful impetus to innovation.

Finally, growing competition in international financial markets is a factor increasing the pressure for innovation and structural change. There are at least two sources of the rise in competition over and above the worldwide trend towards deregulation, and these sources have both a direct and an indirect effect in the process of innovation. Firstly, technological change appears to foster a rise in competition as the developers of new technology seek to exploit its advantage in as many markets as possible. Secondly, the shifting patterns of savings and investment may put pressure on financial institutions whose markets are shrinking to innovate and to compete more aggressively for a larger share of their traditional market or to expand into new areas of business, and for institutions resident in geographic areas with excess liquidity to seek new ways of deploying it.

The interaction of these forces has led to an explosion in the demand for innovative financial instruments - that is, to the desire of economic agents for new vehicles that perform the functions of transferring risk, enhancing liquidity, and generating debt and equity - that help to meet the requirements of the changing financial landscape. These forces have also fostered very rapid growth in the supply of new instruments - supply in the sense of an increased willingness and ability of financial institutions to

provide, and to make markets in, these new instruments. The influence of demand and supply factors with respect to particular innovations is discussed in Part IV of the Report.

A look at four major new instruments

New financial instruments (or those that have newly re-emerged) have had a particularly prominent influence in international financial markets in the past two to three years. These newest entries to the financial arena represent the latest generation of innovative instruments. They are examined in depth in Part II of this Report on the basis of discussions with market participants, and our findings are summarised below. Each of the four instruments differs from the others in terms of form and purpose. Together they show not only the importance of the new instruments but their diversity and the pervasiveness of the spread of innovation to so many sectors and corners of the market.

1. Note issuance facilities (NIFs)

A NIF is a revolving facility which enables a borrower to issue a stream of short-term notes, generally known as "Euro-notes", over a medium-term period.

This technique separates the functions performed by a single institution in a traditional syndicated credit and allows them to be perfomed by different institutions. The function of funding the borrower's requirements is transformed from one of lending money into one of setting up a borrowing mechanism. The function of maturity transformation is turned into one of underwriting.

The credit risk is shared between the holders of the notes, who stand to lose if the borrower fails before the notes mature, and the underwriters, who face the prospect of having to take up the notes of a borrower in whom investors have lost confidence. For holders of Euro-notes, the notes are an asset and as such will appear on their balance sheets. The underwriting commitment, however, does not appear on the face of the balance sheet.

The popularity of NIFs benefits not only from the cost savings of unbundling but also from the market's current preference for lending to high-grade borrowers through securities rather than bank loans. The attractions of NIFs to a borrower are principally their low cost combined with great flexibility in the form of drawing. In a large number of cases NIFs have been arranged to replace existing, more expensive borrowings.

The market for NIFs is developing into a Euro-commercial-paper market which provides a mechanism for high-grade borrowers to raise funds cheaply without directly associated credit backing by banks. The popularity and continued future potential of NIFs is illustrated by the fact that the market has grown tenfold in the past two years to $75 billion, although outstandings lag behind at $10-15 billion. Corporate borrowers increased their share of the NIF market from around 45 per cent. in the early 1980s to more than 60 per cent. in 1985.

2. Currency swaps* and interest rate swaps

The swaps referred to in this Report are financial transactions in which two counterparties agree to exchange streams of payments over time according to a predetermined rule, which reflects interest payments and may also reflect amortisation of principal. Swap markets are utilised for several broad reasons: to obtain low-cost financing, to obtain high-yield assets, to hedge interest rate or currency exposure generated from the structure of normal business, to implement short-run asset/liability management strategies, to earn fees, and to speculate.

The currency swaps evolved as a successor to the traditional back-to-back loans, but are designed to avoid most of the drawbacks associated with that technique. Swaps do not usually increase assets or liabilities on the balance sheet, and they limit credit risk, since a performance failure by one counterparty should relieve the other party of his obligations.

Government regulations have stimulated currency swaps. Official restrictions limit access to some European capital markets, including Euro-bond sectors, and swaps can be used indirectly to access these markets. In addition, restrictions can make it more expensive for certain classes of borrowers in particular national markets. Moreover, swaps can be helpful to a borrower to gain access to a particular market where he has already borrowed heavily and investors are wary about taking on more of that borrower's debt.

The market in swaps accelerated sharply during the first part of this decade and from available evidence is most likely to continue to expand rapidly. The major step in the evolution of the swap market was the extension of the swap concept from the currency market to credit-market instruments denominated in the same currency in about 1982. At this time, the global market for swaps was estimated to be about $3 billion. By late 1982 and 1983 the swap market had evolved further and interest rate swaps began to be conducted between domestic counterparties such as regional banks and thrift institutions. Swap activity accelerated sharply in 1984 and 1985. Large commercial and investment banks developed the capacity to make markets in swaps and began to book swaps without an offsetting swap in hand. Variations on the standard "plain vanilla" swap multiplied in 1984 and 1985. Swaps became callable, extendable or deferred. Options on swaps and swaps on zero coupon bonds became common and there has been some discussion of fitting swaps to mortgage-backed securities. A market in secondary swaps has also developed, encompassing reverse swaps, swap sales and voluntary terminations. At the end of 1984 outstanding swaps were estimated to amount to $80 billion and by mid-1985 this figure had jumped to almost $150 billion. In their early stages, swaps were most often executed in conjunction with another capital-market transaction, such as the flotation of a Euro-bond. More recently, swaps have come to be traded mainly as completely independent transactions, often to transform the currency of denomination or the interest terms of assets or liabilities already on the books of a financial or non-financial firm.

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* The currency swaps under discussion here are not those traded for years in the foreign exchange markets involving simultaneous spot and forward transactions. Those under consideration in this Report in all cases involve streams of interest payments over the life of the contract, and may or may not involve exchange of principal either initially or at maturity. The same term is used by market participants to describe both types of transactions.

3. Foreign currency and interest rate options

An option is a contract conveying the right, but not the obligation, to buy or sell a specified financial instrument at a fixed price before or at a certain future date. Options differ from all other financial instruments in the patterns of risk which they produce. Both the market and credit risk patterns are asymmetrical between writers and buyers of options. With respect to market risk, the buyer has the possibility of unlimited profit if price moves in his favour but his loss is limited to the amount of premium paid (option price) if price moves adversely. Conversely, the writer is limited in his income to the amount of the premium earned, while in principle he is exposed to unlimited loss. With respect to credit risk, the writer of the option is exposed to the buyer for the amount of the premium between the transaction date and the payment of premium. Thereafter, and through the life of the contract, the buyer must take the risk that the writer will fail to meet his obligations, while the writer has no credit risk since the buyer has no obligations to perform.

Options involve a high degree of exposure to price risk, and for this reason most option traders pursue various hedging techniques. They may lay off some of their exposure by buying options from other banks or in the option exchanges - where standardised contracts of both currency and interest rate options are traded. Alternatively, they may establish and then manage cover by buying or selling appropriate amounts of the underlying asset (delta hedging), following various mathematical formulae (e.g. Black-Scholes). Such formulae cannot assure full protection, however, since they rely on estimates of future volatility, and also because transactions costs can quickly mount up in unsettled markets.

Options have existed for many decades on foreign currencies or interest rates. Active trading, however, surged in the early 1980s spurred by growth in customer demand, as both corporate customers and institutional investors began to express a wish that banks offer, for a fee, what amounted to insurance against the effect of rising interest rates as they reached unprecedented levels and as exchange rates became increasingly unpredictable.

Growth of this market, however, has been hindered relative to the markets for NIFs and swaps owing to the sheer complexity of options, and as a result there is a lack of uniform rules governing accounting regulations and procedures, such as the booking of premium income. In addition, the absence or ambiguity of regulations governing the trading and tax treatment of options has been a factor limiting the further expansion of the market in some countries.

4. Forward rate agreements (FRAs)

An FRA is an agreement between two counterparties, one wishing to protect itself against a future rise in interest rates and the other against a future fall. Without any commitment to lend or borrow the principal amount, the parties agree to an interest rate for, say, a three-month period beginning six months hence. At maturity, they settle by paying (receiving) only the difference between the interest rate agreed earlier and the then current interest rate.

FRAs are used mainly by banks and some non-bank customers for the sole purpose of hedging interest rate exposure. There is little use of FRAs as a source of arbitrage profits. The FRA is the least visible, least risky of the four new instruments discussed in this Report.

The FRA developed out of the forward/forward deposit market, where one party contracts to make a deposit with the other party on a date in the future at a predetermined rate. A forward/foward deposit or loan ensures the availability of a deposit or loan at a certain price in future but at the same time expands a bank's balance sheet. An FRA covers the interest rate exposure without expanding the balance sheet, but does not ensure the availability of a deposit or loan.

The main attraction of FRAs is the fact that they cover interest rate exposure without expanding the balance sheet and enable banks to reduce their interbank book (in some cases by as much as 40 per cent.) to the benefit of capital ratios and return on assets.

An FRA is in effect an over-the-counter cash-settled financial future. It offers some advantages over traditional financial futures in terms of simplicity, flexibility, absence of margin requirements, and the possibility of an instrument tailored to meet exactly an interest rate mismatch. But it is less attractive in other respects; most importantly, it lacks the advantages of a central market-place where instruments can be bought and sold. Differing accounting treatment in a number of countries and differences in some nations' gambling laws can alter the relative attractiveness of the two instruments. Also, the FRA may involve greater credit risk because of the absence of margin requirements or exchange backing.

FRAs or similar instruments have been offered for about two years, and the volume of business continues to grow rapidly. Towards the end of 1985, it was estimated that deals with notional principal of about $7 billion were being done each month.

The broad process of financial innovation

The scope of this study is not limited to these four new instruments - NIFS, swaps, options, FRAs - which represent the latest wave of innovation. Our interest also encompasses "innovation" in the form of other instruments introduced earlier which have grown enormously in use and importance - such items, for example, as floating rate notes, asset sales and financial futures. But the focus of this Report is not directed just toward individual instruments or techniques - we are looking more broadly at the process of financial innovation taken as a whole.

In that wider context, the evolution of international financial intermediation over recent years has shown three main strands: firstly, a trend towards securitisation and a related blurring of distinctions between bank credits and the capital markets; secondly, the increasing importance of off-balance-sheet business; and thirdly, the global integration of financial markets. These trends are discussed in Part III.

The first of these trends, the move towards securitisation, has been driven by the broad forces described earlier, but also by certain more specific influences. Firstly, the gradual decline of long-term interest rates from the abnormally high levels of several years ago and the restoration of positive-sloped yield curves have clearly enhanced the appeal of long-term marketable instruments and facilitated the recovery of bond markets. Secondly, the impact on banks' portfolios of the international debt problems has stimulated banks to improve the liquidity and marketability of their other assets and has

encouraged them to strengthen their balance sheets by funding themselves through longer-term bond issues. Thirdly, the highly publicised problems of a few banks in various countries and the weakening of banks' balance sheets more generally because of exposure to problem debtors at home and abroad have impaired banks' comparative advantage as a channel for lending, at least to prime borrowers with recourse to securities markets.

Securitisation has shown up in a massive shift from international bank credit to international securities markets. Between 1981-82 and the first half of 1985, syndicated Euro-bank loans fell by a factor of four (from $100 billion to an annual rate of $25 billion), while international bond and note issues rose by a factor of almost four (from $44 billion to an annual rate of about $160 billion), and NIFs, also a securitised instrument, grew very rapidly as well.

The banks' balance sheets have reflected the trend towards securitisation in many ways other than the decline in international loan activity. On the liabilities side, banks have become far more important borrowers in the international bond markets, motivated by the need to strengthen their capital bases, by a desire for closer symmetry between their long-term lending and their funding, and by the new opportunities to benefit from participation in interest rate and long currency swaps.

On the assets side, banks' own holdings of long-term marketable securities have increased strongly in most if not all countries for which information is available. Also, innovative steps have been taken to increase the marketability of bank assets by such techniques as sales of participations, loan swaps and loan sales, and, mainly in the United States and the United Kingdom, by using assets such as mortgages, automobile loans and export credits as backing for marketable securities.

All of these changes have important ramifications for banks, not just in their balance sheets, but also in their sources of income, their modes of operation, their management strategies and indeed the very structure of the banking industry and the rôle of banks versus other financial institutions in the intermediation of international financial flows.

Closely related to the trend towards securitisation, and to some extent a by-product of it, is the increasing importance of off-balance-sheet items in international banking. Banks have become strongly attracted to off-balance-sheet business, in part because of the increased focus on and desire to improve return on assets, and in part because of constraints imposed on their balance sheets by the need to improve capital ratios. They have looked for ways to hedge their interest risks without having to inflate balance sheets by recourse to the interbank market.

All four of the most recent new instruments discussed above - NIFs, swaps, options, FRAs - and many additional ones feature off-balance-sheet business, and in some cases much of their attractiveness depends on that feature. The growth in off-balance-sheet items has been spectacular. The volume of international back-up facilities in the form of NIFs, one of the most successful off-balance-sheet items, has grown extremely rapidly. Euro-dollar futures, used by international banks to hedge interest risks without expanding balance sheets by interbank operations, have grown fourfold in the past two years, and have become by far the most important item traded in the financial futures exchanges.

The third main trend in international financial intermediation in recent years has been the sharp acceleration in global integration of financial markets. It is now possible to discern the outlines of what could be called truly global markets for individual financial instruments. This process of integration has been greatly helped by - and has itself greatly contributed to - the tide of deregulation and dismantling of domestic and international controls that most or all industrial nations have, to a greater or lesser degree, experienced in the past decade. Technology has made this high degree of integration possible by cutting transactions costs drastically, facilitating the prompt dissemination of information and linking different exchanges and markets. The borderlines between international and individual domestic markets are becoming increasingly blurred. Securities markets as well as the banking sector are becoming globally integrated, fostered in part by the growing international diversification of investment. The high degree of integration is leading to alternative sources and methods of finance becoming close substitutes, with the result that differences in the level of real returns between various financial markets tend to be rapidly offset by capital flows.

The future of innovation

To what extent will the dramatic growth of markets in new financial instruments continue and to what extent are the factors behind rapid change temporary?

Certainly, the exceptional economic circumstances of the early 1980s - high inflation, volatile interest and exchange rates and sharp changes in the creditworthiness of large economic sectors - were major spurs to innovation. Within that environment, the innovations themselves were, to some extent, an effort to restore the kind of world that existed before those events erupted. A more stable environment would therefore reduce many of these incentives for financial innovation.

There are, however, long-lasting forces that support the growth and development of innovations even in a stable environment. Technological advance, both in its "hardware" aspects - computer and communications systems - and in its "software" aspects - sophisticated financial models and financial product designs - is certainly going to continue. But even beyond technology, the momentum for two other broad forces - the global integration of financial markets and the institutionalisation of financial innovation - is likely to continue.

The global integration of national financial markets has many aspects: around-the-clock markets in many financial instruments with institutions based in different countries participating in many national markets; highly mobile international capital flows; expanded international asset diversification by institutional investors in different countries. These and other aspects of global financial integration create profit opportunities that might be described as the substructure of financial innovation. International integration is affecting the diffusion of new instruments as well as their development. As the new instruments developed, pressures arose for liberalisation in the domestic financial markets in Europe and Japan. The moves by the authorities in the national markets toward increased liberalisation can be seen as an aspect of the diffusion of innovations generated by the global integration of markets.

The integration of national financial markets is related to and supported by the broader forces of the global integration of overall economic structures. These linkages through increased trade, investment and travel are working not only among the industrial nations but between them and the rest of the world as well. So, closer economic integration leads to greater financial integration, which, in turn, creates opportunities for new instruments to emerge. These connections then provide a more permanent support for the process of financial innovation.

Moreover, the shift from banks to direct credit channels that has occurred in recent years has led to the development or revival of financial markets in some countries. Bond markets that were inactive in some countries have been restored. This has been viewed in the countries affected as a healthy result of innovation.

It should be acknowledged, however, that the current trend toward greater reliance on capital markets as channels of credit to the large prime borrowers reflects to a large extent the particular circumstances of the present, and the market's view about the relative credit-rating of banks versus the major corporations, as well as other reasons. Perceptions will change as conditions change, for both banks and large prime borrowers. For example, strengthened bank capital can improve the perceived attraction of bank intermediation, and a shift of credit flows back into the banking system is certainly possible and has occurred in the past.

A second important development affecting the character of financial innovations is the institutionalisation of the process at the level of the firm. A cornerstone of the economics of technological innovations - the research and development relation - holds that there is at least a statistical relationship between the "output" of the innovation process, however it is measured, and the amount of resources committed to the process, measured, say, as real research and development expenditures. In the past few years a number of the major international financial institutions, both investment and commercial banks, have established "new products" groups within their organisational structures.

If the institutionalisation of financial innovation endures, it may change the economics of innovation. Once a kind of R & D relation is established at the level of the firm as part of its organisational structure, the pace of future financial innovations may become in part a function of the quantity of resources committed to product development. In other words, future financial innovation may be generated by a dynamic that does not rely on the developments in the economy that generated innovations in the past. New instruments, or variations in existing ones, may be developed to exploit not just a few major profit opportunities but a large number of minor ones.

Part II

New financial instruments

This second part of the report examines in separate chapters four new types of instruments - note issuance facilities, currency and interest rate swaps, currency and interest rate options and forward rate agreements - which in the past two or three years have become prominent in international financial markets.

Each chapter describes the principal characteristics of the specific innovation, the manner in which the structure of each market has evolved over time, the function and purpose of the instruments and the nature of the risks to which they may give rise. The chapters report the findings of extensive discussions carried out with market participants in the different financial markets and also look at some unresolved policy questions, in particular those having to do with accounting practices.

Chapter 1

Note issuance facilities (NIFs)

A. The instrument

Note issuance facility (NIF) is the most common of several terms used to describe a medium-term arrangement under which a borrower can issue short-term paper,[1] known as Euro-notes, backed up by commercial-bank underwriting commitments. Other terms - which are specific to either particular organisations or to specialised types of facility - include revolving underwriting facility (RUF), note purchase facility and Euro-note facility.

A rather different instrument, also discussed in this chapter, is the non-underwritten NIF, known generally as a Euro-commercial-paper programme. These arrangements closely parallel commercial-paper issuance in the United States, which is usually done without any underwriting or back-up facility explicitly attached.[2] This chapter mainly describes NIFs, however, since these facilities entail off-balance-sheet underwriting commitments by banks.

1. Definition

A NIF is a medium-term legally binding commitment under which a borrower can issue short-term paper in its own name, but where underwriting banks are committed either to purchase any notes which the borrower is unable to sell, or to provide standby credit. For bank borrowers the paper is usually short-term certificates of deposit, while for non-bank borrowers it is in the form of promissory notes (commonly known as Euro-notes).

The NIF commitment is typically for five to seven years, while the paper is issued on a revolving basis, most frequently for maturities of three or six months. Over time a broader range of maturities has become available, including maturities up to one year, as short as seven days and odd dates. Most Euro-notes are denominated in US dollars and are issued with high face values (often $500,000 or more), intended for professional or institutional investors rather than private individuals. Holders of notes (whether or not they have underwritten the facility) show them as an asset on their balance sheets, but an underwriting commitment normally does not appear on the face of the balance sheet.

The NIF has been successful mainly because it allows the various functions performed by a single institution in a syndicated credit to be separated and performed by different institutions. Instead of lending money, as in a syndicated credit, the NIF arranger provides a mechanism for placing notes

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1 Throughout this report, the terms underwriting and underwritten are intended to refer to the broad process whereby banks commit themselves under certain circumstances to acquiring notes or making advances to issuers. The use of these terms should not be taken to mean that these banks are engaged in securities underwriting as defined in national law.

2 Most commercial-paper issuers do, however, arrange a separate standby commitment in support of their programme, generally to ensure a better credit-rating on their paper.

with other investors when funds are required. Maturity transformation (assuring the borrower access to short-term funds over the medium term) is provided by the underwriting commitment, which remains off-balance-sheet unless called upon. Short-term credit risk is taken by the holders of the notes, who stand to lose if the borrower fails before the notes mature, but longer-term credit risk is taken by the underwriters, who face the risk of having to lend to a borrower in whom investors have lost confidence.

2. Growth and evolution

The NIF market has expanded with striking speed, especially in 1985. NIF techniques continue to evolve, particularly in the areas of paper placement and borrowing options, the changes designed mainly to enhance the flexibility and attractiveness of the instrument to borrowers, and to a lesser extent to investors as well.

The first publicly announced facility was arranged for New Zealand in 1981 (although earlier unpublicised facilities are believed to have been arranged). In that arrangement, the managing banks fully underwrite the issue of notes, which they purchase on a discount basis at a yield of 1/4 per cent. per annum over LIBOR. The notes are either held by the managing banks or distributed to other investors. An underwriting fee of 1/4 per cent. per annum is paid as long as the facility is not drawn.

An alternative technique, known as a revolving underwriting facility (RUF), was developed in 1982. It differs from the first technique in separating the functions of underwriting and distribution. The lead manager acts as sole placing agent and is responsible for placing any notes issued. The underwriters take up any notes which cannot be placed or extend loans of an equivalent amount. (This may be necessary in some cases to enable interest to be paid gross of withholding tax.) This technique is attractive to the lead manager, which retains total control over the placing of the notes and is able to earn a small placement profit (by placing the notes at a higher price than it pays).

The sole placement agency technique had two drawbacks. Firstly, since the notes were placed by the lead manager, the underwriters could not be sure of securing any notes to place themselves. In 1983 a facility incorporating a tender panel of banks was developed for the distribution of notes. The tender panel is separate from, but usually with many members common to, the group of underwriters. The panel members bid for any notes issued, up to a predetermined maximum spread. The underwriters take up any notes not bid for or extend loans of an equivalent amount. This technique allows the borrower to benefit from any improvement in terms available in the market, while still being assured of funds at a known maximum cost. The tender panel banks generally expect to place any paper they receive rather than hold it themselves. The tender panel technique was further extended in 1984 through the system of a continuous tender panel. Under this method the underwriters are entitled to purchase notes from the lead manager up to their pro rata share at any time during the offer period, subject to availability, at the price at which notes are being offered to the market. This gives the underwriters access to paper which they can place with their clients.

The second shortcoming of the sole placement agency was that the spread on notes was preset and consequently borrowers could not benefit from

any improvement in the terms available. This shortcoming was removed by arranging NIFs with an issuer-set margin. Under this technique the issuer determines the margin over LIBOR at which notes will be offered and thus is able to benefit from any improvement in market conditions. The notes are placed by the placing agent, but senior underwriters have the right to take up a prearranged share of any notes issued. Any notes not taken up at the issuer-set margin are allocated to underwriters at the pre-agreed maximum (cap) rate.

By the middle of 1985, the tender panel technique was being used in about two-thirds of NIFs, with the issuer-set margin accounting for a further 15-20 per cent. Many older facilities using sole placement were modified to include a tender panel. More recently, greater quantities of paper have come to market, and the debate on the most appropriate distribution method has intensified. The tender panel continues to be widely used, but many question whether the technique promotes efficient placing of paper with investors. Increasingly, dealerships of two or three firms have been formed, which ensure that competitive pricing is available to the borrower. In addition, the dealers are sure of receiving paper to place whenever the borrower decides to issue, and therefore can maintain more regular investor relationships.

The multiple component facility, first used by the Kingdom of Sweden in 1984, is another major development in the market for Euro-notes. This type of facility allows the borrower to draw funds in a variety of forms, including short-term advances, swingline credits, bankers' acceptances, etc., all of which have been included with a NIF. The borrower gains greater flexibility in choosing the maturity, currency and interest rate base of his drawings. The variety of forms enables the borrower to draw funds in a currency in which Euro-note issuance is not permitted.

A growing proportion of new facilities include extra borrowing options, to the degree that few facilities now are arranged with just a note issuance option. The most popular option is short-term advances, which enable borrowers to draw in a greater number of currencies and are also preferred by some banks as an alternative to holding notes. Advances options were included in around 45 per cent. (by value) of the underwritten facilities arranged in 1985.

Swinglines enabling borrowers to draw at short notice (generally same-day funds in New York) to cover the delay in issuing notes or making other forms of drawing were included in 35 per cent. (by value) of underwritten facilities arranged in the same period. (It is likely that more facilities include this and other options than are publicised.)

Bankers' acceptances, generally in US dollars and pounds sterling, are a fairly recent addition, first appearing in a facility for ICI in March 1985. Since then a growing number of facilities have included this option. The option featured in around 10 per cent. (by value) of underwritten facilities arranged in 1985.

The ICI facility was also the first to include an option for the issuance of sterling 1-5 year notes, which was made possible in March 1985 by changes in the UK Banking Act. Several further facilities - all for UK or US borrowers - have included the option, although it is not thought that any such notes have yet been issued.

Multiple component facilities enable the borrower to draw funds under whichever option is cheapest or most convenient at the time, or can be tailored to meet the borrower's particular funding requirements. An example of the latter is the borrower's option for notes and underwritten standby (BONUS) technique. Under this technique, first used by Volvo in 1985, an uncommitted NIF, a US commercial-paper (CP) programme, and a committed standby, each for the same amount, are combined in a single package. If conditions are unfavourable for the issue of Euro-notes or commercial paper, the borrower can draw on the standby as a revolving credit.

In favourable conditions, the borrower can issue the full amount of both the commercial paper (supported by the backstop, as a swingline) and the notes (sold via a tender panel on a best-efforts basis). Under these circumstances, outstanding paper will total twice the value of the committed standby, but the underwriting banks remain committed only for the amount of the standby. By contrast, under a conventional underwritten NIF, once the notes have been issued and placed with investors, the underwriting commitment cannot be used to back up any other facility.

A number of transferable RUFs (TRUF) have been arranged. Each underwriter has the ability - usually subject to the prior approval of the borrower - to transfer all rights and obligations under its underwriting commitment to another institution at any time during the life of the facility. This practice, however, might be undesirable for the borrower if banks less creditworthy than those who originally made the commitments are substituted. (It is not known in how many cases the borrower has any real power of veto.) Twelve facilities in 1985 (value $2.8 billion) can be identified as including this provision. It is likely, however, that there are similar arrangements in other facilities.

3. Non-underwritten facilities

As mentioned in the introduction, more NIFs have recently been arranged partly or entirely without underwriting commitments. The appearance of such facilities dates back to the second half of 1984, but the trend may have been encouraged by the actions of some supervisors in 1985 to include underwriting commitments in measurements of capital adequacy. Non-underwritten NIFs expanded from about 5 per cent. of the total of NIFs arranged in the second half of 1984 to about 15 per cent. in the first half of 1985 and in the second half reached nearly 50 per cent. These facilities are similar to underwritten NIFs except that they do not include underwriting or a standby credit in case notes cannot be sold. The borrowers under such facilities are of the highest credit rating and are therefore confident of their ability to sell notes. As a result they are able to dispense with the cost of underwriting a separate back-up (although many borrowers will already have considerable unused bank lines).

The details of non-underwritten facilities often remain sketchy. They often take the form of a general undertaking by the arranging banks to place notes for a borrower if required, rather than a facility which is likely to be substantially drawn. Some are even for an open-ended amount and maturity.

Since the middle of 1985, NIFs have become more like US commercial-paper programmes. The issuance of notes has been separated from the standby arrangement, more paper is issued for shorter and odd maturities, quick

drawdowns are available (same-day funds in some cases), rates are set on an absolute basis (instead of a spread over LIBOR), and paper has been rated in a small number of cases. Such non-underwritten facilities are known as Euro-commercial-paper programmes, and should be considered quite separately from underwritten facilities as they entail no bank commitments to back the issue of notes.

A major distinction between Euro-commercial-paper facilities and standard NIFs concerns the process of note issuance. Under a NIF, the issuer requests propositions for a given amount of paper on a given date, while Euro-commercial-paper issuance can be driven by the market (the dealers), who bid for paper from the issuer in response to investor demand. Variable maturities are also more generally available under the Euro-commercial-paper structure, as is same-day settlement. Several clearing systems can arrange same-day settlement, either by physical delivery or more commonly by book entry. Under at least one facility, note issue is purely a book-keeping exercise as no physical notes ("definitive instruments") are in fact issued.

Facilities can quickly become outdated in a rapidly changing market. It is not uncommon to revise a facility substantially after only a few months to incorporate new features. Thus there is no definitive Euro-note facility, but rather a spectrum of facilities incorporating various methods to issue notes, different forms of drawing and back-up. It seems likely, however, that the market will converge on one or a few standard formats as it matures. Most probably a distinction will emerge between mostly non-underwritten commercial-paper programmes for the very top borrowers and underwritten NIFs (possibly with a number of extra borrowing options) for other borrowers.

B. The market for NIFs

1. Structure of the market

The NIF market has evolved through three roughly distinguishable phases. In the first phase (1981-83) facilities were generally for fairly small amounts (up to $300 million). The main borrowers were banks and OECD governments and state entities. There were also several facilities for Latin American borrowers. At that stage, many facilities were essentially disguised syndicated loans.

Late in 1983 and throughout 1984 the techniques rapidly gained popularity, mainly as a low-cost substitute for syndicated credits. High-quality corporate borrowers entered the market, and a number of very large multiple component facilities were arranged for smaller but good-quality OECD sovereign borrowers such as Sweden, Spain and Denmark. The introduction of these better-quality borrowers and the growth in the market encouraged a wider range of banks to take underwriting positions, and in the process they insisted on being given a chance to bid for and place paper. The latter development led to the introduction of the tender panel as an alternative to the sole placement agency. The average size of facilities grew from under $200 million in 1982 to over $500 million.

In the third phase (1985), non-bank corporations from major and minor OECD countries, particularly the United States, Australia and the United Kingdom, became the largest borrowers. Corporate borrowers rose from an

average of 41 per cent. of the market in the previous four years to over 60 per cent. For these borrowers NIFs are not an alternative to syndicated loans, but an alternative or a supplement to FRNs and to US commercial-paper programmes.

Table 1.1

Geographical distribution of borrowers in the NIF market*

	1981	1982	1983	1984	1985
	in billions of US dollars				
Major OECD	-	0.53	1.73	6.31	29.27
of which: France	-	-	*0.78*	*1.24*	*2.98*
Netherlands	-	-	-	-	*1.32*
Switzerland	-	-	-	*1.10*	*0.07*
United Kingdom	-	-	-	*0.70*	*3.81*
United States	-	*0.43*	*0.35*	*3.05*	*17.52*
Minor OECD	0.50	1.17	1.25	11.24	17.55
of which: Australia	-	*0.25*	*1.03*	*2.70*	*7.89*
Denmark	-	-	-	*1.02*	*0.40*
New Zealand	*0.50*	*0.10*	-	*2.05*	*0.74*
Sweden	-	*0.05*	*0.07*	*4.73*	*4.81*
Others	0.53	0.67	0.31	1.28	2.67
of which: developing countries	*0.53*	*0.58*	*0.15*	*0.27*	*1.00*
oil exporters	-	*0.05*	*0.10*	*0.23*	*0.52*
international institutions	-	-	-	*0.50*	*0.85*
Total	1.03	2.37	3.29	18.83	49.49
of which: underwritten NIFs ..	*1.03*	*2.37*	*3.29*	*18.20*	*33.14*
non-underwritten NIFs/Euro-commercial-paper programmes ..	-	-	-	*0.63*	*16.35*

* These data record the value of facilities arranged rather than drawings. They include underwritten and non-underwritten facilities (Euro-commercial-paper programmes) and multiple component facilities. Compilation is by announcement date.

Source: Bank of England.

In 1985 nearly two-thirds of the total facilities arranged were for the borrowers of just three countries - the United States (35 per cent.), Sweden (10 per cent.) and Australia (16 per cent.). Non-OECD countries (including developing, oil-exporting and eastern European countries) accounted for only around five per cent. A few facilities were also arranged for international institutions.

Although the market is at present dominated by OECD borrowers, there are signs that less-developed countries are becoming more active. Already several borrowers from South Korea, Singapore, India and Indonesia have arranged facilities, although mostly for small amounts. As the market becomes more established, it is possible that something approaching the range of borrowers with access to the syndicated credit markets will also be able to arrange NIFs.

Table 1.2

Type of borrower in the NIF market

	1981	1982	1983	1984	1985
	in percentages				
Government	48.7	25.3	-	40.2	7.7
Financial	9.8	29.3	53.9	17.1	27.5
Industrial	41.5	45.4	46.1	40.1	63.0
International institutions	-	-	-	2.6	1.8

Source: Bank of England.

Facilities have predominantly been arranged in US dollars; a few have been arranged in Singapore dollars, and multiple component facilities often offer ECU notes as an alternative form of drawing. The issue of Euro-notes in pounds sterling, Swiss francs, Deutsche Mark or yen has not been permitted, although it is believed that there would be considerable interest in issuing notes in some of these currencies if it were allowed. (Sterling 1-5 year notes were permitted in certain circumstances by a UK regulation change in March 1985.) Activity in the market remains centred largely in London. In some centres, such as Singapore, a small local market has developed, catering mostly for domestic borrowers and with notes issued in local currency rather than US dollars.

Table 1.3

Alternative borrowing options included in NIFs

	1984		1985			
	3rd quarter	4th quarter	1st quarter	2nd quarter	3rd quarter	4th quarter
	in billions of US dollars					
Short-term multicurrency advances	1.60	1.95	2.20	6.85	1.93	3.92
Swingline	0.52	1.95	3.08	5.56	1.00	1.89
Bankers' acceptances (generally US dollar and pound sterling)	-	-	0.48	0.94	1.45	0.79
Pound sterling 1-5 year notes	-	-	0.45	1.82	0.30	0.12

Source: Bank of England.

2. Drawings on NIFs

Although more than $75 billion of facilities (including multiple component facilities) has now been arranged ($17 billion of which is non-underwritten), the proportion of facilities actually drawn remains quite low. According to some estimates, no more than $10-15 billion of Euro-notes has been outstanding under the facilities at any time. In addition, some multiple component facilities have been drawn in other forms, such as short-term advances or bills of exchange. There are various reasons for this low use of facilities. A large number of facilities have been arranged as back-up lines to US commercial-paper programmes, but have remained as a back-up since interest costs on commercial paper have been lower than on Euro-notes.

The usage of NIFs in any case should be expected to build up gradually. Some NIFs were arranged in anticipation of borrowing needs, but many others were explicitly designed as standby facilities. Other facilities may only be drawn down in stages to avoid flooding the market with paper.

Recently the number of drawings has begun to pick up. Secondary market bid and offer prices are publicly available for the notes of around a hundred different borrowers, both in the press and on screens, although there is no indication of the volume of secondary-market trading (which is believed to be very small).

Little is known about the identity of investors in the notes issued under NIFs. The underwriting function on NIFs has largely been assumed by commercial banks, with US, French, Japanese and some Canadian, Swiss and UK banks being prominent.[3] These banks seem to hold only nominal amounts of paper, mainly in their cash management portfolio (they may be less inclined to do so when interest rates are rising). Banks do not generally consider Euro-notes as an investment vehicle and little paper has been placed with the underwriting banks. Until recently most of the paper was placed with smaller banks, since placement of paper with non-bank investors is not very highly developed.

There are differences of opinion about which banks hold Euro-notes. French, Italian, Canadian, Middle Eastern and (increasingly) Far Eastern (for example, South Korean) banks are mentioned as note holders, although no data are available. Japanese banks are thought by some to be particularly important, partly because they may have access to cheap funding through interest rate swaps. But their interest in holding notes is limited by the very low yields on most notes and the generally short maturities, which may not fit in with their investment policies.

Only a minority of notes is held by non-bank investors, although the proportion is rising. According to various estimates, in early 1985 non-bank investors purchased between a quarter and a third of notes issued, roughly double the proportion of 1984. By late 1985 some firms with strong placement ability claimed that 50 to 75 per cent. were sold to non-banks, and several firms organised familiarisation seminars for potential investors. The principal non-bank investors appear to be money-market fund managers, corporations, insurance companies, wealthy individuals and (for some issues) central banks. For these investors Euro-notes offer an alternative to bank deposits, which may have lower credit-standing than the liabilities of some prime non-banks. Many may also be able to earn a higher return than is available to them on Euro-currency deposits. For example, a non-bank investor may be unable to place in volume at LIBID in the deposit market, but can purchase notes at just a few points below. A firm's existing customers may therefore invest in Euro-notes as an alternative to bank deposits or certificates of deposit.

A number of obstacles are cited in explanation of non-bank investor reluctance. Firstly, the paper often has a high face value, generally $100,000-500,000, which is considerably higher than the $10,000-50,000 typically found on FRNs. Large denominations may exclude smaller banks as well as non-bank corporate and institutional investors. To counter this problem, some recent facilities have provided for notes in denominations as low as $10,000.

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3 Euromoney lists the top ten underwriters in 1985 as Banque Nationale de Paris, Crédit Suisse, Orion Royal Bank/RBC, IBJ, Sumitomo Bank/Sumitomo Finance, Bankers Trust, Crédit Lyonnais, Swiss Bank Corp./SBCI, Bank of America and CIBC Ltd.

Secondly, the paper is not generally rated (unlike US commercial paper). Certain major investors are restricted by their articles or regulations to purchases of rated paper only, and corporate treasurers are often prevented from investing in Euro-notes by stringent credit approval requirements. This problem may soon fade, since both Standard and Poor's and Moody's rating services have begun to rate Euro-notes. There is concern, however, that some dealers may be misleading investors by quoting a borrower's US rating as also applying to their Euro-notes. At times a US rating is based on backing by an irrevocable letter of credit (which is used to improve the rating), but is not available for Euro-notes.

Thirdly, the secondary market for notes remains relatively undeveloped. Trading is thin and concentrated in the first few days after notes are issued. Most short maturity notes are apparently held to maturity. There is some secondary-market activity in the three and six-month maturities. Some, but not all, traders make a market in the paper they sell, although the lead manager of the facility would not necessarily expect to support prices in the secondary market in the way that it would for FRNs.

An active secondary market is a requisite for assuring investors of liquidity, in part because it allows investors to obtain desired maturities not available in the primary market. This function is becoming less important as variable maturities and investor-driven issuing have begun to emerge. In the absence of these developments, an investor seeking a two-month asset might purchase a three-month note and then sell it in the secondary market after two months, or buy a three-month note with two months left to maturity. It is now becoming possible for investors (through a dealer) to request that an issuer make available paper of the required maturity. Maturities tailored more closely to individual investors' requirements may therefore become more commonplace over time and the artificial maturity creation function of the secondary market may become less important.

The handful of firms most active in distributing paper are making great efforts to broaden the investor base, and there are signs that a multi-tier market may be developing. Many borrowers issue at a margin over LIBOR and their notes are held largely by banks. Better regarded borrowers can issue at around LIBID, and such investments are an alternative to bank deposits for non-bank investors. The very top borrowers (some sovereign-guaranteed borrowers and multinational corporations) are able to issue at yields of around 1/16-1/8 percentage points below LIBID, and such notes are comparable in investment to certificates of deposit. Euro-notes thus compete with several different investments.

At least one borrower (Canada's Export Development Corporation) has been able to sell paper at even lower yields: 25-30 basis points below LIBID for six-month paper, 45 basis points below for three-month and even 60 basis points below for 30-day paper. There are several reasons for these low yields. Firstly, attempts have been made to attract the US Treasury bill investor, for whom the notes can be viewed as offering a sizable differential (say, 50 basis points) above the return on Treasury bills rather than a similar differential below the benchmark of LIBOR or LIBID. Secondly, the tranches of borrowing have been kept small. Thirdly, the notes have flexible maturities and unusually small face values ($10,000 compared with $100,000). Fourthly, the programme's dealers have been successful in placing paper with niches of untapped investors. Investors in the paper, in order of importance, are said to be Swiss institutions, central banks, corporate investors and Japanese entities.

While only an extremely limited number of issuers can attain such low yields, there are already signs that other top borrowers are seeking similar results. Many market practitioners believe that lower yields relative to LIBOR are attainable and that purchases by non-banks (on which increasing volume depends) can be increased. This will require a continuing process of education to familiarise investors with the concepts, attractions and issuers of Euro-notes. The routine rating of notes is also an important factor.

3. Standardisation and documentation

The documents prepared for a NIF typically include agreements covering the underwriting of the notes, the issuing and paying agency and operation of the dealership or tender panel, and a brief information memorandum for circulation to prospective note buyers. The notes themselves are generally bearer instruments, and so must be printed to high security standards. It is not usual to prepare a prospectus.

The documentation for each facility is drafted separately taking into account the individual circumstances of the borrower, but on the basis of more or less standardised master contracts. The documentation seems to follow a general pattern closely based on that for syndicated credits with only minor variations. For the protection of the underwriter, covenants and "escape" clauses nearly identical to those in syndicated credits are being used. These fall into two distinct categories: firstly, those which relate directly to the borrower's circumstances; and, secondly, those which relate to external circumstances.

The clauses relating directly to the borrower's circumstances are generally the same as in a conventional syndicated credit and include cross default and negative pledge clauses and representations and warranties (legal and fiscal). However, most contracts also include one of two sets of special clauses. The first contain specific convenants: for example, that the borrower undertakes to maintain a given "own funds" ratio or that the funds borrowed must be earmarked for a specific use. The second, generally entitled "material adverse change" (MAC) clauses, specify that the underwriting banks may by majority decision obtain release from their commitment if they ascertain and are able to prove that a major change - in the activities, assets or ownership of the borrower - impairs the borrower's ability to repay.

US corporations have preferred the former type of clause, objective covenants, since under Financial Accounting Standards Board (FASB) Statement No. 6 they are permitted to treat such facilities as long-term borrowings. Thus, replacing a revolving credit facility with a NIF can improve their reported liquidity by substituting what are shown as long-term borrowings for what are shown as short-term borrowings.

Views differ on the degree of "comfort" underwriters may take from these clauses. Some banks see covenants as providing mere early warning signals, which would do no more than trigger talks when a borrower's situation has started to slip. Others, however, believe that these covenants would allow banks to extract themselves from the underwriting commitment, provided they are unambiguously worded.

The clauses relating to external circumstances include either an increased cost clause, which permits the underwriting banks to pass on to the borrower the consequences of a change in national legislation which leads to an increase in the costs borne by the underwriters, or clauses relating to changes in market conditions such as the method of quoting the currency, the calculation of the benchmark rate, or the impact of exchange controls.

A majority of underwriting banks have to agree on certain of these provisions before they can be invoked.

4. Bank and investment-bank marketing strategies

For investment banks the NIF technique has the attraction of transforming an activity for which they have no particular expertise or capacity (taking deposits and making loans) into one of their traditional activities (placing paper with investors). A number can draw on their experience as sole or joint placers of commercial paper in the United States. The most prominent arrangers of NIFs have been either investment banks or the merchant banking arms of commercial banks.[4] As well as front-end fees for arranging facilities, these banks are able to earn placement profits from placing notes with investors at lower yields than those at which they received them. They generally do not expect to have any exposure to the borrower. However, they are not always able to withstand the pressure to join the underwriting group.

The commercial banks, too, consider it in their interest to act as the arranger, which enables them to keep the custom of the issuers and to benefit from any spin-off business (such as other borrowings or foreign exchange transactions). On the other hand, banks have little desire to participate in a subordinate capacity (at the level of manager or underwriter). That rôle can use up internal (and, in some countries, regulatory) customer limits for a small return. In addition, undertakings to lend in the future can cause difficulties for liquidity management.

Nevertheless, not infrequently banks have joined underwriting facilities at very thin margins, mainly in order to maintain customer relationships. Banks have joined in the arrangement of prestige facilities (for example, Kingdom of Sweden and Nestle), and when the facility replaced a syndicated credit in which the bank was involved. Some banks participate in order to retain a presence in the market, and so that their foreign office networks might also maintain their share of the market in certain highly competitive financial centres (for example, London or Singapore).

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4 Euromoney lists the top ten arrangers of facilities in 1985 as Citicorp Investment Bank, BankAmerica Capital Markets Group, CSFB, Merrill Lynch Capital Markets, Morgan Guaranty, Chase Manhattan Ltd., Salomon Brothers International, Bankers Trust Co., S.G. Warburg & Co. and Bank of Tokyo International.

5. The attractions of the instruments

Borrowers like NIFs because of their low cost and great flexibility. An issuer may use a NIF for funding or to hold in reserve as a standby facility. A NIF that is drawn regularly may replace an alternative source of variable rate funding, such as a floating rate note (FRN) or a syndicated loan. (The most notable drawback is the lack of choice on currencies.) Under present market conditions, a number of NIFs have been arranged to replace existing, more expensive borrowings. When arranged as a standby, a NIF may back up other types of financing, such as US commercial paper, or act as an emergency funding source.

For US corporations the US commercial-paper market probably remains the cheaper source of funds in most cases. Therefore, most of the US corporate NIFs, while giving the borrower the option to issue in London, for the present serve as supplements, and perhaps ultimately as substitutes, for the corporations' domestic revolving credit arrangements that back up their commercial-paper programmes. For non-US corporations, the NIF (Euro-commercial-paper) market may be as cheap as the US commercial-paper market, given the premium that foreign issuers pay in the commercial-paper market. This is particularly true for new issuers who must go to the time and trouble of obtaining a rating before they can enter the market. Other borrowers who require flexible financing but who have neither the size nor the rating necessary to gain access to the US market may also see advantages in entering the Euro-market, especially as it matures.

6. Regulations, government restrictions and accounting considerations

The Appendix to this chapter contains details of the differing regulatory approaches to the underwriting commitments under NIFs and RUFs adopted by member countries. Although no common approach is yet discernible, most supervisory authorities have either already instituted regulations governing commitments under such facilities or are actively considering them. In many cases underwriting commitments are covered in some way by existing regulations.

In April 1985 the Bank of England required banks in London to include underwriting commitments under NIFs in the measurement of capital adequacy. As a provisional measure, pending the outcome of a review with banks and other institutions of the full range of banks' off-balance-sheet business, such obligations will be treated as contingent liabilities for capital adequacy purposes. They will be included at a weight of 0.5 (half the weight accorded to normal commercial lending) in the calculation of the risk asset ratio, whether or not the facility has been drawn by the borrower. Where an institution holds paper issued under a facility of which it is an underwriter, its holding of the paper will be weighted as a balance-sheet item, and the amount of its underwriting obligations reduced accordingly.

Shortly afterwards the Japanese authorities indicated their intention to accord these obligations a 0.3 risk weight (equivalent to 30 per cent. of the weight applied to normal commercial lending). In January 1986 proposals emerged from the US Federal Reserve to apply a 0.3 risk weight and in February 1986 a 0.5 risk weighting was proposed by the German supervisory authorities.

It is too soon to assess the full impact of these measures on the volume of facilities or on terms.

C. Bank assessment and control of market and credit risk

1. Definition of risks

The risks incurred by banks participating in NIFs depend on the rôle they play and the technique used. Most exposed are those banks which provide an underwriting commitment, whereas banks which take part in a tender panel have the choice whether or not to bid for notes. Where the underwriting banks have taken part in a facility of the type arranged for New Zealand (as described in Section A.2), their obligations are closely analogous to a loan commitment. That is, the banks are obliged to acquire an asset whenever the borrower chooses to call for funds, and do so at a maximum spread over LIBOR. For banks underwriting a facility using the single placement agency, dealership or tender panel techniques, their obligation is closer to a contingent liability, since they will only be called upon to acquire Euro-notes if these cannot be placed elsewhere. Moreover, this is likely to occur in circumstances when there are doubts about the creditworthiness of the borrower.

NIFs also involve liquidity risk. This is the risk that banks will be called upon to provide funds at a time when they cannot easily do so, either because the individual bank is unable to fund itself at market rates or because of the general conditions in the interbank market. While this risk has generally attracted less attention, banks now appear to be becoming increasingly concerned about funding risk and the extent to which they may be protected by documentation.

Banks holding notes issued under NIFs face straightforward credit risk on the issuer for the life of the notes. If the bank holding the note is not also an underwriter of the facility, then over the banking system as a whole there will be an element of double-counting of exposure since both the bank holding the note and the bank underwriting the facility will be recording exposures to the same borrower. Clearly, any sudden large movements in interest or exchange rates will affect the value of outstanding notes, but in this they do not differ from other short-term instruments.

2. Assessment and control of risks

Underwriting commitments on NIFs seem always to be included by banks under their country or customer limits for similar instruments. Practice differs over whether underwriting commitments are treated analogously with undisbursed loan commitments or with guarantees; the former seems to be rather more common. In many cases a significant proportion of NIFs is booked in overseas offices. In the case of Japanese banks, all underwriting commitments are booked abroad, mainly with subsidiaries in London, in order to meet legal requirements on the separation of banking and securities business. But most banks (including the Japanese) require head office approval before they can enter into commitments.

Some protection against being required to buy the notes of a borrower in difficulties may be provided by "material adverse change" clauses or financial covenants in the underwriting agreement (described in Section B.2).

Such clauses are untested in law and, on the whole, underwriting banks seem not to place very great reliance on them. Most agreements also apparently contain provisions for underwriters' fees to be increased or for underwriters to opt out if costs increase owing to regulatory changes.

Less information is available on the means adopted by banks to control the funding risk on NIF underwriting commitments. Some Canadian banks place a limit on particular NIF underwriting commitments, which is related to the maximum commitment that they would be prepared to fund at short notice. Similarly, Japanese banks are starting to control their funding risk by limiting their overall commitments under NIFs in relation to capital, by ensuring the availability of funding through back-up lines or long-term funding or by including all outstanding NIF underwriting commitments in internal gearing calculations.

The information available suggests that banks' holdings of Euro-notes are treated like credits to the issuer of the notes.

3. Pricing

The costs to the borrower consist of two components: the rate paid on the notes issued (or on other forms of borrowing), and fees relating to the arrangement and operation of the facility.

Where the facility provides for notes to be issued through a tender panel or similar mechanism, the rate paid on these drawings will vary, depending on conditions at the time of issue (although there may be a cap rate - see below). Prime borrowers have been able to issue notes through tender panels at very low rates, often sub-LIBID. Borrowers such as the Kingdom of Sweden, Commonwealth Bank of Australia and Unilever have consistently been able to issue notes at yields well below LIBID, usually five or ten basis points below (Canada's Export Development Corporation, as described in Section B.1, has obtained yields nearly 50 basis points below LIBID). These, of course, are the terms which the most highly rated borrowers are able to achieve, and others pay rates above LIBOR.

The majority of facilities arranged to date have set a ceiling on borrowing costs in relation to market rates. This is done either by having the issue of notes underwritten at a predetermined spread, or by including in the facility a standby credit, again at a predetermined spread. This ceiling is usually set in relation to LIBOR (occasionally Singapore interbank offer rate - SIBOR) and represents the coupon on the notes or the yield achieved by issuing notes at a discount. For prime borrowers the ceiling rate may be as low as LIBOR flat, and range up to LIBOR plus 20 basis points depending on the standing of the borrower. In some cases the ceiling rate may vary according to the extent to which the facility is drawn, for example, LIBOR plus 20 basis points if less than 50 per cent. of the facility is drawn, and LIBOR plus 25 basis points if 50 per cent. or more of the facility is drawn. In some cases the ceiling rate rises over the life of the facility, for example, LIBOR plus 5 basis points for the first five years, then LIBOR plus 12.5 basis points for the next two years, and LIBOR plus 20 basis points for the last three years. The ceiling rate is often still below the rate which a borrower would have to pay for a regular standby. This may be because the banks making the NIF-related standby expect to make an additional profit when they receive notes and are willing to concede a lower cost on the back-up because they appraise the facility as a whole.

Where facilities incorporate a swingline option this usually carries a cost of US prime rate.

Four types of fee are payable on NIFs, although not all are necessarily present in every facility.

(i) Participation or front-end management fees are single payments made when a facility is arranged. They generally range up to 15 basis points and sometimes vary with the size of each participant's commitments.

(ii) Underwriting fees are paid annually to the institutions underwriting the issue of Euro-notes and are usually paid on the full amount of the facility regardless of the amount utilised at any time. They tend to vary between 5 basis points for the very top borrowers and 15 basis points for others.

(iii) Commitment or facility fees are also paid annually and are usually an alternative to underwriting fees (although there are a few facilities with both an underwriting and a commitment fee). Sometimes the commitment fee is payable on the full amount of the facility regardless of utilisation, sometimes only on an unused portion. In some facilities the borrower is able to designate part of the facility as unavailable, on which no or a lower commitment fee is payable. (A notice period is often required before this part of the facility can be redesignated as available.) Commitment fees range from 5-10 basis points, and sometimes rise over the life of the facility.

(iv) Utilisation fees are charged on a small number of facilities and range up to 20 basis points depending on the degree of utilisation of the underwriting commitment.

A recent comparison of the costs of note issuance facilities and syndicated credits has shown that, in the small number of cases where it is possible to compare the two, NIFs may be between 10 and 50 basis points cheaper than a syndicated credit. The saving to the borrower is in the lower interest spread; this is reduced slightly by the higher fees generally payable on NIFs.

There may also be additional agency and administration fees and one-time payments to cover out-of-pocket expenses.

4. Rôle of banks' profitability

As described in the previous section, banks' possible sources of income from NIFs are the following:

(i) a spread on any notes held;

(ii) placement profits;

(iii) front-end fees;

(iv) annual underwriting or commitment fees;

(v) possibly, utilisation fees;

(vi) agency and administration fees.

There is a widespread consensus among banks that NIF underwriting fees have been driven down to the point where they do not, on their own, represent adequate compensation for the type of exposure incurred. Since margins are extremely fine, Euro-notes are not generally considered very attractive instruments for major banks to hold. The profitability of NIF operations therefore depends on other factors.

Since the arrangement of NIFs tends to be dominated by a fairly small number of investment or merchant banks, the majority of banks look to other sources of income for their profits. Placement profits (earned on the difference between the rate at which the bank is awarded Euro-notes and the rate at which it resells them to its customers, supplemented in some cases with placement fees) can amount to around 5 basis points and may be repeated at six-monthly intervals. To earn them, however, it is necessary for banks to have access to the notes which are issued (underwriting banks are not necessarily able to obtain paper to place themselves) and to have a client base with whom the notes can profitably be placed.

Most banks, then, would regard the arrangement of NIFs as the most profitable form of participation, followed by participation in the distribution of notes with the opportunity to earn placement profits. Participation as an underwriter with no additional fees is widely regarded as unattractive.

5. Impact of taxation

Two cases have been noted where taxation may affect the attractiveness of NIFs.

(i) In Switzerland stamp tax is payable on notes which are actually issued and on secondary trading in Euro-notes, but this is not an impediment to facilities being arranged in Switzerland, as long as only a small proportion is drawn.

(ii) In Australia withholding tax is not payable on widely distributed bearer debentures issued outside Australia, provided the funds are for use in an Australian business. The distribution mechanism on a NIF normally meets this requirement, making a NIF an attractive source of funds compared with syndicated loans, which can only be exempted from withholding tax if they are raised by an entity in which there is substantial Australian participation. This may partly explain the relatively large number of NIFs arranged for Australian borrowers, particularly Australian offices of foreign banks.

6. Evidence of underpricing

It is a widespread opinion that competitive pressures have driven down underwriting fees on NIFs below the levels which offer an acceptable return on the risks incurred. Apart from the arrangement of facilities and placing of notes, there is thought to be little opportunity for profit. Except in the interest of customer relations banks seem to have become reluctant to accept underwriting positions without opportunities for placing notes. One response to this view has been to give underwriters a greater rôle in the distribution of the notes (as described in Section A.2) to allow them to supplement their underwriting fees with placement profits. Another consequence has been a growing proportion of NIFs which are not fully underwritten (as also described in Section A.2). Nevertheless, there is still no sign of any tendency for underwriting fees to rise on facilities for prime borrowers.

Appendix

Regulatory approaches to NIF underwriting commitments*

Belgium: No capital adequacy requirements for underwriting commitments or off-balance-sheet business of this kind. Changes to the requirements are under consideration by the Commission Bancaire.

Canada: Included in capital requirements in principle. Changes are under consideration by the Inspector General of Banks.

France: Included among off-balance-sheet items subject to the solvency ratio with a weight of 5 per cent. if the facility is for a bank and 25 per cent. if it is for a non-bank.

Germany: The supervisory authorities have proposed that underwriting commitment should be made subject to capital adequacy requirements with a weight of 50 per cent. Hearings on this proposal will be held shortly.

Italy: There are no capital adequacy requirements in Italy. Banks are subject to a rule that "crediti di firma" in lire and foreign currency should not exceed 15 per cent. of total deposits (excluding interbank). Although the issuance of NIFs does not come under these ceilings, banks in practice consider NIFs as "crediti di firma".

Japan: At present claims on non-residents must not exceed 14 times capital. As from the beginning of May 1985 the authorities asked the Japanese banks to report, on a trial basis, their calculated risk asset ratio with the intention of introducing certain capital adequacy requirements in the future. Commitments under NIFs have a weighting of 30 per cent. in this calculation. This compares with a weighting of 100 per cent. for medium and long-term loans.

Luxembourg: No capital requirements for off-balance-sheet business.

Netherlands: Underwriting commitments attract a weight of 50 per cent. in the computation of solvency ratios.

Sweden: No capital adequacy requirements for underwriting commitments or off-balance-sheet business of this kind. Changes are under consideration.

Switzerland: Guarantees are generally included within capital adequacy tests but commitments to lend may not be. Banks regard NIF underwriting commitments as commitments to lend.

United Kingdom: Holdings of notes are subject to capital requirements on the same basis as other loans. Commitments are subject to a risk asset weighting of 50 per cent.

United States: Proposals for the inclusion of some off-balance-sheet items in risk asset ratio calculations were disclosed in January 1986. Commitments under NIFs would attract a weighting of 30 per cent.

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* In the absence of precise guidelines from regulatory authorities the treatment of NIFs in measurements of capital adequacy may depend in some countries on whether they are reported to the supervisory authorities as guarantees or commitments to lend.

Chapter 2

Currency and interest rate swaps

A. The instruments and the markets

1. Definition

A swap is a financial transaction in which two counterparties agree to exchange streams of payments over time. The two main types are CURRENCY SWAPS and INTEREST RATE SWAPS.

The term CURRENCY SWAP generally refers to a transaction in which two counterparties exchange specific amounts of two different currencies at the outset and repay over time according to a predetermined rule which reflects both interest payments and amortisation of principal. Normally fixed interest rates are used in each currency. In some cases there is no exchange of principal amount initially, and in others not at maturity either.

The currency swaps under consideration here, which have come into common usage only in the past few years, differ from those which have been traded for many years in foreign exchange markets. The latter transaction involves the sale of one currency against another for one delivery date with simultaneous agreement to reverse the transaction at a future date. In such transactions only the principal amounts are exchanged on the initial and again on maturity dates, with no exchange of interest streams in the interim.

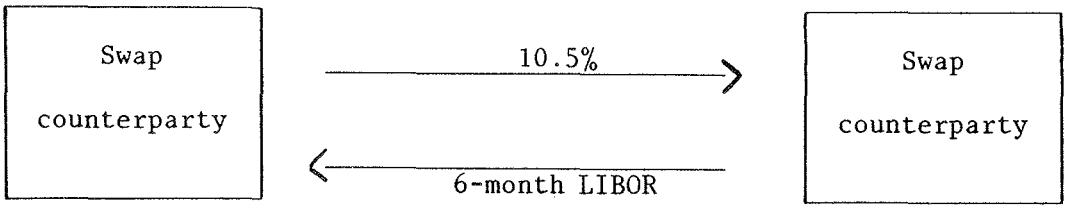
At the present time, the term currency swap is applied to both types of transactions, and no generally agreed terminology has appeared to distinguish them. Throughout the present study, all references are to currency swaps involving exchange of interest streams, and there is no discussion of the currency swaps historically traded in the foreign exchange markets.

In an INTEREST RATE SWAP no actual principal is exchanged either initially or at maturity, but interest payment streams of differing character are exchanged according to predetermined rules and based on an underlying NOTIONAL PRINCIPAL amount. The three main types are: COUPON SWAPS (or fixed rate to floating rate swaps), BASIS SWAPS (from floating rate against one reference rate to floating rate with another reference rate) and CROSS-CURRENCY INTEREST RATE SWAPS (swaps of fixed rate flows in one currency to floating rate flows in another).

In a coupon swap, one party pays a stream of fixed rate interest payments and receives a stream of floating rate payments, both denominated in the same currency. The counterparty, of course, receives fixed and pays floating. No cash flows of principal are exchanged. For example, one party may agree to pay a fixed rate of 10.5 per cent. on a notional amount of $10 million for five years. In exchange, this party receives six-month LIBOR payments based on the same notional amount (see Figure 2.1).

Figure 2.1

Example of interest rate swap

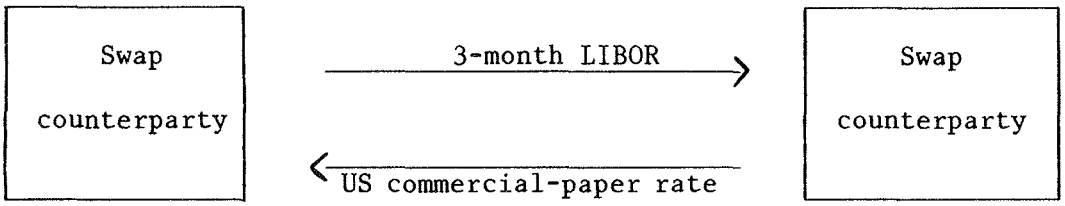


Notional amount: $10 million.
Maturity: 5 years.
Payment frequency: both fixed and floating rate payments are made semi-annually.

In a basis swap the interest payments exchanged are calculated from two different floating rate indices, e.g. three-month dollar LIBOR against the US commercial-paper composite rate (see Figure 2.2).

Figure 2.2

Example of basis swap

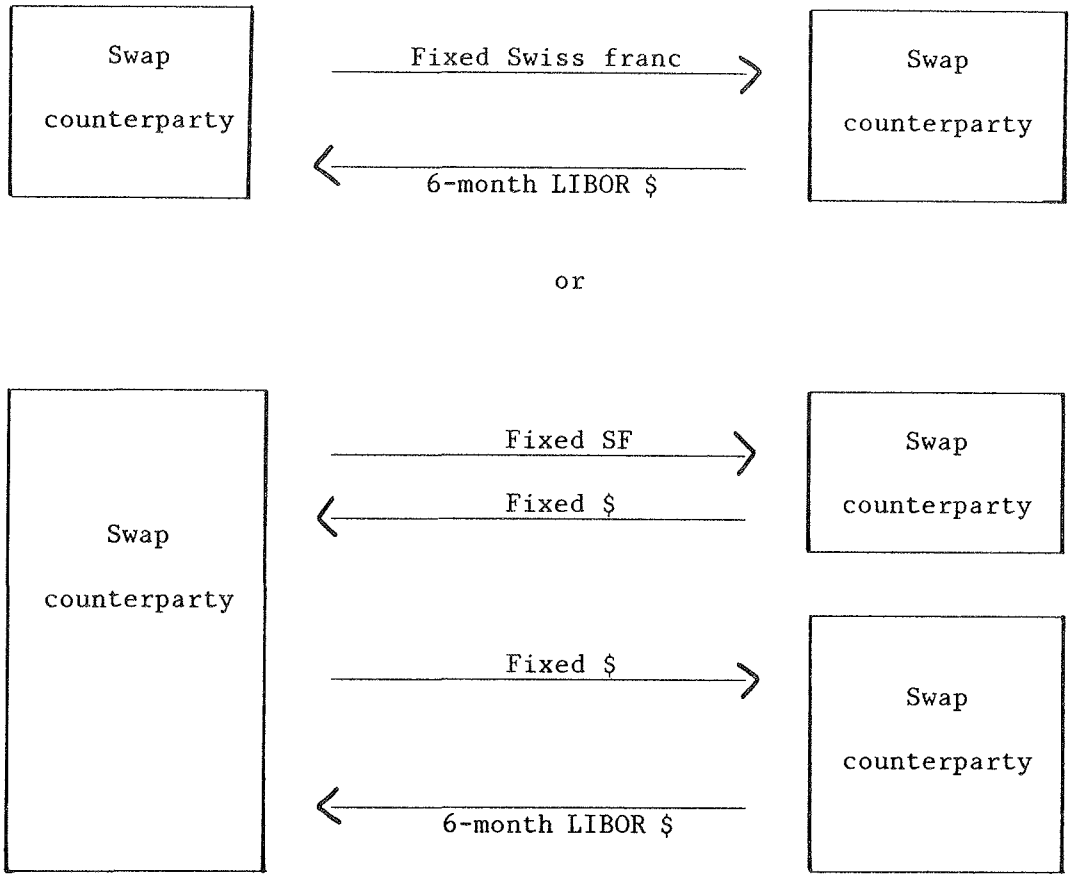


Notional amount: $5 million.
Maturity: 3 years.
Payment schedule: every three months.

A cross-currency interest rate swap involves the exchange of payments in different currencies and also on different interest rate bases, such as floating rate to fixed rate. Some dealers execute such arrangements as a single transaction, while others separate the cross-currency and interest rate components. Typically, this type of swap involves the exchange of non-dollar fixed rate interest payments for dollar floating rate interest payments (see Figure 2.3).

Figure 2.3

Example of cross-currency interest rate swap



2. Market size

The volume of swap transactions and the outstanding amount are both normally measured in terms of the notional principal on which payments are made. Global swap-market volume is difficult to estimate, and there is little historical data. Market participants estimate that the outstanding amount of interest rate swaps at mid-1985 was between $100 and 150 billion of notional principal. The market is concentrated in New York and London, but is not exclusive to those centres.

The outstanding volume of currency swaps is less than that of interest rate swaps, but is growing rapidly. Currency swap activity has generally been concentrated in Europe, Japan and Australia, and in 1985 activity picked up in New York.

Most coupon swaps are denominated in dollars, largely because of the important rôle of the dollar in world finance. Also, there are many willing payers of fixed dollar interest rates, and open dollar swap positions can easily be hedged in the broad and deep dollar asset markets.

Small amounts of coupon swaps have been transacted in other currencies as well, mainly pounds sterling but also Swiss francs, Deutsche Mark, Japanese yen, ECUs, Dutch guilders, Canadian dollars, Australian dollars and Belgian francs. In fact, one of the first coupon swaps was effected in sterling between a bank and a UK local authority, the bank paying a fixed rate and hedging with a Euro-sterling bond. The sterling coupon swap market was estimated at £1 billion in 1984. Currency swaps have been written in all the major currencies.

Basis swaps, according to one estimate, account for 10 per cent. of the interest rate swap market, but recent indications suggest that they are growing relatively rapidly. A large portion of basis swaps are initiated by dealers who have entered into two coupon swaps in which the interest rate index used for the two floating sides differs. For example, one coupon swap might be from fixed to floating (LIBOR), while the second might be from fixed to floating (prime-based). To cover against the basis risk involved in paying LIBOR and receiving prime, the dealers arrange a third swap, from LIBOR into prime.

3. The evolution of the swap markets

The history of swap activity varies somewhat between its main sectors. While assorted claims have been made that each type of swap was done on an ad hoc basis well back in the 1970s, currency swaps in fact have an earlier origin than interest rate swaps.

The currency swap has evolved as a successor to the back-to-back loan. In a back-to-back loan, two parties in different countries make loans to one another, of equal value, each denominated in the currency of the lender, and each maturing on the same date. In such transactions, the payment flows are identical to those of spot and forward currency transactions, since the initial loan is concluded at the spot rate, while the interest payments and repayments of principal are set to correspond to forward foreign exchange rates. Back-to-back loans were developed when exchange controls were in force in the United Kingdom in the 1970s to provide non-residents with a means of borrowing fixed rate sterling. After the abolition of exchange controls in 1979, they continued to be used as a means of creating or hedging long-term foreign currency exposure at lower costs than in the foreign currency markets.

The back-to-back approach had some drawbacks, however. Under most circumstances, each loan is a new debt obligation on the balance sheet. In addition, the two loans are usually covered by separate agreements. If one party fails to make a payment, the other is usually still obligated to continue payments.

The currency swap can be seen as a natural evolution of the back-to-back loan, since it avoids most of these problems. Firstly, it does not usually increase assets or liabilities on the balance sheet. Secondly, it limits credit risk, since a performance failure by one counterparty relieves the other party of its obligations. Thus, risk is limited to the cost of replacing the expected income streams, which depends on interest and exchange rate movements since the time of commitment. Interest rates and exchange rates are generally as likely to move in favour of the surviving counterparty, so it is quite possible that default will result in a gain to the surviving firm.

The World Bank was a major driving force in the development of the currency swap market. It sought low interest rate borrowings, mainly in Swiss francs or Deutsche Mark, since it wished to make loans in these currencies. The World Bank borrowed considerable amounts directly, but at times wished to issue more debt in the Swiss and German markets than could be absorbed easily. On the other hand, it could borrow relatively cheaply in the larger dollar markets. These circumstances created a natural opportunity to carry out swaps with counterparties who had European currencies or good access to borrowings in Europe, but who needed dollar finance. Indeed, a currency swap between the World Bank and IBM in August 1981 was a strong catalyst to the development of the currency swap market.

Government restrictions have also stimulated currency swaps. Official sanctions limit access to some major European capital markets, including Euro-bond sectors, and swaps can be used to gain indirect access to these markets. In addition, restrictions can make it more expensive for certain classes of borrowers in particular national markets. For example, swaps involving the New Zealand dollar were extremely active in the second quarter of 1985: foreign investors were attracted to New Zealand dollar assets because of a combination of high nominal interest rates and the appreciation of the New Zealand dollar against the US dollar, but a withholding tax of 15 per cent. deterred them from buying domestic government bonds. Foreign borrowers issued New Zealand dollar Euro-bonds at yields as much as 300 basis points below comparable New Zealand government bonds, swapping the proceeds into US dollars. The firm floating the New Zealand dollar Euro-bond obtained cheap US dollars, and a New Zealand counterparty, which borrowed abroad and swapped into New Zealand dollars, obtained funds below the rate available in the domestic market. During the second quarter of 1985 NZ$ 260 million (US$ 120 million) of New Zealand dollar Euro-bonds were issued, probably all linked with currency swaps. In early 1986, a similar spate of Australian dollar floating rate notes was issued in the United States, apparently motivated in large part by withholding tax considerations in Australia, the proceeds of which were swapped into US dollars.

The major step in the evolution of the swap market was the extension of the swap concept from the currency market to credit-market instruments denominated in the same currency. The paternity of this breakthrough innovation is hotly contested. Most observers agree, however, that by 1982 interest rate swaps had grown beyond isolated deals to the point where one could speak of a market.

The most common interest rate swap concluded in 1981 and 1982 has come to be known as the classic, or "plain vanilla", swap. It is a five to seven-year swap of six-month LIBOR-based floating rate funds against fixed rate funds, both denominated in US dollars. Deal size was typically $50-100 million or greater. Swaps were generally tied to Euro-bond issues of the end-users, which provided the fixed rate funds, but which wished floating rate funding at reduced all-in costs. Fixed rate payers, which had comparatively better access to floating rate money, entered into swaps to obtain a lower cost substitute for bond finance or to acquire fixed rate funding that was otherwise unavailable.

The global market in 1982 was estimated to be about $3 billion. Floating rate payers were usually highly rated European banks. Fixed rate payers were typically BAA-rated US companies, although non-US banks and

corporations were also involved. As a result of the swap transaction, floating rate payers were able to raise floating rate funds at perhaps 200 basis points or more below LIBOR. Swap arrangers received 50-75 basis points in fees on a "plain vanilla" swap.

By late 1982 and 1983 the swap market had evolved further and interest rate swaps, which began as a decidedly international transaction, began to be conducted between purely domestic counterparties, mainly in the United States. Regional banks and insurance companies in the United States appeared on both sides of the market. US thrift institutions became active as fixed rate payers, frequently with the Student Loan Marketing Association of the United States as the end-user counterparty which wished to pay floating rates. Minimum size was reduced to $25 million, and swaps were no longer tied exclusively to new bond issues. Swaps were concluded against existing assets, encouraging use of the swap market for routine asset/liability management. With increased activity strictly among US counterparties, Treasury bills became a commonplace index on the floating rate side. The estimated size of the interest rate swap market in 1983 was $20 billion.

Swap activity accelerated sharply in 1984 and 1985. Large US and UK commercial and investment banks developed the capacity to make markets in swaps as they do in other financial assets, and began to book swaps without an offsetting swap in hand. They developed techniques to hedge an open swap position until an offsetting deal could be arranged, which greatly enhanced the liquidity of the market. Real estate companies, leasing companies and other financial firms entered the market as fixed rate payers, as did high-grade US corporations. US thrift institutions and corporations became active as floating rate payers. Federal Home Loan banks in the United States began to execute swaps for their own accounts and in some cases wrote letters of credit to support the swap activity of member thrift institutions. Swap deals were broken into units as small as $1 million, and shorter maturities became more common. Heavy competition among intermediaries reduced fees to the 12 1/2 - 25 basis point range or lower. Most swaps were transacted between an end-user and an intermediary or among different intermediaries. Coupon swaps were being transacted in non-dollar currencies.

By mid-1985 the link between swaps and new Euro-bond issues had apparently weakened significantly, although a considerable difference of opinion remains on this score. Some believe that about half of all fixed rate dollar Euro-bond issues remained swap-related (with nearly all such issues made by banks), with about 25 per cent. of new non-dollar Euro-bonds being linked with swaps. Euro-bond activity was thought to account for over half of swaps with end-users on the fixed rate side. Other observers, however, have suggested that only 10-20 per cent. of recent coupon swaps were tied to new Euro-bonds. Instead, fixed rate funds were more often being provided by banks through certificates of deposit, corporations with US market bond financing (both public issues and private placements), existing fixed rate assets and liabilities, and firms unwinding earlier swaps.

Variations on the standard "plain vanilla" swap multiplied in 1984 and 1985. Some swaps are callable or extendable, others are deferred, i.e. written to begin after a fixed interval. In some contracts, the floating interest rate is reset more frequently than usual (e.g. a six-month LIBOR reset monthly) to correspond to rates on "mismatched" floating rate notes. Options on swaps and swaps on zero coupon bonds are now common and there has been some

discussion of fitting swaps to mortgage-backed securities. Large financing packages often include swaps as one component.

A "secondary" market in swaps has developed, encompassing reverse swaps, swap sales and voluntary terminations (described below in Section V). This trend was enhanced by the development of master documents by leading market-makers. New floating rate indices have become common, including US certificates of deposit, US commercial paper, bankers' acceptances, US prime, Federal funds, and the average thrift cost of funds. The basis swap market between these indices has grown rapidly. In 1984 outstanding swaps were estimated to amount to $80 billion; by mid-1985 this figure had grown to well in excess of $100 billion.

Although growth in the swap market has been very rapid, current estimates of swap volume overstate the volume of assets and liabilities on which exposure has been swapped. Furthermore, estimates do not exclude swaps between dealers or "mirror" swaps with the original counterparty.

4. The nature and motivations of swap-market participants

There are two broad classes of participants in the swap market: end-users and intermediaries. An end-user is a counterparty which engages in a swap in order to change its interest rate or currency exposure for some economic or financial reason. An intermediary (or a dealer) enters into a swap in order to earn fees or trading profits. In principle, then, end-users and intermediaries are distinguished by their motivations. In practice, however, some institutions are active on both sides.

(a) End-users

A wide variety of end-users are involved in the swap markets today. Banks and corporations around the world, thrift institutions and insurance companies, government agencies, international agencies and foreign states have all been active. End-users utilise the swap markets for five broad reasons: (i) to obtain low-cost financing; (ii) to obtain high-yield assets; (iii) to hedge interest rate or currency exposure generated from the structure of normal business; (iv) to implement short-run asset/liability management strategies; and (v) to speculate.

In the currency swap market the main motivations are to obtain low-cost financing or to hedge existing structural exposures. A borrower may wish to obtain, say, Swiss francs to finance business expansion in Switzerland but may not be able to obtain funds readily or at low cost in the Swiss capital market. At the same time, that borrower may have ready access to dollar capital markets and be able to borrow there on relatively attractive terms. If a counterparty exists who has, say, a net asset position in Swiss francs and a desire for low-cost dollar funds, the opportunity for a currency swap exists.

The main motivation of end-users in the early stages of the interest rate swap market was to exploit differential borrowing advantages to raise funds cheaply. In the classic swap, a highly rated European bank raised fixed rate funds in the Euro-bond market and swapped these out to a lower rated US corporation that had raised floating rate funds in the international banking markets. Price was the primary motivation. Because the international bond markets required a higher premium for the corporate borrower relative to the

bank borrower than did the international banking markets, a borrowing cost wedge existed that could be exploited. Each borrower raised funds in the market where it had a comparative advantage and traded the obligations to mutual benefit.

Swap-market participants offered a variety of reasons to account for this relative borrowing cost differential: relatively greater risk aversion in the bond market; over-capacity in the bank loan market, which has reduced the premium for high-risk borrowers; differences in information across markets; banks' superior ability to manage deteriorating credits; or banks' desires to diversify out of their LDC risks.

Some of the explanations provided by participants describe temporary arbitrage opportunities in the financial markets. As the swap market develops, these opportunities may disappear. Other factors, however, such as the difference in information and risk aversion of lenders across markets, may persist. Most swap dealers believe that the evolution of the market depends on the exploitation of new arbitrage opportunities as they develop.

Another explanation for the attraction of swaps is that they offer corporate treasurers flexibility in the timing of borrowing and in the management of assets and liabilities. A treasurer who has a need or opportunity to borrow now, but believes rates are going to fall, can borrow fixed now and swap to paying floating. He would immediately benefit to the extent that short-term rates are lower than long-term rates. When rates later fall, he can reverse the swap and lock in the lower fixed rate. As asset and liability management tools, swaps are relatively inexpensive and have no balance-sheet implications.

Availability of access to fixed rate funds for the weak side counterparty is also cited as a factor in the rise of swaps. There have, however, been no obvious legal or institutional impediments to access for lower-quality borrowers in the international dollar bond markets (unlike the case for bond markets in other currencies). Furthermore, the increased volume of new so-called "junk" bond issues suggests that at least some low-grade borrowers could obtain direct access to fixed rate funds, but at costs that were unattractive compared with the swap market.

It soon became apparent that the swap market was a vehicle that <u>any</u> borrower with access to bond finance on relatively attractive terms could use to generate cheap floating rate finance. A wide range of financial institutions and official agencies became involved in liability-based swaps as fixed rate providers. And, US thrift institutions, needing to hedge risks inherent in making fixed rate mortgages with floating rate deposits, were drawn into the swap market on the other side as a way of raising fixed rate funding.

Swaps could also be used to transform exposure on the asset side. Suppose an institutional investor, such as an insurance company that holds high-grade floating rate assets, desires to switch into fixed rate assets to obtain attractive yields. This could be done by entering into a swap as a floating rate payer instead of making an outright sale and purchase of the underlying assets and thereby exposing the asset principal amounts to price risk or credit risk to obtain a high fixed rate yield.

(b) Intermediaries

In the early days of the swap market, most intermediaries merely brought together the two swap parties and arranged swaps. At times, they also provided letters of credit or other forms of credit enhancement for weaker credits. As the variety of end-users on both sides of the market increased, potential counterparties grew increasingly reluctant to accept the credit risks involved in a purely brokered swap. This created the opportunity for large commercial and investment banks to take on the rôle of intermediary by entering into two offsetting swaps. Today most large intermediaries act almost exclusively as counterparties, and frequently the intermediary is a more acceptable counterparty credit risk to both end-users in the swap chain. More recently a few of the largest end-users with high credit ratings have begun entering into swaps directly with other highly rated end-users, eliminating the need for intermediaries.

The largest intermediaries in the swap market are major US money-centre banks, major US and UK investment and merchant banks, and major Japanese securities companies. Commercial banks in Canada, France, Japan, Sweden, Switzerland and the United Kingdom are also active. These institutions have undertaken dealing in swaps in order to earn fee income and to profit from trading opportunities. For both commercial and investment banks, swaps are an attractive source of off-balance-sheet earnings as well as a product which facilitates other types of business (e.g. underwriting Euro-bonds).

But commercial banks and investment banks have different approaches to the swap market. Commercial banks tend to view swaps as an extension of more conventional banking business. For example, when a bank combines a floating rate loan with a swap, it is creating the equivalent of a fixed rate loan for a borrower. In the past, banks have found it difficult to extend fixed rate loans outright because their fixed rate funding costs have been high, sometimes as high as those faced by some of their customers. Moreover, they felt obliged to accept prepayments on fixed rate loans when rates had moved to the disadvantage of the borrower. By unbundling the components - the floating rate loan and the swap - banks can price each more efficiently. Commercial banks stress that as swap-market intermediaries they offer a large customer base and expertise in assuming long-term market and credit risks.

Investment or merchant banks tend to view swaps as tradable securities. They are in the forefront of efforts to standardise swap contracts and market practices in order to improve the liquidity of the swap market. Investment banks also attempt to equalise the credit exposure on all swaps by incorporating collateral provisions in the contract. These provisions give the investment bank (and sometimes the other counterparty) the right to call for an amount of collateral equal to the credit exposure on the contract. As intermediaries, investment banks are able to offer competitive pricing because of their trading and hedging expertise.

By mid-1985 there was an active market in swaps between swap dealers that serves to match end-users in much the same way that the interbank Euro-market connects non-bank depositors with ultimate borrowers. Thus, for example, a bank (which is not a swap specialist) may enter into a swap with an end-user for which it has arranged a bond issue. It covers itself by entering into an offsetting swap with a dealer, who in turn enters into an offsetting swap with another dealer. This second dealer may then find a bank which wants

to offset a swap it is arranging with an end-user. In this example, a swap between two end-users has given rise to four intermediate swaps. One report estimates that the interdealer share in the swap market rose from 40 per cent. of the market in 1983 to 55 per cent. in 1984.

Among dealers, more or less continuous quotations are available for the standard types of swaps, generally with a bid/offer spread of 10-15 basis points. Deals are agreed to by telephone, with the most significant variables confirmed by telex. Detailed documentation may sometimes take months to be put in place.

5. The secondary market in swaps

The secondary market in swaps includes three distinct types of transactions: swap sales (or assignments) to a new counterparty; voluntary swap terminations; and reverse swaps. Of these only swap sales are directly analogous to the secondary market in securities. One estimate puts the secondary market - sales, terminations and reverses - at 20 per cent. of the total market, or $25 billion. Sales and terminations both involve a cash payment and the extinction of the seller's swap obligations. Reverse swaps are merely new swaps arranged as a perfect or near-perfect offset to existing swaps. Some define the secondary market to include only sales and terminations, which together are estimated to constitute 10-15 per cent. of the market. The growth of the secondary swap market springs from the enhanced use of swaps as an integrated technique of asset/liability management, the increased rôle of market-making by intermediaries and the desire of dealers to generate trading profits from swaps.

The purpose of swap sales and terminations is typically to realise the capital gain on a swap. If, for example, a fixed rate receiver entered into a five-year swap one year ago when rates were, say, 14 per cent. and rates on four-year money today are 11 per cent., his swap has accrued a capital gain. He can realise this gain (at least, in part) by assigning the rights (and obligations) to a third party or by negotiating a termination of the swap with his counterparty, each in exchange for a cash payment. Or he can lock in the gain by entering into an offsetting swap in which he pays 11 per cent. fixed for four years.

The secondary market for swaps has developed unevenly. The volume of swap sales or assignments has reportedly remained low. There are a number of reasons for this. The remaining original counterparty to a potential swap assignment may and often does object to the assignment because he would wind up with a different counterparty credit risk. The assuming counterparty may be unacceptable for some reason or outstanding credit lines to that counterparty may be fully utilised. Assignment clauses must be drafted to ensure that all rights are properly transferred and documented. In addition, many swap contracts are highly customised, making assignment cumbersome or making it difficult to find parties willing to assume at all. Finally, swap sales usually entail a lump-sum cash payment from the assuming party to the assigning party that can be difficult to agree upon. In some cases, the lump-sum payment is undesirable for tax or accounting reasons.

Cash payments are also involved in voluntary terminations, and this method of realising gains is simpler and more popular. There are none of the credit risk problems involved in assignments. Frequently, the method of

calculating close-out payments is specified as part of the original swap contract. Still, the amount of the cancellation fee is normally negotiated and this can make voluntary termination an unwieldy technique. As a consequence, the most common technique for reversing swap exposure is to put in place a roughly equal but offsetting swap.

Unlike a swap sale or a termination, a reverse swap does not entail a lump-sum cash payment. The party that is closing out its swap exposure does not realise a one-time gain; rather it locks in a stream of cash payments over time. There are two ways of effecting a reverse swap: writing a reverse swap into the market or writing one with the original counterparty.

Writing a reverse swap into the market is technically the easiest kind of secondary-market transaction. But it has two drawbacks from the point of view of the party seeking to lock in gains on the original swap. Firstly, it doubles the party's credit exposure. Secondly, if the original swap was highly customised, it can be difficult or expensive to find a market counterparty willing to write an exactly offsetting swap. In this case, there may be some residual exposure resulting from different payments frequencies, price reset frequencies, or floating rate bases.

Writing an offsetting swap with the original counterparty (a "mirror swap") avoids most of these problems. Mirror swaps reduce credit risk, since all amounts payable under the original agreement are applied against amounts receivable under the second agreement. Since the mirror swap is written with the original counterparty, there should be no practical difficulties in duplicating any customised details of the original contract. A mirror swap is an alternative to termination that avoids a large cash outlay.

From the point of view of an observer, distinguishing a reverse swap written into the market from a new swap is difficult. For one party in the reverse swap, of course, there exists an original swap that is an offset. For the other party to the reverse swap, however, no such offset need exist and it may very well perceive that swap as a new one. This ambiguity in classification suggests that treating reverse swaps written into the market as part of secondary-market activity may be inappropriate. Mirror swaps, on the other hand, are more easily identified as secondary-market transactions because they offset agreements with the original counterparty.

B. Pricing of swap transactions

The cost of a typical coupon swap is expressed in the rates on the fixed and floating interest payments. The cost of a currency swap is the forward exchange rate implicit in the currency payments. Few swaps now include additional upfront or arrangement fees, although these were common in the early days of the swap market.

More specifically, the price on a non-dollar interest rate swap of a given maturity is quoted as an absolute fixed rate (for example, 10 3/4 per cent.) against a floating rate index, quoted flat (with no margin over or under the index). The price on a generic dollar coupon swap is quoted as a spread over the fixed rate index against the floating rate index flat: for example, an intermediary might quote the price on a seven-year Treasury-LIBOR swap to a fixed rate payer as "the seven-year Treasury rate plus 60 basis points versus

six-month LIBOR". Under market convention, this is an "offer" swap price, i.e. the price at which the market is willing to sell fixed rate exposure. The spread quoted to a floating rate payer is the "bid" swap price. In such a swap, the intermediary receives six-month LIBOR flat and makes fixed payments. The trade date is the date on which the counterparties commit themselves to the swap.

The precise definition of the "seven-year Treasury" rate in the above example can be the subject of dispute, and will normally be agreed upon at the time of commitment. Generally, it is either:

(i) the semi-annual yield on an actively traded US Treasury security with a maturity of seven years; if the swap's maturity lies between that of two actively traded securities, the yield is computed as a weighted average; or

(ii) the semi-annual yield to maturity of the specific US Treasury note or bond with a maturity closest to that of the swap.

The second approach is often criticised because it does not exclude thinly traded securities with anomalous prices.

Swap prices are closely tied to the cost of hedging swap exposure. Before a swap is matched with another swap, it is generally hedged with a combination of securities, futures contracts and some form of floating rate funding such as repurchase agreements. For example, if the intermediary is the fixed rate payer on the swap, the hedge usually involves the purchase of an appropriate amount of Treasury securities with the same maturity as the swap. The purchase of securities is in turn financed by borrowing in the repurchase agreement market. The Treasury security creates a hedge against capital loss if long-term interest rates change, and also generates fixed rate income which matches the fixed payments of the swap. The floating rate income from the swap covers the floating rate cost of the repurchase agreement.

Swaps of shorter maturity are more likely to be hedged in the futures market. Although cash-market hedges offer a wider choice of maturity and payment dates, they appear on the institution's balance sheet and potentially tie up capital. Futures contracts avoid these costs.

The effective date on a swap is the date on which fixed and floating interest starts accruing. Normally, this is five business days after the trade date. The settlement date is the date on which the transaction is priced for value. Normally in swap transactions this is the same as the effective date.

Apparently, some swap agreements are executed on an "as of" basis; that is, the agreement is prepared and executed some time after the effective date. This custom enhances the liquidity of the swap market, but should a party fail before the contract is executed, the protection offered by the agreement, obviously, might not be present.

1. Market factors which influence swap pricing

Apart from hedging costs, the price on a generic swap reflects arrangement fees, risk, the level of competition among swap dealers and the supply of and demand for fixed rate funds.

Over the past few years there has been a loose association between swap prices and the yield spread over US Treasury securities for typical A-rated industrial borrowers in the bond markets. Early in 1985 a rush of new Euro-bond issues provided a steady supply of parties willing to pay floating rates and receive fixed rates. The oversupply tended to depress swap prices, particularly in the five to seven-year range. This was partly offset by increased competition among swap dealers for the business of these floating rate payers. Still, there was a pronounced supply/demand mismatch at different maturities, and quotes on seven-year LIBOR swaps fell to 40 basis points over the yield on US Treasury securities of similar maturity, compared with 60-70 basis points for three-year swaps, where floating rate payers remained scarce.

A second example of price movements due to changes in the demand for and supply of fixed rate funds can be found in the sterling coupon swap market. With a dearth of fixed rate payers, the swap price was actually below the corresponding gilt yield from May 1984 to April 1985.

Another market factor which sometimes influences swap prices is an intermediary's decision to raise or lower the price on a swap in order to maximise gains from a larger set of transactions. For example, as explained above, many swaps have been related to newly issued Euro-bonds. In order to be both the underwriter and the swap dealer on a particular issuance, an intermediary may subsidise either the underwriting fees or the swap price.

2. Pricing of customised swaps

The all-in cost of a swap can be affected by the introduction of a deviation from generic terms, including abnormally high or low principal amounts, different amortisation structures (not a bullet loan) and long maturities for which markets are thin. On the fixed payments side, generic terms call for a semi-annual (sometimes annual) payments frequency and a 30-day month/360-day year basis for accruing fixed interest.

On the floating payments side, generic conventions are as follows:

(i) no spread above or below the floating index;

(ii) payment frequency equal to the term of the floating index itself. The payment frequency on a prime-based swap is quarterly; Federal funds-based swaps are compounded daily to a mutually agreeable payments frequency;

(iii) the day count convention is 360, except for Treasury-bill based swaps, where it is actual/actual;

(iv) the reset frequency is equal to the term of the floating index itself; except for Treasury-bills, for which the index is reset weekly, regardless of term; prime is reset daily;

(v) the quotation basis for floating rate payments in swaps is the CD equivalent, with the exception of Treasury-bills, which are quoted on a bond equivalent basis.[1]

Deviations from generic features will cause the swap price to differ from the market price for a generic swap. For example, a swap may be structured to incorporate a spread of 25 basis points below six-month LIBOR on the floating rate side (perhaps reflecting creditworthiness considerations, in this case a highly regarded floating rate payer). To express this swap price according to market convention it should be quoted as a fixed rate against LIBOR flat. The conversion is more involved, however, than simply adding 25 basis points to the all-in cost of the market price for a generic swap. The swap dealer has to take account of the different day count conventions between the fixed and floating payments sides of the swap.

Mismatches in payments frequency, day count conventions or reset frequency can also cause the price on a customised swap to deviate from the quoted market price on a generic swap. In many cases the valuation of these customised details or deviations from the generic standard cannot be precisely and objectively determined but has to be negotiated between the counterparties. Such necessarily subjective elements in the pricing of swaps, together with credit risk, are a major impediment to the development of secondary-market transactions. Assignment of an existing swap with customised features, for example, may be difficult because a third party will not place the same value on non-generic terms as the original counterparties did.

To illustrate some of the problems, let us consider the case of a reset frequency mismatch. A reset frequency mismatch occurs when the reset frequency does not agree with the maturity of the floating rate index, as with monthly resets of six-month LIBOR, for example. Frequent resets will generally have a valuation effect. Investors who choose a six-month maturity have forsaken shorter maturities and more frequent repricing opportunities. Theoretically, on average the market's expectations for the course of interest rates over the next six months will be incorporated in the six-month rate. Therefore, altering the reset frequency will generally have valuation effects relative to the generic swap structure. The specific valuation effect, however, will vary with the expectations and portfolio considerations of swap counterparties and cannot be objectively priced.

A swap may trade into the secondary market with a first floating rate payment period different from those for the remainder of the swap's life. For example, consider a generic six-month LIBOR swap with four months to go until a floating rate payment. Clearly, the two months' accrued interest on both the fixed and floating rate sides of the swap must be factored into the swap price. The appropriate index to use for the floating rate over the next four months remains subject to debate, especially if the original swap was based on six-month LIBOR reset monthly. There is no definitive market convention on this question. The need to negotiate these points is another impediment to secondary-market liquidity.

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1 If d is an interest rate quoted on a discount basis, the bond equivalent (b) and CD equivalent (c) are given by:

$$b = \frac{365 \times d}{360 - d \times t} \quad \text{and} \quad c = b \times \frac{360}{365}$$

where t is the actual number of days in the floating rate period. Treasury bills, bankers' acceptances and commercial paper are quoted in the cash market on a discount basis; LIBOR, prime, certificates of deposit and Federal funds are quoted on a CD basis.

C. Risk management by swap intermediaries

Parties engaged in swaps must contend with two major kinds of risk: price risk and credit risk. Price risk arises because interest rates or exchange rates can change from the date on which the swap is arranged. Credit risk arises because a counterparty may fail to perform and that event may expose a swap participant to an unexpected and unintended mismatch.

1. Price risk

The preferred method of controlling exposure to price risk on a swap is to close it out by entering into an offsetting swap. If inflows match outflows, apart from spreads taken by the intermediary as income, the intermediary is fully hedged against price risk. Mismatches in payment dates, reset periods or floating rate indices lessen the coverage of the hedge.

In the current market, only a small proportion of swap dealers match each swap as it is taken on. Under competitive pressures, most dealers now buy and sell each swap independently; that is, most dealers are ready to commit themselves to one swap before an offsetting swap has been arranged. This is done on the assumption that the offsetting side of the transaction can be completed without an adverse change in the market during the interim period. The length of time dealers are willing to carry an open swap varies across institutions. Some intermediaries seek to close their book by the end of the day; others are willing to carry an open swap for weeks.

Most unmatched positions are in single-currency interest rate swaps rather than in currency swaps. This is explained by the difficulty of hedging long-term currency exposure in any market other than the swap market. Furthermore, the majority of intermediaries' open coupon swap positions are swaps in which the counterparty is a floating rate payer. This is because floating rate payers often enter into swaps in conjunction with issuing fixed rate debt. The swap is done at the time the financing is arranged. The timing of swaps with fixed rate payers is usually more flexible.

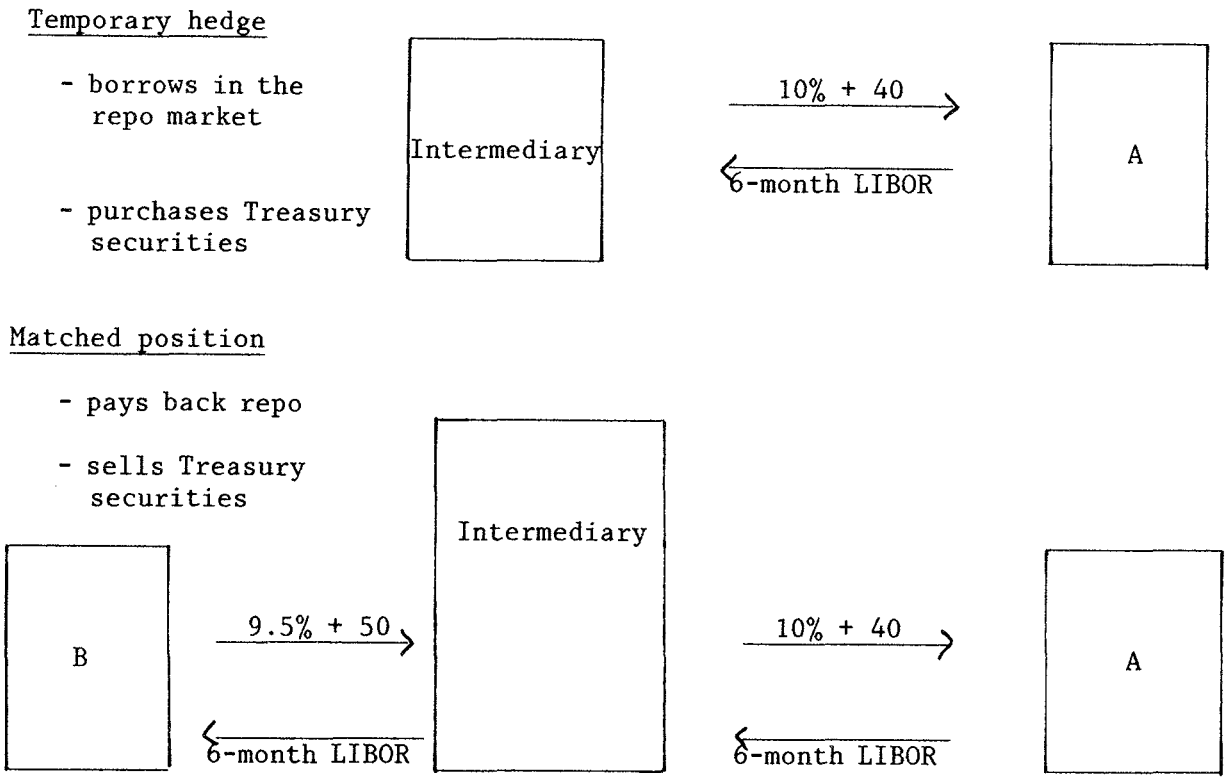
Before a swap is matched, it is always at least partially hedged. The typical hedge for a dollar coupon swap was described above. While this hedge protects the dealer from a move in the level of market interest rates, it does not cover a change in the spread over US Treasury securities. Let us consider the following example.

Suppose the intermediary commits itself to a five-year swap with a corporation (A) when the yield (T) on five-year US Treasuries is 10 per cent. It pays 10 per cent. + 40 basis points in exchange for six-month LIBOR and hedges the swap temporarily with Treasury securities. A few days later, the bank decides to match the swap. In the interim the spread on swaps has remained constant at T + 40 (bid), T + 50 (offer), but the yield on five-year US Treasuries has fallen to 9.5 per cent.

Looking only at the matched swap position, the bank loses 40 basis points on the notional principal at every payment date. This loss is more than offset, however, by the gain on the Treasury holdings. In total, the intermediary earns 10 basis points on the matched swap position.

Figure 2.4

Examples of hedged and matched dealer position



Suppose that before the swap is matched, Treasury yields remain constant but spreads decline to T + 30 (bid), T + 35 (offer). The Treasury hedge does not cover this type of exposure. The intermediary loses 5 basis points on the notional principal at each payment date.

Intermediaries must also be able to manage other types of market risk. They face basis risk when the floating rate indices on two matched swaps differ (for example, paying six-month LIBOR and receiving a margin over the Treasury bill rate). Differences in the maturities of matched swaps or between the swap and the underlying instrument create other gaps. Another type of risk arises when the reset date on swap flows differs from that on its hedge.

The interest rate exposure generated by open swap positions is effectively folded into the global interest rate exposure of the dealing institution. A common way of doing this is to have the swap desk buy its hedge internally from another area, such as the Treasury function, that has overall institutional responsibility for managing the interest rate exposure of the bank. Similarly, the swap desk often handles all swap requests from other divisions or affiliates of the dealer institution.

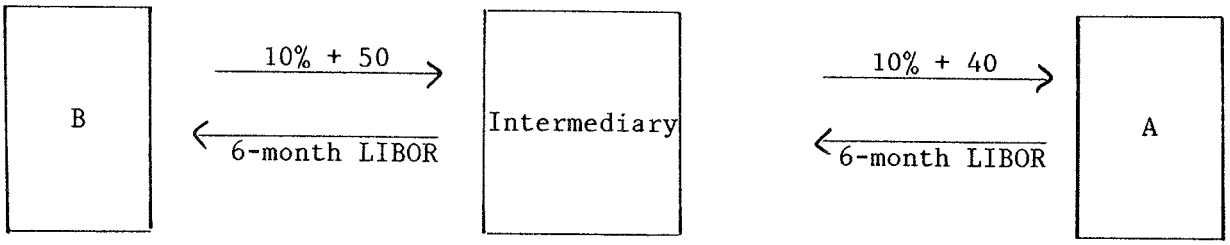
2. Credit risk

Matching or hedging swap positions does not reduce an intermediary's exposure to credit risk. An intermediary's credit exposure depends on the joint probability of an adverse move in interest rates and a performance failure by the swap counterparty.

The following example describes a swap dealer's exposure to the possible default of its counterparties when two swaps are perfectly matched.

Figure 2.5

Example of credit risk on dealer's exposure



SWAP 1 SWAP 2

An intermediary commits itself to two $30 million five-year coupon swaps simultaneously. On one it receives 10.5 per cent. (T + 50 bp) in exchange for paying six-month LIBOR. On the other it pays 10.4 per cent. (T + 40 bp) for six-month LIBOR. There are no mismatches in payment or reset dates. If both counterparties perform according to their contracts, the bank is exposed to no interest rate or market risk. It is, however, exposed to credit risk.

A fall in the five-year Treasury yield to 9.5 per cent., however, increases the value of the dealer's swap with B because the dealer is now receiving above-market rates. Similarly, the swap with A has fallen in value, because the bank is paying above-market rates. If these two swaps were marked to market (that is, valued at current interest rates), the gain on the swap with B would be equal in magnitude to the loss on the swap with A.

The opposite would be true if rates had risen. The swap with B would have negative value, the swap with A would have positive value. Of course, if rates had not changed, neither swap would have changed in value, assuming that the payment flows related to the swaps could be replaced at current market rates with no loss or gain.

The credit exposure on a swap is the potential loss when a counterparty fails. The magnitude of this loss, or the market value of the swap contract at current interest rates, is the cost of re-establishing the swap's interest and currency flows at current market rates. The value of the contract to the party receiving fixed rate payments is the difference between (1) the fixed rate payments discounted at current rates and (2) the present value of the floating rate payments.

Alternatively, we can think of the potential loss as the cost of re-establishing the swap payments by borrowing and investing in other markets. The intermediary could re-establish its floating rate payments by issuing a floating rate note with a coupon of LIBOR. Its fixed rate receipts can be re-established by purchasing a security or group of securities yielding payments identical to those on the swap. The potential loss is the difference between the discounted value of the two securities plus any issue costs.

Credit risk is managed internally with limits on expected exposure by counterparty, periodic monitoring of actual exposure over time and, in some cases, calls for collateral.

Before executing a trade, swap dealers must obtain approval from the credit desk for the expected exposure on the swap. The most common and simplest practice is to calculate potential exposure by assuming that the consumer defaults shortly after the swap is written when rates have moved against the customer by a specific amount. The resulting exposure is expressed as a fixed percentage of the notional principal per annum. The method yields a simple rule of thumb that exposure is 2-3 per cent. of notional principal times the number of years until maturity.

A more sophisticated approach is to base the assumptions of interest rate movements on an analysis of historical data and to base exposure on a movement of two standard deviations immediately, with the band widening over time. Exposure is then taken as the present value of the consequent loss. This approach is less restrictive, and probably more realistic, than the rule-of-thumb method described above. For a ten-year swap, it typically gives a maximum exposure of 24 per cent. of notional principal at the start of the swap. Some banks, having made calculations using the more sophisticated present-value approach, have subsequently reduced it to new rules of thumb, such as 5 per cent. in the first year and 2 per cent. thereafter.

Credit officers in some institutions merely approve or disapprove credit extensions on swaps, charging the exposure against the institution's overall credit line to the counterparty. Others approve the swap only if the institution receives a certain number of basis points for credit risk. In some cases the swap dealer actually pays the credit officer shadow income for the exposure. Typically, however, the swap dealer does not pass this charge explicitly through into the quoted price of the swap. If the swap officer cannot cover this charge at the prevailing swap price in the market, he does not do the deal.

An estimate of the minimum spread required between two offsetting swaps for profitability can be obtained by charging such a premium on the estimated credit exposure. A "shadow charge" of 6 basis points to a particular customer might be arrived at in the following fashion. A loan to a customer would normally incorporate a spread of 3/8 of 1 per cent. over the bank's cost of funding the loan. For a swap where the credit exposure is calculated to be 16 per cent. of notional amount, the charge to cover the credit risk is 3/8 of 1 per cent. of the 16 per cent., or 6 basis points (.0006). This covers the exposure to the failure of one counterparty.

In addition to setting aside credit lines for expected exposure, most swap dealers also monitor actual swap exposure as prices change. Management is periodically informed of the potential exposure if some or all counterparties were to default.

Practice differs among dealers on whether they monitor their credit exposure to a counterparty with which they have swaps in opposite directions. Some examine their exposure on a gross basis on the assumption that the counterparty could default on each swap only when interest rates have moved in the wrong direction. Others monitor exposure on a net basis, assuming that if the counterparty fails, the bank gains on some swaps and loses on others.

Rights of offset provided by the swap contracts and the national law under which the contracts are made are important factors in making this choice.

In some institutions, credit lines are a serious constraint for swap traders. When a line with a particular customer is limited, swap dealers often compete with other divisions of the bank for credit approval.

A third method used in the management of credit risk is to request some form of credit enhancement (for example, a letter of credit) or collateral from counterparties. When necessary, a letter of credit is usually written for the amount of initial expected exposure. Collateral may be requested in the form of an initial margin which is reduced over the life of the contract, or the bank may retain the right to make a call on collateral over the life of the swap if exposure increases. The contracts of some intermediaries include a two-way call for collateral - both the intermediary and his counterparty have the right to call for collateral from the other.

In general, investment banks request collateral more frequently than commercial banks. Investment banks favour collateral over a more complex set of credit agreements to facilitate the trading of swaps as securities. The competitive advantage of commercial banks in the swap market, however, is their willingness to assume long-term credit risk. They prefer not to see collateral used to equalise the credit-standings of all counterparties.

Performance failures in the swap market have been extremely rare so far. One swap has come to court in a dispute over whether termination was justified. Only one dealing institution mentioned an instance of actual counterparty default and this involved a very small probable loss. A number of dealers, however, cited their concerns for the future, suggesting that such incidents would be highly likely in the wake of such rapid market growth.

3. Other risks

A swap transaction involving an exchange of currencies delivered to locations at different times or in different time zones exposes the swap party to settlement risk. This exposure arises when one party has fulfilled the obligation under the contract by delivering funds, but has not received the offsetting funds from the counterparty. Most intermediaries attempt to minimise settlement risk by matching the timing of each set of payments as closely as possible. Whenever possible, only net amounts are actually transferred.

D. Accounting and tax issues

1. Accounting for swap transactions

The central issue in accounting for swaps is whether to view all contracts as trading positions or to treat them as hedges of underlying assets and liabilities. Trading positions and portfolios are generally marked to market daily, that is, they are priced at their daily liquidation value. Other on-balance-sheet assets and liabilities, on the other hand, are usually valued at cost or at whichever is lower, cost or market. Some argue that a swap put in place to change the exposure on an underlying position should receive the same treatment as the underlying position.

Four different types of swap positions can be distinguished:

(i) swaps that hedge commitments valued at cost;

(ii) swaps which involve an open position on exchange rates or interest rates;

(iii) swaps which hedge other swaps;

(iv) swaps which hedge or are hedged by trading positions.

Contracts in the first group usually receive the accounting treatment applied to other long-term assets or liabilities. The second type of swap is most often valued at market prices. There is no general consensus on treatment of swaps in the third and fourth groups.

A fundamental problem in swap accounting is that there are no authoritative accounting standards which cover interest rate swaps. Rulings on similar instruments have been discussed in the United States by the American Institute of Certified Public Accountants (AICPA) in Accounting for forward placement and standby commitments and interest rate futures contracts, and by the US Financial Accounting Statements Board (FASB) in Statement No. 80, Accounting in futures contracts. US standards applying to currency swaps are set forth by FASB in Statement No. 52, Foreign currency translation. Some accountants have indicated that FASB-52 criteria are clearest in their application to fixed-fixed currency swaps but that they can be interpreted to apply to cross-currency interest rate swaps as well.

(a) Accounting for currency swaps

A currency swap is construed to be a series of forward exchange contracts. Under FASB-52, accounting rules for forward contracts differ depending on whether the position is a hedge or a position taken in expectation of exchange rate changes. A forward contract (and by implication a currency swap) qualifies as a hedge if it reduces exposure related to (1) a net investment in a foreign subsidiary, (2) an identifiable, firm foreign currency commitment (for example, an obligation to pay or a right to receive interest), or (3) some other existing exposure (for example, a foreign currency receivable or payable). A currency swap is a hedge for accounting purposes if it is designated as a hedge and is effective as such.

The accounting treatment for forward contracts identified as hedges first separates the gain or loss on the position into two parts:

(i) the original discount or premium - that is, the foreign currency amount of the contract multiplied by the difference between the contracted forward rate and the spot rate at the start of the contract;

(ii) changes in the spot rate from the start of the contract until the time of expiration.

The treatment of the two components depends on the nature of the commitment that is hedged.

(i) For hedges of a net investment in a foreign subsidiary, the gain or loss arising from changes in the spot rate is included in the foreign currency translation component of shareholder equity. The original discount or premium is amortised over the contract's life either to income or to the translation component of equity;

(ii) For hedges of an identifiable firm commitment the gain or loss from spot rate changes is deferred to the transaction that is hedged. For hedges of interest, the gain or loss from spot rate changes is included in interest income or expense when payment becomes due. The original premium or discount may either be amortised to income over the contract's life or deferred to the hedged transaction when that occurs;

(iii) For hedges of other exposures, the gain or loss from spot rate changes is included in current income, where it offsets the loss or gain from the hedged item. This includes hedges of principal. The original premium or discount is amortised to income over the contract's life.

The accounting treatment required for open positions (non-hedges) is to include all gains and losses due to price changes in current income.

If a currency contract that hedges a foreign currency commitment is terminated before the commitment is satisfied, the gain or loss on the contract continues to be deferred. For example, if a currency swap that was used to hedge interest expenses is terminated early at a loss, that loss will not be reflected in income immediately but will be spread out over what would have been the remaining life of the swap. In other words, once a hedge, always a hedge.

(b) Accounting for interest rate swaps

While no authoritative standards have been set forth for interest rate swap accounting, current practice generally utilises a type of hedge/deferral accounting which is similar to that applied to currency swaps. Each of the four types of swaps noted above are treated separately.

Payments related to swaps which hedge commitments valued at cost are usually accrued over each period and reported as a net adjustment to the interest payment/expense of the underlying asset/liability or income. This has the effect of changing the terms on the underlying asset or liability to reflect the swap payments. For example, suppose a corporation issues a floating rate loan at LIBOR plus 40 basis points and then swaps into fixed rate funds for the same maturity at 10.5 per cent. If payment dates are identical the treatment of the floating rate loan plus swap would be equivalent to the treatment of a fixed rate loan at 10.90 per cent.

Costs incurred in executing the swap, such as commission, brokerage or organisation fees and legal fees, are also deferred and amortised over the term of the swap agreement. That is, they are not treated as expense.

This treatment, as far as it goes, is in accordance with authoritative standards set forth in FASB Statement No. 80 on Accounting for futures contracts. But FASB-80 has stricter criteria for

considering a contract as a hedge than does current practice for swaps accounting. Under FASB-80 a contract serves as a hedge only if it hedges a firm commitment that exposes the party to interest rate risk as assessed on a total enterprise basis, i.e. considering other commitments and existing assets and liabilities.[2] FASB-80 also requires an ongoing assessment of the correlation between the hedge and the hedged commitment. If this criterion were applied to swaps it would require the interest rate on which the swap is based and the interest rate of the hedged item to have been highly correlated in the past and remain so. Relative to these criteria, current accounting practices for swaps are very flexible.

Swaps which take interest rate positions are generally either marked to market or valued at whichever is lower, cost or market. This is consistent with the treatment of speculative off-balance-sheet positions.

There is no difference between valuing swaps perfectly hedged with other swaps at cost or at market value. Gains on one are always offset by losses on the other. Differences arise when there are mismatches in payment dates, reset frequencies, floating rate bases or any other terms. Most institutions mark these swaps to market.

The treatment of swaps which hedge or are hedged by other trading positions (primarily dealers' unmatched swap positions) also varies among institutions. As explained above, these positions are generally only partially hedged. Many dealers mark the unmatched swaps to market on a daily, weekly or monthly basis to reflect the liquidation value of the position. The basic problem with marking swaps to market is that market value is not well defined. The prices used in the procedure are somewhat subjective since there are often no readily available quotes for thinly traded swaps. An alternative valuation is to use the termination payment derived from the close-out calculations built into the contract.

Other problems arise with some swaps valued at cost and others valued at market prices. Under different circumstances traders face incentives to move swaps from one book to another in order to realise short-term gains.

Similar issues arise in the treatment of swap terminations - either those involving a cash settlement or those done with a reverse swap. Again, the approach taken generally depends on whether the swap is a hedge or a non-hedge. Current treatment of forward currency contracts and futures contracts suggests that the gain or loss due to termination of a hedge before maturity should be deferred over the life of the hedged commitment. In the autumn of 1984, the Emerging Issues Task Force of FASB proposed that deferral and amortisation be the standard. The US Federal Home Loan Bank Board has taken the same view.

Finally, similar hedge/deferral approaches are generally applied to options on swaps. The institution first determines whether or not the option is a hedge for accounting purposes. Non-hedges are marked to market. The intrinsic value on the option premium is deferred; the time value is amortised to expenses during the option period.

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2 The FASB-52 requirements for a definition of a hedge that apply to currency swaps do not require that risk exposure be assessed on a total enterprise basis.

(c) Disclosure

Assuming a swap has a material effect on the financial condition of the firm, the existence of the swap and its terms (including its impact on the interest rate of the underlying borrowing and the period of the agreement) should in principle be disclosed in the footnotes to the financial statements (usually in the note dealing with debt).

At this juncture most accountants in the United States apparently consider swaps not to be material, and few appear in public financial statements. This significantly lessens the usefulness of company accounts.

2. Legal and tax issues with swaps

A swap contract has become a relatively standardised document. It usually runs to about 10-12 pages and has two or three principal sections. The first part defines the payments to be exchanged, including the method of calculation, the amounts and the timing of each payment. The second section provides for the early termination of the swap. The agreement defines specific events of default and defines the amount, if any, which must be paid by one party to the other as a result of the termination. Finally, some contracts include a third section on credit-related issues.

In mid-1985 the International Swap Dealers Association (ISDA) published a "Code of standard wording, assumptions and provisions for swaps" with the intention of standardising interest rate swap contracts used by different counterparties. The Code covers the definition of cash flows and the calculation of amounts payable at early termination. Credit-related issues are left to parties to negotiate among themselves. The ISDA hopes to publish a similar code for currency swaps in the near future.

Another group of swap-market participants has been meeting in London under the auspices of the British Bankers' Association (BBA). Its focus is on short-term transactions, up to two years, between banks. The BBA recently adopted new standard interest rates and exchange rates for settlement purposes, beginning in September 1985.

Much of the documentation for swaps draws on standard loan documentation. Events of default usually include:

(i) non-payment; in some cases there is a grace period;

(ii) making of representations and warranties that are incorrect in any material aspect;

(iii) failure to perform covenants other than promises to pay;

(iv) mergers involving the defaulting party in which it is not the servicing entity.

In addition, some contracts include a cross-default clause which ties performance on the swap contract to performance of all other contracts with each counterparty.

Other circumstances are usually specified in which the swap may be terminated without either counterparty being in default. These include optional terminations agreed to by both parties, termination in the event of the imposition of withholding taxes (in cross-border swaps)[3] and termination due to supervening illegality, that is, when changes in laws, regulations or treaties make payments under the swap illegal.

The ISDA Code provides three different options for settlement on the early termination date:

(i) "Agreement value" fixes the profit or loss on the basis of quotations from market-makers at the price of a replacement swap that would generate the same payment streams as the rate swap being terminated;

(ii) "Formula" calculates profit or loss on the basis of hypothetical alternative borrowings and investments available on the early termination date. Adjustments for an element of fault or differences in creditworthiness of the parties may be made by specifying spreads above or below the relevant borrowing and investment rates;

(iii) "Indemnification" allows the parties to calculate damages on the basis of a general indemnity.

Some contracts stipulate that payments are to be made on a "fault" basis. The party suffering the greater loss recovers only if it cannot be held accountable for the event that caused the early termination. If neither party is at fault, whichever suffers the greater loss is compensated by the other. Other contracts are written on a "no-fault" basis and use two-way payment procedures regardless of which party is responsible for the default.

The central legal concern is that no swap documentation has been tested in court. Thus the bankruptcy implications are at present unknown.

Additional legal concerns in the United States have not been tested in court. They focus on the power of a bank to enter into swap agreements and the possible applicability of gambling laws. Generally a bank would be likely to be found to have the power to enter into swap agreements that are hedged or that hedge other commitments under its power to take actions that are "incidental to" the powers expressly conferred on the bank. The power to enter into unhedged swaps is less well established. The extent to which swaps hedge other commitments is also likely to be an important factor in determining the applicability of gaming or gambling laws.

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3 Other contracts require the payer to bear the costs in the event that withholding taxes are imposed. The payer adjusts payments such that the net amount actually received by both parties free and clear of taxes is equal to the amount that the party would have received had no such taxes been withheld.

Chapter 3

Foreign currency and interest rate options

This chapter describes options on foreign currency and interest rate instruments, but much of the material applies equally to options on any other financial instrument or commodity. Indeed, the theory of option pricing was developed mainly for equities in the 1970s and only in the last few years has it been modified for fixed-income securities and foreign exchange.

A. The instrument

1. Definition

An option is a contract conveying the right, but not the obligation, to buy (CALL) or sell (PUT) a specified financial instrument (the UNDERLYING) at a fixed price (EXERCISE or STRIKE PRICE) before or at a certain future date. There are two parties to an option contract: the option seller (WRITER or GRANTOR) and the option purchaser (BUYER or HOLDER). The buyer purchases from the writer a commitment that the option writer will stand ready to sell or purchase a specified amount of the underlying instrument on demand. The option buyer's cost for this right (PREMIUM or OPTION PRICE) is paid to the option writer, and can be expressed in a variety of ways, e.g. as a percentage per unit of the underlying, or in cents (or other currency units) per unit of the underlying.

The option extends or is "alive" until a set EXPIRATION or MATURITY DATE. If the option contains a provision to the effect that it can be exercised at any time (EXERCISE DATE) between the date of writing and the expiration date, it is termed an AMERICAN OPTION; if it can be exercised only at maturity, it is termed a EUROPEAN OPTION. On the expiration date, the option owner can exercise his right to buy or sell the underlying, can let the contract expire, or, under certain conditions, can sell the option contract in the market.

As an example, an investor pays a premium for an American call option on £50,000 sterling with an exercise price of $1.25 and an expiration date of 15th October. This gives the purchaser of the contract the right to buy £50,000 at a rate of $1.25 per £1 any time between issuance of the contract and 15th October. The writer of the contract is obligated to sell £50,000 at a rate of $1.25 if the contract is exercised.

To take another example, an investor may purchase a European put option on $1 million in US Treasury bonds with an exercise price of $72 (per $100 face value) and an expiration date of 15th October. This gives the purchaser of the contract the right to sell $1 million in US Treasury bonds of a particular issue at a price of $72 only on the maturity date, 15th October. The writer of the contract is obligated to buy $1 million in US Treasury bonds at a price of $72 if the contract is exercised.

Options are purchased and traded either on an organised exchange or in the over-the-counter (OTC) market. Exchange-traded options are standardised

contracts on specified underlying instruments, in multiples of standard amounts, with predetermined exercise prices, set according to predefined formulae and with standard maturities. OTC option specifications are generally negotiated as to the underlying instrument, amount, exercise price, exercise rights and maturity. Some OTC options are written to correspond to exchange-traded instruments in exercise price and expiration, although generally not in amount.

The PREMIUM PAYMENT DATE is the day on which the premium is due and payable, and is usually the same as the transaction date for exchange-traded options, and usually one or two business days after the transaction date for OTC options. The SETTLEMENT DATE is the day on which delivery of the underlying is required, and is always specified in relation to the exercise date. For American options the settlement date is generally one or two business days after exercise, and for European options it is normally one or two days after the expiration date. SETTLEMENT PRICE is the price of the underlying at the point at which the option is exercised. Most option contracts specify an objective basis on which the settlement price will be determined, such as the closing price on exercise date for exchange-traded options or a market price at a predetermined point in time on the exercise date for OTC options.

A call or put option whose exercise price is the same as the spot or cash price of the underlying is termed AT-THE-MONEY. A call whose exercise price is below the current spot price of the underlying or a put whose exercise price is above the current spot price of the underlying is termed IN-THE-MONEY. A call whose exercise price is above the current spot price of the underlying or a put whose exercise price is below the current spot price of the underlying is termed OUT-OF-THE-MONEY.

The option owner will only exercise the contract if it is profitable to do so, i.e. if it is in-the-money. Otherwise the contract will expire unexercised. When the market price of the underlying increases, the value of a call option increases as well, since it moves towards, or further into, the in-the-money range. Under the same circumstances, the value of a put option decreases, since it moves towards, or further into, the out-of-the-money range.

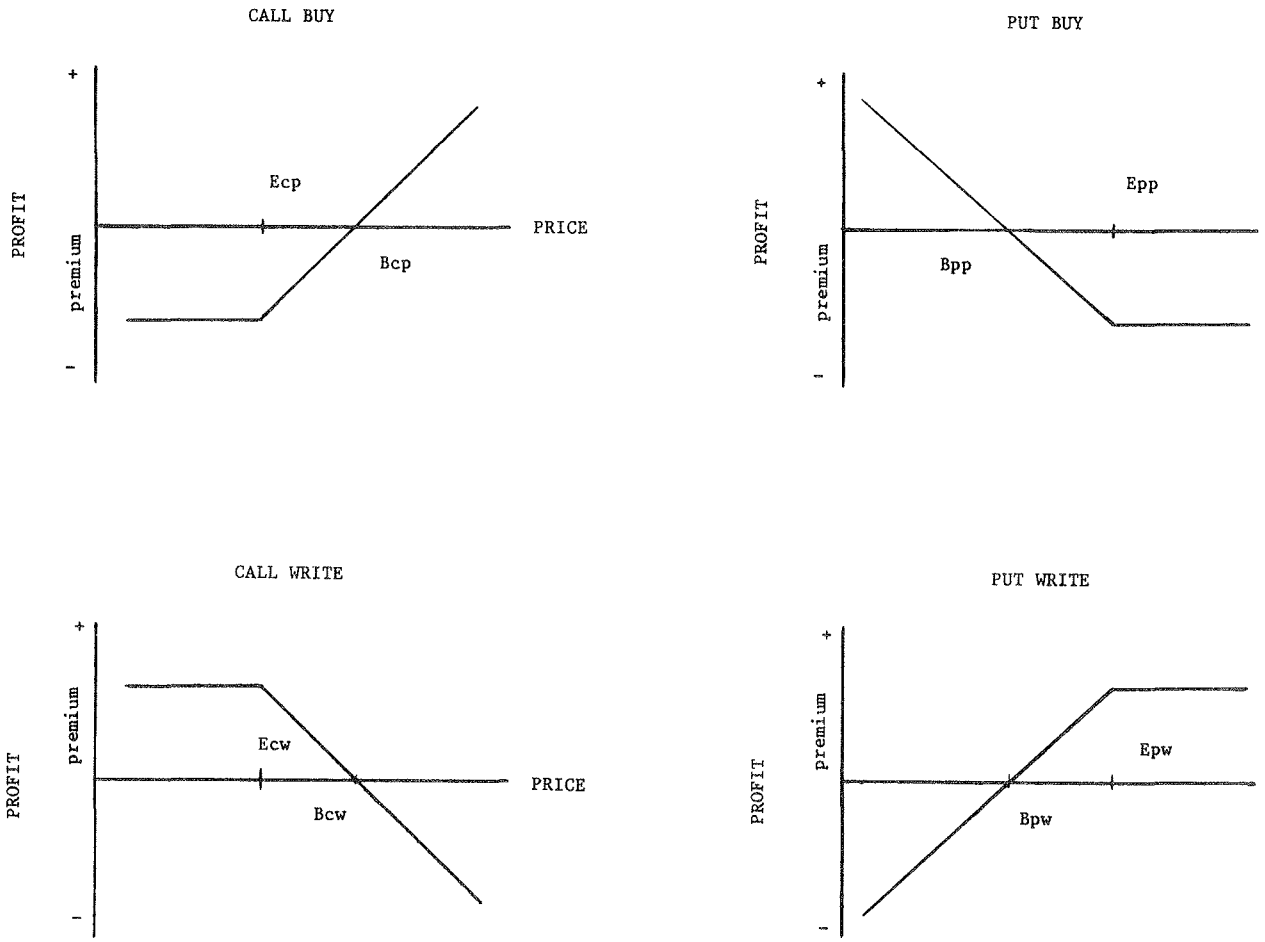
Options differ from all other financial instruments in the patterns of risk which they produce. Both the market risk and the credit risk patterns are asymmetrical as between writers and buyers of options. The holder of an option has the possibility of unlimited profit should the option move increasingly into-the-money, but his loss is limited to the amount of premium paid should the option expire at or out-of-the-money. Conversely, the writer of an option is limited in his income to the amount of premium earned, while in principle he is exposed to unlimited loss should the option move increasingly into-the-money.

As shown by the graphs below, the purchase of a call option involves limited market risk when the exercise price of the option (Ecp) is above the market price of the underlying. The break-even point (Bcp) for the option purchaser is the exercise price plus the premium paid. A rise in the price of the underlying beyond the break-even point results in a profit for the call purchaser which is potentially unlimited. Conversely, for the writer the sale of a call option involves unlimited market risk when the exercise price of the option (Ecw) is below the market price of the underlying. The break-even point (Bcw) for the option writer is the exercise price plus the premium received. A

fall in the price of the underlying below the break-even point can, at most, result in a profit equal to the premium received.

Figure 3.1

Option profit versus underlying price change



The graphs also show that the purchase of a put option involves limited market risk when the exercise price of the option (Epp) is below the market price for the underlying. The break-even point (Bpp) for the option purchaser is the exercise price less the premium paid. A fall in the price of the underlying below the break-even point results in profits for the put purchaser which could be substantial. Conversely, for the writer the sale of a put option involves substantial market risk when the exercise price (Epw) is above the market price. The break-even point (Bpw) for the put option writer is the exercise price less the premium received. A rise in the price of the underlying, at most, results in a profit equal to the premium received.

The distribution of credit risk is also asymmetrical. Between the transaction date and the payment of premium, the writer of the option is exposed to the buyer for the amount of the premium. Thereafter, and through the life of the contract, the buyer must take the risk that the writer will fail to

meet his obligations, while the writer has no credit risk since the buyer has no obligations to perform. After exercise, there are several possible settlement risks, but all involve obligations to perform by both parties. With foreign currency options both parties are obligated to deliver one of the two currencies involved, whether the option is a put or a call. With interest rate options, exercise obliges the writer to purchase or deliver securities, while the buyer must deliver securities or cash.

Some OTC option contracts are CASH SETTLED, which means that no delivery of the underlying is made upon exercise. Instead, the cash value of the option contract is determined by taking the difference between settlement price and strike price, and that sum is remitted in cash. In such cases, the settlement risk changes substantially, and only the party receiving payment, the option holder, will be at risk.

Exchange-traded option contracts exist both with an actual currency or financial asset as the underlying, or with a futures contract on a currency or financial asset as the underlying. For example, on the Philadelphia Stock Exchange (PHLX) the Deutsche Mark currency option contract requires delivery of Deutsche Mark. The Deutsche Mark option contract traded on the Chicago Mercantile Exchange (CME) requires delivery of a futures contract on Deutsche Mark. Likewise, there are options on both interest rate instruments and futures contracts on interest rate instruments. Options on actual underlyings produce precisely the same profit and loss profiles as do options on futures, since the prices of futures and their associated underlying instrument move in virtually identical patterns.

2. History

Options on foreign currency or interest rates have been written in various forms for many years, but only on a very limited basis and almost entirely in OTC. Active trading in options surged in the early 1980s, spurred initially by growth in customer demand in the OTC market and then by the introduction of new option contracts on organised exchanges around the world. Option contracts were first introduced in the Netherlands on the European Options Exchange in 1978. They were first introduced in Canada on the Montreal Exchange in 1982. The first contracts introduced in the United States, in 1982, were options on the pound sterling and the Deutsche Mark on the Philadelphia Stock Exchange, and options on US Treasury bond futures on the Chicago Board of Trade (CBT).

By early 1986 the number of major option contracts traded on organised exchanges had expanded dramatically, as had transactions volume. Options on six major currencies as well as the ECU are traded on the PHLX and options on three currency futures contracts are traded on the CME. The Chicago Board of Trade is the centre of activity for options on US Treasury bond futures and the CME trades options on Euro-dollar futures. The European Options Exchange also trades options on three currencies, precious metals and Dutch government bonds. There are also five currency options traded on the Montreal Exchange and recently currency option contracts began to be traded in London.

OTC options on currencies and interest rates predate exchange-traded contracts by many years, but trading in OTC options grew rapidly at the same time as exchange-traded options. The acceleration since 1982 in the growth of options trading in both markets appears in general to spring from the desire by

corporations and financial institutions to manage foreign currency and interest rate risks more effectively and in particular from an increased willingness to surrender a fee in order to transfer such risks to another party. Indeed, as among all recent financial innovations, options seem most strongly to be a product of demand by the ultimate corporate and institutional buyer, and almost all commentators suggest this reflects the view that the high level of interest rates and the volatility of exchange rates and interest rates have increasingly exposed firms to risk of loss from developments which were difficult to predict and in any case beyond their control.

3. Incentives and uses of options

Commercial and investment banks generally believe that the growth of the market for interest rate options was driven by customer demand. In the late 1970s and early 1980s, both corporate customers and institutional investors began to express a wish that banks offer, for a fee, what amounted to insurance against the effects of rising interest rates. Plainly, firms engaged in producing products where the production process was lengthy and the demand for the product was interest rate sensitive could be expected to be most interested in such protection.

The most obvious examples of this type of problem would be a builder of residential or commercial real estate, where his capacity to sell the property once construction was finished depended on the interest rates prevailing at the time. By purchasing an option on an interest rate instrument, he could expect to recoup much or all of the potential loss on the project which might occur if interest rates rose and the value of the property was therefore lower. The interest rate option in such a case could take the form of an extra fee to fix the maximum rate on a prearranged credit, or of an actual option on a long-term financial asset, where the offsetting gain would come in the form of a cash payment. The popularity of fixed rate mortgages in the United States is certainly one source of the greater activity in interest rate options there.

Thus, demand for OTC interest rate caps and other forms of options appeared most strongly in the early 1980s when interest rates were reaching unprecedented levels. More recently, however, demand has apparently slackened off for loan caps or for other interest rate options used for similar purposes since interest rates have fallen considerably from their earlier levels. Implicit in this view is that customers do not think rates will move back up to levels that would be catastrophic for their businesses.

Foreign exchange options also developed mainly in response to customer demand, although the source of that demand stemmed more from the trend in the early 1980s towards greater exchange rate volatility than from any particular level of exchange rates. With exchange rates increasingly unpredictable, firms were attracted to the possibility of paying a fee to purchase insurance against an adverse rate move, but preserving the chance to gain should it move favourably. Also, the use of options enables firms to retain their competitive position relative to other firms that have not hedged, if rates move in their favour.

Typical examples of users of options might be financial firms holding large investments offshore, where sizable unrealised gains had occured because of exchange rate changes, and where these gains were thought likely to be partially or fully reversed. Also, limited use of foreign exchange options has

been made by firms while bidding on foreign contracts, where the foward purchase or sale of the currency for hedging purposes would expose the firm to sizable actual loss should the contract not be won. OTC options have proved to be attractive to non-bank firms which do not wish to manage their exposure actively, or which lack experience and do not have the ongoing needs that would warrant the expense of developing the experience necessary to do so.

Some banks offer forward transactions contingent upon winning a foreign contract. These are not true options because the firm must fulfil the forward transactions if it wins the foreign contract, even if exchange rates have moved adversely. However, the firm is released from the forward contract if it is unsuccessful in the bidding.

A number of banks apparently first entered the foreign exchange option market either because they saw the opportunity to profit by meeting this customer demand, or because they were concerned that the customers might go elsewhere. At the same time, some banks apparently began writing options to gain experience so that they might use them to hedge their own market risks better.

The sections above described how pricing of options by the writer or seller is normally based on one of the formulae. But higher prices for options will of course tend to reduce the amount demanded, and once in the business, option writers feel competitive pressure to reduce the price, especially at times when expected volatility is high. With respect to interest rate options in particular, several banks in the New York market concluded in 1985 that competitive pressures had forced prices down to levels that were not profitable and therefore pulled back from the market. Volatility of foreign exchange rates rose dramatically in the spring of 1985 forcing option prices up as well. During this period many market participants indicated that customer demand fell off sharply. On the other hand, market participants in all major centres frequently express the view that some dealers, especially new market entrants, underprice options slightly or sometimes substantially in order to gain business.

The developments in early 1985 point to an interesting difference of views between option writers and buyers. Writers consider that the key variable in selling options is the volatility component. Many buyers, however, feel they are buying insurance. Certainly these perceptions are not inconsistent, and with the growth of trading in options some firms, usually more likely to purchase options, have begun to write options in order to earn the premium income. One common strategy is "covered writing" of interest rate calls, in which a portfolio manager, controlling large holdings of long-term fixed rate securities, writes calls on the option on the bond futures contract. So long as the option expires unexercised, the premium generated can add significantly to the portfolio's average rate of return over time. However, a strategy of covered call writing can involve sizable lost opportunities during market rallies such as the US Treasury market experienced in May and early June 1985, since the assets are likely to be called away just as they appreciate in value or the options must be bought back at substantially higher prices.

B. Pricing

The terms "OPTION PRICE" and "PREMIUM" are interchangeable. The price is expressed in various ways, the main variations being either as a percentage per unit of the underlying or as a number of cents (or other currency units) per unit of the underlying. For example, a $1.25 call on sterling, priced at a premium cost of 4 per cent. of the exercise price, may be quoted either at 4 per cent. per pound or at $0.05 per pound.

From a theoretical point of view, the value of an option is comprised of two components: INTRINSIC VALUE and TIME VALUE. Intrinsic value is the financial benefit to be derived if an option is exercised immediately, reflecting the difference between the exercise price and the market price of the instrument. For example, the intrinsic value of a call option on pounds sterling with an exercise price of $1.25 and a market spot rate of $1.27 would be $0.02 per pound. The intrinsic value falls to zero when the market price equals the exercise price (reaches the "at-the-money" level). An option will generally sell for at least its intrinsic value.

During the time remaining before an option expires, the price of the underlying can move so as to make the option profitable, or more profitable, to exercise. That is, an option which is out-of-the-money can move into-the-money or one already in-the-money can become more so. The chance that an option will become profitable, or more so, is always greater than zero, consequently the time value of an option is greater than zero.

Therefore the selling price, or total value, of an option generally exceeds its intrinsic value. This is true for American style options because the time value is always positive up to the expiration date. However, the case is more ambiguous for European style options, since increasing the time to maturity may not increase its value, given that it can only be exercised on the maturity date. That is, a European style option may be in-the-money before expiration, yet by the later maturity date it could be out-of-the-money.

The time value and intrinsic value of an option can always be calculated separately, most simply by calculating the intrinsic value and total value, and then taking the difference between them. For example, the $1.25 call on pounds sterling mentioned above, given a current spot rate of $1.27, may cost $0.03 per pound with four months remaining until expiration of the contract. The $0.02 would represent the option's intrinsic value, the $0.01 per pound would represent the option's time value.

It should be understood that exactly the same calculation is required to quote a price on a new option contract before it is agreed, or to calculate the current value of an option during its life. In principle, it is the expected volatility of the underlying over the remaining life of the option that determines its current value, and for this reason an existing option can increase or decrease in market value simply because the market changes its expectation of future volatility.

The most common pricing models for interest rate and currency options derive from the Black-Scholes European call option valuation formula, developed originally for the pricing of options on stocks. The principle behind this formula is to seek a "riskless hedge". Starting with a long position in the underlying, one should be able to sell a number of calls so that every fall

in the underlying's value will be offset by the premium income from the short call position. Conversely, starting with a short position in the underlying, one can buy a number of calls so that every rise in the underlying's value will be offset by the profit on the long call position. Since this is a riskless portfolio, it should bear the same return as the risk-free rate of interest. Thus, the underlying plus options portfolio has the same beginning and ending values as a "risk-free" underlying instrument. From this one can determine what the beginning and ending values of the option must be.

1. The basics of time value

The section above described how the time value of an option can be inferred from the difference between the total and intrinsic value. It is also useful to examine directly the determinant of time value, especially the expected variability of the price of the underlying instrument. The direct calculation of time value is complicated because it involves both the volatility element and interest rate considerations.

Statistically, the price of the underlying is a continuous random variable. For a continuous random variable, the probability of any given price occurring is determined by a mathematical function, typically portrayed by a density function or probability distribution. The volatility component of option pricing is measured by evaluating a form of the cumulative normal distribution of prices for the underlying. The "log-normal" distribution is generally used for commodity or financial asset prices because it implies that the price can rise to infinity, but not fall below zero.

The normal model is characterised by a symmetric distribution that is completely described by its mean and variance; 67 per cent. of the observations should fall within one standard deviation and 96 per cent. within two standard deviations of the mean, etc. The normal distribution assumes that the price in the future is as likely to rise as to fall, and thus that the current price reflects the mean of the distribution of expected future prices. The area under the curve between any two points gives the probability of being between those two points. The model, in effect, calculates the difference between current price and exercise price, in terms of the expected standard deviation of the normal distribution, in order to estimate the chance that an unprofitable option will become profitable, or a profitable one more so.

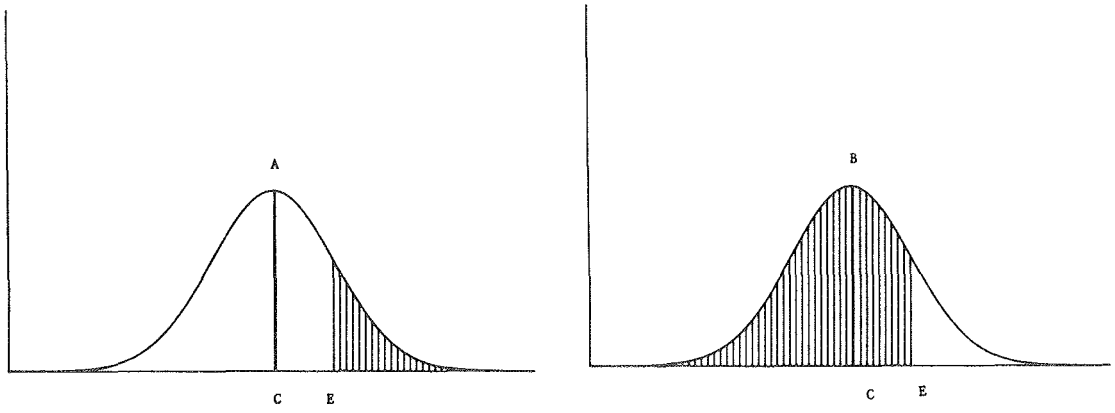
However, these probabilities apply to the end of the time period. They say nothing about the chances that the underlying might fall below or rise above a particular price at some time during the period. The time element thus enters directly since the actual chance that an option will increase (or decrease) in value declines as the period to expiration shortens, and does so at an increasing rate.

It is most common to use some form of the cumulative log-normal distribution in option price formulas, but considerable work has been done by theoreticians and market practitioners on the applicability of other distributions. There are technicians who contend that short-term movements in the price of many financial instruments are not normal, in particular that chances of extreme movements are considerably higher than are predicted by a normal distribution.

Figure 3.2

Graphs of normal distributions

Example: September $1.25 sterling call



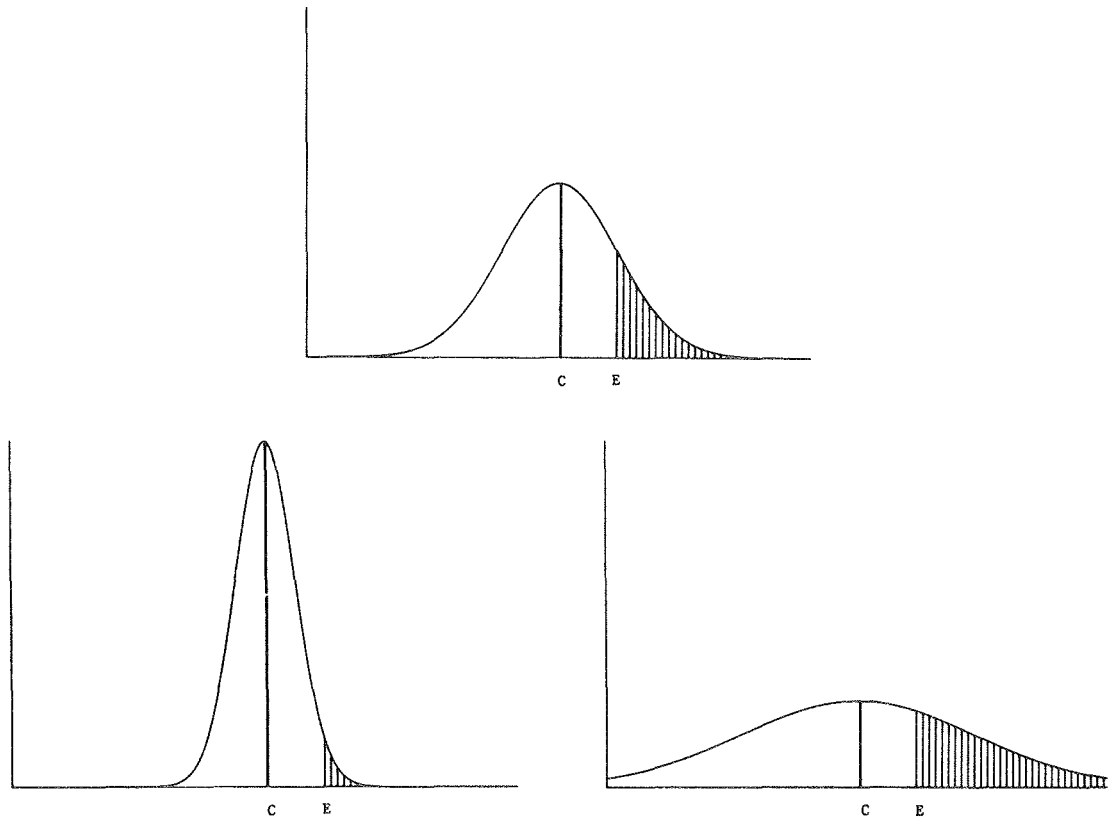
A = Probability that sterling price will be greater than $1.25

B = Probability that sterling price will be less than $1.25

C = Current spot price = $1.22

E = Exercise price = $1.25

Normal distributions with the same mean but different standard deviations



C = Current spot price = $1.22

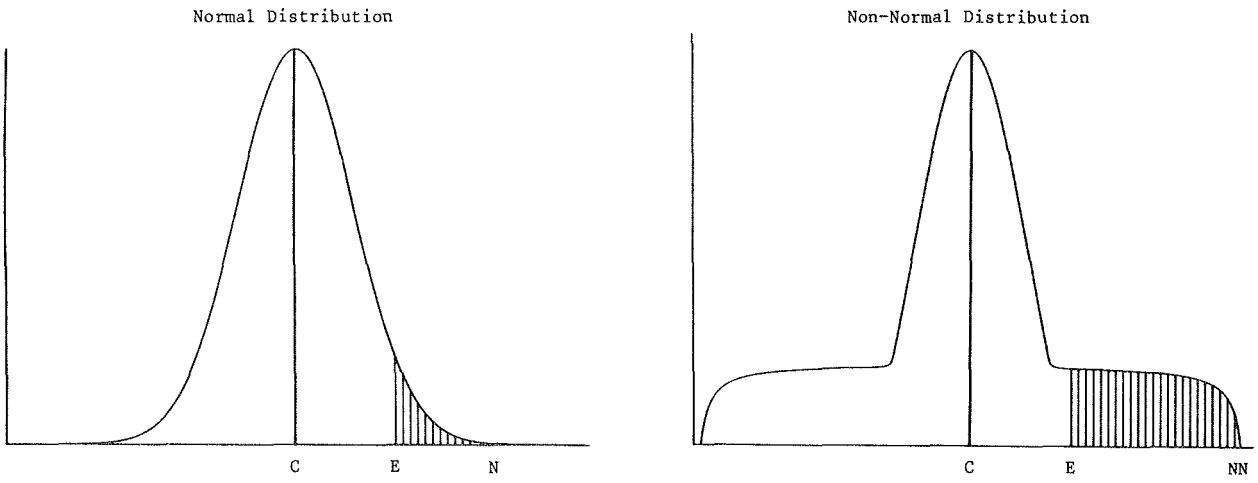
E = Exercise price = $1.25

Shaded area: probability that sterling will be greater than $1.25

A few studies done on the distribution for exchange rate changes find that their distribution differs from the normal in two major ways: firstly, the frequency of extreme observations is much larger than expected under a normal distribution and, secondly, the distributions are more peaked in the centre. These two ideas may seem inconsistent, but as the graph below illustrates, may be captured by a given distribution.

Figure 3.3

Graph of normal and non-normal distributions



C = Current spot price
E = Exercise price

Both distributions have same mean and standard deviation but E,N is less than E,NN

Correct information about the shape of the distribution is extremely important to a market participant, since it defines the true picture of the riskiness of options positions or of the potential cost of choosing not to cover a future exposure. The chance of sizable loss if cover is not provided will differ greatly depending on which distribution corresponds to reality, as will the amount of money which the hedger is willing to pay to avoid that loss.

The second aspect of time value involves interest rates. On any given date the option has a specific present intrinsic value, determined by the exercise price and the price of the underlying. Since the option is a claim on a certain amount of the underlying over a period of time into the future, that claim must have a return in line with market interest rates on instruments of comparable maturity. Therefore, a rise in the interest rate will cause the value of a call to rise and put values to fall. In theory, the interest rate required for option pricing is the expected rate over the life of the option.

However, foreign currency option pricing requires the consideration of both the domestic and foreign interest rates. This is primarily because a foreign currency normally is at a forward premium or discount vis-à-vis the domestic currency, the forward premium or discount determined by relative interest rates. Consequently, for foreign currency options, call values rise and put values fall when the interest differential increases, either because the domestic interest rate increases or because the foreign interest rate decreases.

2. Volatility

The chance that an option will increase in value owing to changes in the price of the underlying gives it most of its time value. Option pricing formulae take into account the manner in which the price of the underlying may move, and options would be comparatively easy to price if the pattern of price movements over the life of an option contract always followed that of the past. But it is possible that the probability distribution of future price movements may change, and it is this possibility which makes option pricing difficult.

The variability of price movements of the underlying is called VOLATILITY. Given that pricing formulae generally assume a cumulative log-normal distribution of prices, volatility is usually measured by calculation of a standard deviation, and future volatiliy is frequently projected by extrapolation from some past period. Thus, past volatility is generally measured by the standard deviation of daily changes in the price of the underlying, expressed at an annual rate, and calculated over some relatively short recent period, commonly one to three months. There are variations in practice, however, and some option traders prefer to use projections of volatility based on long historical periods or use other means, such as technical analysis (charting).

Volatility, in fact, is the only variable influencing option pricing which is not determined either arbitrarily or in some other market. Exercise price and expiration date are set arbitrarily by agreement among counterparties, or by standard formulae of an exchange. The current price of the underlying is set in the cash market for the instrument in question, and the interest rates are also market-determined. Viewed in this way, it is clear that the market for an option on any underlying is in fact a "market" for volatility on the price of that underlying, quite separate from the price of the underlying itself.

The notion that volatility is itself a price is manifested in the way in which many option traders approach the market. Most keep a close watch on prices of options in the exchanges and then convert these prices into IMPLIED VOLATILITY by solving the standard pricing formulae "backwards". That is, they treat the current option price as a "known", take market prices for the underlying and interest rates, contract specifications for exercise and expiration, and solve the formula to determine the level of volatility implied by the current market price of the option. The implied volatility can then be compared with what the trader considers appropriate, and the comparison used as a guide to trading the option.

When implied volatility is considered to be high, relative to what the trader believes is actually likely to occur, traders will tend to write options or combinations of options that will profit from an anticipated decline in implied volatility. When implied volatility is "low", buying strategies predominate. In other words, volatility itself is thought to rise and fall quite independently of the price of the underlying, and option traders can and do take sizable positions in options entirely on their views about volatility and without any expectation whatsoever as to whether the price of the underlying will rise or fall. This is in contrast to the commercial buyer of options who purchases the contract as insurance against volatility and, more precisely, against one-way movements of prices to his disfavour. Generally, the writers of options leave the task of profiting from directional moves in

exchange or interest rates to others who specialise in trading the underlying instrument directly in spot, forward or futures markets.

C. The market

1. Market structure

OTC foreign exchange options are traded to varying degrees by banks in virtually all financial centres, although activity is concentrated in London and the US market. Rough statistical evidence on market activity has been collected from major bank and investment-bank market participants, which suggests that the US and UK markets are probably about equivalent in turnover and outstanding amounts. It is generally thought that outstanding foreign exchange options in each market are not more than $10 billion in face value. Switzerland is thought to be the next largest market.

Option activity centres on the major currencies, most often involving US dollars against pounds sterling, Deutsche Mark, Swiss francs, Japanese yen and Canadian dollars. Branches of foreign banks in the major centres are generally willing to write options against the currency of their home country (for example, Australian banks in London write options on Australian dollars). OTC options are generally traded in round lots, commonly $5-10 million in the New York market and $2-3 million in the London market. The average maturity of OTC options ranges between two and six months and very few options are written for more than one year. American options are most common. However, European options are popular in Switzerland and Germany, reflecting customer demand and familiarity.

Commercial and investment banks actively trade foreign exchange options on the organised exchanges in Amsterdam, Chicago, Philadelphia and Montreal. As of January 1986, outstanding open interest, in dollar equivalent at face value, amounted to $0.4 billion on the European Options Exchange in Amsterdam, $7.8 billion on the Chicago Mercantile Exchange, $9.9 billion on the Philadelphia Stock Exchange, and $0.1 billion on the Montreal Stock Exchange. Some of the banks in the Netherlands confine themselves to trading on the European Options Exchange only.

Commercial and investment banks often write option contracts for their commercial customers. Banks' willingness to be net writers, however, has dwindled, in part as a result of the sizable increases in exchange rate volatility in early 1985, and a perceived reluctance of customers to pay commensurately higher premiums. Most customers are corporations active in international trade or financial institutions with multi-currency asset portfolios. These market participants are apparently willing to pay what amounts to an insurance premium to protect against unfavourable exchange rate movements, but in circumstances where they preserve the possibility to profit should exchange rates move favourably. These customers, of course, can purchase foreign exchange puts or calls on organised exchanges, but generally turn to the banks for options in order to find precisely the terms which match their needs. Transactions are commonly tailored with respect to amount, strike price, expiration date and currency.

Most market participants suggest that at this juncture few customers are willing to write options, in view of the limited premium income and the

potentially unlimited risk of loss. Thus it appears appropriate to describe the OTC options market as consisting of two sectors, a "retail" market composed of non-bank customers who purchase what amounts to customised insurance against adverse exchange rate movement from banks, and a "wholesale" market among commercial banks, investment banks and specialised trading firms, which may take the form of interbank OTC trading or trading on the organised exchanges. The "wholesale" market is used by banks mainly to hedge or "re-insure" the risks undertaken in trading with customers, or to take positions in options themselves ("volatility positions").

Banks' practice in buying back options previously sold varies widely. Some sellers discourage the practice by quoting fairly wide bid asked spreads. A number of European banks seek to avoid buying back options out of concern about customer relations, presumably feeling that customers would only seek to sell options on which they had taken an unwelcome loss. Along these lines customers with a gain would exercise their options.

The growth of exchange-traded options, especially for "wholesale" purposes, is apparently putting pressure on the OTC markets for greater standardisation in interbank trading. In some instances, OTC foreign currency options are traded for expiration on the third Wednesday of March, June, September and December, to coincide with expiration dates in the US exchanges. In general, the market structure just described is distinctly asymmetrical as compared with the ordinary market for spot or forward foreign exchange, where customers are expected to be more equally balanced between purchase or sale of currency, and thus where the interbank market likewise has a reasonable balance.

In contrast to foreign exchange options, the interest rate options market appears to be less developed. Only in the United States do banks report significant involvement in both OTC and exchange-traded interest rate options, although the extent of participation varies widely among banks. Banks in the Netherlands and, to a lesser extent, in Belgium are active on the European Options Exchange. Canadian and British banks apparently see a limited flow of customer interest in OTC options such as interest rate caps, but actually write very few contracts.

Usually OTC options are written against short-term lending rates (mainly LIBOR), prices of US mortgage-backed instruments, and prices of US Treasury securities. One attraction of the OTC market for customers is the bank's ability to customise the option contract as to size, particular rate or security involved, strike price and expiration date. Buyers of mortgage-backed options are frequently trying to offset exposure against those rates, while buyers of options on Treasury securities are frequently seeking to offset movements in their borrowing rates which they feel are likely to move in tandem with Treasury yields. The maturities on these types of options are usually in a range of three to six months.

LIBOR-based options are often written as interest rate caps and may run for as long as three years, although they generally consist of a series of options covering discrete, consecutive three-month intervals. As the name implies, cap rate options place a ceiling on the maximum rate a borrower will be obliged to pay on a particular loan. Currently most cap rate products are priced explicitly and may be sold to customers who are actually borrowing at a different institution. Most banks assert that they are hedging these positions

in an option-like fashion, presumably delta hedging. In the past, however, particularly in the 1970s, banks did not always explicitly price and hedge option features such as rate ceilings on loans. This approach proved to be very costly when rates moved up in the late 1970s and early 1980s.

Option features have been included in Euro-dollar issues from time to time. In the autumn of 1984 Euro-bond borrowers incorporated detachable warrants in their offerings, giving the holders the right to purchase additional bonds from the borrower at a specified coupon and price. More recently, option features were incorporated in floating rate note offerings (FRNs). In late June and early July 1985, approximately twenty issues, mostly by large banks, offered $2 3/4 billion of capped floating rate notes with a maximum coupon generally set at about 13 per cent. and most maturities at twelve years. In return for forgoing interest rates above the ceiling, the investors received a slightly wider spread above LIBOR compared to the going spreads in the market for uncapped FRNs. While it may not have been explained as such, the investors were in essence writing a capped rate loan option to the bank borrowers. Having purchased such options, the banks were in a position to turn around and sell similar options. The upfront fee from the sale of the options reduced the banks' overall cost of borrowing, in some cases to rates 5 to 10 basis points below LIBOR. A series of floating rate notes were issued incorporating a "deferred cap". These issues were generally of five to seven years' maturity, with the interest free to float for the first two or three years.

In the simplest form, the banks operated as intermediaries, buying options from one group to sell them to another. The identities of the buyers of these options are not clear, although speculation centred on US savings and loan associations facing the mismatch between short-term liabilities and long-term fixed rate assets. In a number of instances, though, the options were sold to other intermediaries. The overall investor demand for capped FRNs proved to be limited, since the spate of issues ended as abruptly as it emerged.

As in the currency option market, the customers form a retail base for the banks. In some options, such as contracts used to put a ceiling on interest rates, there does not appear to be a wholesale market for the banks to try to offset directly the risks undertaken. For other products there is a wholesale interdealer market, most notably for options on mortgage-backed instruments such as Government National Mortgage Association (GNMA) pass-throughs of mortgage pools. Standardisation of the GNMA option has helped this process. There is only one delivery date each month, the current production interest rate is used (based on rates on home mortgages guaranteed by the Veterans Administration or insured by the Federal Housing Administration) and the strike price is set very close to the market price. Therefore, a firm selling a GNMA option to a customer can frequently offset the risk by buying a similar option from another dealer soon afterwards.

Organised exchanges also provide a ready outlet to hedge risks undertaken in writing interest rate options. However, until recently the only active interest rate option contract covered long-term US Treasury bond prices (actually the bond futures contract at the Chicago Board of Trade). Trading of the option on the bond futures contract had grown rapidly to about 80,000 option contracts per day on average in the early part of 1986, for a nominal principal amount of about $8 billion per day. The Chicago Mercantile Exchange inaugurated an option on its Euro-dollar futures contract in early

1985. This Euro-dollar option contract also expanded rapidly with a daily average volume of nearly 6,000 contracts per day in January 1986, for a nominal principal amount of $6 billion daily. It may be that the high volume in these contracts arises mainly because they are used by banks and investment banks as approximate hedges on the wider variety of OTC interest rate options they write. Also, banks may have devised strategies for incorporating the Euro-dollar option in managing their asset/liability maturity mismatches.

Naturally the standardised exchange-traded option contracts cannot hedge all the risks a bank takes in writing a customised contract for a customer. The bank is left with the risk that the price of the option purchased will not move in lock-step with the exposure on the option sold to the customer. Writers of OTC interest rate options often manage a sizable and complex book of options, hedging the net exposure in relevant cash or futures markets. A sizable amount of the activity in exchange-traded options probably represents the mix of speculation, arbitrage and professional hedging experienced on the underlying futures markets. Customer activity in exchange-traded options reportedly contains a higher element of speculation than customer activity in the OTC market. That is, there is a higher incidence of individuals trading for their own account and fewer business firms hedging exposures generated in the normal course of their business.

Complicated financial transactions with currency and interest rate features have also begun to appear, and in some cases the aggregate value to the bank of the individual components of the transactions may exceed their combined cost. For example, currency option features on some Euro-bond issues, when separated or "unbundled" from the financial package, can be worth more than the additional value the option feature brings to the package. As in the case of capped floating rate notes or detachable warrants, the bank may separate out the option portion of the transaction and either take it into its own option portfolio or sell it into the option market. The original risk is thereby redistributed and the bank is able to realise as profit the amount by which individual elements of the transactions may have been priced below their true value.

2. Standardisation and documentation

Exchange-traded option contracts are of course all standardised. Expiration dates, nominal principal amounts, delivery points and agents, strike prices, margin rules, counterparties, position limits, trading hours and exercise provisions are all set by the exchanges. Participants need only agree on the price and number of contracts being traded. Documentation is straightforward once contract positions are accepted at the clearing organisation. (Of course, disagreements may arise on disputed items, so-called "out-trades", which the clearing house cannot process properly.) Trades take place on the exchange floor among exchange members or other affiliated parties. Some banks own subsidiaries that are members of the exchange and have their own employees transact the business. Others place their orders with independent members or firms. Customers choose the firms or banks through which they wish to operate, possibly receiving advice on strategies and tactics or making their own decisions.

OTC options, on the other hand, are most commonly tailored to meet the needs of individual customers, and the elements that are standardised on the exchange-traded options are open to negotiation. Indeed, the main

attraction of OTC options to customers is customisation, but nevertheless efforts have been made to standardise OTC interest rate options to a degree. Some option writers have standardised forms and documents to achieve greater efficiency and reduce the need to negotiate every point. Greater standardisation of documentation also simplifies back office confirmation of agreements made in telephone conversations. In at least one case a loan cap rate contract had been reduced to a one-page legal document with blanks to be filled in to specify elements such as expiration, strike price (interest rate) and premium. The British Bankers' Association has prepared standardised terms for the interbank currency options market which became effective in the fall of 1985. In general, however, the progress toward standardisation of OTC options across banks or among national markets has been slow.

3. Regulation

The growth of foreign exchange and interest rate option trading does not appear to be the result of regulations or government restrictions which have produced unusual profit opportunities. However, pilot programmes by US regulatory agencies permitting such exchange-traded options beginning in 1982 gave the overall market a boost. The popularity of exchange-traded options highlighted the uses of options for customers and provided bank writers with an outlet to offset positions. Earlier, there was a sharp increase in investors' interest in options following the opening of the European Options Exchange in Amsterdam in 1978. In Japan, currency option trading began in April 1984 after the authorities had abolished the actual demand principle in foreign exchange trading.

The relative novelty of the market has meant that accounting regulations and procedures, such as the booking of premium income, have not been uniformly established and some market participants believe that this problem has hindered market growth. In addition, the absence or ambiguity of regulations governing options has been a factor limiting the further expansion of the market in some countries. Canadian banks suggest that the lack of regulatory, tax and accounting guidelines, along with a need for greater liquidity, were factors limiting the growth of the market in OTC foreign exchange options. In the United States the absence of a specific ruling by the Financial Accounting Standards Board on foreign exchange options has engendered a more cautious approach by corporate treasurers. Some Swiss banks take premiums into income when they are paid, while others value the options periodically or wait until the options have been exercised. Belgian banks face the same question in the absence of official rules.

On the other hand, some feel that the introduction or growth of options has been held back by regulations. For example, currency controls in Italy have hindered the introduction of options. In Germany, regulations indirectly affect the relatively small number of banks willing to write options. At present currency options are not taken into account when a bank's foreign exchange position is calculated for supervisory purposes. Banks' hedging options sold in the spot and forward markets are thus creating a nominally open position, although they are effectively covered.

4. Accounting practices

At this point there appears to be little to guide market participants as to standard accounting approaches to options. At least some market

participants believe this has limited the growth of the market, in part by prompting some caution among corporate treasurers who constitute the principle long-term potential market of customers. The necessity of receiving approval from boards of directors is another constraint.

An example of the difficulties faced by US option writers and buyers is the different definitions of a hedge under generally accepted accounting principles (GAAP), regulatory accounting principles (RAP) and tax accounting. A further complication is that generally accepted accounting principles for options must be inferred from the treatment of other contracts, often futures contracts and standby commitments. Using those guidelines, a GAAP hedge on a purchased option must meet two conditions: the option must be designated and effective as a hedge; and the underlying commitment must be firm. Through hedge accounting, gains or losses are deferred until a transaction takes place with regard to the item being hedged. Speculative positions in purchased options and all options sold are marked to market with gains and losses recognised in income immediately, which can add to the volatility of reported income.

The definition of a hedge is crucial to tax accounting because the tax rate applied can depend on the definition. Based on rulings by the US Supreme Court and Tax Court, a hedge requires a balanced market position and the transaction must be a method of protecting ordinary operating profits realised in a firm's day-to-day business. General definitions, of course, allow some scope for selecting a hedged option position over an unhedged position. Banks in other countries have noted the ambiguity in accounting for options. In the absence of firm rules some banks apparently have wide latitude in choosing book fee income on options.

D. Risk

1. Hedging options exposures

As described briefly above, buyers and writers of options face asymmetrical exposures to changes in prices of the underlying. The buyer has unlimited profit potential if the price moves in his favour but risk is limited to the premium paid for the option if prices move adversely. Conversely, profit for the seller is limited to premium income, and loss from adverse movement in the price of the underlying is in principle unlimited.

The option writer can seek to hedge against the effect on the value of the option of an adverse movement in the price of the underlying. Given the asymmetrical pattern of risks, the only certain way to hedge an option completely is through purchase of an equivalent option, identical with respect to all attributes of the exercise price, face value and expiration date. The premium cost of an option purchased as a hedge will probably roughly equal that received for an option written. Therefore, if options written are hedged with identical options purchased, trading profit opportunity will in principle be limited on average to a bid/offer spread between the two. In practice, at least some market participants claim to achieve higher profits than implied by this notion.

One of the attractions of trading options on exchanges is that contracts are standardised in key ways, and thus it is possible to hedge or close out an options position completely. In contrast, OTC options markets

generally lack sufficient depth and liquidity to hedge the customised options written for customers by precisely matched purchased options. The option writer may be able to purchase a "similar" option whose contract specifications may differ in one or more of several features, such as underlying instrument, face value, exercise price and maturity. For example, the sale of an October $1.25 pound sterling call may be hedged by the purchase of an October $1.27 pound call. If sterling trades below $1.25, both calls will expire worthless and the hedger will at most profit by the premium it received from the $1.25 call, less the premium paid for the $1.27 call and transactions costs. If sterling trades above $1.27, then both calls will be exercised, resulting in the hedger's maximum loss being the difference in the call exercise prices, $0.02, less the net credit received in call premium. (See APPENDIX A for additional hedging and trading strategies.)

Other hedging techniques have been developed which do not involve hedging an option sold with another purchased option. The most common of these, DELTA HEDGING, involves hedging in the cash or futures markets for the underlying, and is based on option pricing formulae. Since a pricing formula shows the option price for any price of the underlying, it can also be used to calculate the "risk" exposure of the option to any change in the price of the underlying. The common practice is to calculate the change in the value of the option for a given change (usually one cent) in the price of the underlying. The ratio of these two is called the DELTA. (See Appendix B for a typical option transaction.)

The delta of an option has a value between 0 and 1. A delta of one means that the value of the option increases in proportion to the price of the underlying: one dollar for every one-dollar increase in the value of the underlying. A deeply in-the-money option will have a delta close to or equal to one, since the intrinsic value of the option will increase in proportion close or equal to the increase in the price of the underlying, while the time value will become very small. A deeply out-of-the-money option will have a delta close to 0, since it will have no intrinsic value and low time value owing to the small chance that it will become profitable.

The ability to calculate a measure of the sensitivity of option value to the price of the underlying suggests a natural way to hedge option-market risk. The notion is that a writer of a call option can cover his price risk by purchasing an amount of the underlying in proportion to the delta, for any given price of the underlying instrument. For example, a call option written on £1 million sterling with a delta of 0.6, an at-the-money option, will rise or fall in value by about 0.6 per cent. for each 1 per cent. fall or rise in the sterling exchange rate. Therefore, the option writer can purchase £600,000 in the spot market, and in theory the value of the cash position will move in exactly offsetting fashion to the value of the option written on sterling, leaving the financial position of the option writer unaffected by changes in the exchange rate. An option which is hedged by an offsetting cash position according to this approach is called DELTA-HEDGED, or DELTA-NEUTRAL.

Delta hedging of a short option position may not provide full protection against adverse movements in the price of the underlying, however. This is because the delta of an option changes as the option moves further in and out-of-the-money. For example, £100,000 face value $1.25 sterling call may have a delta of 0.5 if it is at-the-money, while an increase in the price of the underlying to $1.26 may imply that the delta rises to 0.6. If so, the hedge

position must be adjusted from £50,000 to £60,000 in order to preserve "delta neutrality".

Moreover, the rate at which the delta changes itself varies with the price of the underlying. For deeply in-the-money or deeply out-of-the-money options, the delta is highly insensitive to changes in the underlying. For example, a deeply in-the-money option will have a delta close to one, and the delta will remain generally unchanged over wide movements in the value of the underlying. On the other hand, the delta of an at-the-money option is quite sensitive to changes in the value of the underlying.

The variability of deltas creates a practical complication when delta hedging a large book of options, since in general strike prices will be spread out over a wide range above and below any current price of the underlying. Thus some options will require frequent adjustments of the hedge position to maintain delta neutrality, while others will require little. To cope with this problem, option traders measure the rate at which the delta changes in response to a change in the price of the underlying, called GAMMA. In the preceding example, a $1.25 at-the-money sterling call, the delta moved from 0.5 to 0.6 when the price of the underlying increased by $0.01 to $1.26. The gamma in this case is 0.1, and is defined as the change in the delta per unit change in the price of the underlying (measured here in cents).

To simplify hedging, a "gamma position" is calculated, which is the product of the gamma for a specific option times the underlying amount of the contract. For example, if the above sterling call option was written for a face value of £1 million, has a delta of 0.6 and a gamma of 0.1, the delta-equivalent position of the option would be short £600,000. If the writer wanted a delta-neutral position he would purchase £600,000. The gamma position would be £100,000. Since a $0.01 move in the price of sterling will change the option's delta to 0.5 if the rate move is down, or 0.7 if the rate move is up, to remain delta-neutral the writer would have to adjust the underlying position by £100,000 for each one cent change in the price of the underlying. (It is important to remember that in addition to now having a new underlying price and a new delta, a new gamma would also be in effect since it is a derivative of the price and the delta.)

The gamma is a key factor for the management of a short option position on a delta basis. Since a given rate movement can potentially cause significant changes in the exposure profile of an option portfolio, traders attempt to limit and often "neutralise" the gamma position of the option book. This is because a book can have a delta-neutral position but still have a large gamma exposure.

Generally, traders try to achieve a gamma-neutral position by balancing options sold against options purchased on the basis of the proper delta and its gamma. For example, the short sterling position mentioned above has a gamma of £100,000, indicating that if the price of sterling increased by $0.01, then the delta-equivalent position would increase by £100,000, or if the price of sterling decreased by $0.01, then the delta-equivalent position would decrease by £100,000. If, in addition, the trader purchased a call option on £250,000 with a delta of 0.5 and a gamma of 0.4, then the delta-equivalent position would increase or decrease by £100,000 for a $0.01 rise or fall in sterling. Since the trader is short the call option on £1 million and long the call option on £250,000, the gamma position will be flat or neutral.

With this background, the notions of delta and gamma neutrality can be stated more simply. A delta-neutral option or book of options (at least partially hedged with offsetting positions in the underlying) is one whose value is unaffected by (small) changes in the price of the underlying. A gamma-neutral option book is one that remains delta-neutral as the price of the underlying changes (by small amounts).

There are three important characteristics of gamma: (1) the shorter the time to expiration the higher the gamma will be; (2) at-the-money options have the highest gammas in relation to other options in the same expiration period; and (3) gammas vary with volatility, but in a complex way. Gammas tend to decrease on medium to long-term options (i.e. options with 60 days or more to expiration). For short-term options (with 45 days or less to expiration), the gammas of out-of-the-money options increase as volatility increases, but decrease as volatility increases for at-the-money options. These features of the gamma are important considerations for delta-hedging management as they address the need for active rehedging of option positions.

2. Risk assessment and control

Writing an option involves the seller in a contingent liability: the bank must perform at the choice of the buyer. In one sense, the contingencies are fairly straightforward since buyers will only exercise in-the-money options. Using pricing models the sellers can assess the likelihood that a particular option will finish in-the-money (in practice most writers judge the risk arising out of their entire portfolio of options). As mentioned earlier, the writer must estimate the key variable in determining risk in an option, i.e. the price volatility of the deliverable item over the life of the option. Consequently the writer's risk assessment is only as good as the writer's ability to estimate volatility. In recent months some option writers have come to feel that measured volatility is highly variable and difficult to estimate.

In general a firm's risk exposure in options is communicated frequently to senior management, generally once a day. Traders typically monitor exposure throughout the trading day, including overall marking to market of positions, expressed on an outright basis, a delta position, and a gamma position.

Senior management generally imposes various limits on option trading, on items such as:

- the instruments and currencies against which options can be written;
- positions with counterparties;
- the face value of options written and purchased, aggregated globally and by country;
- expiration concentration;
- concentrations of strike price and settlement date;
- maximum allowable losses from contingent market developments such as a specified change in rates or volatility.

Most of the above risks are managed specifically. Concentration of settlements with particular non-bank counterparties - a combined settlement date and counterparty risk - can be reduced either by spreading settlements over several days or by only making payment against confirmed receipt of funds. Concentrations of settlements are frequently greater with other bank counterparties, however, and these present special management problems. Most banks wish to maintain large lines with bank counterparties to facilitate interbank trading. Thus far the problem has been handled mainly by imposing restrictions on the number of counterparties or on the amount of options written relative to those purchased from individual bank counterparties. Some banks have proposed net settlement of options as a longer-term approach, although to date there appear to be no agreements between banks for net settlement.

The limit on counterparties mentioned above reflects some concerns about credit risk. In writing options bank writers assume market risk while the buyer assumes credit risk, with the possibility that the writer will be unable to perform. The credit risk concern may be one reason why banks do not often buy options from their non-bank customers, although the prime reason is that customers have shown little inclination to assume the market risk in writing options. Those banks that do purchase options from customers assert that they perform careful credit checks before taking on the credit risk.

Liquidity risk is a concern at some banks, mainly the problem that an individual market participant may dominate the market and so limit its scope to adjust position without exaggerated price movement. Consequently, some banks limit their overall positions in certain markets, notably in exchange-traded markets where liquidity is vital.

3. Management of price risk

The principal problem for option-trading banks is to manage the basic market risk arising from changing prices of the underlying and changing volatility. Dating from the inception of trading in options in interest rates and currencies, there have been three fundamental approaches taken, which are known as: (1) biased view; (2) pooled insurance method; and (3) delta-neutral hedging.

A "biased view" of option exposure management dictates that the option position or book is a reflection of management's view on the price direction of the underlying. This practice frequently led to some banks writing uncovered options and then taking no action to hedge the exposure, on the expectation that the price of the underlying would move in the direction (with the "bias") expected by the trader. This approach was commonly taken by foreign exchange option writers, where the option trading was added to an existing foreign exchange trading desk. This approach produced sizable profits in cases where the expectations of the trader on exchange rate movements were fulfilled, but substantial losses were also suffered at times. In fact, this method was an inefficient way of expressing a view on rate movements because profits were limited to the amount of the premium, while losses could be substantial. Market participants believe that by early 1985 no major option-trading bank was still using this approach.

The "pooled insurance" method of managing exposure stipulated that if an option book had a good dispersion of exercise prices and maturities and

balance of puts and calls, the book would be self-hedging. The theory behind this approach is that various combinations of purchased and written puts and calls can be shown to be synthetic forward positions in the underlying. Balanced long and short forward positions will effectively hedge market risk. The problem with achieving this result, many participants found, was that customer demand for options "clustered" around certain exercise prices and maturities and that there was frequently an imbalance between demand for puts and calls. Accordingly this approach had also fallen into general disfavour by early 1985, although some market participants maintain that it will revive again as an approach if the option markets continue to expand.

Early on, many participants began to manage exposure based on the "delta-neutral" hedging approach, briefly described above. The delta of an option indicates the amount by which the option will increase or decrease in price if the underlying moves by one point. The delta can be used as a guide to hedging, since it indicates the paper gain or loss on the options which arises from any change in price of the underlying. An offsetting cash position in the underlying will theoretically leave the option writer fully hedged. The delta or hedge ratio is multiplied by the exercise amount of the contract to indicate equivalent level of cash-market exposure. For example, a call option on £1 million with a delta of 0.6 will indicate a short cash-market exposure for the call option seller of 0.6 times £1 million, or £600,000. The purchase in the cash or futures market of an equivalent amount is the delta-equivalent or hedge-equivalent position.

Delta-neutral hedging does not completely eliminate risk, however. Indeed, the degree of risk in delta-hedging option positions has come to be fully appreciated by some market participants only through hard experience. The fundamental difficulty is that the delta is derived from the estimate of future volatility, which can turn out to be wrong. If the price of the underlying does vary more widely than expected, then a delta-hedging strategy will prompt far more active trading than can be covered by the premium income earned, since trading always has positive transactions costs. Especially in volatile markets these transactions costs can become very large, as bid/offer spreads widen and markets become thin. Even if volatility remains fairly stable, strict delta hedging can be more costly than expected if a market becomes nervous and choppy. Delta hedging also requires the writer to monitor the position around the clock to adjust hedge positions, an approach which can be quite costly.

As the market grew rapidly in 1983 and 1984, commercial banks relied heavily on delta hedging their option exposure, and several wrote very sizable books of options on this basis. However, the deficiencies of delta hedging large exposures resulted in a number of the most aggressive banks sharply curtailing the amounts of options they were willing to write without cover in the form of an offsetting option.

The reassessment of delta-hedged exposure limits by a number of major commercial banks has apparently led to some redistribution of option positions among active option trading institutions. It is likely that, as a result, less of the total outstanding amounts of options written to customers are delta hedged, but instead have been transferred to option specialists who hedge using a variety of specialised trading strategies. Some of these will be described in a subsequent section.

4. Influence of options markets on the cash markets

The potential effect of option trading on the underlying cash or futures markets has been a subject of active debate. Some argue that delta hedging may serve to reduce volatility. The argument for this view depends on the comparison of the likely behaviour of a corporate buyer or seller of foreign exchange who can choose between forward cover or an option. If the customer has a known forward exposure of £1 million, one choice is to cover fully on a forward basis, or alternatively to purchase an option on the same amount. Of course in the latter case that option will be written by another counterparty who may end up delta hedging the option. When writing an at-the-money call option on £1 million sterling where the delta is about 0.5, the option seller enters the cash market to purchase £500,000, or one-half of the nominal principal amount of the option. This applies less pressure on the cash market at the time the option is written than would occur if the original customer had purchased the forward cover.

The counter-argument that options increase volatility is as follows. Writers' efforts to manage their net option positions on a delta-neutral basis require them to buy the underlying foreign currency or interest rate instrument when the price of the underlying is going up and to sell the underlying when the price is going down. For example, in the above case the writer of the option would have no incentive to change his position in the cash hedge so long as the exchange rate remained unchanged. However, if the exchange rate were to rise, the hedger would purchase the underlying, and would do so regardless of whether the option written were a put or a call. If a call, the hedge cover would be a purchase of sterling, and if the exchange rate rose the delta would also rise, requiring an additional purchase. If the option were a put, then the initial cover would be a short sterling position, and a rise in the exchange rate would reduce the delta and require a parallel reduction in the short sterling hedge position (a purchase of sterling). In the absence of other factors these purchases and sales would tend to reinforce existing price movements. The degree to which this phenomenon actually occurs is unknown, but in some instances cash-market participants have suspected that large amounts of options written at closely concentrated strike prices have tended to exacerbate short-term rate movements in the foreign exchange markets. Participants in the London market believe this phenomenon has occurred a number of times in 1985.

The extent of trading and position-taking is believed to have an important bearing on the transmission of volatility. Participants in interest rate options appear less concerned about the problem, noting the high volume of activity in the underlying cash and futures markets relative to the option activity. Also bank and non-bank dealer firms and trading accounts in the United States often take sizable net long or short positions in securities. Consequently, the hedging activity in the underlying instruments associated with writing options may be small relative to other positions. Foreign exchange option writers have expressed more concerns about the transmission of volatility, possibly reflecting the tendency for banks to carry fairly small net positions in currencies. With a dearth of speculators willing to take a view on exchange rates, positioning related to option writing can at times be relatively sizable compared to overall open positions.

The concentration of writing at the commercial and investment banks is also seen as contributing to the possible transmission of volatility. Until recently customer buyers turned to bank writers who were delta hedgers in the

underlying markets. Recently a number of banks, seeking to reduce their net exposure, have begun to ask portfolio managers, investors and corporations with specific interest rate and foreign currency positions to become writers. By finding natural writers the banks could play more of a rôle as intermediaries and reduce their asymmetrical risk exposure.

Some private banks see a rôle for central banks to write options at times when the underlying currency markets are highly volatile. In their view, central banks might at times want to stabilise markets without enforcing or defending a particular exchange rate. Some have suggested that central-bank selling of options in periods of high volatility would have a calming effect on the exchange market, since selling options to the market would reduce the need for the commercial and investment banks to delta hedge their current positions, thereby reducing their activities in the spot or forward markets. Also, the commercial and investment banks would pass the options through to their customer buyers seeking the protective insurance of options. Central banks could also signal a desire to reduce overall volatility by selling both puts and calls. The two-sided nature of the operation would indicate that the banks were not taking a view on the level or direction of rates but only on the level of volatility.

Appendix A

Trading strategies

The trading of options in the equities markets has long been associated with a broad range of trading strategies. Some of these are simple and straightforward, others complex and subtle, some for hedging purposes and others to speculate. Many of them have been directly adapted to trading in foreign currency and interest rate options.

By and large, the complex and subtle strategies are more frequently used in trading on the organised exchanges, since they can require a variety of different contract terms, each trading with sufficient depth to enable a complex position to be first established and later unwound. The following describes a basic number of the many strategies used by active market participants. It should be understood that such a list cannot be regarded as complete, since there are virtually infinite permutations and variations which a creative trader can devise to suit a specific set of circumstances and market expectations.

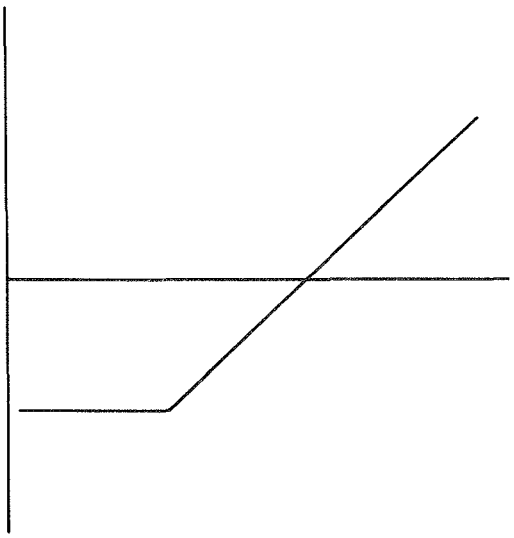
The basic option strategies allow the market participant to take a straightforward position based on expectations of movement in the price of the underlying, the relation between prices in the cash market and the options market, or the variability of the price of the underlying. These strategies fall into three broad categories: (1) a "bullish" or "bearish" view on the price of the underlying; (2) arbitrage profits between the options market and the market for the underlying; or (3) a view on the volatility of the underlying.

But even in these simple strategies, the risk characteristics and leverage of the position will generally be substantially different from those associated with a long or short position in the cash or futures market. For example, strategies may provide for (1) unlimited loss/unlimited profit; (2) limited loss/limited profit; (3) unlimited loss/limited profit; and (4) limited loss/unlimited profit. Only the first, unlimited loss/unlimited profit is directly parallel to the conventional long or short position in cash or futures markets.

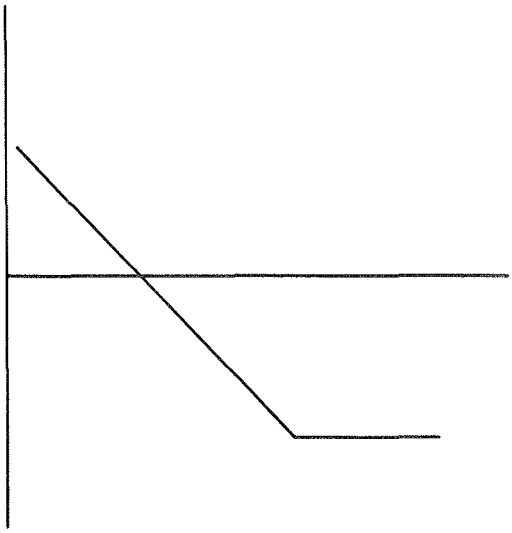
Bullish (or bearish) view: options positions taken in the expectation that the price of the underlying will rise (or fall).

The simplest bullish (bearish) strategy is of course an outright "PURCHASE OF A CALL" ("PURCHASE OF A PUT"). This purchase gives the holder the benefit of unlimited profits on an appreciation (depreciation) of the underlying, while any loss would be limited to the premium paid; that is, the asymmetrical risk/return profile that distinguishes an option from all other financial instruments.

CALL BUY

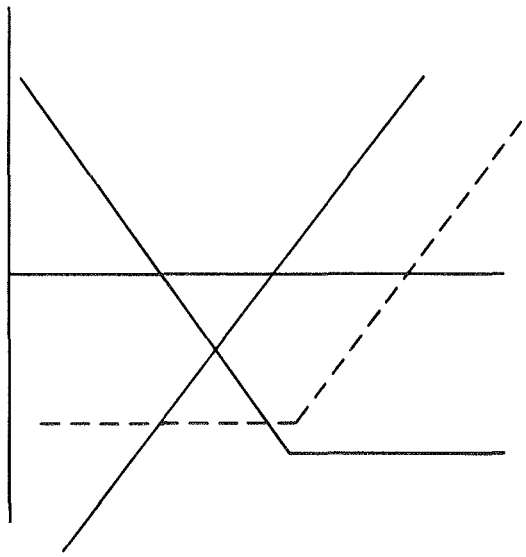


PUT BUY

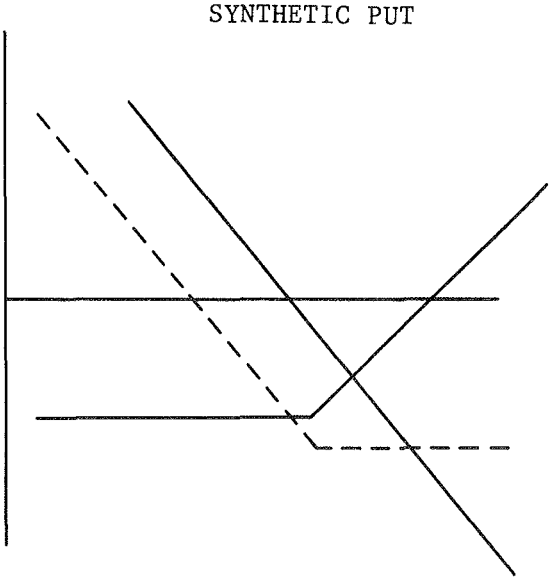


If a trader is unable to obtain a call (put) option, a "SYNTHETIC CALL" ("SYNTHETIC PUT") position can be established by the purchase of a put (call) option and the purchase (sale) of the underlying. The long (short) position in the underlying provides the feature of unlimited profit from an appreciation (depreciation) in price. The purchased put (call) provides the feature of limited loss from a depreciation (appreciation) in price.

SYNTHETIC CALL



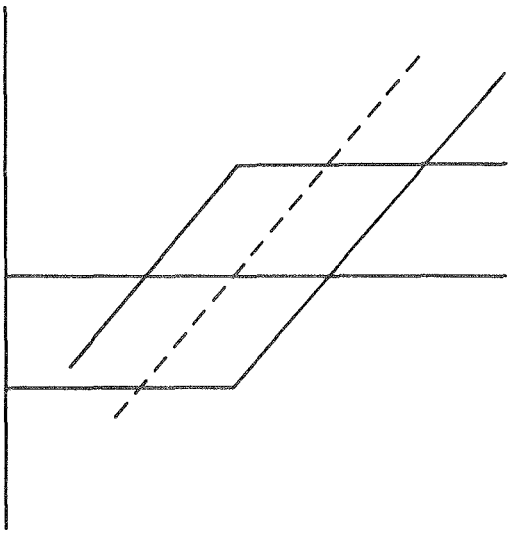
SYNTHETIC PUT



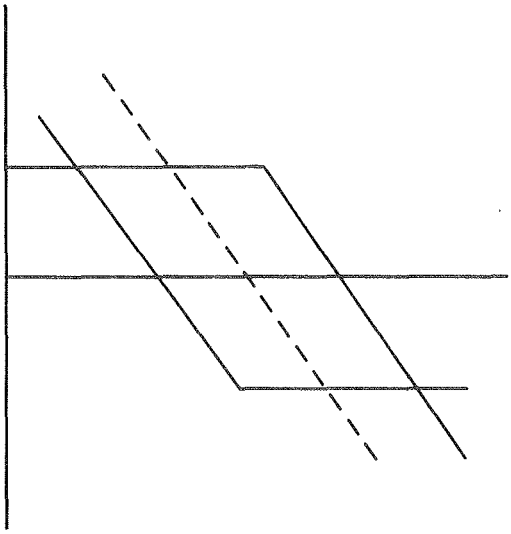
It should also be noted that options can be used to establish a position essentially similar to a long (short) position in cash or futures. This is called a "SYNTHETIC LONG" ("SYNTHETIC SHORT"), and is established by buying a call (put) option and selling a put (call) option with the same exercise price and expiration date. This will produce a return profile of unlimited loss/unlimited gain on a pro rata basis with movement in the price of the underlying, just as the outright purchase (sale) of the underlying would.

If both options are at-the-money, the premium income earned by writing the put (call) will be fairly close to that paid for buying the call (put), so that the cost of establishing the position will be comparatively small.

SYNTHETIC LONG



SYNTHETIC SHORT

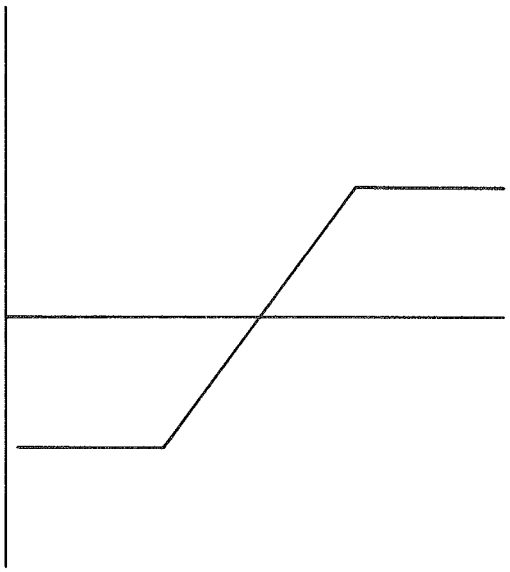


Frequently, for options traded actively on the exchanges, it is possible to use the options market in this way to establish a long (short) position in the underlying at a cost not much greater than that available to institutions trading in the interbank markets. The most important point illustrated by a comparison of a synthetic long (short) strategy and an outright call (put) purchase is that options can be used to duplicate risk profiles of positions in the cash market, but not the reverse.

The most common variant of a bull strategy is a "VERTICAL BULL CALL SPREAD", which differs from a synthetic long or call purchase in that both profit and loss are limited. This position is established by the purchase of a call at one exercise price and the sale of a call at a higher exercise price. The maximum loss in this strategy is the net difference between the premium earned on the sale and that paid on the purchase. The cost of the purchased call with the lower exercise price will always be more than the income received from the call with the higher exercise price, and the difference will increase with the difference between the two exercise prices. Obviously, the opportunity for gain increases as the spread between the two exercise prices widens, while the cost of establishing the position will likewise be greater.

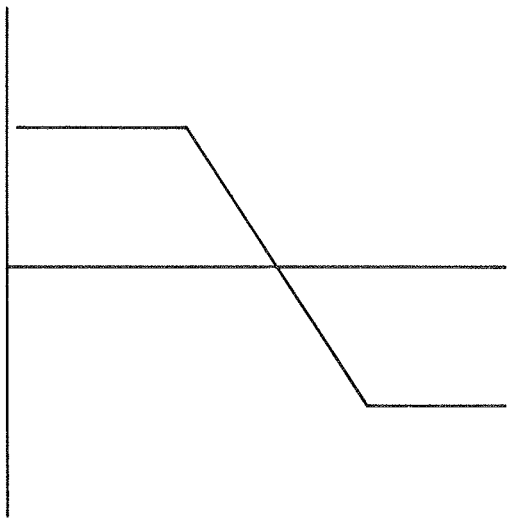
If both options expire out-of-the-money the trader will suffer a loss equal to the net premium paid. Profit is generated if the option purchased moves into-the-money, and reaches a maximum when the option written is at-the-money or in-the-money. The trader will generally close the position at this point, since the profit cannot increase further but may decline if the price of the underlying moves back towards the exercise price of the purchased call.

VERTICAL BULL CALL SPREAD



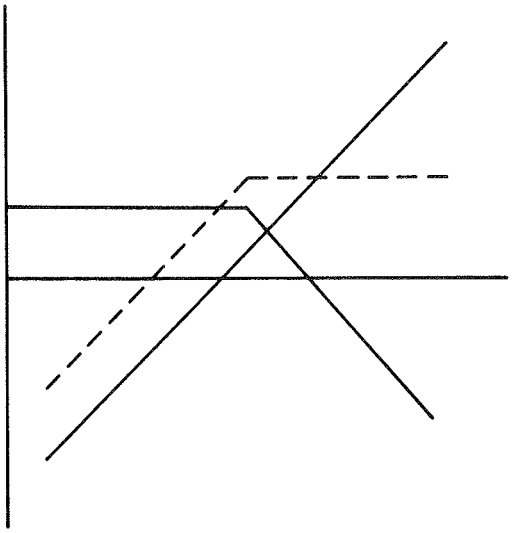
A "VERTICAL BEAR PUT SPREAD", the mirror image of a vertical bull call spread, can be established by purchase of a put at one exercise price and sale of a put at a lower exercise price. Loss is limited to the net of the premium received for the sale and that paid for the purchase. Maximum gain will occur if the price of the underlying falls to the exercise price of the put written.

VERTICAL BEAR PUT SPREAD

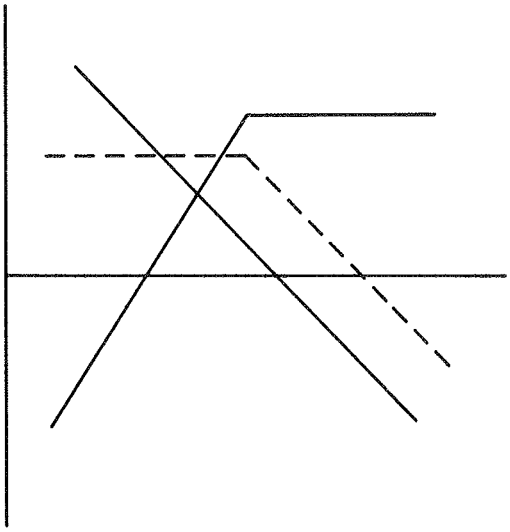


Another common bullish (bearish) strategy is "COVERED CALL WRITING" ("COVERED PUT WRITING"), which consists of writing a call (put) option while also owning (shorting) an equivalent amount of the underlying. Profit is generated from a rise (fall) in the price of the underlying but is limited since an appreciation (depreciation) of the underlying beyond the exercise price of the written call (put) will cause it to be exercised. Loss is unlimited if the trader continues to hold the underlying as its price falls (rises) beyond a level at which his loss is offset by the amount of the premium received for the call (put) written. Consequently the risk/reward profile of a covered call (put) write is identical to that of a put write (call write).

COVERED CALL WRITE



COVERED PUT WRITE



Covered call writing is very common in the equities market, where a trader wishes to increase the gain from holding a stock whose price he expects to be steady or to rise (fall) at a modest pace. Similar strategies are adopted by firms that have natural foreign currency positions when exchange rates are expected to be steady or rise (fall) slowly.

Covered put writing is far less common than covered call writing in financial asset markets, since there are far more commercial firms which will naturally be holders of assets than there are firms which are naturally short. Theoretically, one might expect there to be a more even balance between covered put writing in foreign exchange and covered call writing, reflecting the balance between firms naturally long and naturally short a given currency. In reality neither practice is widespread, and commercial firms seem more comfortable trading a call than a put for reasons of familiarity.

Arbitrage: strategies which take advantage of price differences among markets for the same good, without a view on price movement of the underlying.

Synthetic long and short positions can be used to take advantage of arbitrage opportunities in the cash or futures markets for the underlying. For example, purchasing the underlying and establishing a synthetic short position (buying a put and selling a call) results in a position unaffected by movement

in the price of the underlying. Profit from the position results from inconsistent prices between the cash or futures markets and the options markets. This trading strategy is a "CONVERSION". Alternatively, by selling the underlying and establishing a synthetic long position (selling a put and buying a call) a "REVERSE CONVERSION" or "REVERSAL" is established.

Volatility view: positions established on the expectation that the variability of the price of the underlying will change.

This final group of strategies is by far the most complex and subtle, but does not involve an expectation on the direction or level of the price of the underlying. Instead, a trader may take a view on volatility itself, and do so in a myriad of ways.

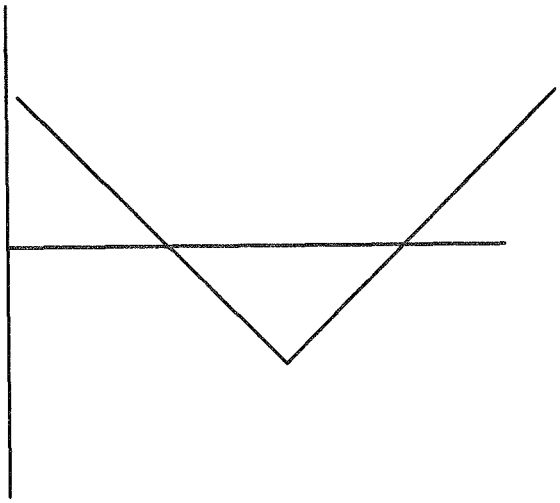
Among the most common means of establishing a position which takes a view on volatility is simply to buy or write options and undertake to delta hedge that position. In principle, a trader will profit if he writes options and delta hedges so long as the actual volatility of the underlying is less over the life of the option than was implied by the price of the options when originally written. Thus, if the trader expects volatility to decline in the future, he will write options, a strategy known as "SELLING VOLATILITY" or establishing a "SHORT VOLATILITY" position. This trading strategy is very frequently adopted by options-market-makers and by floor traders on the options exchanges.

A less common approach is the mirror-image strategy, i.e. to "BUY VOLATILITY" or take a "LONG VOLATILITY" position by purchasing options and establishing a "delta-hedge" position in the underlying ("REVERSE HEDGE" or "SIMULATED STRADDLE"). Note that this idea is the reverse of the delta hedging described earlier, which is normally applied to a book of written options. This position would be taken if the trader expects the actual volatility of the underlying to exceed that implied by the current price of options, and the profit is achieved by alternately buying and selling the underlying as its price varies. The purchased options provide protection against the risk of sizable loss.

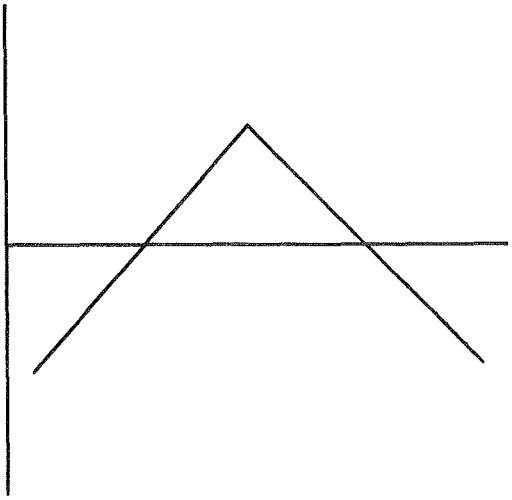
Another common volatility position is a "STRADDLE". A long straddle position is based on expectations that the volatility of the underlying will increase. The return profile is limited loss/unlimited profit. A straddle is established by buying a put and a call with the same exercise price and expiration date. Profit is generated if the price of the underlying moves enough in either direction to cause the gain from either the in-the-money put or call to exceed the total premium paid. Losses are limited to the premium paid.

Conversely, if a trader expects volatility to remain stable or decrease, he can establish a "STRADDLE WRITE", consisting of writing a put and a call with the same exercise price and expiration date. Profits from a straddle write are limited to the premium earned, while losses are potentially unlimited if there is a substantial movement in the price of the underlying.

STRADDLE BUY



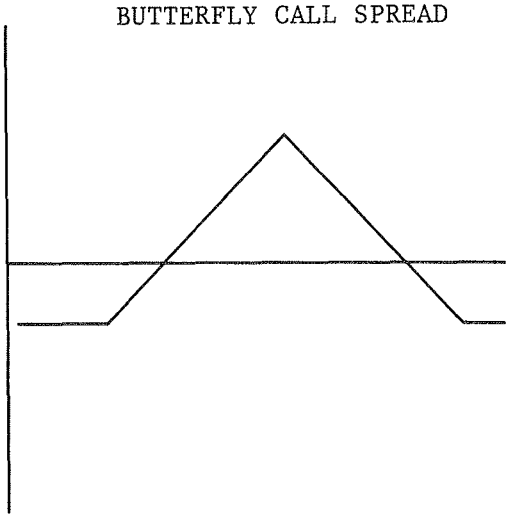
STRADDLE SELL



Even though a straddle is basically a play on volatility, a trader may feel that the underlying is more likely to trade in one direction than in another. A straddle position can be biased to reflect a bullish or bearish view. For example, if the trader desires a long bullish straddle, a "STRAP" may be established by purchasing a greater number of calls than puts. This will increase the trader's profit if volatility increases and the price of the underlying increases. If the trader desires a long bearish straddle, a "STRIP" may be established by purchasing a greater number of puts than calls. This will increase the trader's profit if volatility increases and the price of the underlying decreases.

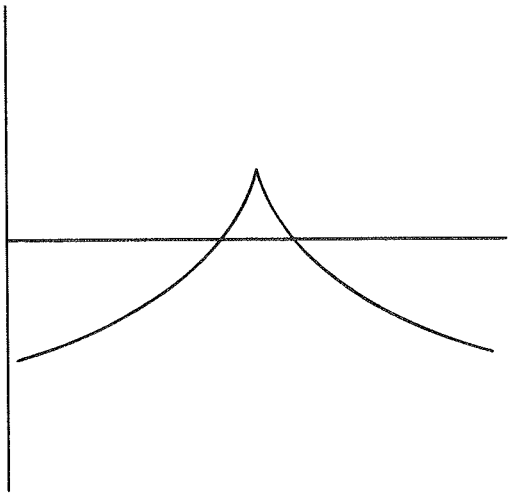
A strategy reflecting an expectation of stable or decreasing volatility and which has a profile of limited losses/limited profits is a "BUTTERFLY CALL SPREAD". This spread is constructed by combining a bull spread and a bear spread. A call is purchased with a low exercise price, two calls are written with mid-range exercise prices, and a call is purchased with a higher exercise price. Profit is generated when the price of the underlying remains within an establishing range. Loss is limited to the amount of the net debit required to establish the spread.

BUTTERFLY CALL SPREAD



Another such strategy for stable or decreasing volatility is a "CALENDAR or TIME CALL SPREAD" (sometimes called a "HORIZONTAL SPREAD"). This position is established by selling a near-term call option while purchasing a further-dated call. If volatility does not increase, time will erode the value of the near-term option at a faster rate than that of the far-term option. Thus the premium spread between the two options will widen and a profit may be made by closing the position at the expiration date of the near-term option.

CALENDAR SPREAD



Finally, a strategy that reflects an expectation of increasing volatility and has a profile of unlimited profits/unlimited losses is a "RATIO CALENDAR SPREAD". In the ratio calendar spread, the trader sells a number of near-term calls while buying fewer far-term calls. Since more calls are being sold than are being bought, uncovered options are involved. The uncovered call position at the near-term leaves the trader exposed to unlimited losses should the price of the underlying appreciate beyond the exercise price. The long far-term call position offers the trader unlimited profit opportunities if, after the expiration of the near-term calls, the price of the underlying appreciates.

Appendix B

Example of an options transaction

The following description is intended to provide a practical illustration of just how an options transaction might be contemplated, executed and accounted for by a typical market participant.

Phase 1

An international corporation based in the United States faces a contingent liability, to a British supplier, in three months. Such a liability may arise where the supplier has won contracts in the past and has indicated it will bid on a contract to supply goods in the future, but where the contract has not yet been awarded. The prospect of this future sterling payment exposes the corporation to a possible foreign exchange risk if the firm wins the contract and the dollar cost of sterling rises in the interim.

The corporation's treasurer has several alternatives to consider: he can (1) wait three months to determine whether the liability will be realised and then, if necessary, purchase the sterling; (2) enter into a forward contract now with a bank to buy sterling three months forward; (3) purchase a sterling futures contract now; and (4) purchase a call option on sterling.

Alternative (1), doing nothing until payment time, exposes the corporation to exchange rate risk over the next three months in the event that the payment must be made, i.e. sterling could appreciate relative to the corporation's base currency, thus making the payment more costly than current rates indicate.

Alternative (2), entering into a forward contract, guarantees a rate of exchange three months forward but the corporation will be unable to benefit if the price of sterling depreciates relative to the base currency, i.e. if sterling is "cheaper" three months hence, the corporation must still pay the higher rate. More important, if the supplier fails to win the contract, and payment does not therefore have to be made, the corporation will be left with a long sterling exposure.

Alternative (3), purchasing a futures contract, has similar drawbacks to a forward contract, with other inconveniences. Firstly, futures contracts are standardised agreements with pre-established contract amounts and maturities. The maturity date and contract size may not match precisely the needs of the corporation, resulting in residual exposure to maturity date and underlying amount risk. Secondly, exchange-traded futures contracts are marked to market, i.e. revalued on a daily basis. Compensation for a loss in the value of a position must be included in the margin posted with the exchange. This implies that the corporation may be subject to cash-flow problems over the next three months.

Alternative (4), purchasing a call option on sterling, guarantees that the purchase of sterling will not become more expensive even if the exchange rate appreciates, allows the corporation to benefit from a lower sterling rate should the exchange rate depreciate, and (except for the premium

payment) does not involve cash flows over the next three months, regardless of the rate movement. In addition, if the option is purchased, from a bank "over-the-counter", the terms of the contract can be tailored to accommodate the specific needs of the corporation. If the supplier fails to win the contract, the option can be permitted to expire unexercised for a maximum cost of the premium, or, if it has remaining time value, some portion of the premium cost may be recovered.

Phase 2

The treasurer decides to purchase a call option on sterling. Several banks, with which the corporation has dealing relationships, are asked to quote a price on a sterling call option with a specified exercise price for a three-month period. Generally, a response to this request will be received within 15 to 20 minutes at most, and the quote may only be in effect for a very short period.

The treasurer decides to pay the offer on the call option to Bank A. At this juncture, both parties to the agreement are exposed to credit risk. Bank A is exposed to the credit risk of the corporation until it receives the fee or premium charged for the option contract. Generally, payment is made to Bank A within a few days. The corporation, on the other hand, is exposed to the credit risk of Bank A for the life of the contract since the corporation is dependent on Bank A to fulfil the terms of the agreement should the contract be exercised.

Since a contract has been executed it will affect both the balance sheet and the income statement of both parties. Since the contract is contingent, the option itself may be treated as an "off-balance-sheet" or memorandum item, and may not be reflected in the actual balance sheet of either firm. For the bank writing the option it will be a contingent liability, for the corporate buyer it will be a contingent asset.

But execution of the contract also has an immediate effect on the balance sheet, reflecting the payment of the premium. In the first instance, the firm will show a decrease in a cash account and an increase in an account such as "premium paid". The bank will show reverse entries, an increase in a cash account and an increase in an account such as "premium received".

CORPORATION

Assets	Liabilities
-cash	
+premium paid	

BANK A

Assets	Liabilities
+cash	+premium received

These transactions will also have potential implications for the income statements of both the corporation and the bank, which will continue for the life of the option. But here the accounting treatment is far less uniform among various market participants and there remains considerable debate as to appropriate treatment. Some banks selling options will immediately transfer

"premium received" into another account such as "premium earned", which in effect counts the premium as realised profit. If subsequently the delta hedging of the option, for example, were to incur costs which cut into that premium earned, it would be booked directly as a loss.

An alternative approach, regarded by some as more precise, is to hold the premium earned in its separate account, and transfer from this account to a profit account only as the time value of the option erodes, and only insofar as the premium is not consumed in the process of delta hedging, or in the purchase of other options to hedge the written option. This approach is obviously more expensive from an operational point of view.

The final alternative would be to defer all entries to profit or loss accounts until the written option has expired, without any accrual to profit as the time value of the option erodes.

Phase 3

Bank A, having sold an option, is now exposed to unlimited exchange-market risk. If the price of sterling stays below the exercise price, Bank A's maximum profit is the premium received from the corporation. If the price of sterling is above the exercise price and the corporation calls on Bank A to fulfil the terms of the contract, then Bank A will have to sell sterling to the corporation for a price lower than it can acquire it in the market.

Bank A, if it chooses to manage its market risk, can hedge its exposure by (1) buying an option identical to the one sold; (2) buying an option similar in terms to the one sold; or (3) buying sterling in the spot or forward market.

Buying an identical option would perfectly hedge the risk of the short option position but would limit any profit for Bank A to the bid/offer spread. In addition, if Bank A has sold a customised option, it may be difficult to find another counterparty willing to write an option with the same features.

Bank A, unable to obtain an identical option and eliminate its risk, may attempt to limit its exposure by the purchase of an option with similar terms and features. The purchased option may differ from the option sold in maturity, underlying amount, exercise price, underlying currency and/or exercise features. A certain amount of risk will remain but it should be substantially less than the exposure from the original short option position.

Bank A may also choose to "delta neutral hedge" its short option position. A purchase of sterling in the spot or forward/futures markets, in amounts dictated by the degree the option is in or out-of-the-money, should have the effect of balancing any gains or losses occurring on the short option position as a result of rate movement. However, a delta-neutral hedge does not eliminate volatility risk.

Different approaches by Bank A to managing this options exposure will have different balance-sheet implications. For present purposes, the choice of a matched or only similar purchased option to hedge the written option will produce identical balance-sheet impacts, while the delta-hedge approach will be quite different. These two approaches are set out below in stylised form.

BANK A

Option-hedge approach		Delta-hedge approach	
Assets	Liabilities	Assets	Liabilities
-cash +premium paid		-cash +foreign currency	

Note that the amount of premium paid on the option purchased will, in general, not match precisely the amount of premium earned on the original option written. It is the difference between these two which will be taken to profit or loss, either on an accrual or cash basis.

Phase 4

The option contract will expire worthless if the price of sterling is below the exercise price of the contract at maturity. If, on the other hand, the market price of sterling rises above the exercise price and the corporation finds that it does not have to make a sterling payment, it may be able to sell the option (usually back to Bank A) and recover some, if not all, of its premium cost. However, if the contingent liability is realised, the corporation will decide to exercise the option. This gives rise to a new risk for both parties: settlement risk. The corporation is exposed until Bank A delivers sterling, and Bank A is exposed until the corporation delivers the base currency. Once the contract expires or is exercised and settlement occurs, the transaction is complete.

Appendix C

Interest rate and foreign exchange options

	Amount	Introduction	Open interest[1]	Turnover[2]
			in millions of US dollars	
	Philadelphia Stock Exchange (Settlement dates: Mar., June, Sept., Dec.)			
Currency				
Pounds sterling	£ 12,500	1982	2,285	2,469
Deutsche Mark	DM 62,500	1983	2,365	2,776
Swiss francs	Sw.fr. 62,500	1983	1,841	1,576
Japanese yen	Yen 6,250,000	1983	2,565	3,492
Canadian dollars	Can.$ 50,000	1983	696	809
French francs	Fr.fr. 125,000	1984	191	51
Interest rate				
3-month Euro-dollar	US$ 1,000,000	1985	-	-
	Chicago Mercantile Exchange (Settlement dates: Mar., June, Sept., Dec.)			
Currency				
Deutsche Mark[6]	DM 125,000	1984	5,227	9,643
Pounds sterling[6]	£ 25,000	1985	1,154	1,399
Swiss francs[6]	Sw.fr. 125,000	1985	1,371	2,285
Interest rate				
3-month Euro-dollar[6]	US$ 1,000,000	1985	60,689	129,576
	European Options Exchange (Amsterdam) (Settlement dates: Feb., May, Aug., Nov.)			
Currency				
Dutch guilders	US$ 10,000	1982	275[3]	446[4]
Deutsche Mark	US$ 10,000	1984	11[3]	3[4]
Pounds sterling	£ 100,000	1984	30[3]	5[4]
Pounds sterling v. guilder	£ 10,000	1985	32[3]	59[4]
ECU	ECU 10,000	1985	5[3]	15[4]
Interest rate				
Dutch guilder bonds	Fl. 10,000	1980	386[3]	204[4]
	Montreal Stock Exchange (Settlement dates: Mar., June, Sept., Dec.)			
Currency				
Canadian dollars	Can.$ 50,000	1982	44	60
Swiss francs	US$ 100,000	1985	-	-
Deutsche Mark	US$ 100,000	1984	-	-
Pounds sterling	£ 100,000	1984	58	11
Interest rate				
Canadian Government bonds	Can.$ 25,000	1982	286	412

	Amount	Introduction	Open interest[1]	Turnover[2]
			in millions of US dollars	
	Chicago Board of Trade (Settlement dates: Mar., June, Sept., Dec.)			
US Treasury note[4]	US$ 100,000	1985	3,575	4,015
US Treasury bond[4]	US$ 100,000	1982	56,096	174,825
	Chicago Board Options Exchange (Settlement dates: Mar., June, Sept., Dec.)			
Currency				
Pounds sterling	£ 25,000	1985	-	-
Canadian dollars	Can.$ 100,000	1985	-	-
Deutsche Mark	DM 125,000	1985	-	-
Japanese yen	Yen 12,500,000	1985	-	-
Swiss francs	Sw.fr. 125,000	1985	-	-
French francs	Fr.fr. 250,000	1985	-	-
Interest rate				
US Treasury bond	US$ 100,000	1982	3,320	2,725
US Treasury note	US$ 100,000	1985	581	260
	American Stock Exchange (Settlement dates: Feb., May, Aug., Nov.)			
US Treasury note	US$ 100,000	1982	33	90
	London International Financial Futures Exchange (Settlement dates: Mar., June, Sept., Dec.)			
Currency				
Pounds sterling	US$ 25,000	1985	319[3,7]	412[4,7]
Deutsche Mark[5]	US$ 50,000	1986		
Interest rate				
3-month Euro-dollar[6]	US$ 1,000,000	1985	3,989[3]	2,486[4]
	London Stock Exchange (Settlement dates: Mar., June, Sept., Dec.)			
Currency				
Pounds sterling	£ 12,500	1985	) 260[3,7]	n.a.
Deutsche Mark	DM 62,500	1985	)	n.a.
	(Settlement dates: Feb., May, Aug., Nov.)			
Interest rate				
British Government gilts[5]	£ 50,000	1985	308[3,7]	368[4,7]

1 As of 31st January 1986.
2 Turnover for the month of January 1986.
3 As of 31st December 1985.
4 Turnover for the month of December 1985.
5 Contract introduced on 31st January 1986.
6 Options on futures contracts.
7 In pounds sterling.

n.a. = not applicable.

Appendix D

Implications of large unexpected price movements for option trading

There is a wide variety of current and possible users (buyers) of options, but at this time only comparatively few institutions and traders are both capable and willing to write the instrument. Thus the writing of options is concentrated among a few prominent market-makers which, significantly, results in a concentration of market and credit risk. The nature of this risk concentration is probably the main feature of options which will condition how the effects of various types of large unexpected price movements might be distributed through the financial system. Substantive changes in the character of the writing institutions or the underlying could have severe repercussions on financial markets.

Generally, purchasers of option contracts have seemingly secured protection against adverse price movements on the underlying. However, these purchasers are now exposed to the default risk of the writer since any assumed market protection from buying an option is contingent on the writer's ability to fulfil the terms of the contract. A series of defaults in a bank's loan portfolio or a default by a clearing agent, for example, resulting in the bankruptcy of a major option writer, could adversely affect the financial soundness of numerous counterparties.

More precisely, the bankruptcy of a major option writer would primarily affect two parties; those who purchased options (commercial banks and other option writers) from the writer and those who have spot, forward and/or future agreements with the bankrupt writer related to options positions. Buyers who purchased the option contracts as a hedge for a pending or contingent liability (or to offset a short option position) are again confronted with their original exposure. However, their willingness and ability to rehedge are dependent on the cost of recovering and whether the original exposure has become favourable or unfavourable.

The premiums paid for the original options are now a sunk cost with zero probability of a return on the investment. A firm or bank may be reluctant or unable to commit additional resources to cover the position with another option or in the spot or forward/futures market. Furthermore, the decision if and when to rehedge will also be influenced by the price and volatility movements of the underlying since the original option contract was conceived. If the purchased option was out-of-the-money, the firm may be slower or less likely to rehedge since the market has moved in favour of its underlying position. On the other hand, if the option was in-the-money at the time of the bankruptcy then the firm should be compelled to rehedge since the market has moved against its underlying position. If a number of firms or banks are caught in this position, a sudden rush to the market for cover in the underlying could easily result in conditions distorting the pricing process and orderly trading.

Other broad developments such as drastic shifts in critical commodity prices or political upheavals in countries with substantial foreign debt could also have serious consequences. The effect of such developments would be reflected in drastic changes in the prices and volatility of the underlying. For the major option writers with sizable, short options positions,

a quick sudden move may prove disastrous. If the option writer is "properly" hedged, either options against options or delta-hedged, then an isolated price move may be a manageable situation. However, it is not uncommon for option writers to leave deeply out-of-the-money options uncovered. A sudden price move which brings these options into or nearer-the-money quickly would adversely affect the writers' position. Still, it is more than likely that such events will also have the effect of altering volatility.

A short options position is effectively a short volatility position. When an option is sold, an increase in volatility, often irrespective of price movement, increases the value of the option, which places the short position at a loss. Options hedged with other options are relatively safe from adverse volatility movement; however, options hedged under a delta scheme are subject to large losses. A delta-hedged portfolio is hedged against price changes, not volatility changes. The higher the volatility, the lower will be the delta and vice versa. Consequently, a position which is assumed to be delta-neutral may actually be delta-long or delta-short. Given the substantial delta-hedged and uncovered position of the surveyed institutions, a major market event, which has the effect of increasing volatility in foreign exchange rates, could easily promulgate disorderly market conditions as traders come into the market to cover the short volatility position.

Appendix E

Option pricing and hedge ratios

This section presents several formulae commonly used for computing (1) the market price of an option; and (2) the proportion of underlying securities or currency needed to hedge an option that has been written. Also examined are the sensitivities of these values to changes in various factors.

Three models are presented. The Black-Scholes model (1973) is the industry standard, widely used with or without modifications by many traders to guide their trading decisions. It was the first exact option pricing formula to be derived. It is based on an arbitrage argument, namely that the market price of an option must be such that no risk-free profits can be made by any combination of trading in options and the underlying securities. The formula is therefore obtained by construction of a riskless hedge using the option and its underlying securities and then solving the resulting equation for either the option price or the hedge ratio. The derivation is carried out under a number of special assumptions, as follows:

(i) the underlying security pays no dividends;

(ii) the option cannot be exercised prior to the expiration date (This assumption is true of European options. For American options, early exercise is not rational if the underlying security pays no dividends.);

(iii) there are no margin requirements, taxes or transaction costs (such as commissions or bid/ask spreads);

(iv) the interest rate is constant;

(v) the price volatility of the underlying security is constant, and proportional stock price changes are log-normally distributed;

(vi) only very small changes in the stock price can occur over a very short period of time.

The resulting equations are shown in Table 3.A.1. Only call options are computed, as put options are directly analogous.

The second model, by Garman and Kohlhagen (1983), applies to foreign exchange options. It is a modification of the Black-Scholes model which takes into account the fact that interest rates may vary across currencies. The basic assumptions are those listed above, with "underlying currency" substituted for "underlying security" or "stock". The formulae are displayed in Table 3.A.2.

A third model is by Leland (1984) and represents a modification of the Black-Scholes formula to take account of transaction costs. This formula allows direct comparison of the effects of changes in transaction costs or in the "revision interval" (i.e. the frequency with which the position is rehedged). One of the peculiarities of option management is that a hedged portfolio of options and stocks (or currencies) must be rehedged every time the

stock price (or exchange rate) changes. In the Black-Scholes model, rehedging is assumed to be continuous. However, transaction costs make such a strategy too expensive in practice. Traders generally rehedge their positions only at certain fixed intervals or when the hedge becomes sufficiently imperfect. In that case, the Leland formulas shown in Table 3.A.3 are more accurate.*

Transaction costs and fixed rehedging or revision intervals have the same effect as a modified stock price volatility, as shown in Table 3.A.3. The call price shown is actually an upper bound. Leland also computes the range between upper and lower bounds, and the sensitivity of this range or "bound" is also shown in Table 3.A.3.

Figures 3.E.1 to 3.E.28, beginning on page 107, contain graphs of the important relationships among pairs of variables within the option pricing formulae. Most of these relationships are carefully monitored by market participants in managing options portfolios. In general, these charts plot either options value or hedge ratio on the vertical axis against price of the underlying, volatility, time to expiration, or interest rates on the horizontal axis. The main purpose of the charts is to show the complexity, and particularly the non-linearity, of these relationships.

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* Even in this case, however, the Black-Scholes formula gives the exact subjective valuation if traders have logarithmic utility functions; see Cox and Rubinstein (1985), pp. 213-215.

Table 3.A.1

The Black-Scholes option-pricing model

Variables

S = spot price

K = strike price

r = interest rate

σ = spot price volatility

T = remaining time to expiration

$N(x)$ = cumulative normal distribution

Call price (Cox and Rubinstein, pp. 205, 221)

$$C = SN(x) - Kr^{-T}N(x - \sigma\sqrt{T})$$

where

$$x = \frac{\ln (S/Kr^{-T})}{\sigma\sqrt{T}} + 1/2\ \sigma\sqrt{T}$$

Sensitivity to other variables (See Figs. 3.E.1-4)

$\partial C/\partial S = N(x) > 0$ (the hedge ratio δ)

$\partial C/\partial K = -r^{-T}N(x - \sigma\sqrt{T}) < 0$

$\partial C/\partial \sigma = S\sqrt{T}\,N'(x) > 0$

$\partial C/\partial T = (S\,\sigma/2\sqrt{T})N'(x) + Kr^{-T}(\ln r)N(x - \sigma\sqrt{T}) > 0$

$\partial C/\partial r = TKr^{-(T+1)}N(x - \sigma\sqrt{T}) > 0$

Hedge ratio sensitivity to other variables (See Figs. 3.E.5-8)

$\partial \delta/\partial S = N'(x)/S\sigma\sqrt{T} > 0$

$\partial \delta/\partial r = N'(x)(-x/\sigma + \sqrt{T}) \lesseqgtr 0$

(>0 unless option is far enough out-of-the-money)

$\partial \delta/\partial T = N'(x)\,[-x/2T + \sigma/4\sqrt{T} + \ln r/\sigma\sqrt{T}] \gtreqless 0$

(>0 unless option is far enough out-of-the-money)

$\partial \delta/\partial r = N'(x)\,(\sqrt{T}/r\,\sigma) > 0$