Recent developments in the swap market

Over the past five years, one of the most rapidly growing and innovative areas in the international capital market has been the swap market—comprising interest rate swaps, currency swaps and, more recently, asset swaps. The market is estimated to have grown from about $5 billion in 1982 to some $400 billion at end-1986.

Swaps provide a mechanism for exploiting market imperfections and are also a valuable technique for managing financial flows—on both the liability and the asset side. As such they are widely used by all kinds of institution in the financial, corporate and government sectors.

This article[1] has several aims: to explain the mechanics of different types of swap and the basic principles underlying the transactions; to consider the origins and evolution of the market; to present empirical data on the size and nature of the swap market; and to discuss the prospects for the market.

Origins and evolution of the swap market

It is probably only correct to speak of a swap 'market' existing since 1981, although isolated examples of swap agreements date back to the mid-1970s. The earliest swaps on record were currency swaps, which evolved from the parallel or back-to-back loans popular in the United Kingdom in the late 1960s/early 1970s as a means of financing investment abroad consistent with exchange control regulations. Swaps were developed to overcome the problems with the right of set-off and complicated documentation associated with these loans. A distinguishing feature of currency swaps was that the documentation did not include an initial exchange of principal, and as such was an off-balance-sheet instrument. If the transactions did include an initial exchange, this was 'hidden' in the form of a separate spot forex transaction—a practice which persists today. Conceptually, the earliest swaps can be regarded in part as a mechanism for arbitraging between regulatory regimes—exchange control, accounting and supervisory.

A measure of acceptance and popularity was imparted to the swap technique by the historic Swiss franc/deutschemark/US dollar currency swap between IBM and the World Bank in 1981, which sparked off a certain amount of activity. Swaps evolved as a mechanism for arbitraging many types of segmented market. The interest rate swap developed as a means of exploiting differentials between the bond market and the short-term credit market arising from different credit perceptions among bond investors and banks. Such swaps were normally between a bank and a company because banks at that time generally found it relatively easy to raise fixed-rate finance, and corporations often found it relatively cheaper to borrow floating-rate funds, although corporate treasurers would frequently have preferred fixed-interest liabilities (see the note 'The classic swap' on page 68).

Since their inception, swaps have been used to arbitrage different perceptions of credit risk; different perceptions of interest rate risk and exchange rate risk; imperfections arising from systems of taxation, regulation or accountancy; differential access to information; market illiquidity; and transactions costs. Paradoxically, while swaps have been a mechanism for reducing market inefficiencies, the early swap market itself, like barter, was arguably inefficient. As the name implies, such swaps were matched deals, in which an intermediary bank brought together two counterparties, or end-users, with matching requirements. The intermediary bank would write separate contracts with each end-user, acting as principal in both swaps and charging an intermediation margin and possibly an arrangement fee.

The movement away from matched deals began in the dollar interest rate swap market, with banks developing techniques to enter into a swap agreement with one counterparty, while taking out a temporary hedge in the bond or futures market until an offsetting swap was found. This process, known as 'warehousing', has been common in the dollar interest rate swap market since 1984, and, at the present time, a large number of financial intermediaries act as market makers in the instrument. There are far fewer market makers in interest rate swaps in the other currencies, and, as yet, only a handful actively make a market in currency swaps. Swaps involving less well traded currencies still tend to be done on a matched basis.

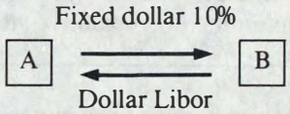
The liquidity and depth of the dollar interest rate swap market owes much to the ease of hedging swaps in the US Treasury bond repo or futures markets, and does much to explain why growth in the interest rate swap market has outstripped growth in the currency swap market (the other major factor being the demand for dollar interest rate swaps). The principal amount of outstanding currency

(1) Written by Miss G M S Hammond of the Bank's International Division.

What are swaps and how do they work?

A swap is a transaction in which two parties agree to exchange a predetermined series of payments over time. As creative techniques and new applications are constantly being found, it is not practicable to cover every type of swap transaction in one article. Nevertheless there are four basic structures which define the most common swaps, and which usually form the building blocks for more complex ones.

Interest rate swaps
An interest rate swap is a contract between two counterparties to exchange fixed interest rate payments for floating interest rate payments. The swap may be used to transform the nature of existing liabilities or assets—for example to convert fixed-rate debt to floating-rate debt—or the swap may exist independently. The payments will be in the same currency on a given *notional* sum. For example, party A may agree to pay to B semi-annual interest at 10% per annum on $100 million in return for receiving interest on the same principal amount at the six-month dollar London interbank offered rate (Libor). Note that there is no exchange of principal. Every six months, A pays $5 million to B in return for the six-month dollar Libor rate applied to the principal, as the diagram shows. (In practice payments are usually made net from one party to the other.)

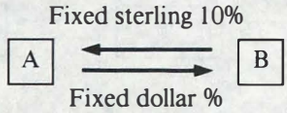


In the vast majority of such fixed/floating interest rate swaps, the floating rate used is Libor, although other interest rates such as US commercial paper, Treasury bill, prime rate and Federal funds rate are occasionally used. The US dollar interest rate swap market is by far the largest but there are sizable markets in several other currencies, of which the yen, sterling, the Swiss franc, the deutschemark, the Australian dollar and the Canadian dollar are probably the most significant.

Basis swaps
Basis swaps or floating/floating swaps can be regarded as a subset of interest rate swaps. Here, floating-rate interest payments calculated on one basis are swapped for floating-rate payments in the same currency calculated on another basis, eg dollar Libor for dollar commercial paper rate, or three-month Libor against six-month Libor.

Currency swaps
A currency swap is a contract to exchange payments denominated in one currency for those denominated in another. The term 'currency swap' sometimes gives rise to confusion as it has two meanings. In the foreign exchange markets the term 'swap' is used to denote a spot sale and forward purchase of a currency. In the capital markets a swap usually involves an exchange of interest payments and principal denominated in one currency for payments in another. It is with the latter transaction that this article is concerned. There are two main types of currency swap: fixed/fixed currency swaps and fixed/floating currency swaps. The latter are usually known as cross-currency interest rate swaps.

Fixed/fixed currency swaps
Fixed interest payments in one currency are exchanged for fixed interest payments in another. There is normally a final exchange of principal and sometimes an initial exchange of principal. There are three main parts to the contract; the two fixed interest rates, the principal and the exchange rate. In nearly all cases the spot exchange rate is used (generally the mid-point of the bid/offer spread). To take an example, party A agrees to pay party B 10% per annum in sterling on a principal of £100 million, in return for 8% per annum in dollars, and the sterling/dollar spot rate is £1 = $1.50. Each year A pays B £10 million and receives $12 million (8% of $150 million). At the end of the transaction there is also an exchange of principal *at the exchange rate prevailing when the deal was struck.* A pays B £100 million and receives $150 million.



Cross-currency interest rate swaps
As the name implies, this type of swap is essentially a combination of a currency swap and an interest rate swap. The structure of the transaction is identical to that of a fixed/fixed currency swap, except that one or both sets of interest payments are on a floating-rate basis. As with fixed/fixed currency swaps there is a final exchange of principal at the spot exchange rate prevailing when the deal was struck.

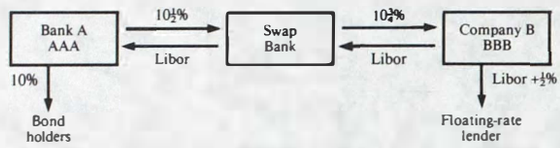
Asset swaps
Traditionally swaps were used to transform the currency or interest base of liabilities. Over the past two years the same techniques have increasingly been used to transform assets. Asset swaps (or synthetic securities as they are also known) simply combine an asset and a swap—thus a fixed-rate asset can in effect be transformed into a floating-rate asset in the same or a different currency. The market works by taking advantage of price imperfections in the bond market and the swap market, the technique being to buy a bond trading in the secondary market inexpensively relative to its credit rating, and combine this with an interest rate swap.

The bulk of the market to date has involved the creation of synthetic FRNs. The buyers of synthetic assets include commercial banks seeking high-yielding assets as an alternative to conventional loans; FRN portfolio managers; and company and institutional fund managers. Buyers may either purchase the bond and arrange a separate swap themselves, or, as is more common at present, buy a package of a bond plus swap from an intermediary. Intermediaries tend to be major investment, merchant or commercial banks with a presence in the secondary bond market, swap capabilities and marketing/sales capabilities.

The classic swap

The example illustrated below is a swap between a bank which has a competitive advantage in the bond market but a preference for Libor funds to match its floating-rate assets, and a company which has a competitive advantage in the floating-rate market but a preference for fixed-rate funds.

Rather than borrow floating-rate funds directly at, say, Libor, bank A issues fixed-rate US dollar bonds worth $50 million; because of its AAA rating, the issue is on the finest terms available, say 10%. Company B, which is not well known in the international capital markets, but a reasonable credit in the banking market, could only issue a bond at say 11¾%, a cost it regards as prohibitive. Company B therefore borrows $50 million at Libor +½%. Each party enters into an entirely separate swap agreement with an intermediary bank. Company B pays fixed interest at 10¾% in return for receiving Libor, and so transforms its floating-rate obligation into a fixed-rate liability at a rate of 11¼%,



Net cost to bank A: Libor −½%
Net cost to company B: 11¼%

which is ½% per annum less than it would have to pay in the bond market.

Similarly bank A transforms its fixed-rate liability into Libor −½% funding—½% per annum better than it would have achieved by borrowing directly. The example also contains a ¼% per annum fee for the intermediary bank, to compensate it for the credit risks it has acquired. The use of intermediary banks initially stemmed from the fact that end-users frequently preferred the credit risk of a major bank to that of a direct counterparty, and for reasons of confidentiality. More recently the role of intermediary banks has been expanded by their ability to 'warehouse' the first swap by taking out a temporary hedge in the cash or futures market until an offsetting swap counterparty can be found. The arbitrage possibility exploited in this example is the difference in perception of the creditworthiness of company B between floating-rate lenders and eurobond market investors.

The above example illustrates an important feature of the swap market: *swaps enable a borrower to raise funds in the market to which it has best access but to make interest and principal payments in its preferred form or currency.* This separation of the funding decision and the choice of servicing debt enables borrowers to exploit their comparative advantage.

swap contracts is estimated to have increased from $2–3 billion in 1982 to perhaps $80–100 billion by end-1986, while the aggregate notional principal of outstanding interest rate swaps rose from a similar base in 1982 to an estimated $350 billion at end-1986. Liquidity in the interest rate swap market has been further aided by the moves towards a standardised product; in mid-1985 both the International Swap Dealers Association (ISDA) and the British Bankers' Association brought out standardised dealing terms and documentation for interest rate swaps. Further revisions are currently underway to the ISDA code.

Although the interest rate swap market has moved further than the currency swap market away from the matched deal towards a tradable instrument, the process is far from complete. The secondary market remains extremely thin because of the mutuality of obligations involved in a swap. In the asset swap market for example, out of a total of almost $10 billion synthetic securities sold to date, only a few hundred million—less than 5%—have been resold in the secondary market. Currently, end-users wishing to unwind a swap position have a number of choices. They may ask a market maker to quote for a cancellation. This would involve payment or receipt of an agreed sum representing the present value of the future income streams generated by the swap. If the market maker is the other counterparty to the swap, the agreement may be terminated. If a third party is the counterparty, the rights and obligations of the first end-user under the swap may be assigned to the market maker, subject to the consent of the third party. Alternatively the end-user may choose to write a reverse swap with the counterparty (in which case some credit risk still remains); or to write a mirror swap with another counterparty (in which case there is potential exposure to both parties).

Risks

The risks faced by those involved in swap activities depend on their precise role in the swap market—whether as broker, end-user or intermediary. For a broker, once the fee charged for bringing two counterparties together is received, there is no more risk. A principal in a swap agreement, whether an end-user or intermediary bank, faces *credit risk*,[1] which is the risk that the counterparty defaults, together with *position risk*, which is the risk that interest rates and exchange rates move adversely after the deal is struck. Losses can arise either if interest and exchange rates move adversely, resulting in a position loss, or if rates move favourably, resulting in a position gain, but the counterparty defaults.

There are three main features of position risk: (1) Position risk varies over the life of a deal according to movements in interest rates and/or exchange rates. (2) Position risk

(1) These issues are addressed in the Bank of England's consultative paper on off-balance-sheet credit risk (March 1986).

can be either positive or negative. (3) Position risk cannot be determined in advance.

An additional credit risk occurs when the frequency of payments on the two sides of the swap differs. If a party is making semi-annual payments and receiving annual payments, then for the second six months of each year there is an additional unsecured credit exposure equivalent to the first semi-annual payment it has made. The most extreme case occurs in a zero-coupon swap.

The intermediary bank which warehouses a swap (ie takes out a temporary hedge until a matching swap is written) faces additional risks, the most important being the *spread risk*. This is the risk that the spread between the swap price and the price of the hedge may change. While changes in absolute interest rates can be hedged reasonably well, it is not always possible to hedge against spread risk.

More complex swaps

Some of the most popular innovative structures seen as the swap market has evolved include amortising swaps, forward swaps, zero-coupon swaps, options on swaps, callable swaps, multi-legged swaps and index swaps. Recently there has been a proposal by Comex for an exchange traded futures contract in interest rate swaps.

Amortising swaps, as the name implies, are structured so that the payments are calculated by reference to an amortising principal amount and are commonly used to hedge a stream of amortising payments. *Forward swaps* are swaps which come into operation at an agreed point in the future on terms decided today. The instrument is a means of locking into future interest rate costs at the currently implied future level, and is therefore a hedge against rising or falling interest rates. In a *zero-coupon swap,* the fixed-rate payments on one side are only payable at maturity. The notional 'interest' payments are compounded over the life of the swap at the agreed swap rate.

An *option on a swap* gives the buyer the right but not the obligation to enter into a swap at some point in the future, on terms decided today. A *callable swap* gives the fixed-rate payer the option of cancelling the agreement—usually only on one specific future date. A *multi-legged swap* or 'cocktail' swap brings together a number of counterparties whose positions net out in aggregate. The structure usually involves a set of bilateral contracts between each counterparty and an intermediary bank which are transacted simultaneously. In an *index swap*, the payments are calculated by reference to indices such as the RPI, stock indices and bond prices.

Most players in the swap market take account of several factors in assessing risk. First, the creditworthiness of the counterparty. Swap intermediaries typically make a yes/no credit decision on the counterparty, hence there is usually only one price in the swap market, and that price presumably reflects average expected exposure. Two points are worth noting here. First, assessment of credit risk in the swap market follows banking rather than bond market criteria. Second, access to the swap market is, in the main, limited to higher-rated credits, although some intermediaries add on margins to their prices for lesser-rated credits. There have also been efforts to develop collateralised swaps.

The second measure used to assess risk is the current mark-to-market value or 'replacement cost' of a swap. This can be calculated as the net present value of the future cash flows, using either current swap rates or the appropriate opportunity borrowing and lending rates, together with the current exchange rate. The third is potential or expected exposure over the remaining life of the swap. This depends, *inter alia*, on the size of the swap, its structure, maturity and strike rate, plus the liquidity of the market, as well as on the expected volatility of the relevant interest rates and exchange rates.

As is the case with other innovations, there is a danger that the risks involved in swaps may not be fully understood by all market operators and their managers. While some of the more established players have developed systems to monitor and control risks and have acquired several years' experience, this will not be true for some of the new entrants to the market.

Other types of risk

There are other types of risk generated in the swap market that are less easy to define and probably impossible to measure. It is also more difficult to see who bears these risks.

The first set of problems arises from the fact that the accounting, taxation and legal treatment of swaps is far from certain. On the accountancy side for example swaps are off balance sheet, and consequently give rise to *transparency risk*. A company may raise funds in one currency—say deutschemarks—and swap into sterling. The annual accounts however may continue to show a deutschemark liability. As the company becomes more active in the swap market the true underlying position becomes increasingly divorced from the picture given by the accounts. (This type of disclosure problem, which applies to a number of other off-balance-sheet items, in fact extends beyond the level of the company accounts to the measurement of financial flows at the national and international level.)

On the legal side perhaps the main concern is on swap documentation. There has yet to be a serious default in the swap market; consequently the documentation has not been tested in court. A second concern is that it is not unusual in the market to have quite lengthy delays

between the striking of the deal and the signing of the full documentation. (This problem may have been ameliorated to some extent by the moves towards standardised documentation.)

Empirical analysis of the interest rate swap market

Size of the interest rate swap market

Measurement of the volume of swap activity is fraught with problems, both conceptual and practical. Conceptual difficulties arise from the fact that it is market convention to use aggregate notional principal amounts despite the fact that there is no actual exchange of principal in an interest rate swap. Double-counting is a perennial problem. Some transactions may involve a whole chain of banks between the two end-users. Each bank may be writing matching contracts for two counterparties, which, in their own reports, will both be counted. A contract written between two banks will show up in both banks' totals. The figures therefore need to be interpreted with considerable care. Such double-counting makes it difficult to assess the size of the 'interbank' market within the overall market. Nevertheless there is now a sufficient volume of data from a variety of sources to give a reasonable idea of the size and nature of the market.

The notional principal value of outstanding interest rate swaps is estimated to have grown from $3 billion in 1982 to $20 billion in 1983 and $80 billion in 1984. The rapid growth has continued, with volumes reaching over $100 billion in mid-1985. With some $35–50 billion of new contracts written per quarter in 1986, the value of outstanding interest rate swaps at end-1986 is estimated at about $350 billion.

In terms of currency, dollar interest rate swaps account for the bulk of transactions, although there are interest rate swap markets in sterling, yen, deutschemarks, Canadian dollars, Australian dollars and Swiss francs as well as several other currencies. These markets are small by comparison, but not insignificant. Activity in the sterling swap market for example is estimated to have grown from about £2 billion in 1985 to £6 billion in mid-1986 (measured by notional principal of new contracts).

Table A
Volume of interest rate swap activity

Outstanding notional value, $ billions equivalent

	Dealer/end-user	Dealer/dealer	Total(a)
End-June 1985	92	18	110
End-Sept. 1985	111	23	134
End-Dec. 1985	142	28	170
End-Mar. 1986(b)	173	35	208
End-June 1986(b)	212	44	256
End-Sept. 1986(b)	249	57	306

Source: ISDA, October 1986.

(a) In addition to these figures the dealers act as broker for a further $1–2 billion of swaps per quarter. The figures exclude swap contracts written by non-ISDA dealers and dealers who did not respond to the questionnaire (27 out of 60 in 1986 Q3).

(b) Stock figures for 1986 are estimated by adding new contracts to the contracts outstanding at end-1985 and probably overestimate growth. In addition, some of the apparent growth in 1986 stems from an increase in the number of respondents.

The results of surveys by the International Swap Dealers' Association (ISDA) record the aggregate notional principal of interest rate swap contracts written by members. When an ISDA dealer writes matching swaps with two counterparties, each contract is counted. Contracts between two ISDA dealers are counted only once.

Table A shows that the notional value of outstanding contracts more than doubled between mid-1985 and mid-1986, from $110 billion to $256 billion. About 80% of contracts are written between an ISDA dealer and an end-user. This corroborates the impression of a mature interest rate swap market in which dealers are warehousing rather than immediately matching swaps.

The surveys also record that the average size of an interest rate swap is $20–25 million.

Table B
Call Report data on interest rate swaps

Oustanding notional value, $ billions equivalent; end-quarters

	Domestic US banks	Foreign banks(a)	Total
1985 Q2	113		
Q3	143		
Q4	186	28	214
1986 Q1	220	37	257
Q2	266	48	314

(a) Foreign banks have been required to report interest rate swaps only since the fourth quarter of 1985.

A useful cross-check on these numbers is provided by the Report of Income and Condition (Call Report) in the United States (Table B). Since the second quarter of 1985, FDIC-insured US chartered banks have been required to report the notional value of interest rate swaps on a consolidated basis. Foreign banks in the United States report swaps booked in the United States.

The aggregate call report data need to be interpreted with care, in view of the double-counting involved. ISDA data indicate that at least 20% of the market is inter-dealer; these contracts will be reported twice in the aggregate figures. The call report also captures the swap business of non-ISDA banks. Allowing for this and for the fact that the ISDA figures will include some swaps by non-US banks outside the United States, and possibly some US investment houses, the overall pictures are very similar.

Some idea of the concentration of the market is given by the fact that the five largest banks in the call report sample accounted for $168 billion, or 53%, of the call report total at mid-1986. The ten largest banks accounted for $222 billion, or 70%, of the total. (It is important to note that the sample excludes the swap activity of the US investment houses and non-US banks, some of whom may be among the largest players.)

By mid-1986 the total notional principal value of the outstanding interest rate swap contracts of the largest five

banks in the sample was equivalent to about 45% of their combined assets. These figures however must be viewed in relation to the risks involved. At end-1985, a sample of six large US banks produced estimates of their marked-to-market swap exposure. These snapshot estimates showed actual credit exposure (but not potential exposure) varying between 1.4% of notional principal and 5.6% with an average of 3.6%.

Analysis of currency swaps

It is difficult to estimate the extent of activity in the currency swap market with any accuracy. Banks are not yet required to report currency swaps on a regular basis, either to regulators or to shareholders, although some have publicised the extent of their involvement. While currency swaps can be used to hedge any income stream (such as export earnings) or to change the structure of existing liabilities, a considerable number are closely linked to eurobond issues. Table C gives Bank of England estimates of the volumes of currency swaps and swap-driven new issues.

The table needs to be interpreted with care. First, where the currency swap takes the form of a parallel issue—ie two borrowers simultaneously issue a bond and swap the proceeds—each bond will be counted. Second, only bonds publically indentifiable as swapped are included. Third, bonds with an associated interest rate swap are excluded.

Table C
Currency swaps
Flows, $ billions

	Currency swaps entered into	Eurobond issues with an associated currency swap
1981	½	1
1982	3	2
1983	6	3
1984	13	6
1985	24	20
1986	40–45	33

Some of the apparent growth in issues swapped since 1984 may in fact reflect an increased tendency to publicise swaps attached to bonds. Nevertheless, there is evidence that the bond market itself is becoming increasingly swap-driven. The percentage of non-dollar eurobonds swapped is estimated to have risen from about 1% to about 24% between 1981 and 1986.

Table D, based on data from the Bank's international capital markets database, shows the currency distribution of fixed-rate bonds identified as swapped in 1986. US dollar and yen-denominated bonds each accounted for about 30% of the total value of all bonds swapped: although fewer yen bonds were issued, a far higher proportion was swap-driven. Bonds denominated in Swiss francs, Australian dollar and ECU accounted for the third, fourth and fifth largest shares of the market respectively. A notable development in the past two years has been the emergence of issues in currencies new to the euromarkets which are largely swap-driven. In 1985 and 1986 a significant number of euro Australian dollar and euro New Zealand dollar bonds were issued, at least 70% of which have been swap-driven. In 1986 European currencies such as the French franc, Danish krone and Netherlands guilder increased their share of the euromarkets, largely reflecting swap activity.

Table D
Currency distribution of fixed-rate international bonds swapped in 1986
US $ billions equivalent, *percentages in italics*

	Total swapped	Total issues	Per cent of issues swapped	Share of all swaps by value
US dollar	11.3	82.3	*14*	*34.1*
Yen	10.3	21.9	*47*	*31.1*
Swiss franc	3.3	23.2	*14*	*9.8*
Australian dollar	2.4	3.4	*72*	*7.4*
ECU	2.1	5.8	*37*	*6.5*
Canadian dollar	1.2	5.9	*20*	*3.6*
Deutschemark	1.0	14.6	*7*	*3.1*
French franc	0.5	3.2	*17*	*1.7*
New Zealand dollar	0.4	0.4	*91*	*1.2*
Sterling	0.2	5.4	*3*	*0.5*
Danish krone	0.2	1.3	*13*	*0.5*
Netherlands guilder	0.1	3.2	*5*	*0.4*
Others	—	0.8	—	—
Total	**33.2**	**172.6**	***19***	***100***

Source: Bank of England international capital markets database.

Analysis of the bonds swapped in 1986 sheds some light on why some sectors of the eurobond market are more swap-driven than others, and on the arbitrage underlying these transactions.

The swap market enables a borrower to raise funds in the market in which it has comparative advantage—in terms of investor appeal, currency and as between fixed and floating interest rates—and swap into its preferred type of liability. The data show that comparative advantage arises from a number of sources. Perhaps the most common stems from different perceptions of an individual borrower's credit standing in different markets. The data support the broad generalisation that the additional risk premia demanded by investors in the non-dollar eurobond market for certain less-than-top-rated credits are lower than in the dollar eurobond market, resulting in the classic swap arbitrage.

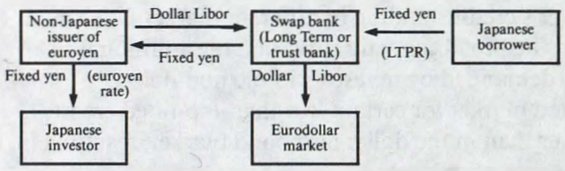
Perhaps the best example of this is the *Swiss franc market* where the preference among retail investors for household names sometimes appears to mean that the name is more important than the credit rating. (An A-rated company for example may achieve terms usually only available to AA-rated companies.) In the first half of 1986 a number of less-than-top-rated US corporate names issued Swiss franc bonds and swapped into fixed-rate dollars. Anecdotal evidence suggests that the counterparties to these issuers—those paying Swiss francs and receiving dollars under the currency swap—are sovereigns, supranationals and others who prefer to keep a spread of currencies in their debt portfolio. Other counterparties are those—such as the IBRD—with a preference for (low interest rate) Swiss franc liabilities who fear reaching saturation point for their own issues in the market.

ECU swaps seem also largely to be driven by the fact that credit differentials in the ECU bond market are narrower than in the eurodollar market. However the market is more complicated than this. There have been a fair number of top-rated borrowers swapping out of ECU bonds. The pattern and timing of issues suggest that windows for ECU swaps open fairly infrequently, depending on investor demand and availability of counterparties. Counterparties are reportedly drawn from two groups: European companies with insufficient status to come to the market, and entities with large dollar liabilities and assets in Europe who wish to hedge their exposure. Supply of the latter will of course vary according to the ECU/dollar exchange rate. Further uncertainty can be imparted to the market by expectations of a revaluation of currencies within the EMS.

The market imperfections circumvented by swap-driven *euroyen* bonds are numerous. Among the most important are the wedge between domestic and international markets; different interest and exchange rate expectations among lenders; and favourable terms offered by Japanese intermediaries competing for market share.

The linkages between regulated domestic markets and more liberalised international capital markets have resulted in a wealth of swap opportunities. A series of deregulatory measures beginning in December 1984 (when the euroyen bond market was opened to certain non-Japanese borrowers and swaps were permitted off euro-yen issues) resulted in a surge of euroyen issues in 1985 and 1986—from about ¥225 billion in 1984 to ¥3,400 billion in 1986. The ability of issuers to swap into non-yen debt was a key factor since relatively few borrowers had a natural need for yen funds.

A typical swap is shown below:



In this swap, a non-Japanese counterparty issues a euroyen bond, assuming an obligation to pay fixed-rate yen to the investors. A swap is attached to the issue, whereby the swap bank (the Long Term Credit Bank or a trust bank) pays fixed-rate yen in exchange for dollar Libor. The bank's yen obligation is matched by a fixed-rate yen asset, normally in the form of a long-term loan to domestic industry which yields the long-term prime rate (a regulated domestic interest rate aligned to the Japanese government bond coupon). The swap bank's receipts of floating-rate dollars under the swap are used to meet its borrowings in the eurodollar market which form part of its international business.

In this scenario the principal source of arbitrage is between the regulated LTPR and the euroyen bond rate. On the fixed yen side, the swap rate is priced off the LTPR, and this reflects the demand for fixed-rate finance from domestic borrowers, together with expectations of interest movements. The euroyen rate is more influenced by Japanese government bond yields and international bond markets, as well as exchange rates. It is more volatile than LTPR, and therefore windows open up between the two rates to provide arbitrage opportunities.

A further factor driving the market has been the aggressive pricing of euroyen issues by Japanese securities firms. Their willingness to offer fine terms to counterparties for relationship reasons reduces the post-swap dollar cost of finance. There are also reported instances of favourable (below market) swaps rates offered by Japanese banks which produce the same effect.

Since 1985 there have been a number of dual-currency bonds (yen/dollar), which seem to hinge on the fact that investors will accept the final exchange rate risk at a rate lower than that implied by the forward market, whether for tax reasons or because of different expectations.

Issues of *euro Australian dollar* and *euro New Zealand dollar* bonds with attached currency swaps have risen from about $150 million in 1984 to $2,800 million in 1986. In simple terms the swap exploits the differential between interest rates in the domestic markets and the euromarkets. The Australian and New Zealand domestic bond markets are poorly developed, and the supply of fixed-rate funds from the banking sector is limited. This has produced a large pool of companies in search of fixed-rate liabilities. In Australia an additional twist was provided by the fact that several Australian companies and other entities had earlier borrowed through US dollar syndicated credits, and therefore acquired a currency exposure, which bit quite sharply in 1985. These companies proved ideal counterparties to a non-Australian issuer.

The high nominal yields on the euro Australian dollar and euro New Zealand dollar bond issues proved extremely attractive to investors—particularly those who pay more regard to the coupon than to the exchange rate risk. Borrowers have on occasion been able to command finer terms than the Australian government, no doubt because the eurobonds are in bearer form and exempt from withholding tax.

Swaps off new *deutschemark* eurobond issues have been permitted since May 1985, although prior to this swaps could still be arranged off existing liabilities. The market was rather slow to get off the ground in 1985; only fifteen issues were identified as swapped compared with over sixty ECU issues and more than forty Swiss franc issues. The picture was little changed in 1986. A major factor was the difficulty of finding swap counterparties, which resulted in would-be issuers notifying the Bundesbank of their wish to make an issue with only faint hopes of going ahead with the issue plus swap. Certainly it was the case that frequently only a small proportion of notified issues actually materialised.

The queueing system operated by the Trésor since the reopening of the *euro French franc* market in April 1985 puts a more effective dampener on swaps. The regulations were introduced to impart stability to a fledging market. Swaps of new issues were permitted from the start, but the three to six month waiting list for new issues severely curtails banks' ability to take advantage of swap windows as they open up. Only a handful of bonds appear to have been swapped.

UK borrowers' activity in the swaps market

To date, recorded activity by UK borrowers in the swap markets has been fairly limited. In 1986 the amount of non-sterling eurobonds issued by UK companies and identified as swapped into sterling liabilities was less than $1 billion. There was slightly more activity in fixed-rate eurosterling issues swapped into floating-rate sterling liabilities—about £1.25 billion in 1986. The UK building societies were conspicuous issuers, raising some £0.5 billion fixed-rate funds which was swapped into floating-rate debt. Foreign banks were also important issuers. Counterparties to these swaps—payers of fixed-rate sterling—were apparently fairly heterogenous, including UK industrial and commercial, leasing and financial companies and local authorities. Since the start of 1987, building societies have been permitted to borrow in any currency provided all the proceeds are swapped back into sterling. Some have taken advantage of this to issue fixed-rate dollar eurobonds and swap into floating sterling liabilities. The true level of UK borrowers' activity in the swap market is doubtless rather higher than reported figures suggest; nevertheless the overall amounts are probably not large. The market may be expected to increase over the next few years as end-users' familiarity with the products increases.

Prospects for swaps

Analysis of the arbitrage opportunities underlying the currency swap and interest rate swap markets leads to the question of whether the rapid growth of the swap market seen over the past few years will continue, or whether market imperfections will be arbitraged away, resulting in a stabilization of the market. Empirically it is certainly true that the profit margins which could be achieved in the early days of the swap market have been whittled down, yet the market doubled in size last year.

Three main themes emerge. First, the forces currently driving arbitrage-based swaps may be finite processes, which in the limit result in efficient global markets with few possibilities for arbitrage. Second, prospects for the swap market are likely to depend crucially on developments in risk and credit assessment. Finally, even if all market imperfections are arbitraged away, there are likely to be other motivations for swaps, including asset and liability management, hedging and speculation.

Arbitrage-driven swaps

A number of factors underlie arbitrage-driven swaps. First, the *liberalisation of capital markets* has been important, both in Japan and in some of the European markets. Yet, while partial deregulation often creates swap opportunities, complete liberalisation will tend to reduce market segmentation and swaps. Second, broader developments in the *securitisation* and *internationalisation* of lending and the accompanying growth of the euromarkets have increased the opportunities available to borrowers and lenders. The proliferation of swap techniques into a wider range of markets, however, is also a finite process. Third *technological progress,* particularly the rapid computerisation of the financial sector and advances in telecommunications, has fuelled the growth of the swap markets by increasing the number of markets in which arbitragers can operate. Nevertheless, as the technology gap between market leaders and others is narrowed, and as market segmentation is eroded, swap opportunities are correspondingly reduced.

To the extent that the recent growth in arbitrage-driven swaps has depended on finite processes, it may reflect step changes and portfolio adjustments which peter out over time. Yet it is more realistic to expect some market imperfections to prove more durable. National systems of taxation, regulation and accountancy for example have provided a considerable number of swap opportunities. International harmonisation is likely to remove some of these anomalies in the relatively near future; others will doubtless persist for longer.

Assessment of credit and risk

Prospects for the swap market are likely to be crucially dependent on counterparties' perceptions of credit and risk. One reaction by intermediaries to the decline in profit margins on swaps may be to extend swap techniques to lesser-rated credits. To date, the swap market has been almost exclusively the preserve of better credits—probably A rated and above. Yet to the extent that intermediary banks are willing to accept the credit risk of counterparties previously denied access to the market at finer rates than those prevailing in the bond markets, swaps will proliferate. Perhaps the most likely area for this type of growth is the asset swap market. That market may also benefit from some of the techniques developed in the collateralised mortgage obligation (CMO) market. For example, intermediaries in the synthetic FRN market have not yet issued paper against bonds on which they themselves retain the credit risk.

An alternative scenario would involve a general re-evaluation of the risks and profitability of swaps. Increasing sophistication among investors, for example, may reduce their willingness to accept currency risk and credit risk at below 'market' rates. The learning curve effect is likely to be reinforced by attempts to improve the quality of information given to investors at the launch of new issues.

More generally, the recent report on innovation by a study group of the central banks of the Group of Ten countries,

published by the BIS,[1] noted the possibility that new instruments may be underpriced, either because the true risks are only apparent over the course of a cycle, or because of aggressive pricing to gain market share. Certainly some participants—both investors and counterparties—appear to have re-evaluated the risks inherent in swaps in the light of experience. Further, forthcoming requirements on banks to hold capital against swap activities are likely to affect the assessment of profitability of swap operations. The Bank of England and the US federal banking supervisors recently confirmed their intention to capture swaps and other off-balance-sheet items within a common risk ratio framework.[2] Finally, the swap market has yet to be tested by a severe bear market. Should such market conditions occur, currency swaps might be affected more than interest rate swaps. To the extent that profitability on the latter stems from trading, there is little difference between a bull and a bear market. Currency swaps on the other hand are closely linked to eurobonds. New issues could be severely hit in an environment of rising interest rates. In turn there would be fewer opportunities for cross-subsidisation of swaps from profits derived for example from lead-management of bonds. Indeed, to the extent that trading profits in a strong bull market have subsidised swap activities, the impact of a bear market could be more pronounced.

Other motivations for swaps

In addition to the factors influencing arbitrage-driven swaps, there are a number of quite separate motivations for swaps.

The use of swaps as a *tool for asset and liability management* is probably the most important. Swaps can be a cost-effective way for entities to refinance existing borrowings without incurring the transactions costs of reissuing. On the asset side, the same techniques can be used to increase the return to the investor. Second, the use of swaps for *speculation* is independent of arbitrage opportunity. Interest rate swaps and currency swaps may be used to take a position on interest rates and exchange rates respectively. Third, swaps may be used to hedge existing positions. (The market is not insignificant. ECGD, for example, recently completed a $2 billion interest rate swap programme to hedge the interest rate exposure arising under its interest equalisation scheme.) The use of swaps for hedging is less related to the imperfection or otherwise of markets than to the volatility of markets. The demand for swaps as speculative or hedging instruments will therefore depend on the volatility of markets in the future. Fourth, swaps *extend existing markets.* Currency swaps extend the market for forward exchange of foreign currency beyond what is usually available in the forex market, while interest rate swaps effectively extend the market in interest rate futures beyond their current eighteen-month limit into the medium term. Even where swaps overlap with existing investments they offer the convenience of a bundled instrument. Currency swaps for example offer a bundle of forward contracts at the same exchange rate. Swaps can also be a substitute for markets in long-term debts; a company can raise finance in a well-traded currency and swap into fixed-rate debt in one of the smaller currencies. Finally there are possibilities, which are only just beginning to be developed, for swaps related to commodity prices, which would extend commodity futures markets. To the extent that these markets deepen in the future, the demand for swaps is likely to be reduced.

Conclusion

Swaps seem set to be a permanent feature of the financial landscape, although the exponential growth seen in recent years is unlikely to continue. There are two possible responses to the decline in profit margins caused by increased competition. First, there may be a tendency towards increasingly complex swaps related to more exotic underlying instruments, and the spread of the swap technique into new markets. More complex hedging techniques are also likely to emerge. The second response, somewhat paradoxically, is likely to be continued efforts to standardise products and moves to increase the tradability of swaps. Moves to increase the tradability of swaps might include a swap futures contract, or some type of 'swap clearing house' with which swap dealers could write contracts and net their positions.

The fastest growing sector of the swap market, dollar interest rate swaps, owes much of its success to the relative efficiency of hedging techniques and the existence of the Treasury bond repo market, although end-user demand has also contributed. The volume of interest rate swaps in currencies such as sterling is only likely to grow rapidly if there is demand for the product, and if the current difficulties involved in hedging the swap are removed. In this context Big Bang may be expected to stimulate activity in the sterling market by increasing the number of gilt-edged market makers, although there has been little evidence of this so far.

(1) *Recent innovations in international banking.* BIS, April 1986.

(2) See 'Agreed proposal of the United States Federal Banking Supervisory Authorities and the Bank of England on primary capital and capital adequacy', reproduced on pages 87–93.

Appendix
Analysis of price data for interest rate swaps[1]

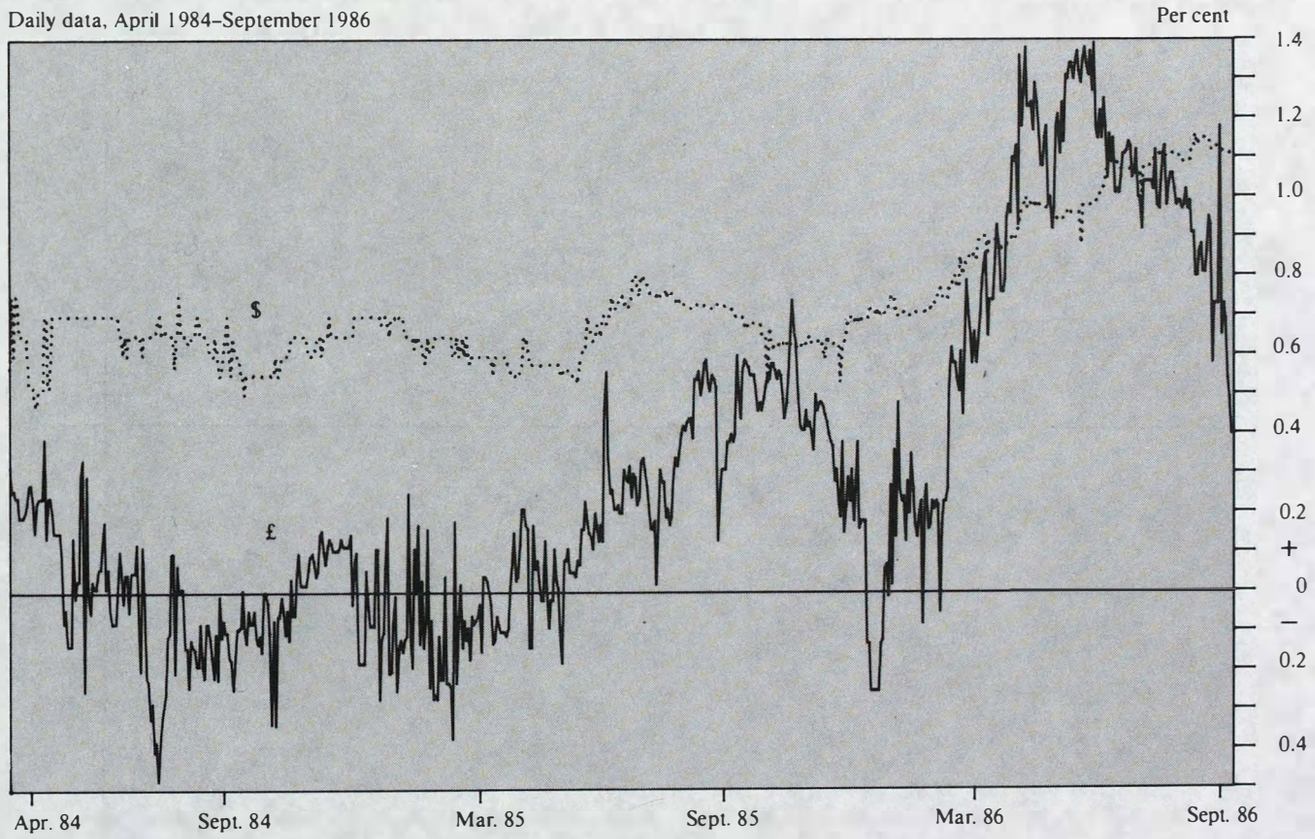
The ultimate determinants of the price of an interest rate swap are the supply and demand for fixed-rate and floating-rate finance. More narrowly, the swap price is closely related to yields on government securities and eurobonds. Yields in the eurobond market are important since the basic interest rate swap is essentially an arbitrage between this market and the market for short-term credit. Government securities, particularly US Treasuries, are important as the primary hedging instrument for interest rate swaps. To the extent that the price of a swap is the cost of producing it from the warehouse, the influence of government securities—both cash and futures—will dominate eurobond yield considerations.

In the dollar swap market, the swap price is quoted on a semi-annual bond basis as a spread over the US Treasury bond of corresponding maturity, in relation to a given floating rate, usually six-month Libor. A swap rate of 55/50 for a five-year swap, for example, means that the fixed interest rate payable in return for receiving six-month dollar Libor is 55 basis points above the equivalent US Treasury rate. Similarly the fixed rate receivable under the opposite swap is 50 basis points above the Treasury rate. In the sterling interest rate swap market, the bid and offer prices are usually quoted as absolute rates, again semi-annually, in relation to six-month Libor. The difference reflects the closer relation between the swap and government security in the dollar than in the sterling market. The existence of the US Treasury bond repo market greatly facilitates the hedging and warehousing of swaps and is one reason why the dollar interest rate swap market dwarfs swaps in other currencies.

The contrast between the mature, highly liquid dollar interest rate swap market and the relatively illiquid sterling interest rate swap market is an interesting one. Chart 1 shows the margin between the sterling swap price (fixed payment versus six-month sterling Libor) and the par yielding gilt, and the margin or spread of the dollar

Chart 1
Spreads on £ and $ interest rate swaps[a]

Daily data, April 1984–September 1986



(a) Five-year swap price (pay fixed versus six-month Libor) minus government security yield.

(1) The data in this appendix were supplied by Morgan Grenfell & Co.Limited.

swap price (fixed payment versus six-month dollar Libor) over the US Treasuries for the period May 1984–September 1986. All rates are for five-year maturities. There are three striking features of this chart; the greater volatility in the sterling interest rate swap market; the fact that for some of this period the sterling swap price was below the gilt; and the widening of the margin in both markets since the beginning of 1986. Each point is discussed in more detail in the following sections.

Dollar interest rate swaps

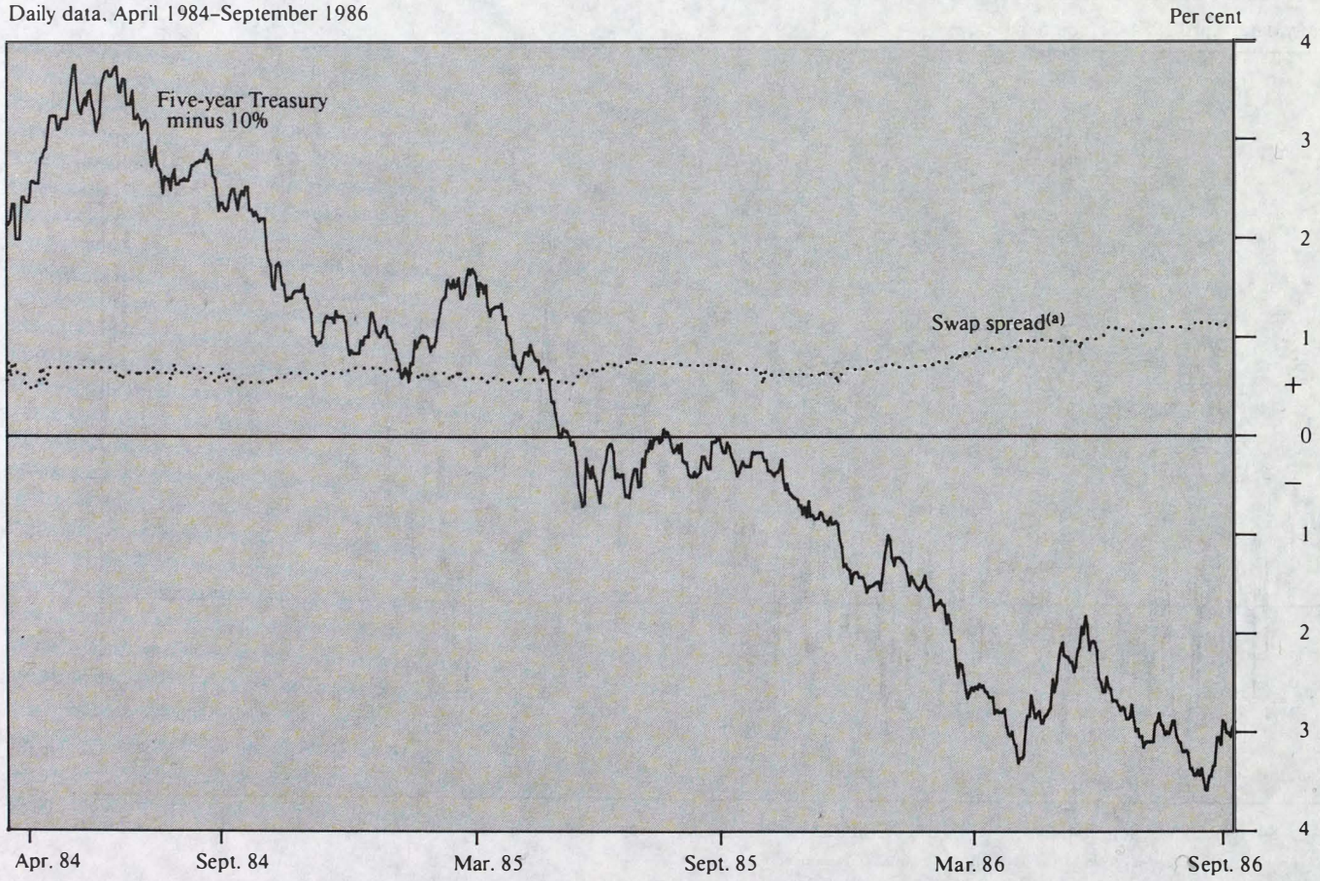
A feature of the dollar interest rate swap market has been the relative stability of the margin of the swap over the US Treasury, given the volatility of absolute interest rates. For most of the period March 1984–January 1986 the five-year swap price remained within a range of 55 to 75 basis points above the yield on the five-year US Treasury, which peaked at 13¾% at end-May 1984 before falling to 8½% by January 1986 (see Chart 2). Moreover, daily fluctuations in the Treasury yield were on occasion as much as 45 basis points, while daily movements in the swap margin of more than 5 basis points were infrequent. Over this period the bid/offer spread on the swap price was also fairly stable at around 5 basis points.

In some ways the five-year swap is perhaps atypical in its stability. Chart 3 compares the margins over the Treasury of the two-year, five-year and ten-year swaps and shows that overall the five-year swap price has been the least volatile. The chart also illustrates the split between the short and long ends of the market; while the five and ten-year maturities move in tandem, the two-year maturity is both more volatile and uncorrelated. This reflects twists in the interest rate swap yield curve and the different hedging techniques at the short end of the market, together with the fact that the shorter maturities are less closely aligned to the bond markets. Short dollar interest rate swaps are often hedged in the eurodollar futures market, rather than the administratively more complex and higher risk Treasury cash and repo market.

The change in the slope of the dollar yield curve from negative to positive in early 1986 coincided with the widening of spreads on the longer maturities. The five-year swap spread increased from around 70 basis points at end-January 1986 to 100 basis points in June, and by a further 15 basis points by September. The bid/offer spread also widened to about 10 basis points. Part of the explanation is the sharp fall in the five-year US Treasury yield to about 7½% by June and 6½% in September, which produced a surplus of potential fixed-rate payers over floating-rate payers in the swap market, pushing up the spread over the Treasury yield. As the steepening of the yield curve suggests, interest rate expectations had become more bearish and more volatile and there was a surfeit of borrowers wishing to lock into

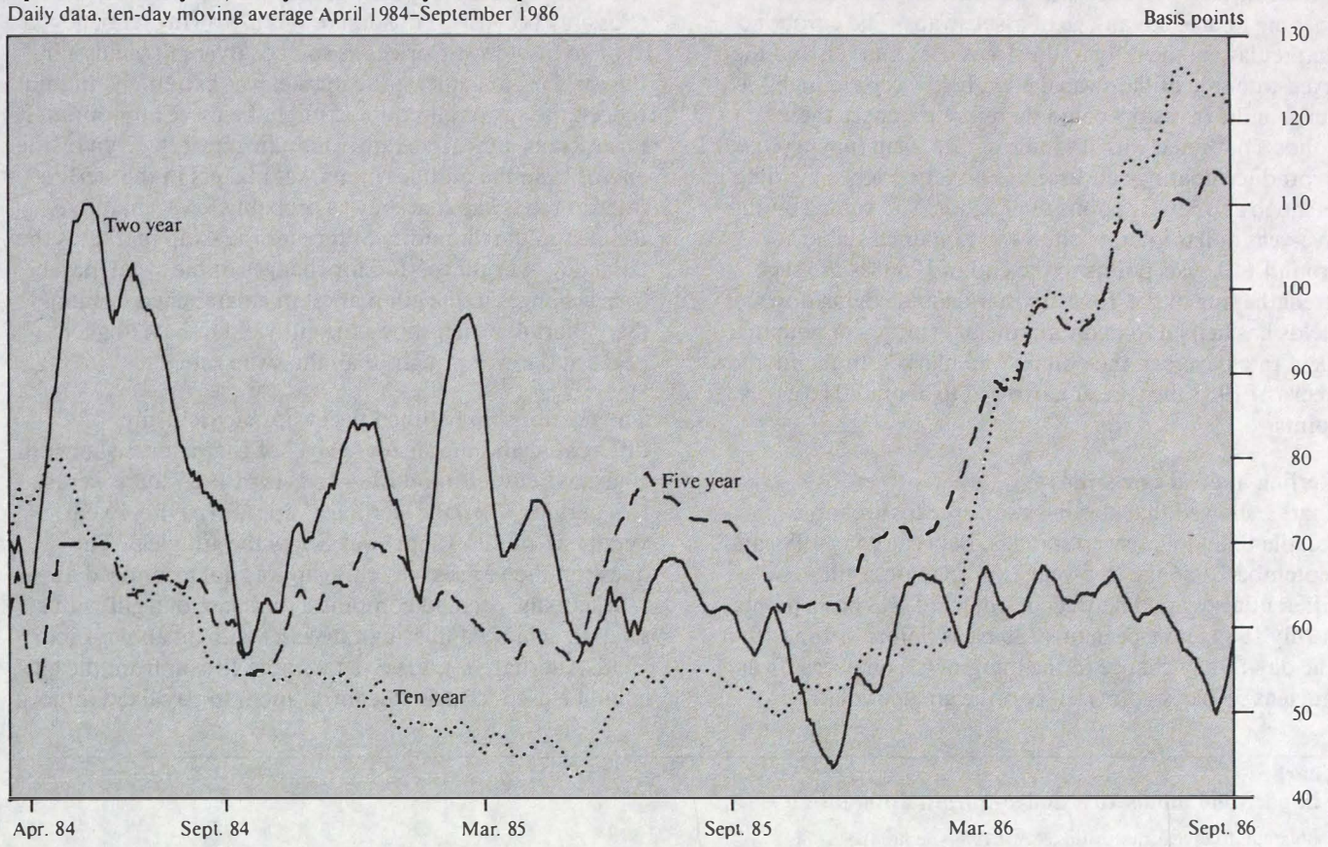
Chart 2
Five-year Treasury bond yield and five-year swap spread

Daily data, April 1984–September 1986



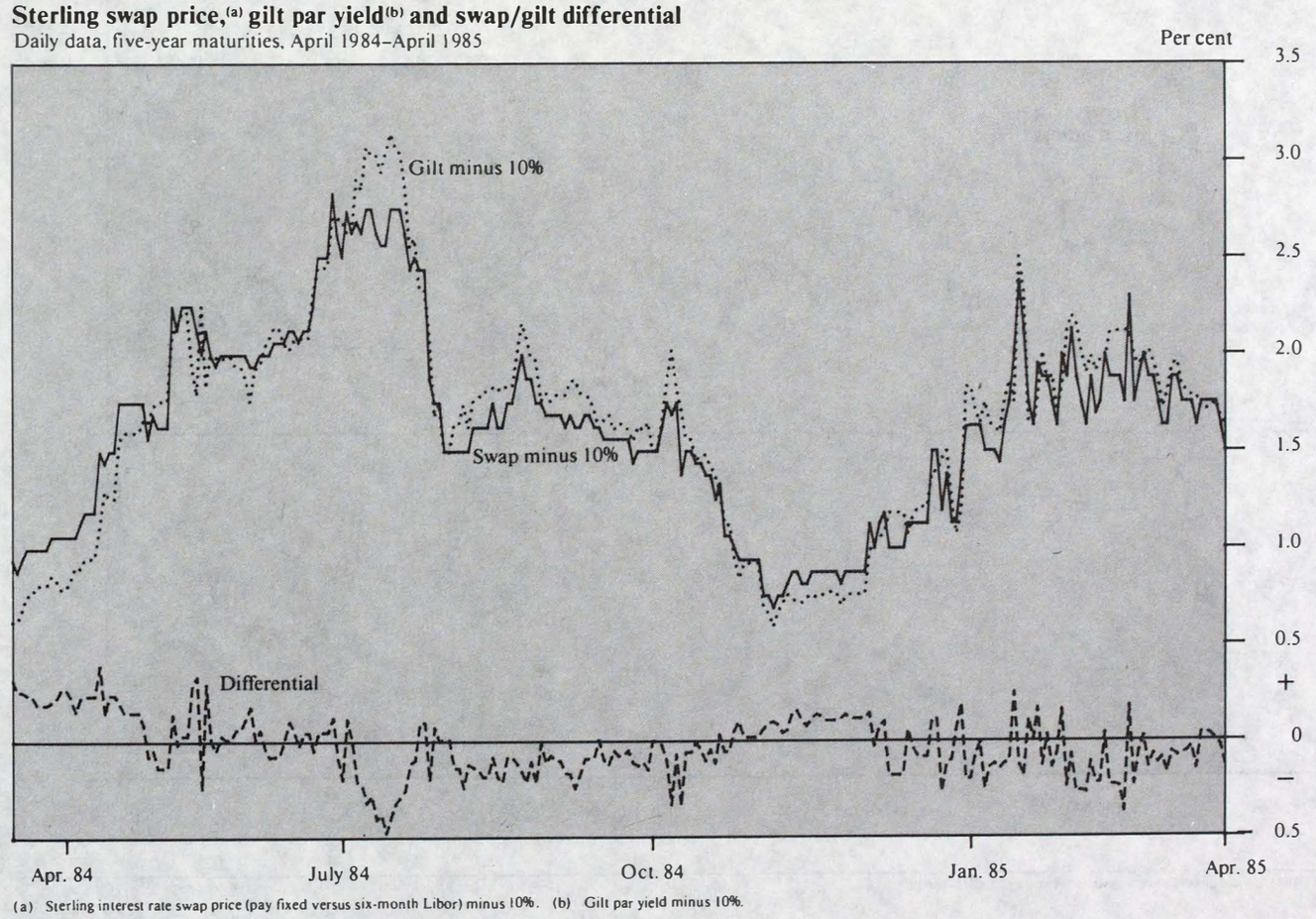
(a) Five-year swap price (pay fixed versus six-month Libor) minus five year Treasury bond yield.

Chart 3
Spreads on two year, five year and ten year swaps [a]
Daily data, ten-day moving average April 1984–September 1986



(a) Dollar interest rate swap price minus Treasury yield.

Chart 4
Sterling swap price,[a] gilt par yield[b] and swap/gilt differential
Daily data, five-year maturities, April 1984–April 1985



(a) Sterling interest rate swap price (pay fixed versus six-month Libor) minus 10%. (b) Gilt par yield minus 10%.

historically low cost of funds. The supply of potential fixed-rate payers was further increased by investors wishing to take advantage of asset swaps. The eurobond market lagged the rally in the Treasuries market, and the fixed-rate side of the swap drifted below certain high-yield eurobonds. Investors could therefore purchase these bonds, combined with an interest rate swap (paying fixed) to produce floating-rate assets (synthetic FRNs) yielding as much as 35 basis points over Libor. The spread on the five-year dollar interest rate swap remained stable at around 110 basis points to the end of 1986, as the slight strengthening of the Treasury market and edging down of yields has helped to maintain the oversupply of potential fixed-rate payers in the dollar swap market. In the first few weeks of 1987 the spread narrowed to about 90 basis points.

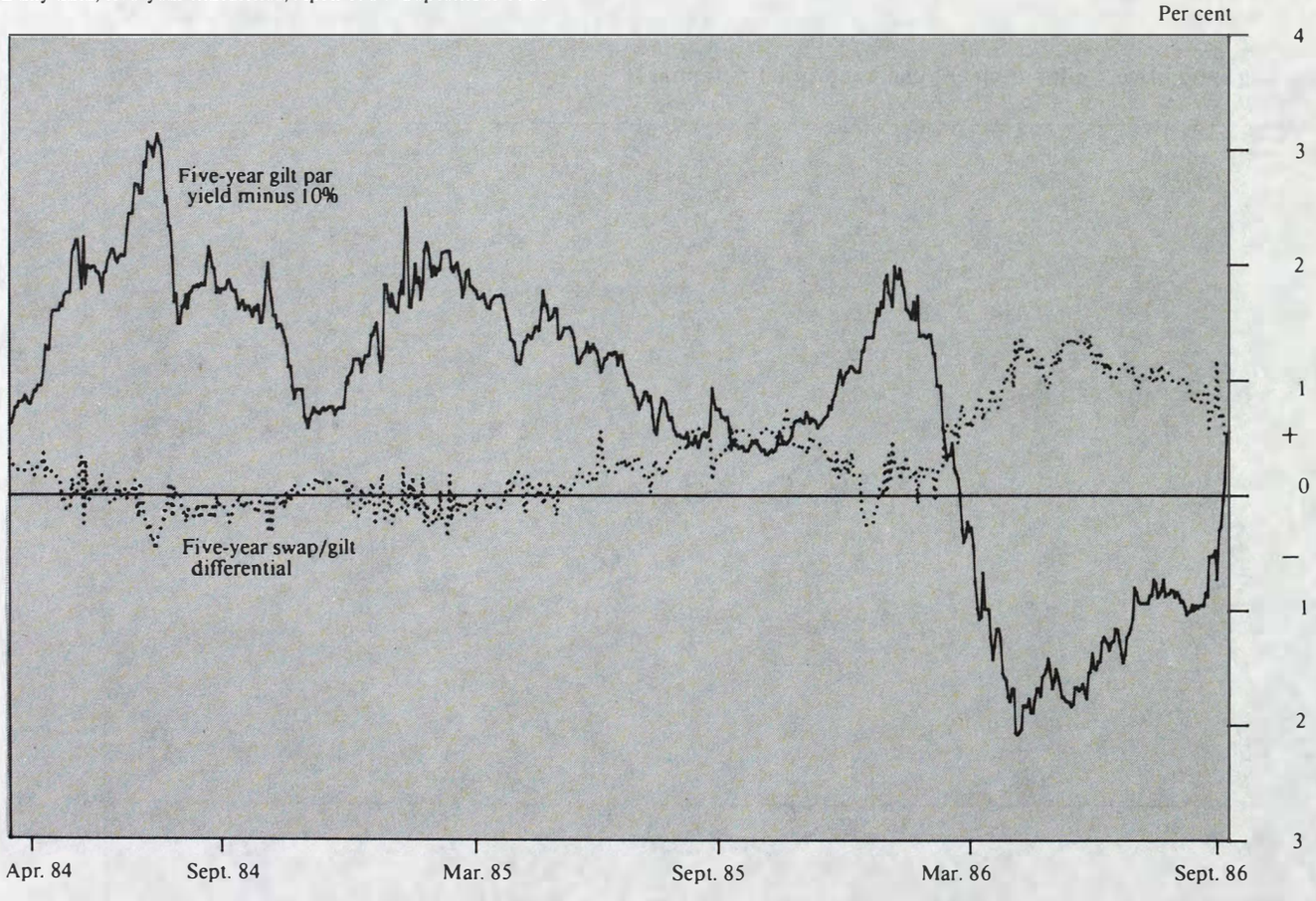
Sterling interest rate swaps

Chart 1 showed that sterling swap spreads are more volatile than dollar swap spreads. Between May 1984 and September 1986 the five-year swap/par yield gilt differential[1] varied between a trough of −48 basis points in July 1984 and a peak of +130 basis points in June 1986. The day-to-day change in the margin was on occasion as much as 30 basis points. In part the greater volatility of the sterling swap margin reflects the fact that because of the way prices are quoted, the margin is a residual. (Possibly because of this, there was a growing tendency in 1986 to quote swap prices as spreads over gilt yields.) In the early period at least the market was extremely illiquid: indeed the swap rates quoted might be more appropriately regarded as indicative rather than firm prices. Even by the end of 1986 the number of market makers in the sterling interest rate swap market was probably fewer than five. Related to the illiquidity of the sterling swap market is the tendency over this period for changes in the swap market to lag changes in the gilt market in a dampened fashion. (See Chart 4, which shows the gilt yield to have higher peaks and lower troughs than the swap rate.)

The relationship between the swap/par yield gilt differential and the absolute level of gilt yields is shown in Chart 5. Between June 1984 and April 1985 there were two periods when the sterling swap rate (paying fixed versus six-month Libor) was below the gilt yield. The question then arises why this gap was not arbitraged away. Market players could combine a purchase of a gilt with a swap to achieve a floating-rate asset with an above-Libor yield. Alternatively, the fixed income stream from the gilt could be used to hedge a commitment to pay fixed interest

Chart 5
Gilt par yield minus 10% and swap/gilt differential

Daily data, five-year maturities, April 1984–September 1986



(1) The par yield gilt measure overstates the real swap/gilt differential.

under a swap at a profit. Part of the answer is that such transactions would expand a bank's balance sheet, and the swap/gilt differential seldom yielded the required return on assets—particularly on an after-tax basis. Moreover gilt-edged dealing costs and swap brokerage fees were higher during this period. The illiquidity of the market was probably an additional constraint. Finally, the sterling interest rate swap market was dominated by local authorities, and less directly related to the gilt market.

A more popular source of arbitrage in the market appeared in early 1985 when, following a sharp increase in UK interest rates and troughs in the sterling/Swiss franc and sterling/deutschemark exchange rates, eurosterling yields went well below the gilt yield, reflecting strong European demand for sterling assets coupled with a strong preference on the part of these investors for the tax and registration structures of eurobonds compared with gilts. Some UK borrowers took advantage of this window to issue eurosterling bonds and buy gilts for a running profit. Others issued eurosterling bonds and swapped into sub-Libor funds. A similar arbitrage opportunity occurred in the first few weeks of 1987.

One of the most interesting features of the sterling swap market is the fairly robust negative relationship between the absolute yield on gilts and the swap/gilt differential. The widening in the swap margin over the gilt in the first half of 1986 from around 20 basis points in January to 130 basis points in June is clearly related to the sharp fall in absolute rates, and, as in the dollar swap market, the resulting potential surplus of fixed rate payers. The negative correlation has persisted over the rest of the year; between April and early September the margin fell slightly as gilt yields firmed, while the sharp rise in gilt yields in September resulted in a sharp narrowing of the margin. Nevertheless, the low absolute level of interest rates and the state of interest rate expectations were sufficient to maintain a positive spread, reflecting the supply of fixed-rate payers.