Index Amortizing Rate Swaps

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As short-term interest rates have declined over the past several years, investors have increasingly sought higher yielding investment vehicles. The index amortizing rate (IAR) swap is one of several new instruments that have been developed in response to this investor demand for yield enhancement. An IAR swap is an interest rate swap based on a notional principal amount that may decrease over time in accordance with the path of future interest rates.[1]

The IAR swap market has grown rapidly since its inception in 1990, achieving a market size in late 1993 estimated at $100 billion to $150 billion notional principal. IAR swaps should continue to be popular because they can be an attractive investment under certain interest rate scenarios and a good hedging vehicle for dealers' written options exposures.

This article explains the structure and pricing of IAR swaps, the risks associated with the product, and the uses as well as the growth prospects for the market. We find that while the product has advantages for dealers and investors, its complexity may be a drawback. To price and hedge IAR swaps, dealers must use highly technical models with parameters whose values are difficult to forecast. Investors may have trouble comparing the risk-return tradeoffs of an IAR swap with those of more liquid and traditional instruments.

The structure of IAR swaps

An IAR swap is an over-the-counter contract between two parties to exchange interest payments—one based on a fixed rate and the other on a floating rate—on an amortizing notional principal amount. Like the so-called plain vanilla interest rate swap, the IAR swap involves no exchange of principal. But unlike the plain vanilla swap, whose net interest payments are made on a fixed notional amount, the IAR swap calls for net interest payments made on a notional principal balance that may decrease over the life of the swap. The rate at which the notional principal amount decreases will vary with a specified short-term interest rate according to a schedule predetermined by the two parties. In general, however, notional principal amortizes more quickly when short rates fall and more slowly when short rates rise.[2]

In a typical IAR swap, an end-user[3] (or fixed rate receiver) receives interest payments based on the fixed rate while paying the dealer (or fixed rate payer) floating interest indexed to three-month LIBOR. The amortizing notional amount on which both interest payments are based is typically $100 million at origination. Net interest payments are most often made quarterly throughout the life of the swap, just as they are in a plain vanilla swap.

The standard contractual maturity for an IAR swap is five years with a two-year "lockout" period, meaning that the swap does not start amortizing until the beginning of the third year. The amortization schedule is usually designed so that if short-term interest rates remain unchanged, the IAR swap will have a life of about three years. However, if the floating rate index falls sufficiently, the swap could fully amortize at the end of the lockout period. Alternatively, if rates rise, the swap would amortize at a slower rate and

[1] The IAR swap is also known as an index principal swap (IPS) or an index amortizing swap (IAS)

[2] Despite the use of the term "amortization" by market participants, the amortization of notional principal does not imply payment of principal, it refers to the declining notional principal amount on which interest payments are based

[3] An end-user or customer is typically an institutional investor such as an insurance company, bank, or mutual fund

have a longer than expected maturity, perhaps reaching its five-year maximum life. The variable maturity of an IAR swap is another feature distinguishing it from a plain vanilla swap, which has a fixed maturity date.

Table 1 presents a typical IAR swap amortization schedule If LIBOR remains at 4 50 percent, the swap amortizes by 80 percent per year after the lockout period, if LIBOR rises to 5.50 percent, the swap amortizes at 30 percent per year Alternatively, if LIBOR drops to 3.50 percent, the swap amortizes at 100 percent in year 3 This particular schedule assumes yearly amortization, although quarterly amortization is also common in IAR swap schedules

Changes in future short-term interest rates affect the swap in three ways they 1) directly affect future net interest payments, 2) indirectly affect future net interest payments by changing the principal amount on which interest calculations are based, and 3) alter the maturity of the swap

The interest rate scenarios presented in Table 2 illustrate how the notional principal of an IAR swap amortizes given the schedule set forth in Table 1 If future interest rates follow LIBOR path 2 (case 2), then, in year 3, $800 of the notional principal amortizes, reducing the remaining notional principal to $200 [4]

An IAR swap's maturity is usually described in terms of a weighted average life because the instrument's maturity and notional principal may vary First, the date of the swap's last payment will vary with the path followed by short-term interest rates Second, the date of the last payment can be a misleading representation of the swap's maturity because the remaining notional principal is also variable Consider, for example, two IAR swaps that originate with the same notional principal of $100 While both may end after three years, one may end with a notional principal amount of $60 while the other may end with a notional amount of $30 The weighted average life of an IAR swap is calculated by summing the percentage of the remaining notional principal amounts over each interest rate path These amounts are then averaged across the possible paths. Note that the weighted average life is simply used to describe the instrument's maturity It is not used for pricing and hedging because it does not describe the actual cash flows with sufficient precision.

Table 1
Amortization Schedule of Typical IAR Swap

LIBOR[1] (Percent)	Change in Basis Points	Amortization Rate (Percent)
3 50	−100	100
4 50	0	80
5 50	+100	30
6 50	+200	10

Notes The amortization rate in the table is based on annual changes in LIBOR The terms and conditions of the IAR swap illustrated here are as follows

Notional amount	$1,000
Fixed rate	4 745 percent
Lockout period	2 years
Final maturity	5 years
Payment frequency	Annual
Amortization	After the lockout period, yearly amortization of remaining notional principal balance based on changes of yearly LIBOR

[1] The initial spot rate is 4 50 percent

[4] Given an interest rate of 4 50 in year 3 (case 2), the amortization schedule specifies that $800 of the notional principal will amortize This amortization leaves $200 in remaining notional principal at the end of year 3 In this example, the amortization rate applies to the current outstanding notional principal

Table 2
IAR Swap Notional Principal Balance
Notional Principal Given Various LIBOR Paths

Paths	Year	0-1[1]	1-2[1]	2-3	3-4	4-5
Case 1 declining rates						
LIBOR		4 50	4 00	3 50	3 25	3 00
Notional principal		1,000	1,000	0	0	0
Case 2 stable rates						
LIBOR		4 50	4 50	4 50	4 50	4 50
Notional principal		1,000	1,000	200	40	8
Case 3 rising rates						
LIBOR		4 50	5 01	5 53	5 82	6 13
Notional principal		1,000	1,000	705	539	445

Notes Amortization is applied to the remaining notional principal balance of the previous period and is based on the schedule in Table 1 Amortization for rates not given in Table 1 is computed through linear interpolation

[1] No notional principal amortization during two-year lockout period

Optionality of an IAR swap

The amortizing feature of an IAR swap is an implicit call option that essentially gives the fixed rate payer the right to "call" or cancel a portion of the swap (according to the predetermined schedule) if interest rates decline substantially. The fixed rate payer in an IAR swap thus owns an implicit option analogous (but not identical) to the prepayment option in a callable bond or mortgage security For this right, the fixed rate payer pays a yield premium for the implicit option However, in contrast to the embedded options on long-term rates in callable bonds and mortgage securities, the implicit options in an IAR swap are usually options on short-term interest rates [5]

Because an IAR swap's behavior is dependent on the path of interest rates, the exact set of interest rate options embedded in an IAR swap are difficult to determine directly from the amortization schedule. Instead, these implicit options must be determined indirectly from interest rate models that estimate the IAR swap's exposure profile in different interest rate scenarios. For example, in Table 2, the amount of notional principal remaining in case 2, year 4, depends not only on the short-term rate that will prevail in year 4, but also on the rate that will prevail in year 3 Hence, it is not always possible to purchase the correct number of options or futures contracts in year 1 to hedge the cash flow risk in year 4, since the exposure in year 4 depends on the intermediate path of future interest rates. Specifically, dynamic hedging is required as the exposures to be hedged change with each period

Behavior of IAR swaps when interest rates change

Like a plain vanilla interest rate swap, an IAR swap has a present value for the fixed rate receiver that will fall when interest rates rise and increase when interest rates fall. However, the magnitude of these changes for an IAR swap and a plain vanilla swap differs because of the option-like behavior of the IAR swap. Specifically, when rates fall, the gain in an IAR swap's value is smaller than the gain in a plain vanilla swap's value; when rates rise, the loss in value of an IAR swap exceeds that of a plain vanilla swap.

The chart illustrates the performance difference between an IAR swap and a plain vanilla interest rate swap (of the same maturity as the expected maturity of the IAR swap) from the perspective of the fixed rate receiver. When long and short rates move together (producing parallel shifts of the yield curve), the IAR swap outperforms the plain vanilla interest rate swap in a stable interest rate environment and underperforms it in a volatile environment. In other words, if interest rates do not change by a large amount, an IAR swap offers the investor a more favorable fixed rate of return than the plain vanilla swap because of the option premium embedded in the IAR swap's fixed rate.

[5] Thus, IAR swaps are not ideal hedges for mortgage securities unless perfect correlation exists between long-term and short-term rates

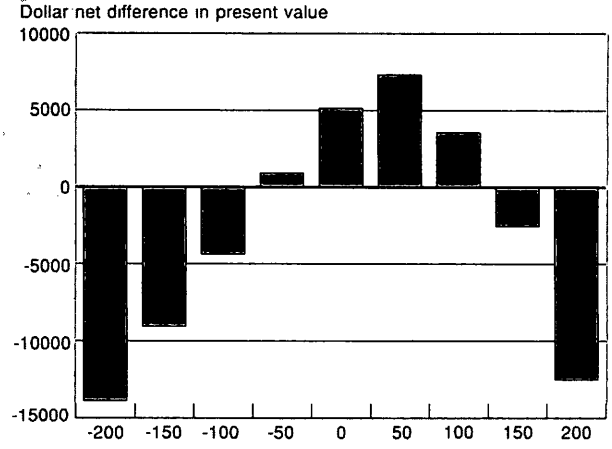
However, for large parallel shifts in the yield curve, the IAR swap will provide a lower return than the plain vanilla swap If both short and long rates fall, the IAR swap will amortize rapidly after the lockout period, subjecting the IAR swap's fixed receiver to reinvestment losses at the lower rates If both short and long rates rise, the amortization rate will slow, lengthening the maturity In this scenario the fixed rate receiver is paid a below-market fixed rate for a longer period than would be the case in the plain vanilla swap

As the chart shows, if the net present value of the plain vanilla swap is subtracted from the net present value of the IAR swap, the difference is similar, but not identical, to the exposure profile of a short straddle.[6] In other words, an IAR swap can be thought of as a plain vanilla swap (of the same maturity as the expected maturity of the IAR swap) combined with a collection of interest rate options written by the fixed rate receiver that replicate the "straddle-like" exposure in the chart. For the fixed rate receiver, the option premium

[6] A short straddle is a collection of written interest rate options Some pay off when rates rise, while others pay off when rates fall

Our chart is modeled loosely on a chart that appeared in *Derivatives Week*, vol 2, no 3 (January 25, 1993)

Net Difference between an Index Amortizing Rate Swap and an Interest Rate Swap from the Perspective of a Fixed Rate Receiver



Notes The net difference equals the present value of the cash flows of the IAR swap along the given interest rate path minus the present value of the cash flows of the interest rate swap along the same interest rate path The interest rate changes, are based on parallel shifts in the yield curve The weighted average life for the IAR swap is three years, with a contractual maturity of five years and a two-year lockout period. The maturity of the interest rate swap is three years The original notional principal for both the IAR swap and the interest rate swap is $1,000,000 The fixed rate on the IAR swap is 4.745 percent and the fixed rate on the interest rate swap is 4.50 percent.

embedded in the fixed rate of the IAR swap causes the IAR swap returns to exceed the plain vanilla swap returns when interest rates stay within a narrow range (because the option is not exercised). But when rates either fall or rise by a large amount, some of the embedded options will be exercised against the fixed rate receiver, thus causing the returns from the IAR swap to fall short of the returns from the plain vanilla swap.

Nonparallel shifts in the yield curve

The embedded options in an IAR swap have complex features that become apparent as soon as nonparallel yield curve changes are considered. If long rates rise and short rates fall, an IAR swap outperforms a plain vanilla swap from the perspective of the fixed rate receiver.[7] As short rates decline, an IAR swap amortizes faster, allowing the fixed rate receiver to enter into another swap at a higher long-term fixed rate, whereas the owner of a plain vanilla swap will continue to hold an instrument that now pays a below-market fixed rate.

Similarly, if long rates fall and short rates rise, the IAR swap will also outperform the plain vanilla swap for the fixed rate receiver. As short rates rise, the IAR swap amortizes at a slower pace, enabling the fixed rate receiver to continue receiving an above-market fixed rate for a longer period. In contrast, the owner of a plain vanilla swap experiences reinvestment losses at the now lower long-term fixed rate when the plain vanilla swap matures.

Pricing of IAR swaps

In principle, the fixed rate of an IAR swap is set at the level that gives the swap an expected net present value of zero at origination. That is, the IAR swap is priced by taking the swap's net cash flows over each of the possible paths of LIBOR rates (in Table 3, three equally likely paths) and solving for the fixed rate that makes the average present value of the net cash flows equal to zero. In practice, all pricing models apply weights to the possible paths. To maintain the internal consistency of the pricing model, these paths and their weights are chosen so that arbitrage possibilities are eliminated.

Table 3 illustrates the difference in pricing between an IAR swap and a plain vanilla swap. Consider an IAR swap with a $1,000 initial notional principal and the amortization schedule presented in Table 1. The cash flows calculated in the example are from the perspective of the fixed rate receiver. For simplicity, assume that the possible future paths of LIBOR rates are the three paths indicated by cases 1, 2, and 3. Case 2 is the path of LIBOR rates implied by forward rates derived from the initial yield curve, and the other two paths are possible alternative interest rate paths.

[7] In reality, medium-term rates of under five years are relevant for IAR swaps because the contractual maturity in most IAR swaps is five years or less.

The price (or the fixed rate) of the plain vanilla swap is the fixed rate that causes the present value of the fixed payments to equal the present value of floating payments as forecast by the initial forward rates.[8] The fixed rate of the IAR swap is 4.745 percent, while the fixed rate of the plain vanilla interest rate swap is 4.50 percent. In effect, the 24.5 basis point difference between the two rates represents the value of the implicit options in the IAR swap.

The complexity of the IAR swap's valuation process is itself a source of uncertainty. Market participants will use different assumptions about volatilities, future interest rate paths, and the correlations between long and short rates in their IAR swap interest rate models. These different assumptions can create larger price variations between different market participants' pricing models for IAR swaps than is the case with plain vanilla interest rate instruments, which are priced using the observable yield curve.

Risk issues

Price risk

The greatest risk for an investor (that is, fixed rate receiver) in an IAR swap is the opportunity cost of holding an IAR swap in the event of a significant interest rate move up or down. If short rates rise sufficiently, the net payout for the fixed rate receiver (end-user) can become negative if the amount of the floating rate payment exceeds the amount of the fixed rate receipt. This interest rate risk is amplified in an IAR swap because as rates rise, the swap's amortization slows and the fixed rate receiver may have a negative cash flow for a longer period.

Since the birth of the IAR swap market in 1990, short-term rates have declined. Thus, most IAR swaps initiated to date have ended immediately after the lockout period, and the behavior of IAR swaps in a rising rate environment has not yet been tested.[9]

Many end-users may find it difficult to determine precisely the risk-return tradeoff provided by IAR swaps. The exact set of interest rate options embedded in an IAR swap is not easily identified because of the IAR swap's path-dependent nature. Hence, buyers cannot go to an exchange and price a specific set of options equivalent to those embedded in the IAR swap. As a result, fixed rate receivers will have a difficult time judging whether or not they have received the appropriate premium for the implicit options

[8] Alternatively, the plain vanilla swap can be priced over the same set of possible interest rate paths used in pricing the IAR swap. If these interest rate paths satisfy a consistency condition known as the "arbitrage-free" condition—a requirement that profitable, riskless strategies be ruled out—then the two pricing methods for the plain vanilla swap will produce the same price.

[9] Recently, barrier-type options called "knock-outs" have been offered on some IAR swap contracts. A knock-out clause typically states that if interest rates rise above a certain level (the knock-out rate), the swap will terminate automatically. This feature effectively eliminates the extension risk for the end-user. However, these contracts are expensive and thus tend to defeat the yield-enhancement feature of the IAR swap.

they have sold, because they lack readily apparent and equivalent market prices for the set of options embedded in an IAR swap

Hedging risk

To hedge IAR swaps, dealers use interest rate term structure models that incorporate several assumptions about the volatility of rates and the correlation of movements in short and long rates As a first step, the dealers estimate the IAR swap's exposures with an interest rate model [10] Next, they take into account the offsetting exposures already in their portfolios to determine a residual exposure. These residual exposures (both to changes in interest rate levels and changes in interest rate volatilities) are then hedged, usually using Eurodollar futures and interest rate options.

An interest rate model is required for hedging because, as mentioned previously, the exact structure of the interest rate options embedded in an IAR swap cannot be easily determined from the swap's amortization schedule The path-dependent nature of the IAR swap requires dealers to use interest rate models to "reveal" and then dynamically hedge the swap's embedded options because the path-dependency of these options cannot be replicated by any simple buy-and-hold options portfolio. Moreover, dealers must use sensitivity analysis or simulations of both the IAR swap and the rest of their portfolios to determine the degree to which the IAR swaps and other exposures in the portfolio offset each other. Hence, hedging the IAR swap's exposures depends on the reliability of the interest rate model used in the simulations

Model risk

Estimating the true profitability over time of an IAR swap can be difficult. Because of the IAR swap's path-dependent behavior, the instrument cannot be easily broken down into

[10] See Julia Fernald, "The Pricing and Hedging of Index Amortizing Rate Swaps," in this issue of the Quarterly Review

Table 3

Comparison of the Pricing of an IAR Swap and a Plain Vanilla Swap

Year	Forward Rate (Percent)	Notional Principal	Fixed Payment†	Floating Payment‡	Net§		Present Value of Net
IAR swap pricing							
Case 1							
0-1	4 50	1,000	47 45	45 00	2 45		2 35
1-2	4 00	1,000	47 45	40 00	7 45		6 85
2-3	3 50	0	0 00	0 00	0 00		0 00
3-4	3 25	0	0 00	0 00	0 00		0 00
4-5	3 00	0	0 00	0 00	0 00		0 00
						Sum	9 20
Case 2							
0-1	4 500	1,000	47 45	45 00	2 45		2 35
1-2	4 500	1,000	47 45	45 00	2 45		2 24
2-3	4 500	200	9 49	9 00	0 49		0 43
3-4	4 500	40	1 90	1 80	0 10		0 08
4-5	4 500	8	0 38	0 36	0 02		0 02
						Sum	5 12
Case 3							
0-1	4 50	1,000	47 45	45 00	2 45		2 35
1-2	5 01	1,000	47 45	50 10	-2 65		-2 41
2-3	5 53	705	33 45	38 99	-5 54		-4 79
3-4	5 82	539	25 58	31 37	-5 79		-4 73
4-5	6 13	445	21 12	27 28	-6 16		-4 74
						Sum	-14 32
Average¶	=	(9 20	+	5 12	+	-14 32)	-3	=	0 00
Plain vanilla swap pricing††							
1	4 50	1,000	45 00	45 00	0 00		0 00
2	4.50	1,000	45 00	45 00	0 00		0 00
3	4 50	1,000	45 00	45 00	0 00		0 00

† Fixed payments are calculated by multiplying notional principal by 4 745 percent
‡ Floating payments are calculated by multiplying notional principal by LIBOR
§ Net is the difference between the fixed and floating payments
¶ The average is calculated under the assumption that the three possible LIBOR paths are equally likely
†† Since the average life of this IAR swap is approximately three years, the comparable swap is the three-year plain vanilla swap

pieces that look exactly like other instruments whose prices are known. Hence, the product's valuation depends critically on interest rate models. This dependence on interest rate models and the possibility of mispricing is known as "model risk."

The set of possible interest rate paths over which an IAR swap is priced and valued is usually generated using one or two factor interest rate models. One factor interest rate models implicitly assume perfect correlation between changes in short and long rates. Two factor interest rate models, by contrast, can simulate imperfectly correlated short- and long-term rates. In this respect, two factor models would appear to provide better representations of the term structure than one factor models. Two factor models, however, require their users to make explicit assumptions about the correlation between separately varying short- and long-term rates. If inappropriate assumptions are made, then a two factor model's results can be less accurate.

The pricing models must also rely on assumptions about the volatility of short- and long-term rates. Assumptions about volatility, like those concerning the correlation of short and long rates, make IAR swaps difficult to "mark to market" and to hedge. The correlation of rates, however, is an especially difficult parameter to forecast, and problems can arise because pricing model results are particularly sensitive to the assumed magnitude of the correlation. For example, the assumptions about correlations can have a substantial impact on the level of the fixed rate determined by the model.

Closely related to model risk is "personnel risk." When the IAR swap market was first formed, finding personnel familiar with the instrument's pricing and hedging demands was difficult. In some cases, only one trader at an institution may have been familiar with IAR swap pricing models. If that trader left the firm, a knowledge gap could arise, making the risk management of outstanding IAR swap positions more difficult. Fortunately, personnel risk tends to diminish as a product matures and market participants become more familiar with the instrument's behavior in a variety of market conditions.

Liquidity risk

For end-users, significant illiquidity exists in the IAR swap market because of the difficulties of hedging and the customized nature of the instrument. Because only dealers with sizable interest rate option exposures can successfully compete in the IAR swap market, only a handful actively trade this product. Smaller dealers, who generally lack sizable interest rate options positions, find it more difficult to hedge IAR swaps in a cost-effective way and typically execute these swap deals only if they can earn a substantial margin up front. Without a sizable interest rate options book, small dealers would have to sell options in the market to offset their IAR swap positions.

Dealers have expressed their willingness to make a secondary market in this product for customers, but as of yet an active secondary market has not developed.[11] Normal industry practice is for the initiating dealer to make a bid to the customer who wants to liquidate an existing contract. But if the dealer chooses not to buy back the swap from an end-user and the end-user is unable to find another dealer to assume the swap, the end-user cannot easily liquidate or offset the position. Hedging, instead of unwinding, would be difficult for most end-users because the precise nature of the exposure to be hedged can be discovered only with an interest rate model, which IAR swap end-users normally do not possess.

Credit risk

Principal risk is not present in an IAR swap because there is no principal investment (as there is in mortgage securities). Hence, potential credit losses are limited to the net exchange of interest payments over the remaining life of the swap. Like plain vanilla interest rate swaps, IAR swaps are priced with a zero net present value at inception. As short-term interest rates change, the net interest payments will acquire a net positive or negative present value. This present value is the credit exposure between the two counterparties and is usually only a small fraction of the notional principal. Thus, IAR swaps pose no additional or fundamentally different credit or settlement risks than those already present in the plain vanilla interest rate swap.

The market for IAR swaps

The number of dealers currently active in the IAR swap market is small but growing. While major U.S. securities firms dominate the market, U.S. money center banks and foreign bank subsidiaries also participate in the market. New York is the market center for IAR swaps, and most IAR swaps are denominated in U.S. dollars. The low short-term interest rate environment in the United States has no doubt been more conducive to the development of the IAR swap market than have other countries' interest rate environments. If the yield curves of other countries begin to steepen, however, investors may begin to use IAR swaps pegged to non-U.S. rates.

Initially, regional banks were the primary end-users of IAR swaps. Much of the recent growth in demand, however, has come from mutual funds, insurance companies, and other institutional investors.

Uses of IAR swaps

For dealers with sophisticated risk management systems, IAR swaps provide offsets to the exposures arising from

[11] Secondary market liquidity has yet to be tested in the swaps initiated before or during 1991 because these swaps ended immediately after the lockout period owing to a dramatic drop in rates over the past two years.

their over-the-counter interest rate options business. As fixed rate payers, the dealers own the options embedded in the IAR swap. Hence they can use these options to hedge their written interest rate option positions as well as other exposures in their interest rate swap book.

From the viewpoint of investors such as mutual funds, insurance companies, and regional banks, IAR swaps provide enhanced yields in a low interest rate environment. These investors, as writers of the options embedded in IAR swaps, are essentially speculating that interest rate changes will be less volatile than buyers of the embedded options expect. In other words, these investors are betting that short- and medium-term rates will remain unchanged or will rise more slowly than predicted by the forward curve. If this scenario does in fact occur, investors will receive an above-market fixed return over the life of the swap from the premiums on the unexercised implicit options that they sold in the swap.

Investors also find IAR swaps to be a useful substitute for mortgage-related securities such as collateralized mortgage obligations (CMOs) and pass-throughs. IAR swaps offer mortgage-bond-type yields and a similar risk profile, but remove the idiosyncratic portion of prepayment risk associated with mortgage securities. Idiosyncratic prepayment risk refers to risk not directly related to changes in interest rates. For example, the need to relocate or a death in the family may prompt a homeowner to prepay a mortgage in what would otherwise seem to be an unfavorable interest rate environment. IAR swaps eliminate risks of this kind, leaving only the interest-rate-sensitive portion of prepayment risk.

For many end-users, the IAR swap combined with a position in Treasury securities provides additional advantages over owning CMOs and other types of cash mortgage instruments. IAR swaps offer a less uncertain absolute final maturity than do CMOs, and as a result, they have a more predictable weighted-average-life profile than CMOs and other mortgage assets. IAR swaps also have fewer operational complexities than mortgage securities. For example, the IAR swaps' typical quarterly pay structure is easier to track than the pay structure of mortgage-backed securities, whose principal and interest payments must be recalculated monthly as prepayment rates change.

By entering into an IAR swap while holding Treasury securities, a regional bank can increase its liquidity while receiving yields similar to those of a CMO and maintaining an interest rate exposure comparable to a mortgage product's. Dealers' marketing materials for IAR swaps also emphasize "capital efficiency," suggesting that some regional bank end-users use IAR swaps to reduce capital requirements. A position combining government securities and an IAR swap has low capital requirements that can offer advantages over the purchase of similar short-dated CMO securities. Note, however, that this difference in capital requirements is justified by the lack of any principal risk in the IAR swaps.

Size and growth prospects

The IAR swap market has been expanding rapidly for the past two years, showing particularly fast growth through the first half of 1993. An estimated $100 billion to $150 billion in notional principal has been originated since 1990. It is unlikely that this expansion will slow markedly unless the yield curve flattens dramatically.

The market for IAR swaps to date is almost completely one-way in nature. Dealers are almost exclusively the fixed rate payers (buyers of the embedded options), and end-users are almost exclusively the fixed rate receivers (writers of the embedded options). Recently, however, a small interdealer market has developed and a modest number of transactions have been completed through interdealer brokers.

Although the market seems to be expanding and maturing, growth could ultimately be limited by dealers' inability to sell the embedded options they have purchased by paying the fixed rate. Dealers must manage their options risk and thus do not want a large net long or net short options position. Dealers may be forced to cease writing IAR swaps if they cannot use the purchased options to hedge other written option risk or if they cannot resell the long options exposures. The cost of hedging the residual exposures created by unmatched positions can become prohibitive, especially as the IAR swap market becomes more competitive and the cost of the embedded options begins to increase.[12] In fact, some dealers have shown reluctance to originate new transactions because the difficulties of hedging and evaluating the prospective profitability of these instruments become more critical as spreads narrow.[13]

Conclusions

IAR swaps have proved useful to both investors and dealers. Investors in this instrument can acquire a position that pays off if rates rise more slowly than predicted by the forward curve. Investors in the swaps have also earned enhanced yields comparable to those on mortgage bond securities while remaining exempt from the idiosyncratic portion of the prepayment risk embedded in mortgage securities. Through IAR swaps, investors have been able to earn short-dated mortgage-type yields for at least two

[12] If dealers were able to sell all of the IAR swaps' embedded options, they would not be forced to go to the Eurodollar futures market to hedge residual risk not offset within their portfolio of other options. Alternatively, if a two-way market for IAR swaps existed, dealers would be able to receive the fixed rate and create a natural hedge for those existing IAR swap positions where they are the fixed rate payer.

[13] The rating agencies have prohibited dealers from placing IAR swaps in their special-purpose AAA-rated swap subsidiaries. The agencies cite concerns that the one-way nature of the IAR swap market would make it more difficult to unwind such a swap book in a timely manner.

years, while many cash mortgage securities have prepaid Dealers with large interest rate options books have found IAR swaps attractive as an alternative instrument for hedging the exposures arising from their over-the-counter options business. In other words, IAR swaps have created a natural offset for most dealers' net short positions in options, thereby helping dealers to meet the market's demand for interest rate options

Most of the risks associated with IAR swaps are similar to those of other instruments. The IAR swap poses the same threat of negative cash flows as plain vanilla interest rate swaps or equity-index swaps, along with prepayment and reinvestment risks similar to those of mortgage securities. Nevertheless, while IAR swaps pose few unique risks for most market participants, significant problems may materialize in a portfolio with a high concentration of IAR swaps

Certainly, model risk figures more prominently in IAR swaps than in other kinds of instruments. Pricing and hedging IAR swaps require highly technical interest rate models, and the absence of benchmark market prices and the instrument's relatively long life mean that pricing model inaccuracies may not become immediately apparent A dealer who enters the market without strong technical expertise may encounter problems arising from mispricing and mishedging Risk management systems in place for plain vanilla interest rate swaps and options may not be sufficient to handle the complexity of IAR swaps. A firm's internal risk control unit must be capable of accurately monitoring the trading desk's pricing and hedging models for IAR swaps. In sum, dealers who are active in the IAR swap market need considerable technical knowledge as well as strong risk management systems.

The variable maturity feature of IAR swaps requires that an institution's risk management system take proper account of longer term exposures embodied in these instruments For example, excessive emphasis by management on short-term trading results may create incentives to enter into IAR swaps strictly for short-term yield enhancement or trading gains, without consideration of the long-term performance results of the instrument Note, however, that this problem exists for all instruments with medium- to long-term option-like exposure, not only IAR swaps.

This problem highlights potential weaknesses in current methods of recognizing trading gains in accounting systems For example, the fixed rate return of an IAR swap contains an option premium for future option-like liabilities or exposures. This feature leads one to ask how much of an IAR swap's yield premium should be incorporated in current income From a broader perspective, the proliferation of IAR swaps and similarly complex financial transactions underscores the need for accounting and disclosure practices suited to such instruments

Appendix: Reverse Index Amortizing Rate Swaps

Instrument structure

Anticipating a possible rise in short-term interest rates, investors are seeking to limit potential losses on their floating rate exposures. In response to this demand, dealers are currently marketing a variation of the IAR swap called the reverse index amortizing rate swap or RIAR swap Like an IAR swap, an RIAR swap is an interest rate swap whose notional principal amortizes at a rate that varies with the level of market interest rates according to a predetermined schedule. In a typical RIAR swap, as in an IAR swap, an end-user receives the fixed rate while paying the dealer a floating rate An RIAR swap's amortization schedule differs from that of an IAR swap, however, in calling for the notional principal to amortize more quickly as market interest rates rise For example, if the floating rate index rises sufficiently, the swap could fully amortize at the end of the lockout period Alternatively, if rates decrease, the predetermined structure of the RIAR swap could cause the swap to amortize more slowly or, in some cases, not at all.

The amortizing feature of an RIAR swap can be viewed as an implicit put option, giving the floating rate payer the right to "put" or reduce a floating rate liability if rates increase For this right, the floating rate payer receives a somewhat lower fixed rate than would be paid on a plain vanilla interest rate swap

At the present time a small number of U.S securities firms and money center banks are developing this product Only a handful of trades are believed to have taken place in the market to date

RIAR swaps are being marketed to corporate end-users, banks, mutual funds, insurance companies, and other institutional investors.

Risks

The RIAR market is presently one-sided To date, only dealers have written the embedded put option in the RIAR swap, and in their normal course of business, they are typically net sellers (writers) of options. Thus, for dealers with net short option positions, writing put options embedded in RIAR swaps may increase their overall portfolio's residual exposure and raise hedging costs.

Like IAR swaps, RIAR swaps involve no principal risk The greatest risk to an investor would be the opportunity cost of holding an instrument paying a below-market rate of interest if rates were to remain stable.