The Role of Interest Rate Swaps in Corporate Finance

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A n interest rate swap is a contractual agreement between two parties to exchange a series of interest rate payments without exchanging the underlying debt. The interest rate swap represents one example of a general category of financial instruments known as derivative instruments. In the most general terms, a derivative instrument is an agreement whose value derives from some underlying market return, market price, or price index.

The rapid growth of the market for swaps and other derivatives in recent years has spurred considerable controversy over the economic rationale for these instruments. Many observers have expressed alarm over the growth and size of the market, arguing that interest rate swaps and other derivative instruments threaten the stability of financial markets. Recently, such fears have led both legislators and bank regulators to consider measures to curb the growth of the market. Several legislators have begun to promote initiatives to create an entirely new regulatory agency to supervise derivatives trading activity. Underlying these initiatives is the premise that derivative instruments increase aggregate risk in the economy, either by encouraging speculation or by burdening firms with risks that management does not understand fully and is incapable of controlling.[1] To be certain, much of this criticism is aimed at many of the more exotic derivative instruments that have begun to appear recently. Nevertheless, it is difficult, if not impossible, to appreciate the economic role of these more exotic instruments without an understanding of the role of the interest rate swap, the most basic of the new generation of financial derivatives.

[1] For a review of these stated concerns, recent policy initiatives, and pending legislation, see Cummins (1994a, 1994b), Karr (1994), and Rehm (1994).

Although the factors accounting for the remarkable growth of the swaps market are yet to be fully understood, financial economists have proposed a number of different hypotheses to explain how and why firms use interest rate swaps. The early explanation, popular among market participants, was that interest rate swaps lowered financing costs by making it possible for firms to arbitrage the mispricing of credit risk. If this were the only rationale for interest rate swaps, however, it would mean that these instruments exist only to facilitate a way around market inefficiencies and should become redundant once arbitrage leads market participants to begin pricing credit risk correctly. Thus, trading in interest rate swaps should die out over time as arbitrage opportunities disappear—a prediction that is at odds with actual experience.

Other observers note that the advent of the interest rate swap coincided with a period of extraordinary volatility in U.S. market interest rates, leading them to attribute the rapid growth of interest rate derivatives to the desire on the part of firms to hedge cash flows against the effects of interest rate volatility. The timing of the appearance of interest rate swaps, coming as it did during a period of volatile rates, seems to lend support to such arguments. Risk avoidance alone cannot explain the growth of the swaps market, however, because firms can always protect themselves against rising interest rates simply by taking out fixed-rate, long-term loans or by bypassing credit markets altogether and issuing equity to fund investments.

Recent research emphasizes that interest rate swaps offer firms new financing choices that were just not available before the advent of these instruments, and thus represent a true financial innovation. This research suggests that the financing choices made available by interest rate swaps may help to reduce default risk and may sometimes make it possible for firms to undertake productive investments that would not be feasible otherwise. The discussion that follows explains the basic mechanics of interest rate swaps and examines these rationales in more detail.

1.   FUNDAMENTALS OF INTEREST RATE SWAPS

The most common type of interest rate swap is the fixed/floating swap in which a fixed-rate payer promises to make periodic payments based on a fixed interest rate to a floating-rate payer, who in turn agrees to make variable payments indexed to some short-term interest rate. Conventionally, the parties to the agreement are termed counterparties. The size of the payments exchanged by the counterparties is based on some stipulated notional principal amount, which itself is not paid or received.

Interest rate swaps are traded over the counter. The over-the-counter (OTC) market is comprised of a group of dealers, consisting of major international commercial and investment banks, who communicate offers to buy and sell

swaps over telecommunications networks. Swap dealers intermediate cash flows between different customers, acting as middlemen for each transaction. These dealers act as market makers who quote bid and asked prices at which they stand ready to either buy or sell an interest rate swap before a customer for the other half of the transaction can be found. (By convention, the fixed-rate payer in an interest rate swap is termed the buyer, while the floating-rate payer is termed the seller.) The quoted spread allows the dealer to receive a higher payment from one counterparty than is paid to the other.

Because swap dealers act as intermediaries, a swap customer need be concerned only with the financial condition of the dealer and not with the creditworthiness of the other ultimate counterparty to the agreement. Counterparty credit risk refers to the risk that a counterparty to an interest rate swap will default when the agreement has value to the other party.[2] Managing the credit risk associated with swap transactions requires credit-evaluation skills similar to those commonly associated with bank lending. As a result, commercial banks, which have traditionally specialized in credit-risk evaluation and have the capital reserves necessary to support credit-risk management, have come to dominate the market for interest rate swaps (Smith, Smithson, and Wakeman 1986).

The discussion that follows largely abstracts from counterparty credit risk and the role of swap dealers. In addition, the description of interest rate swaps is stylized and omits many market conventions and other details so as to focus on the fundamental economic features of swap transactions. For a more detailed description of interest rate swaps and other interest rate derivatives, see Kuprianov (1993b). Burghardt et al. (1991) and Marshall and Kapner (1993) provide more comprehensive treatments.

Mechanics of a Fixed/Floating Swap

The quoted price of an interest rate swap consists of two different interest rates. In the case of a fixed/floating swap, the quoted interest rates involve a fixed and a floating rate. The floating interest rate typically is indexed to some market-determined rate such as the Treasury bill rate or, more commonly, the three- or six-month London Interbank Offered Rate, or LIBOR.[3] Such a swap is also known as a generic, or plain-vanilla, swap.

The basic mechanics of a fixed/floating swap are relatively straightforward. Consider an interest rate swap in which the parties to the agreement agree to

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[2] An increase in market interest rates, for example, increases the value of a swap agreement to the fixed-rate payer, who will subsequently receive higher interest rate payments from the floating-rate payer.

[3] The London Interbank Offered Rate is the rate at which major international banks with offices in London stand ready to accept deposits from one another. See Goodfriend (1993) or Burghardt et al. (1991) for a detailed description of the Eurodollar market.

exchange payments at the end of each of T periods, indexed by the variable $t = 1, 2, \ldots, T$. Let $\overline{r^s}$ denote the fixed rate and $r^s(t)$ denote the floating interest rate on a fixed/floating swap. Payments between the fixed- and floating-rate payers commonly are scheduled for the same dates, in which case only net amounts owed are exchanged. The net cost of the swap to the fixed-rate payer at the end of each period would be $\overline{r^s} - r^s(t)$ for each \$1 of notional principal. If the swap's fixed rate is greater than the variable rate at the end of a period (i.e., $\overline{r^s} > r^s(t)$), then the fixed-rate payer must pay the difference between the fixed interest payment on the notional principal to the floating-rate payer. Otherwise, the difference $\overline{r^s} - r^s(t)$ is negative, meaning that the fixed-rate payer receives the difference from the floating-rate payer. The net cost of the swap to the floating-rate payer is just the negative of this amount. For the sake of notational convenience, the discussion that follows assumes that all swaps have a notional principal of \$1, unless otherwise noted.

Uses of Interest Rate Swaps—Synthetic Financing

Firms use interest rate swaps to change the effective maturity of interest-bearing assets or liabilities. To illustrate, suppose a firm has short-term bank debt outstanding. At the start of each period this firm refinances its debt at the prevailing short-term interest rate, $r^b(t)$. If short-term market interest rates are volatile, then the firm's financing costs will be volatile as well. By entering into an interest rate swap, the firm can change its short-term floating-rate debt into a synthetic fixed-rate obligation.

Suppose the firm enters into an interest rate swap as a fixed-rate payer. Its resulting net payments in each period $t = 1, 2, \ldots, T$ of the agreement are determined by adding the net payments required of a fixed-rate payer to the cost of servicing its outstanding floating-rate debt.

Period t cost of servicing outstanding short-term debt	$r^b(t)$
+ Period t cost of interest rate swap payments	$\overline{r^s} - r^s(t)$
= Period t cost of synthetic fixed-rate financing	$\overline{r^s} + [r^b(t) - r^s(t)]$

Thus, the net cost of the synthetic fixed-rate financing is determined by the swap fixed rate plus the difference between its short-term borrowing rate and the floating-rate index.

Banks often index the short-term loan rates they charge their corporate customers to LIBOR. Suppose the firm in this example is able to borrow at LIBOR plus a credit-quality risk premium, or credit-quality spread, $q(t)$. Suppose further that the swap's floating-rate index is LIBOR. Then,

$$r^b(t) - r^s(t) = [\text{LIBOR}(t) + q(t)] - \text{LIBOR}(t)$$
$$= q(t).$$

The period t cost of synthetic fixed-rate financing in this case is just $\overline{r^s} + q(t)$, the swap fixed rate plus the short-term credit-quality spread $q(t)$.

Now consider the other side to this transaction. Suppose a firm with outstanding fixed-rate debt on which it pays an interest rate of $\overline{r^b}$ enters into a swap as a floating-rate payer so as to convert its fixed-rate obligation to a synthetic floating-rate note. The net period t cost of this synthetic note is just the cost of its fixed-rate obligation plus the net cost of the swap:

$$\text{Period } t \text{ cost of synthetic floating-rate note} = r^s(t) + (\overline{r^b} - \overline{r^s}).$$

The cost of synthetic floating-rate financing just equals the floating rate on the interest rate swap plus the difference between the interest rate the firm pays on its outstanding fixed-rate debt and the fixed interest rate it receives from its swap counterparty.

Thus, interest rate swaps can be used to change the characteristics of a firm's outstanding debt obligations. Using interest rate swaps, firms can change floating-rate debt into synthetic fixed-rate financing or, alternatively, a fixed-rate obligation into synthetic floating-rate financing. But these observations raise an obvious question. Why would a firm issue short-term debt only to swap its interest payments into a longer-term, fixed-rate obligation rather than just issue long-term, fixed-rate debt at the outset? Conversely, why would a firm issue long-term debt and swap it into synthetic floating-rate debt rather than simply issuing floating-rate debt at the outset? The next two sections explore the rationales that have been offered to explain the widespread use of interest rate swaps.

2. INTEREST RATE SWAPS, ARBITRAGE, AND THE THEORY OF COMPARATIVE ADVANTAGE

The rapid growth of the swaps market in recent years strongly suggests that market participants must perceive significant benefits associated with the use of such instruments. The rationale most frequently offered by market participants is that interest rate swaps offer users an opportunity to reduce funding costs.[4] Bicksler and Chen (1986) present what is perhaps the best-known exposition of this viewpoint, which is based on the principle of comparative advantage. In international trade theory, the principle of comparative advantage explains the economic rationale for international trade by showing how different countries facing different opportunity costs in the production of different goods can benefit from free trade with other countries. According to Bicksler and Chen, differential information in different markets, institutional restrictions, and transactions costs create "some market imperfections and the presence

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[4] For example, see Rudnick (1987).

of comparative advantages among different borrowers in these markets" (p. 646). These market imperfections, according to Bicksler and Chen, provide the economic rationale for interest rate swaps.

The Quality-Spread Differential

All firms pay a credit-quality premium over the risk-free rate when they issue debt securities. These credit-quality premiums grow larger as the maturity of the debt increases. Thus, whereas a firm, call it firm A, might pay a credit-risk premium of 50 basis points over the risk-free rate on its short-term debt obligations, the credit-quality premium it is required to pay on longer-term debt, say ten-year bonds, might rise to 100 basis points.

Not surprisingly, firms with good credit ratings pay lower risk premiums than firms with lower credit ratings. Moreover, the credit-quality premium rises faster with maturity for poorer credits than for good credits. Thus, if firm B has a poorer credit rating than firm A, it might pay a credit-risk premium of 100 basis points on its short-term debt while finding it necessary to pay 250 basis points over the risk-free rate to issue long-term bonds. The quality spread between the interest rate paid by the lower-rated firm and that paid by the higher-rated firm is only 50 basis points in the short-term debt market, but rises to 150 basis points at longer maturities. The quality-spread differential, the difference in the quality spread at two different maturities, is 100 basis points in this example. Firm A has an absolute cost advantage in raising funds in either the short- or long-term debt markets, but firm B has a comparative advantage in raising funds in short-term debt markets.

To explore this line of reasoning in more detail, suppose firms A and B both need to borrow funds for the next two periods, $t = 1, 2$. Let $r^f(t)$ denote the period t short-term (one-period) risk-free interest rate and $\overline{r^f}$ the long-term (two-period) fixed risk-free rate. The period t cost of short-term debt to firm A is the short-term risk-free rate plus the credit-quality spread $q_A(t)$. To issue long-term fixed-rate debt, firm A would be required to pay $\overline{r^f} + \overline{q_A}$, where $\overline{q_A}$ denotes the long-term quality spread. Define $q_B(t)$ and $\overline{q_B}$ analogously. Assuming firm A has the better credit rating,

$$q_A(1) \leq q_B(1), \text{and}$$

$$\overline{q_A} \leq \overline{q_B}.$$

An increasing quality spread means that

$$q_B(1) - q_A(1) < \overline{q_B} - \overline{q_A}.$$

Conditions Necessary for Arbitrage to Be Feasible

Under certain assumptions, both firms could lower their funding costs if firm A were to issue long-term debt, firm B were to issue short-term debt, and they

swapped interest payments. To see how this would work, assume A and B enter into an interest rate swap with B as a fixed-rate payer and A as the floating-rate payer. As above, let $\overline{r^s}$ denote the fixed swap rate for a two-period agreement. To minimize the notational burden, assume that the swap floating rate is just the risk-free rate of interest, $r^f(t)$. The resulting period t ($t = 1, 2$) net cost of synthetic fixed-rate financing to firm B is:

	Period t cost of servicing short-term, floating-rate debt	$r^f(t) + q_B(t)$
$+$	Period t cost of interest rate swap	$\overline{r^s} - r^f(t)$
$=$	Period t cost of synthetic fixed-rate financing	$\overline{r^s} + q_B(t)$

The synthetic fixed-rate financing will be less costly for firm B than actual fixed-rate financing in each period t if and only if

$$\overline{r^s} + q_B(t) \leq \overline{r^f} + \overline{q_B},$$

which implies

$$\overline{r^s} - \overline{r^f} \leq \overline{q_B} - q_B(t).$$

The term on the left-hand side of the last expression is the swap fixed-rate credit-quality spread, or risk premium, over the risk-free long-term interest rate. Thus, the quality spread associated with the swap fixed rate must be less than the increase in the credit-risk premium firm B would need to pay to issue long-term debt. Otherwise, synthetic fixed-rate financing will not be cheaper than actual fixed-rate financing.

   Now examine the transaction from the vantage point of firm A, the floating-rate payer. The cost of synthetic floating-rate financing is determined by the cost of servicing fixed-rate debt plus the net cost of the swap:

	Period t cost of servicing fixed-rate debt	$\overline{r^f} + \overline{q_A}$
$+$	Period t cost of swap	$r^s(t) - \overline{r^s}$
$=$	Period t cost of synthetic floating-rate financing	$r^s(t) + (\overline{r^f} + \overline{q_A} - \overline{r^s})$

Period t synthetic floating-rate financing will cost less than actual floating-rate financing for firm A if

$$r^s(t) + (\overline{r^f} + \overline{q_A} - \overline{r_s}) \leq r^s(t) + q_A(t),$$

which, in turn, requires that

$$\overline{q_A} - q_A(t) \leq \overline{r^s} - \overline{r^f}.$$

That is, the increase in the credit-quality premium firm A must pay when issuing long-term fixed-rate debt must be smaller than the risk premium it receives from the swap's fixed-rate payer.

Combining results, firm A will have a comparative advantage in issuing long-term debt and firm B in issuing short-term debt if

$$\overline{q_A} - q_A(t) \leq \overline{r^s} - \overline{r^f} \leq \overline{q_B} - q_B(t), \qquad t = 1, 2.$$

For the floating-rate payer, synthetic floating-rate financing is cheaper than actual short-term financing if the interest rate swap quality spread (which the floating-rate payer receives) is greater than the added interest expense of long-term debt. For the fixed-rate payer, synthetic fixed-rate financing is less costly than issuing long-term bonds if the premium of the fixed swap rate over the two-period risk-free rate is less than the difference between its long-term and short-term quality spreads. Both parties will enjoy gains from trade if the swap floating-rate payer charges the fixed-rate payer a smaller credit-quality spread than the fixed-rate payer would be forced to pay in the bond market.

The astute reader will notice that the conditions outlined above require the parties to the agreement to know future values of $q_A(t)$ and $q_B(t)$. Both firms know their current short-term quality spreads along with $\overline{q_A}$ and $\overline{q_B}$ at the start of period 1. But it is unrealistic to assume that firms will know their future short-term quality spreads with certainty. Bicksler and Chen (1986) implicitly assume that firms expect the above relations to hold (at least on average) based on the past behavior of the quality-spread differential.

There is empirical evidence that long-term quality spreads for lower-rated counterparties are lower in the interest rate swap market than in credit markets (Sun, Sundaresan, and Wang 1993). Smith, Smithson, and Wakeman (1988) and Litzenberger (1992), among others, note that the expected loss to a swap counterparty in the event of a default is much less than that associated with holding a bond because interest rate swaps are not funding transactions and involve no exchange of principal. Moreover, swaps receive preferential treatment under the Bankruptcy Code in the event of a default. Under these conditions it may not seem surprising to find that quality spreads do not increase as rapidly in the swap market and that the cost of synthetic fixed-rate financing often seems lower than that of actual long-term financing. But while interest rate swaps might offer firms a way around paying increasing quality-spread differentials, synthetic fixed-rate financing does not offer firms the proverbial "free lunch." As the following discussion will show, the risks responsible for increasing quality-spread differentials do not disappear when firms use interest rate swaps.

Criticisms of the Comparative Advantage Rationale

Smith, Smithson, and Wakeman (1986, 1988) argue that observed behavior in the swap market is not consistent with classic financial arbitrage of the type described by proponents of the comparative advantage rationale. The use of interest rate swaps to arbitrage quality-spread differentials, they argue, should increase the demand for short-term loans among firms with poor credit ratings

while reducing demand for "overpriced" long-term loans. Eventually, such a process should reduce quality-spread differentials and therefore reduce demand for interest rate swaps. In fact, Bicksler and Chen (1986) did report evidence of declining quality-spread differentials as interest rate swaps came into wide-spread use. But trading activity in interest rate swaps has shown no sign of abating even as quality-spread differentials have declined. To the contrary, the market for interest rate swaps has grown exponentially since these instruments were first introduced in the early 1980s. According to the International Swap and Derivatives Association, the total notional principal amount of interest rate swaps outstanding has risen from $683 billion in 1987 to just over $3.8 trillion as of year-end 1992.

Smith, Smithson, and Wakeman (1986, 1988) observe that much of the apparent savings from the use of swaps can be attributed to the absence of a prepayment option on generic swaps. Fixed-rate bonds typically carry a pre-payment option that allows the borrower to call and refund a debt issue should market interest rates fall. The cost of this option is incorporated into the interest rate the firm is required to pay on such bonds. In contrast, the generic interest rate swap carries no such prepayment option. Early termination of a swap agreement requires the value of the contract to be marked to market, with any remaining amounts to be paid in full. A borrower can buy a "callable" swap, which permits early termination, but must pay an additional premium for this option. Thus, to be fair, the cost of actual long-term debt should be compared to the cost of callable synthetic fixed-rate financing, which would reduce the measured cost advantage resulting from the use of interest rate swaps.

Another problem with the comparative advantage rationale, noted by Smith, Smithson, and Wakeman (1988), is that it does not address the underlying reason for the existence of quality-spread differentials between short- and long-term debt. Loeys (1985) notes that short-term creditors implicitly hold an option to refuse to refinance outstanding loans. He attributes the difference in qual-ity spreads between short- and long-term debt to the value of that implicit option.[5] But while this option is valuable to lenders, it increases the risk of a future funding crisis to the borrowing firm, thereby increasing the risk of bankruptcy proceedings. The risk that lenders will refuse to refinance out-standing short-term debt is known as liquidity risk, or rollover risk. From the firm's perspective, added liquidity risk represents an implicit cost of short-term financing.

Bansal, Bicksler, Chen, and Marshall (1993) compare the cost of synthetic fixed-rate financing with the cost of actual fixed-rate financing when the hidden costs noted above are taken into account. They control for the cost of liquidity

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[5] Wall and Pringle (1987) note that Loeys' hypothesis is only consistent with increasing quality-spread differentials if the ability of short-term debtholders to refuse to renew outstanding debt makes it easier to force reorganization of a financially distressed firm.

risk by adding in the expense of a bank standby letter of credit in which a bank guarantees that it will assume a firm's outstanding debt if the firm finds itself unable to roll over a commercial paper issue. To take account of the value of a prepayment option, they add the premium on a callable swap into the total cost of synthetic fixed-rate financing. Finally, they also take account of transactions and administrative costs. The cost advantage of synthetic fixed-rate financing disappears once these costs are taken into account. Bansal et al. conclude that "a significant part of the reputed gains from swaps . . . were illusory, stemming from the way the gains have been calculated in practice" (p. 91).

3.   ALTERNATIVE EXPLANATIONS

Smith, Smithson, and Wakeman (1988) hypothesize that the rationale for interest rate swaps lies with their usefulness in creating new synthetic financial instruments for risk management. The early 1980s brought unprecedented interest rate volatility, exposing firms to the risk of fluctuating funding costs. Rawls and Smithson (1990) argue that these events led to an increased demand for risk-management services on the part of firms. Smith, Smithson, and Wakeman (1988) argue that the growth of the swaps market effectively increased market liquidity for forward interest rate contracts, citing rapidly falling bid-ask spreads for interest rate swaps as evidence.[6] Thus, they argue, trading in interest rate swaps has helped to complete forward markets and to lower the cost to firms of managing their exposure to interest rate risk.

The Role for Hedging in the Theory of Corporate Finance

The foregoing discussion has focused on increased volatility in financial markets as the major factor behind the growth of the derivatives market in recent years. That firms would wish to hedge against the risk of such volatility simply has been assumed. But as Smith, Smithson, and Wilford (1990) note, much of textbook portfolio theory suggests that not hedging might be a firm's best policy. The well-known Modigliani-Miller theorem states that a firm's financing decisions have no effect on its market value when (1) a firm's management and outside investors share the same information about the returns accruing to all investment projects; (2) transactions costs are negligible; (3) a firm's tax bill is not affected by its financing decisions; and (4) the costs of financial distress are inconsequential. Under these assumptions, portfolio theory holds that individual investors can efficiently diversify away volatility in individual firm profits at

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[6] An interest rate swap can be viewed as a bundle of forward contracts (see Smith, Smithson, and Wakeman [1988]). Sun, Sundaresan, and Wang (1993) find that bid-ask spreads in the interest rate swap market are smaller than those in the underlying market for long-term, fixed-rate corporate debt.

least as well as the firms themselves. If so, there is no reason for firms to expend resources hedging against volatility in future cash flows.

When these assumptions are relaxed, however, financing decisions may affect a firm's value. First, a firm's managers can be expected to know more about the risks and returns to different investment projects than outside investors. Second, the existence of transactions costs makes some kinds of financing decisions more costly than others. Third, a volatile cash flow stream can make a firm more susceptible to financial distress and bankruptcy, which can be extremely costly as well as threatening management with loss of control. Fourth, existing tax laws favor certain forms of funding over others. Firms are permitted to treat interest payments on debt as a tax-deductible expense, but not dividend payments to shareholders. Moreover, tax laws sometimes favor the use of certain derivative instruments to restructure cash flows. For all these reasons, firms will sometimes have incentives to hedge their cash flows.

Agency Costs as a Rationale for Interest Rate Swaps: Incentives to Undertake Synthetic Fixed-Rate Financing

Miller (1977) stresses the tax advantages of debt to explain why firms finance their investments with a combination of debt and equity. As Jensen and Meckling (1976) note, however, firms issued debt long before corporate income taxes came into existence. As an alternative rationale for debt, Jensen and Meckling emphasize the difficulty outside investors face in evaluating the performance of managers. As defined by Jensen and Meckling, an agency relationship is "a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent" (p. 308). If principals could always costlessly monitor the behavior of their agents, they could ensure that agents would always act in their best interests. Monitoring the behavior of agents is costly, however, and requires principals to expend resources. Thus, the agent might be required to incur certain bonding expenditures. Finally, if principals cannot ensure that agents will always act in their best interests despite monitoring and bonding, there may be some deadweight residual loss. Jensen and Meckling define "agency costs" as the sum of these expenditures. They show that debt finance can reduce overall agency costs for a firm, but their analysis does not consider the problem of interest rate volatility and the question of whether a firm should issue short-term or long-term debt.

Interest rate volatility would not affect the investment or financing decisions of firms if revenues were always perfectly correlated with changes in market interest rates, because revenues would vary along with debt servicing costs in this case. Revenues typically are not perfectly correlated with market interest rates, however. As a result, interest rate volatility can increase the risk of financial distress. If financial distress is costly (because of the administrative

costs of bankruptcy proceedings), or if the firm's management values its right to exercise control over the affairs of the organization, management will have an incentive to mitigate such risks. Ideally, then, a firm would wish to schedule repayment of its capital financing costs to match the realization of revenues from its investments (Myers 1977). If a firm's revenues are completely uncorrelated with market interest rates, it could minimize the risk of future financial distress by funding long-term investments with long-term, fixed-rate debt and short-term investments with short-term debt.

Long-term lending carries substantial risks from an outside investor's viewpoint, however. A borrower's financial condition can deteriorate substantially over the term of the loan. Moreover, as Jensen and Meckling (1976) note, management has an incentive to take actions that benefit shareholders at the expense of creditors once a firm has received the proceeds of the loan. As an example, management can pursue high-risk strategies or otherwise attempt to dissipate the organization's assets by paying excessive dividends. Creditors could prevent such behavior if (1) they always knew as much about a firm's investment opportunities as its managers and (2) they could monitor management's behavior costlessly. But such actions are prohibitively costly for most creditors, if even feasible, for they would involve duplicating essentially all the functions of management. For these reasons, bondholders often demand loan covenants that limit management's discretion in deploying loan proceeds. Typically such covenants give creditors the right to exercise greater control over the firm when a condition of the loan is violated or in the event of a material deterioration in its financial condition. To be certain, enforcement of loan covenants still requires some monitoring on the part of creditors. Jensen and Meckling (1976) argue that these monitoring costs are ultimately borne by borrowers through higher interest rates.

Wall (1989) argues that the existence of agency costs is one reason that quality spreads widen with debt maturity. He notes that while established firms with good credit ratings and access to low-cost credit have incentives to limit risks, newer and smaller firms do not have the same incentives. Like Loeys (1985), Wall gives special emphasis to the influence creditors can exercise over borrowers when renegotiating short-term loans. Wall was among the first to observe that synthetic fixed-rate financing carries different incentives for borrowers than actual fixed-rate financing. To understand why this might be so, notice that the interest rate lenders charge a borrower when renewing a short-term loan can change for two reasons: (1) a change in market interest rates or (2) a change in the firm-specific credit-quality risk premium. Interest rate swaps compensate the borrower only for changes in market rates, and not for changes in the short-term quality spread. Thus, as noted earlier, the cost of synthetic fixed-rate financing is $\overline{r^s} + [r^b(t) - r^s(t)]$, the swap fixed rate plus the quality spread between the rate the firm pays on its short-term debt and the swap floating-rate index. A firm that chooses synthetic fixed-rate financing

faces the risk that the quality spread $[r^b(t) - r^s(t)]$ might rise if lenders realize that management has increased the firm's riskiness. In extreme cases, the firm might even find itself unable to roll over its outstanding short-term debt and be forced into bankruptcy proceedings.

Wall's (1989) rationale for interest rate swaps lies with the observation that synthetic fixed-rate financing should discourage management from pursuing risky investment strategies.[7] According to this argument, interest rate swaps lower funding costs by controlling the adverse incentives a firm's management might have to increase the risk assumed by the firm to the detriment of creditors. Thus, interest rate swaps do make it possible for firms to reduce financing costs in Wall's theory. But the savings attributable to the use of swaps result from lower agency costs and do not constitute arbitrage in the sense that term is normally understood.

The Problem of Adverse Selection:
More Incentives to Borrow Short and Swap into Fixed

Flannery (1986) and Diamond (1991) investigate the determinants of debt maturity by focusing attention on the incentives borrowers have to signal information to lenders about their financial condition. Their analysis is based on the assumption that outside investors have imperfect information about firms, and so are unable to discriminate perfectly between safe firms and relatively risky firms. If outside investors cannot perfectly discriminate between risky and safe firms, they will demand default-risk premiums on long-term debt that may appear excessively high to relatively safe borrowers. Conversely, the managers of a risky firm recognize that there is a high probability that the organization's financial condition will deteriorate, leading them to prefer long-term debt over short-term debt.

Firms that lenders can identify as risky borrowers have difficulty securing long-term loans and are forced to issue short-term debt that matures before the returns to an investment are realized. Often such firms must obtain their credit lines from banks, which specialize in credit evaluation and are well positioned to monitor the firm's activities. In the event that a firm's financial condition deteriorates, lenders can demand a higher interest rate upon refinancing, can further restrict the discretion of management, can engage in more intensive monitoring, can take some combination of these actions, or can even refuse to refinance outstanding debt. A firm that defaults on its outstanding debt obligations can be forced into bankruptcy proceedings.

If a firm's management believes that default premiums on long-term loans are excessive, it might choose a short-term funding strategy. By voluntarily

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[7] Diamond (1984) makes a similar observation regarding the optimal hedging behavior of firms, although he does not discuss the rationale for interest rate swaps per se.

taking on liquidity risk, management can signal that it does not expect the firm's condition to deteriorate in the future. Over time a firm that consistently demonstrates its ability to meet its financial obligations develops a reputation as a safe firm. Thus, a safe firm might employ a short-term funding strategy until it can convince creditors to extend long-term loans on better terms (Diamond 1991).

One drawback to such a strategy is that it can leave the firm's cash flows unhedged. Arak, Estrella, Goodman, and Silver (1988) stress that interest rate swaps are not redundant securities, but offer firms new financing choices that were not previously available in credit markets. Like Wall (1989), Arak et al. note that synthetic fixed-rate financing requires the borrower to bear the risk of changes in the short-term credit-risk premium. Their hypothesized rationale for interest rate swaps differs somewhat from that of Wall, however. They hypothesize that firms may have an incentive to bear rollover risk when management is more optimistic about a firm's future prospects than the market. If a firm's management is optimistic about its financial condition, it may choose to issue short-term debt in the expectation that the quality spread will fall in the future. In effect, the firm speculates on its own quality spread while using swaps to immunize itself against market risk.

Titman (1992) and Minton (1993a) derive conditions under which a firm's best strategy is to use interest rate swaps in conjunction with short-term financing. Like Flannery (1986) and Diamond (1991), Titman and Minton emphasize that firms may have an incentive to bear the liquidity risk associated with short-term debt finance as a means of signaling management's belief that the firm's financial prospects will improve. Titman finds conditions under which synthetic fixed-rate financing gives firms an incentive to undertake safer investments. Minton finds that giving firms the option of using interest rate swaps can reduce default risk and, in doing so, increase the capacity of firms to undertake productive long-term investment. Both Titman and Minton find plausible conditions under which interest rate swaps reduce financing costs, albeit not through the channels of financial arbitrage.

Notice that the basic logic of the adverse selection rationale runs closely parallel to that of Wall's (1989) agency cost rationale. While borrowers in Titman and Minton's models choose short-term financing to signal management's belief that the firm is creditworthy, the act of taking on short-term debt mitigates incentives to take on added risk once loan proceeds are received, just as Wall predicts.

Incentives to Borrow Fixed and Swap into Floating

The preceding discussion has focused on the incentives firms might have to enter into a swap as a fixed-rate payer. But every swap agreement must also have a floating-rate payer. Wall (1989) and Titman (1992) hypothesize that

floating-rate payers share in the gains fixed-rate payers receive from synthetic fixed-rate financing. Litzenberger (1992) notes at least two reasons why highly rated firms may be able to lower funding costs by issuing callable fixed-rate debt and then swapping into synthetic floating-rate debt. First, like Wall and Titman, he hypothesizes that floating-rate payers essentially act as financial intermediaries that earn income in return for managing a diversified portfolio of risky contractual obligations. The total exposure resulting from this activity is small, he argues, because (1) the credit risk associated with an interest rate swap is much smaller than that associated with actual lending; (2) most swap agreements take place among parties with at least single A credit ratings (lower-rated counterparties are rejected or required to post collateral); and (3) a diversified swap portfolio has little risk of a large credit loss.

Second, Litzenberger also notes that the highly rated AAA firms that typically become floating-rate payers often issue callable fixed-rate notes, and then sell the prepayment options on these notes by selling callable swaps to swap dealers. He argues that such transactions can create synthetic floating-rate financing at a modest savings in cost because the prepayment options attached to fixed-rate debt tend to be underpriced, probably because of a past history of non-optimal exercises on such options. Thus, Litzenberger attributes at least part of the incentive to become a floating-rate payer to arbitrage opportunities created by the mispricing of prepayment options for corporate bonds.

Smith, Smithson, and Wakeman (1988) emphasize that interest rate swaps can help to conserve on transactions costs. As an example, they note that it can be cheaper to sell an interest rate swap than to call and refund outstanding fixed-rate debt.

4.   A COMPARISON OF INTEREST RATE FUTURES AND INTEREST RATE SWAPS

A discussion of the economic role of interest rate swaps would not be complete without at least some mention of interest rate futures. Interest rate futures can be used to create synthetic fixed-rate debt in much the same way as interest rate futures. In particular, selling a "strip," or sequence, of Eurodollar futures with successive maturity dates can be compared to buying an interest rate swap.

To see how interest rate futures can substitute for an interest rate swap, recall that the buyer (fixed-rate payer) of an interest rate swap receives a net payment from the seller whenever the floating-rate index exceeds the swap fixed rate. In the case of a generic swap with a floating rate indexed to some maturity of LIBOR, the buyer receives the difference in interest on the notional principal amount whenever the specified maturity of LIBOR exceeds the swap fixed rate. When LIBOR is below the fixed rate, the buyer must pay the difference in interest to the seller.

Selling a strip of Eurodollar futures creates a similar pattern of returns and payments. The seller of a Eurodollar contract receives the difference in interest on the notional principal ($1 million) when the futures rate negotiated at the outset of the agreement turns out to be less than the value of three-month LIBOR prevailing on the contract maturity date. Otherwise, the seller must pay the difference in interest to the buyer. Thus, selling a strip of Eurodollar futures produces a return stream comparable to that of a generic interest rate swap. Because of this similarity, an implied swap rate can be derived from Eurodollar futures rates.[8] Minton (1993b) finds evidence that the behavior of swap market rates is closely related to this implied swap rate.

These observations suggest that much of the rationale for interest rate swaps discussed above must also apply to interest rate futures—in particular, to Eurodollar futures. The foregoing discussion has focused on interest rate swaps because the growth of trading in Eurodollar futures in recent years appears to have been driven by the growth of the swap market. Although trading in Eurodollar futures predates the advent of the interest rate swap, trading was limited to contracts extending two years into the future at the time of the first widely publicized interest rate swap in 1982. As a result, Eurodollar futures were not as well suited for use in creating synthetic long-term financing as were interest rate swaps. More recently, the Chicago Mercantile Exchange has begun listing Eurodollar futures for delivery as far as ten years into the future. Burghardt et al. (1991) attribute the recent expansion of trading in Eurodollar futures to the growth of the interest rate swap market. Swap dealers in particular often use Eurodollar futures to hedge their commitments. Thus, although interest rate futures contracts can substitute for interest rate swaps, it was the growth of the swap market that had the greatest effect on corporate finance.

Kawaller (1990) and Minton (1993b) discuss the factors influencing the choice between interest rate futures and interest rate swaps. Kawaller emphasizes transactions costs and other practical considerations of managing a futures position as key factors influencing the choice between interest rate futures and interest rate swaps. The main benefit of a swap is that it can be custom-tailored to the needs of an individual firm, so that managing an interest rate swap is relatively easy compared to managing a futures market position. A firm that enters into an interest rate swap faces a set schedule for receiving or making its payments. As long as nothing happens to change the firm's underlying exposure to interest rates—that is, as long as nothing has happened to change the reasons the firm decided to create synthetic fixed- or floating-rate financing in the first place—managing an outstanding swap position merely requires the firm's treasurer to make or collect scheduled payments.

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[8] For more detailed expositions, see Burghardt et al. (1991) and Kawaller (1990).

The principal disadvantage of interest rate swaps relative to interest rate futures lies with counterparty credit risk. Exchange-traded instruments such as interest rate futures are backed by a system of margin requirements, along with the guarantee of the exchange clearinghouse (which, in turn, is jointly backed by the paid-in capital of the clearinghouse member firms). This system of safeguards removes virtually all risk of default in the futures market. In contrast, a counterparty to an interest rate swap is exposed to the risk that the other counterparty might default. To be certain, most interest rate swaps take place between relatively creditworthy counterparties. Nonetheless, credit risk is a greater concern with interest rate swaps than with futures contracts.

The very factors that make interest rate futures safer also make managing a futures position somewhat more challenging than managing a swap commitment, however. First, a party to a futures contract is required to post margin before being permitted to buy or sell a futures contract. Second, the futures exchanges mark all outstanding positions to market at the end of each trading session, adding any realized gains or subtracting any realized losses from each trader's margin account. While this procedure minimizes default risk, it exposes any party with an open futures position to the risk of margin calls. As a consequence, payments are less predictable in the short run with a futures position than with an interest rate swap. Third, futures contracts are standardized agreements. Contract standardization, along with the clearinghouse guarantee, facilitates trading in futures contracts. Futures markets tend to be more liquid than OTC markets (and actual cash markets for that matter) as a result, lowering transactions costs. But while contract standardization facilitates trading, it also means that an interest rate futures contract will almost never be perfectly suited to the needs of any one trader.[9] Thus, an interest rate futures position requires greater monitoring and can be more difficult to execute unless a firm maintains a staff devoted to trading futures contracts.

While the factors that determine the choice between interest rate futures and interest rate swaps is of great interest to practitioners, it has not received a great deal of attention in the academic finance literature. Minton's (1993a) model of the hedging behavior of firms is a noteworthy exception. Minton finds that relatively safe firms—firms that expect their future credit-quality spreads to fall—may have an incentive to choose swaps over futures contracts so as to avoid the cost of margin requirements.

5.   CONCLUDING COMMENTS

The reasons for the extraordinary growth of the swap market in recent years are not yet fully understood. But there seems to be a consensus that the market has

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[9] For a more detailed description of futures exchanges and interest rate futures, see Kuprianov (1993a).

developed because interest rate swaps offer firms financing choices that were not available before the advent of these instruments. In this respect, interest rate swaps represent a true financial innovation.

The early rationale offered for the existence of the market—that firms used interest rate swaps to arbitrage credit market inefficiencies—cannot by itself explain the exponential growth of the market over the past decade. By the same token, it is unlikely that firms would use interest rate swaps if they did not lower financing costs in some way. Recent research suggests at least two reasons why firms use interest rate swaps. First, in cases where a firm's management expects its financial condition to improve, interest rate swaps make it possible for firms to hedge against changes in market interest rates while avoiding excessive fixed-rate quality-spread premiums. Second, interest rate swaps make possible financial arrangements that reduce the incentives of borrowing firms to take on added risk at the expense of creditors.

Conceived in the wake of unprecedented interest rate volatility brought about by a decade of accelerating inflation, the interest rate swap was born of necessity. In a period of low interest rate volatility, the choice between short- and long-term borrowing was primarily a choice between fixed and floating credit-quality spreads. With rising interest rate volatility, however, the ability to separate the effects of changes in market rates from changes in credit-quality spreads became more valuable, leading firms to experiment with alternative financing schemes. Based on the results of recent research, it appears that interest rate swaps have helped firms to weather the uncertainties of volatile financial markets by reducing default risk and facilitating increased productive investment.

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