

RESIDUAL VALUE INSURANCE: A Risk Management Tool for the Leasing Industry

by Vincent A. Kolber

Uncertainty about the lease investment climate has reached new heights. Increased riskiness now appears to be a pervasive feature of the entire United States economy. Variables such as interest rates and the value of the dollar, which were once relatively stable, are now subject to broad and rapid changes. The financial community has responded to greater uncertainty by designing products that make risk easier to quantify and transfer. The rapid growth of financial instruments such as futures and options, interest

rate swaps, Eurobonds, and lease guarantee bonds are testimony to the importance of understanding risk in the current environment.

Many factors contribute to the increased volatility in leasing. However, the value of the residual is arguably the greatest uncertainty in a lease financing. Forecasting residual value is an arduous task and there is no sure-fire route to success in this area. However, *residual value insurance* (RVI) is a product that can help the parties in a lease transaction better manage the risks associated with residual value.

This article provides the potential user of residual value insurance with an explanation of why RVI can be a powerful tool in lease financing. Residual value insurance is shown to be the economic equivalent of a put option. After a brief discussion of some of the history and institutional detail of the residual value insurance market, the potential benefits of RVI for both lessors and lessees are described. Residual value insurance is not yet widely used; consequently, there are common misconceptions about it. The final section of this article addresses these misunderstandings.

The author is president and founder of RESIDCO, the Residual-Based Finance Corporation, Chicago, Illinois, specializing in remarketing of transportation equipment and underwriting for tax-exhausted leases in transportation equipment. Kolber has an M.B.A. from the Graduate School of Business, University of Chicago and a B.S. from the Wharton School, University of Pennsylvania.

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The Economic Worth of Residual Value Insurance

Residual value insurance, also called *asset value insurance* or *equipment value insurance*, provides the owner of an asset with the ability to guarantee a minimum price or value for that asset. The insurer in an RVI policy promises to pay the policyholder if the value of the insured asset falls below a specified price at a specified time in the future. The policyholder, in exchange for this promise, pays a premium to the insurer. The asset owner who buys an RVI policy is hedging: It is placing a floor below which the value of the asset cannot fall.

The economic implications of residual value insurance for the policyholder are understood best when RVI is viewed as the equivalent of a put option. For a price (sometimes called the premium), the holder of a put option (the insurance company) has the opportunity to sell the underlying asset or commodity to the writer of the put option at an agreed-upon price (called the *exercise price*) on an agreed-upon date (called the *expiration date*). Because the buyer of a put has the choice of whether to sell or hold, the holder will sell only if the exercise price is above the asset's value at the expiration date. The economic value of a put option derives from the fact that it insures a minimum asset price.

Figures 1 through 3 illustrate the insurance property of a put option. Figure 1 shows the gain or loss that accrues to the owner of an asset. If the asset's current price is \$20 million, then any increase or decrease in its value results in a gain or a loss to the owner. Consider the position of a put option buyer, depicted in Figure 2, who buys a put with an exercise price of \$12 million. If the asset price slumps below \$12 million, the option holder can make money simply by buying the asset at its low cash price and selling it to the option writer at the higher exercise price. If the asset's value remains above \$12 million, the buyer will lose money by exercising the put, so he will

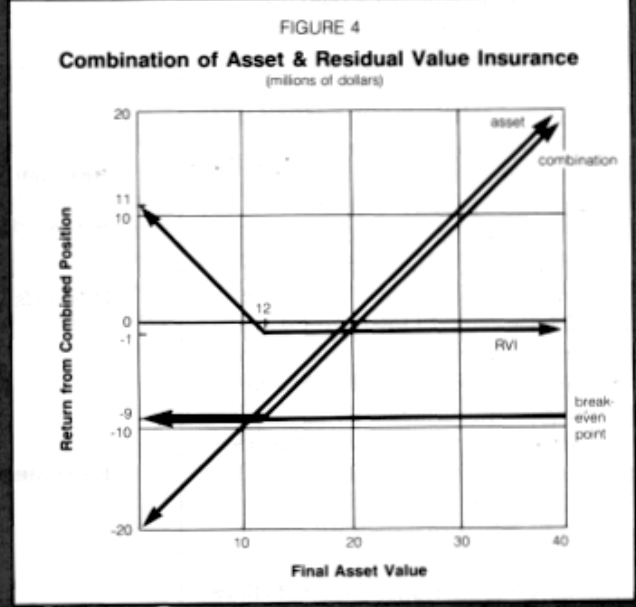
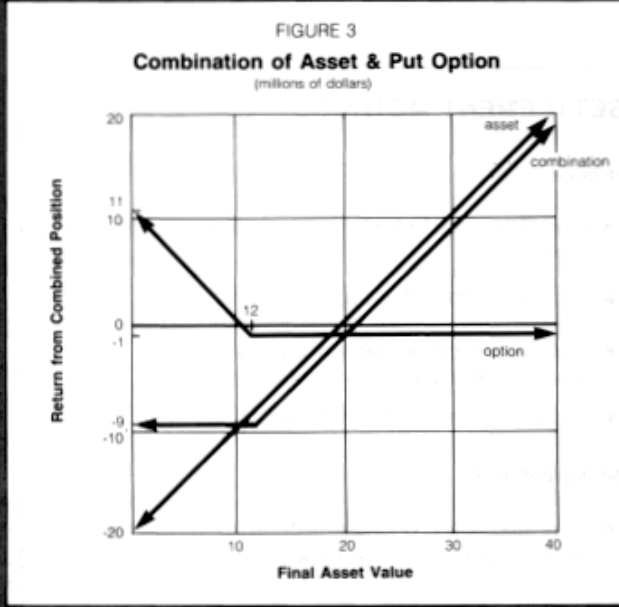
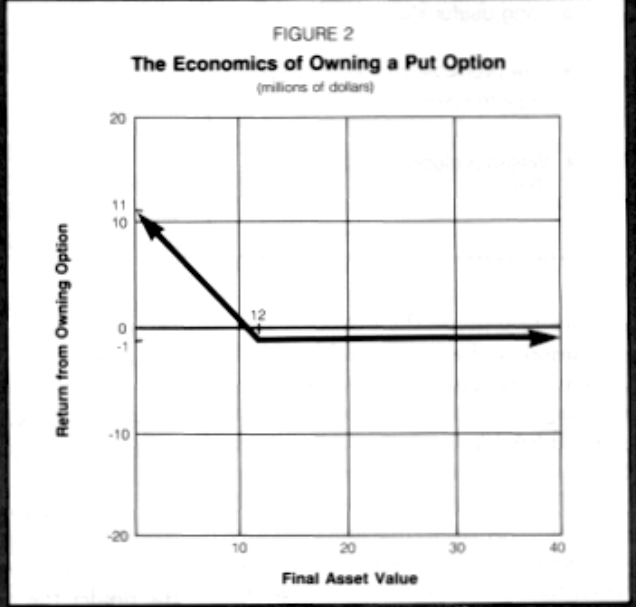
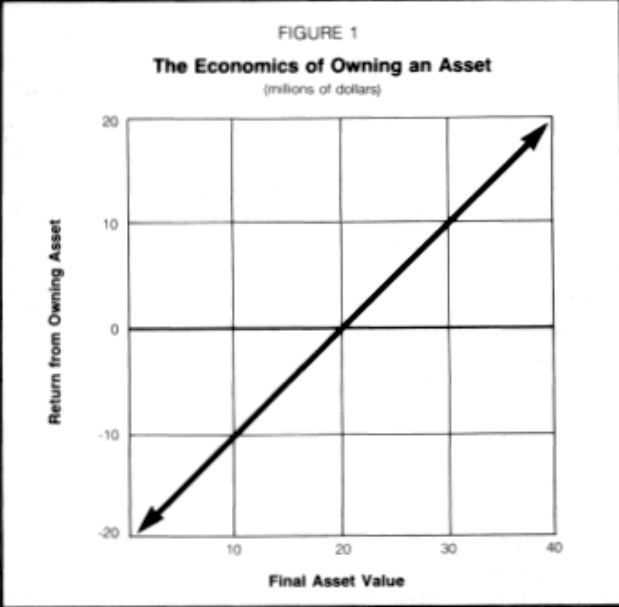
allow it to expire, forfeiting the premium (in this case, \$1 million) but losing no more than that.

In Figure 3, the owner of an asset places a floor below the asset's value by buying a put option. If the asset's value falls to less than \$12 million, the gains from the option position help offset the losses from the asset position. If the asset appreciates in value, the owner sacrifices some of the gains because he has already paid a premium to buy the put option. The results are a guaranteed minimum asset value of \$11 million (the \$12 million exercise price less the premium of \$1 million) and a substantial reduction in the price variability and risks associated with owning the asset.

Figure 4 shows how a lessor can use residual value insurance to lock in profit on a lease. Assume the leased asset currently is worth \$20 million, and the lessor has calculated that the proposed five-year lease will break even (i.e., meet the lessor's minimum yield requirement) with a residual assumption of \$11 million. The lessor finds an insurer who is willing to write a five-year RVI policy covering the asset at \$12 million for a premium of \$1 million. If the residual is worth less than \$12 million, the RVI pays the difference, so the value of the asset plus the insurance claim can never fall below \$11 million (the insured value of \$12 million less the \$1 million premium). The lessor sacrifices \$1 million of profit if the residual ends up above \$12 million, but in exchange it guarantees that the worst it can do on this lease is break even. Comparison of Figure 4 with Figure 3 shows that, even though a residual value insurance contract need not involve the sale of the asset, *it is the economic equivalent of a put option*.

While residual value insurance provides the policyholder with the economic benefits of a put option, an asset owner also may buy an over-the-counter financial instrument called an *equipment purchase agreement* (EPA) or a *sale option* that is a true put option. The option writer in an equipment purchase agreement consents to buy the asset from the owner in the future at a prespecified price, if the owner chooses to sell. An EPA is different from residual value insurance because the asset owner can only receive payment from the option writer as the result of an actual sale. However, for the purpose of yield analysis, RVI and equipment purchase agreements are identical.

Despite their similarity, there are cases where the two instruments are clearly not interchangeable. For example, in a lease involving a fair market value option, a lessor who wants to hedge residual risk will find an equipment purchase agreement less desirable. If the fair market value of the asset goes down and the lessee



ASSET QUALIFICATION CRITERIA

- Long useful life.
- Low probability of technological obsolescence.
- Well-developed secondary market.

chooses to exercise the option at the expiration of the lease, the lessor will be left in the untenable situation of wanting to sell the asset to the writer of the EPA but having to sell it to the lessee at the lower fair market value price. Therefore, lessors may find residual value insurance more flexible than equipment purchase agreements when the lease provides the lessee with residual purchase or renewal options.

The Marketplace

Today's residual value insurance marketplace developed partially in response to the failure of the mainframe computer RVI business. In the late 1960s and early 1970s, there was a brisk leasing market in IBM model 360 and 370 mainframes. When lessors exhausted their ability to absorb residual risk on these computers, Lloyd's of London responded with their "J-policies." The surprise introduction by IBM of a new generation of mainframes caused Lloyd's to take substantial losses on the J-policies and left the young residual value insurance marketplace in turmoil.

After this episode, it was clear that the industry needed guidelines to determine what kinds of assets are insurable. While there are no formal asset qualification criteria, most residual value insurance experts believe that RVI is a feasible option if the asset can pass three tests concerning the likelihood that the residual will be worth a substantial sum. First of all,

the asset must be one for which a *long useful life* is expected or common. Second, the industry's computer leasing experience has made it clear that only an asset with a relatively *low probability of technological obsolescence* should be considered a candidate for residual value insurance. Finally, since insurers want no part of remarketing risk, there should be a *well-developed secondary market* for the asset. Aircraft, automobiles and railroad rolling stock are good candidates based on these criteria, and are the most commonly underwritten assets in the RVI market. However, the three criteria admit a surprising variety of assets. For example, a major owner of beer barrels has employed residual value insurance successfully in a sale/leaseback.

Insurer concerns about remarketing also have led to the development of two different claim settlement methods for RVI. An *assessed value* policy pays the holder the difference between the asset's insured value and its fair market value as determined by an assessment process, usually the three-appraiser method. A *proceeds* policy pays the difference between the insured value and the proceeds from an actual sale of the asset. If no sale materializes, the proceeds form typically reverts to the

three-appraiser method. Insurers have a great deal of experience with assessment procedures, which may help explain their aversion to assuming remarketing risk. Assessment is a common claims settlement technique in the insurance industry, especially in the case of accident insurance. It is not surprising, therefore, that insurers prefer writing assessed value policies and often charge higher premiums for proceeds policies when they are willing to write them. It is important to note that the writer (or issuer) of an equipment purchase agreement is similar to the issuer of an assessed value policy in that both bear the remarketing risk.

An informal survey of the fewer than ten firms that are actively writing RVI policies and EPAs reveals that approximately \$1.2 billion of residual risk was underwritten by these firms in 1984. Half of that amount is in the area of automobile residual value insurance. Many of the lessors using automobile RVI policies are banks; this market is driven, to a large extent, by regulations which control residual risk assumption. (See the next section for an explanation of how bank lessors use RVI to satisfy regulations.) Because auto leases tend to be relatively short,

SETTLEMENT METHODS

Residual Value Insurance

Assessed Value:

- Pays difference between insured value and fair market value.

Proceeds:

- Assessment by three-appraiser method
- Pays difference between insured value and proceeds from sale.
- Involves insurer in remarketing.

Equipment Purchase Agreement

- Pays sale option price in full upon delivery of the asset to be writer of the agreement.
- Involves EPA writer in remarketing.

And the secondary market for cars is very liquid, premiums are quite low. Premiums for automobile RVI run from one to two and a half percent of the insured amount.

The remainder of the market is in various types of capital equipment. The two most popular assets are aircraft and railroad rolling stock; they account for about 85% of this segment of the market. The rest of the equipment RVI and EPA market covers a wide variety of assets, including machine tools, construction equipment, barges, truck tractors, trailers, printing equipment, and computer peripherals. Premiums on nonautomobile RVI policies are generally between five and eight percent of insured value.

Regardless of pricing and economics, lessors should review carefully the credit quality of the insurer. The A.M. Best Company provides credit analysis and a rating system for the insurance industry. In addition, domestic insurance companies file detailed annual statements with the state Department of Insurance in the state in which they are domiciled. These sources, along with insurance company management, should be examined with care at the outset and monitored during the life of an RVI policy.

The Benefits of Residual Value Insurance

Residual value insurance can be advantageous to all parties in a leasing transaction. Although the lessor is usually the buyer of RVI and the recipient of most of its benefits, the lessee gains in an indirect manner when RVI lowers the lessor's costs and makes previously uneconomic transactions into viable investments. The lessee also can gain directly through lower rents and more flexible terms. Residual value insurance allows the lessor to structure innovative sale/leasebacks and enables it to more readily sell an interest in its portfolio. Such a portfolio transaction can involve either the outright sale of a

lease or the sale of the residual interest through a residual value certificate, where the purchaser typically will be the beneficiary of RVI. The lessee also can be the RVI customer when a walkaway option is required. Bank lessors use RVI to comply with federal regulations concerning leasing. Many lessors are interested in RVI to make financial and tax accounting treatment of leases more favorable. But the most important contribution residual value insurance can make to lessors is economic in nature: It is an excellent tool for controlling and managing residual risk.

Economic Benefits

It has been shown that residual value insurance is the economic equivalent of a put option. The result of simultaneously owning both an asset and a put option on that asset is the establishment of a floor below which the value of the asset cannot fall. By creating this minimum price, the holder of a put option reduces the risk of owning the asset. With residual value insurance, lessors can actively and conveniently manage the amount of residual risk to which they are exposed, instead of having risk dictated to them by their asset portfolios.

Farmers for a long time have recognized the value of managing risk. They hedge their asset holdings (crops in the ground) by writing forward contracts and by participating in organized agricultural futures markets. More recently, firms and individuals exposed to risk from changing prices of stocks, bonds, and other investment securities have helped make financial futures and options one of the fastest growing industries in the country. Residual value insurance can serve the same economic role for lessors that the organized futures and options marketplace serves for farmers and for owners of securities.

Leasing companies already manage residual risk by diversifying the assets in their portfolios and by spreading lease maturity dates. However, hedging exclusively by portfolio selection may

close off profitable opportunities. Consider a lessor that manages a \$200 million equipment value exposure in the conventional fashion, by holding a variety of assets and leasing them over differing durations. This firm may be reluctant to deal with a potential lessee who wants to lease \$50 million of a single type of asset over a single lease period. No amount of portfolio diversification could reduce the residual risk of this transaction to an acceptable level. However, purchase of residual value insurance on the equipment can eliminate much of the risk, enabling the lessor to make the investment.

Hedging with residual value insurance can be beneficial to lessors of all sizes. Smaller firms may find it even more useful than large, well-diversified lessors. Many small lessors find it difficult to grow because large lease investments expose the firm to an unreasonable amount of residual risk. By using residual value insurance, the lessor, in effect, brings in an insurance company as its partner in this risk. RVI acts like a form of equity capital for the lessor, and this injection of equity can help speed the firm's growth. The residual value insurance function as a type of equity is important, and will be elaborated upon later.

Regulatory Benefits

The ability of bank lessors to take on residual risk is constrained by two federal regulations. Federal Reserve Board Regulation Y prevents bank-holding company subsidiaries from assuming unsecured residual risk in excess of 20% of the loan advance. Comptroller of the Currency Ruling 7.3400 restricts national banks and their leasing or equipment finance subsidiaries to a residual risk position of 25% of the loan amount. Banks have responded to these regulations by specializing in long-term full payout leases, where receivables are high enough to meet regulatory requirements.

The availability of residual value insurance opens up the short-term

operating lease market to bank lessors. By purchasing an RVI policy, the lessor can transfer a substantial portion of the residual risk to an insurer. This allows the bank lessor to offer the lessee a short-term lease. Total receivables are lowered, but the insurance reduces residual risk as well, so the regulations are met. Thus, the use of residual value insurance blurs the distinction between full payout and operating leases and allows bank-owned leasing subsidiaries to become full-service lessors. Any lessor can use RVI to reduce lease duration without increasing residual risk; this means that lessors can be more flexible in responding to the lease lengths desired by lessees.

Accounting Impact

Corporations often find that their objectives in financial statement and tax reporting are at odds. Financial statements look best when income is reported as early as possible, and matching assets and liabilities are removed from the balance sheet. Taxes, however, are minimized when income for tax reporting purposes is delayed as long as possible. Lessors and lessees face this problem when deciding how to account for a transaction. Residual value insurance can help both parties meet their accounting objectives under generally accepted accounting principles, as long as RVI is purchased at the outset of the transaction, and not afterwards.

When a lessor accounts for a lease under the operating lease method, both the asset to be leased and the liability used to finance it are placed on the balance sheet of the lessor. This hurts the ratios and delays the reporting of income. On the other hand, lower income means lower taxes. Under sales-type or direct finance lease accounting, the lease is treated as a financial transaction. Neither the asset nor the liability appears on the lessor balance sheet. The recording of income is accelerated, but this higher current book income results in a larger tax bill.

The situation for lessees is just the opposite. Under an operating lease, the lessee has nothing on its balance sheet, so current income and taxes are high. Under capital lease accounting, the lessee records both the asset and its financing on the books; the result is low current income and low taxes.

The Financial Accounting Standards Board (FASB) Statement 13 sets four conditions to determine whether a lease is an operating or a capital lease. Both parties of a transaction have to meet all four conditions. FASB 13 does not require symmetry, however, sometimes both parties have to use the same lease accounting treatment. This is no problem if one party prefers to accelerate income while the other would rather postpone it. However, if both lessor and lessee want to keep the

assets and liabilities off the balance sheet and maximize current income, they are ordinarily out of luck. Judicious use of residual value insurance by the lessor can allow the parties to avoid this obstacle.

The fourth condition in FASB 13 regarding transferring residual value risk is key. It says that if the present value of the minimum lease payments exceeds 90% of the asset's fair value, the transaction should be accounted for as a financing transaction by the lessor. The lessee's application of this test is simply the present value of all obligations to the lessor. However, the lessor can count all lessee payments plus any third-party guarantees that insure payment beyond the lessee rents. Residual value insurance provides just this type of guarantee. Therefore, a lease with discounted rental payments worth less than 90% of the asset's fair value, plus the purchase of residual value insurance by the lessor could be classified as an operating lease for the lessee and a financing for the lessor. The result is that the asset and liability appear on one's balance sheet and both parties report higher current income.

Benefits from Product Innovation

Residual value insurance can facilitate the creation of a wider variety of leasing packages. Product development using RVI benefits lessors through increased market share and provides lessees lower rent or more flexible terms. The purchase of residual value insurance allows the lessor to shorten lease duration without increasing residual risk. The lessor then can offer a long-term lease with an early cancellation option or a shorter lease with renewal rights. Both approaches give the lessee more flexibility to change asset mix over time and can permit the use of operating lease accounting.

The lessee's desire for operating lease accounting, in and of itself, can-

not be adequate justification for RVI, particularly in view of other alternative solutions (for example, a slight reduction in lease term is often sufficient). However, this lessee motivation can be accompanied by a desire to limit long-term commitment to a particular asset. A major airline lessee became the beneficiary of an RVI policy directly when it was structuring a long-term lease (fifteen years plus) on six new jetliners. In this instance, the airline had two particular constraints. First, the airline was reluctant to make a long-term commitment to fleet expansion prior to completing union negotiations. A long-term commitment would have increased pressure to accept union demands. In addition, the aircraft model was new to the airline, so it preferred to hedge the initial commitment. The lessee obtained an option to cancel the lease at or about the lease term midpoint in exchange for paying the termination value of the aircraft. The lessee then purchased a residual value insurance policy to coincide with the lease cancellation point and termination value. The purchase of an RVI policy, in this case, permitted the lessee to convert a long-term lease into a more preferable short-term lease.

Residual value insurance also can be a boon in the sale/leaseback arena. A sale/leaseback transaction structured with residual value insurance allows the lessee to maintain flexibility and control. Since RVI blurs the financial distinction between short-term and long-term leases, the transaction can be set up with either a renewal option or a fixed-price purchase option. In this way, the sale/leaseback lessee obtains many of the same benefits enjoyed by a conventional lessee.

FASB 13, which prevents lessors from purchasing RVI to accelerate the recognition of income after a lease is recorded, has given rise to other approaches that enable a lessor to recognize value appreciation in lease investments. The use of residual value certificates (RVCs) incorporating RVI is one means to accomplish this objective. Residual value certificates transfer the right to a fixed amount of the pro-

Residual Value Insurance & Option Pricing

Many buyers of residual value insurance find it hard to tell whether a proposed premium is fair. RVI is the economic equivalent of a put option. Financial researchers have discovered that the fair market value of an option can be calculated with a mathematical model¹. Use of these option pricing models has become widespread, not only in academia but also among professional options traders. It seems plausible that these same pricing models can be used to determine if a given premium on a residual value insurance policy is fair. This sidebar briefly explains the key determinants of the price of an option. An example illustrates how one might use a pricing model to evaluate an RVI proposal.

Determinants of an Option's Price

There are six variables that determine the fair market value of an option. First, the insured value of the underlying asset, referred to in options parlance as the exercise price or the strike price; for a put option (or an insurance policy), it is intuitive that the higher the insured value, the more expensive the insurance. Also important is the current price of the asset being insured. If the, exercise price is below the current price, an increase in the current price should decrease the put option premium. This is because as the current price rises, the probability of hitting the exercise price floor falls.

The length of the option, or its term to expiration, also helps to determine its market value. The longer the term, the greater the chance that the asset price will fall below the exercise price, so option price and term are positively related. Of course, price calculations over time must be discounted, so an interest rate applicable over the option term also is needed.

The fifth variable is the net holding

cost of the asset, the amount it costs to own the asset, less the revenue it produces. For example, common stocks pay dividends, so the price of a stock option has to reflect this source of income. On the other hand, commodities, like soybeans, have storage costs, and these too must be factored into the price. Leased assets both produce rental revenue and incur storage and maintenance cost, so they have similarities to both stocks and commodities. Net holding cost for a leased asset is clearly not easy to measure, especially when taxes are an important consideration.

The final determinant of an option price is the expected volatility of the asset price over the term of the option. This number is measured as the annualized standard deviation of the percentage change in asset price. The more volatile the price of the asset, the more expensive it is to insure. The volatility number required is a forecast. Historic volatility can be used as an input in the model to generate a price, but there is no guarantee that past and future volatility will be the same if economic conditions change. In addition, data on past volatility may not be available.

An alternative way to employ the option pricing model is to "run it backwards." Given the price of the option and values for the other variables, the model can be used to solve for volatility. This solution, called the implied volatility, then can be compared with intuition and, when available, with historic volatility. For example, if implied volatility seems too high, the premium asked by the insurer may be also higher than it seems it should be, based upon data and analysis. On the other hand, if implied volatility appears to be low, the policy may be a bargain.

An Example

Consider the hypothetical case of a Boeing 747-1 00 aircraft in half-time condition with current market value of \$14.5 million. The aircraft is capable of generating \$2.4 million per year for the lessor on a five-year lease, and the lessor borrowing rate is 11 %. The

ceeds from the sale of a leased asset at lease termination. The revenue generated from selling an RVC prior to lease expiration is counted as current income by the lessor, thereby meeting its objective of pushing forward the time when income from the lease transaction is recognized. Residual value insurance is used in this case to secure the RVCs and make them a more creditworthy investment vehicle. An RVC can be treated as a sale for accounting purposes and as a nonrecourse loan for tax purposes.

Lessors, aware of the negative after-tax cash flow effect from holding mature leases, often will consider the sale of such tax-benefit-exhausted transactions once they are past investment tax credit vesting. Such leases are said to have "turned" or have entered into the "phantom income" stage. RVI broadens the market for leases in the phantom income stage. A less complex approach to the residual value certificate occurs when a lessor offers to sell a tax-benefit-exhausted lease outright. The purchaser often supports the transaction with residual value insurance. This mitigates the speculative aspect of purchasing a mature lease with a possibly sizable residual assumption.

Residual Value Insurance as Standby Equity

Many newcomers to the residual value insurance marketplace find the premiums charged by insurers to be quite expensive. Premiums that run from five to eight percent of the insured amount sound like large sums for insurance, and perhaps they are. However, it is misleading to think of RVI simply as an insurance policy. What the insurer gives the policyholder in exchange for the premium is a source of contingent funding. This capital source might be called "standby equity."

It has been explained previously that the buyer of a residual value insurance policy brings in the insurer

as a partner in the residual risk. However, this partnership is not symmetric for gains and losses. The insurer provides funds to the policyholder when times are bad; that is, when the value of the asset falls below its insured level. However, the insurer does not receive a share of the gains when times are good. The writer of residual value insurance, in effect, stands willing to contribute equity when it is most needed and most costly to raise. It is apparent when viewed in this light that residual value insurance is expensive because it performs a scarce and valuable financial function.

RVI also is a riskier proposition for insurers than are traditional products like life or accident insurance. This is because conventional insurance provides protection against independent risks, while the risks hedged with residual value insurance are related to one another. If events are independent, writing insurance against many such events reduces the risk faced by the insurer to nearly nothing. In the case of life insurance, since most deaths are independent events, the insurer can make the most money at the least risk by selling as many policies as possible. However, claims against residual value insurance policies will not be nearly as uncorrelated as life insurance claims. Asset values tend to vary with the business climate and the level of interest rates, so claims against RVI policies will cluster around business cycle downturns and periods of high interest rates. Insurers can diversify their risks just as lessors would, by spreading maturity dates and insuring different kinds of assets, but they can never create a portfolio of residual value insurance policies with totally independent risks. For this reason, residual value insurance is likely to remain more expensive and less widely marketed than traditional insurance products.

Residual value insurance serves a fairly narrow, although valuable, role in leasing. In particular, it cannot be used to insure the creditworthiness of a lessee. It is unreasonable to expect an

insurer to take on credit risk in addition to asset value risk, since the Two are clearly separate. RVI is not a solution if the asset is novel or experimental. As mentioned earlier, insurers will write residual value insurance only on assets with long life expectancy, low probability of obsolescence, and well-developed secondary markets. Residual value insurance may be standby equity, but it isn't venture capital.

Residual value insurance is an exciting financial product in today's leasing industry. Since it is the economic equivalent of a put option, it is an excellent tool for transferring asset value risk to a third party. Residual value insurance can have a significant accounting impact, aid in compliance with regulations, and allow for product innovation in lease structure. An important characteristic of RVI is that it serves as a form of standby equity, coming into play only when it is most needed. Although residual value insurance is costly and cannot be used in all situations, it has added considerably to broadening the lease financing marketplace.

The benefits provided by residual value insurance are essentially economic in nature: They primarily address issues of risk and return rather than tax treatment. Much of the rapid growth of the leasing industry in recent years has come from the tax-driven side of the business. Continued interest rate volatility, along with the increased likelihood of tax reform bringing lower marginal tax rates, and the potential elimination of the investment tax credit, means that risk management tools such as residual value insurance may become even more important in the near future.

The leasing industry interest in residual value insurance is already quite high. It seems that demand for RVI exceeds supply. Insurers are proceeding slowly in developing this market, partially because of unpredict-

FIGURE 1-A

OPTION/ONE VERSION 20

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RESIDUAL VALUE INSURANCE		0
Option on Security - Annual Dividend: 2.40		0
		0
Today's Date:	9/15/85	
Expiration Date:	9/15/90	
Tics/Point, Underlying:	100	Short-Term Rate: 11.00
		Days to Expiration: 1826
		Tics/Point, Option: 100
IMPLIED VOLATILITY ROUTINE		
Call or put option (c/P)	?P	
Put premium (pts.tics)	? 0.55	
Exercise price (pts.tics)	? 11.0	
Underlying price (pts.tics)	? 14.5	
Implied volatility	= 9.66%	

like to insure the aircraft residual for \$11 million in five years; it has been quoted a premium of \$550,000 for this policy. The lessor can use an option pricing model to calculate the volatility implied by this scenario. Figure 1-A shows the output from an option pricing software package², the implied volatility is 9.66%.

At this point, the lessor would like to know if the quoted price of \$550,000 is reasonable. The implied volatility can be employed to provide information about the fairness of the premium. One useful piece of information is the probability of the asset value falling below \$11 million at the end of five years. This possibility can be calculated from the data provided above.

Recall that volatility is the standard deviation of price changes. This implies that the probability of reaching a particular price level is an exponential function of the current price. In particular, it is known that:

$$F = Pe$$

where P is the current price, F is the future price being solved for, e is the base of the natural logarithm, t is time to expiration in years, v is the volatility just

calculated, and n is the number of standard deviations between P and F in the normal distribution.³ A solution can be derived for n and then the probability associated with n can be calculated by reading its value from a table of the normal distribution.

In the example, P=\$14.5 million, F=\$11 million, t=5 years, and v=.0966. After working out the algebra, it can be seen that n= -0.57 standard deviations. From the normal distribution table (which can be found in almost any statistics textbook), the associated probability is 28.43%. This means the insurance company, by quoting a premium of \$550,000, is telling the lessor that it will break even if there is a 28% chance the value of the asset will fall below \$11 million in five years. The lessor can compare this probability with its intuition and with past events to determine whether it seems reasonable.

At first glance, it might appear that half a million dollars is a lot of money to pay for protection against an event that is only likely to happen one quarter of the time. However, the value of an insurance policy depends not only upon the expected



table economic conditions and the current strength in demand for traditional insurance products, and also because insurers tend to be conservative by nature. However, if demand for RVI remains strong and interest continues to grow, insurers likely will follow and residual value insurance will become a leading risk management weapon in the increasingly sophisticated arsenal of the leasing industry.

frequency of an insured event, but also upon the magnitude of the calamity.

The most worthwhile insurance covers events with relatively low probabilities but large potential for losses. For example, having a low deductible on an automobile insurance policy is generally considered less important than having a high maximum amount.

Of course, no analytic technique can turn a complex business decision into a cut-and-dry matter. Because all the parameters required by an option pricing model are not known with perfect certainty, performing sensitivity analysis by varying parameter values is a necessary step. It also should be noted that this application is novel. To my knowledge, no research has been done on the applicability of option pricing models to residual value insurance, and there are some questions which should be subject to further research before the technique becomes used widely.⁴

Despite these caveats, the use of option pricing models to help evaluate the fair market value of residual value insurance is a technique that could prove to be useful for the leasing industry.

Footnotes

1. The best-known models are due to Black-Scholes and Cox-Ross-Rubinstein. See F. Black and M. Scholes, "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy* (1973), pp. 637-54; and J.C. Cox, S.A. Ross, and M. Rubinstein, "Option Pricing: A Simplified Approach," *Journal of Financial Economics* (1979), pp. 229-63.
2. The model used in this software package is a modified version of Black-Scholes described in IF. Meisner and J. W. Labuszewski, "Modifying the Black-Scholes Option Pricing Model for Alternative Underlying Instruments," *Financial Analysts Journal*, November/December 1984, pp. 23-30.
3. This formula is explained in further detail in W.M. Lupoletti and J. W. Labuszewski, "Playing the Odds with Options," *Futures*, forthcoming.
4. Two points should be mentioned. Since firms generally cannot borrow and invest at the same interest rate, two rates rather than one are needed as inputs. Second, the pricing model must take into account the fact that productive assets tend to depreciate in value with use. Current models usually abstract from these points or ignore them entirely.