



American Finance Association

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Source: *The Journal of Finance*, Vol. 38, No. 2, Papers and Proceedings Forty-First Annual Meeting American Finance Association New York, N.Y. December 28-30, 1982 (May, 1983), pp. 595-606

Published by: Blackwell Publishing for the American Finance Association

Stable URL: <http://www.jstor.org/stable/2327996>

Accessed: 27/11/2009 08:00

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Valuation of Safe Harbor Tax Benefit Transfer Leases

FRANK J. FABOZZI and UZI YAARI*

The Economic Recovery Tax Act of 1981 (ERTA) was designed to stimulate capital investment through liberalization of depreciation allowances and investment tax credit for property acquired and placed in service after December 31, 1980. To offer equal incentives to firms which themselves cannot realize tax benefits resulting from these changes, the ERTA made it easier to sell those benefits. The vehicle created by Congress for selling the unused portion of tax benefits is known as the "safe harbor lease." At the extreme, an unprofitable firm can now purchase and own an asset, while selling outright for cash the tax benefits typically associated with ownership. Under this arrangement, referred to as a tax-benefit-transfer (TBT) lease, the firm buying the tax benefits is recognized as "lessor" and *owner of the assets for federal income tax purposes only*.

The purpose of this paper is to analyze the TBT lease and show how it should be valued and priced by the lessor, i.e., the corporation purchasing the depreciation allowances and investment tax credit. Although the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982 repeals "safe harbor" leases after December 31, 1983, the conferees included special transitional rules to allow safe harbor leasing beyond that date for certain troubled industries. Moreover, there is strong sentiment in Congress for its reinstatement [6, p. 22].¹

The paper is organized along the following lines. In the first section, the TBT lease is described and illustrated numerically. In the second section, a closed form valuation formula is derived for this type of lease as seen by the lessor. In the third section, the pricing of this lease is examined. In the fourth section, the effect of two decision variables on the TBT lease value is analyzed: the interest rate charged on the phantom loan attached to this lease, and the term of the lease. In the fifth section, the TBT lease valuation model is contrasted with that of the conventional financial lease. The sixth section is a summary of the paper's main results.

I. Tax Benefit Transfer Lease

Prior to the ERTA, leases were classified for tax purposes as *true* or *pseudo* leases. In a true lease, the tax benefits associated with the ownership of the

* Fordham University and Temple University respectively. We wish to thank Stewart C. Myers for his helpful comments.

¹ Evidence for the recurrence of ideas in federal tax legislation has been documented by Katz [3, pp. 107–20].

leased asset—depreciation tax shield and, if applicable, investment tax credit—are transferred from the user (lessee) to the true owner (lessor).² To the extent that the lessor is profitable and can realize those tax benefits, a portion thereof may revert back to the lessee in the form of reduced rental charges. Solely in terms of tax implications, the rationale behind this transaction lies in the lessor's higher tax bracket vis-à-vis the lessee, and therefore lower after-tax cost of owning the asset used by the latter.

The standard lease valuation model for a true lease has been developed by Myers [4] and applied by Myers *et al.* [5], and then theoretically generalized by Franks and Hodges [2]. That generalization encompasses the scenario of a lessee that currently pays no taxes but anticipates a taxable position at a specified future time.

The *pseudo lease* can be viewed as a credit arrangement.³ The "lessee" finances the possession of an asset by borrowing from the "lessor," using the asset to secure the loan. Formal ownership of the asset may revert to the "lessee" for a nominal price at the end of the lease term. Unlike a true lease, a pseudo lease prior to the ERTA did not allow for transfer of tax benefits associated with ownership. Pseudo leases subject to this restriction should be evaluated with the same technique employed in determining the effective cost of conventional loan arrangements.

The ERTA allows a third class of lease transaction for tax purposes which guarantees that any agreement covering "qualified leased property" for use by a lessee for business purposes will be treated as a lease for purposes of depreciation allowances and tax credits, even to a nominal lessor. A transaction that qualifies under these provisions of the tax code is called a *safe harbor lease*. Unlike a true lease, a safe harbor lease may include a nominal purchase price at the end of the lease term. Moreover, there is ample room for creative financing not possible for a true lease.

The flexibility provided for safe harbor leases means that a qualified *corporate* taxpayer can purchase the tax benefits associated with a qualified asset owned by another business entity for a *lump sum cash payment*. This special type of safe harbor lease is called a *tax benefit transfer lease*. Other terms used are *wash lease*, *offset lease*, *nominal lease* and *phantom lease*.

Consider the following example of a TBT lease arrangement between two companies: Company E (the "lessee") which is expected to operate at a loss for the foreseeable future, and a qualified corporation, Company R (the "lessor"),

² Guidelines for identifying a true lease have been prescribed by the IRS and established by court cases. A key test is whether the lessor owns the asset at the end of the lease term. This requires that any option of the lessee to purchase the asset at the end of the lease term be at a price not below fair market value. For further discussion of these guidelines see Fabozzi [1, Chapter 3]. These guidelines still hold for transactions that fail to qualify for safe harbor treatment.

³ In the leasing industry, a pseudo lease is commonly referred to as a financial lease, since it represents a conditional sale or disguised loan. In the academic literature, a financial lease is often referred to as a true lease and its tax consequences are treated respectively. In Section V of this paper, the TBT lease is compared with the conventional financial lease as referred to in the academic literature (i.e., a full-payout lease that qualifies as a true lease). Compounding the confusion, beginning January 1, 1984, TEFRA establishes a new type of lease for tax purposes, called "finance lease."

expected to remain profitable and taxed at the full corporate rate. Suppose Company E has recently acquired equipment at \$1 million, or plans to do so.⁴ The equipment has an Asset Depreciation Range midpoint class life of 7½ years, and Company E wants to sell the otherwise useless tax benefits associated with owning the equipment, while maintaining legal ownership. Ownership can be transferred solely for federal income tax purposes by entering the following agreement. Company R pays Company E for the equipment's full acquisition cost with a down payment of \$0.16 million (16 percent of cost),⁵ and a nine-year non-recourse installment loan taken from Company E for the balance, \$0.84 million. This is a wash loan whose term is set to match the term of the lease, such that the sequences of phantom lease payments and loan installments (interest plus amortization of principal) exactly match and cancel one another.⁶ Finally, if it is further stipulated that Company E pays all expenses entailed by ownership and operation of the equipment (such as insurance, property taxes, and maintenance), no cash will change hands between the parties after the initial payment of \$0.16 million, except for the nominal price of one dollar paid by Company E to repurchase the equipment at the end of nine years.

This financial arrangement has no effect on Company E beyond the initial down payment, as this company is assumed to remain in the zero tax bracket. In contrast, the arrangement has four tax consequences for Company R: it generates the benefits of investment tax credit, depreciation tax shield, and the shield of phantom interest expense, offset by the cost of tax paid on phantom lease income.

Table 1 shows the after-tax cash flow of this hypothetical lease if the interest rate on the phantom loan is set at 18 percent and Company R is in the 46 percent marginal tax bracket. The value of this TBT lease to the lessor is the present value of the cash flow engendered by the lease.

II. The TBT Lease Valuation Model

The following variables and parameters are used below in developing the TBT lease valuation model.

P = down payment, or "price," paid by the lessor entering a lease contract.

L = wash loan extended by the lessee to the lessor to cover the difference between the leased asset price and the lessor's down payment.

R = phantom rental annuity charged to the lessee throughout the term of the lease; also an equivalent phantom loan annuity charged to the lessor.

⁴ Company E can enter a sale-and-leaseback agreement which would qualify as a safe harbor lease if the equipment was purchased within three months of the transaction.

⁵ To qualify for safe harbor status, the leased equipment cannot be sold for more than the taxpayer's adjusted tax basis, here \$1 million, and the down payment (that is, the amount "at risk" by the lessor) cannot be less than 10 percent of that basis.

⁶ TEFRA states that in order for a transaction to qualify for safe harbor treatment, the lease term must not exceed the greater of 120 percent of the asset's ADR midpoint class life or the recovery period used by the lessor. Although the asset in this example would fall into the five-year recovery class created by the Accelerated Cost Recovery System of ERTA, TEFRA requires that the recovery period used by the lessor be eight years for leased assets with five-year recovery. Consistently, 120 percent of 7½ years—9 years—is used in this illustration.

Table 1
Lessor's Cash Flow for a Hypothetical Tax Benefit Transfer Lease^(a)

Year	Down Pay- ment	ITC ^(b)	Phantom Rental In- come	Phantom Interest Ex- pense	Depreciation Expense ^(c)	Taxable In- come	Cash Flow ^(e)
0	(160,000)	20,000			(85,500)	(85,000)	(100,670)
1		20,000	195,213	(151,200)	(161,500)	(117,487)	74,044
2		20,000	195,213	(143,278)	(133,000)	(81,065)	57,290
3		20,000	195,213	(133,929)	(114,000)	(52,716)	44,250
4		20,000	195,213	(122,898)	(114,000)	(41,685)	39,117
5			195,213	(109,882)	(114,000)	(28,669)	13,188
6			195,213	(94,522)	(114,000)	(13,309)	6,122
7			195,213	(76,398)	(114,000)	4,815	(2,215)
8			195,213	(55,011)		140,202	(64,498)
9			195,213	(29,775)		165,438	(76,101)

^(a) Equipment cost is \$1 million; interest rate on phantom loan is 18 percent; down payment is 16 percent; tax rate is 46 percent.

^(b) Based on TEFRA: ITC is taken in equal amounts over five years.

^(c) Based on TEFRA: 150 declining balance with half year convention, applied to asset cost minus half of ITC. Combined with a gainful switch to straight line depreciation in the third year.

^(d) Phantom rental received, minus phantom interest paid, minus depreciation.

^(e) ITC, minus down payment, plus 46 percent of taxable income decrease.

D_t = annual depreciation allowance claimed by the lessor starting upon commencement of the lease, where $t = 1, 2, \dots, 8$.⁷

C_t = annual investment tax credit to the lessor starting upon commencement of the lease, where $t = 1, 2, \dots, 5$.⁸

I_t = phantom annual dollar interest charged to the lessor throughout the term of the lease, starting at the end of year 1, where $t = 1, 2, \dots, n$.

All of the above variables are measured for convenience per dollar of the leased asset cost. In addition, the following rates are used.

i = rate of interest implicit in the wash loan attached to the lease.

r = lessor's relevant *post*-corporate-tax discount rate (discussed further below).

τ = lessor's marginal corporate tax rate, assumed to remain constant for the foreseeable future.

Phantom rental and loan annuity R. Based on the constraint unique to the

⁷ TEFRA requires that an asset subject to a safe harbor lease not be depreciated using the allowance available to its recovery period as prescribed by the Accelerated Cost Recovery System. Instead, the lessor must depreciate the asset using the 150 percent declining balance, half-year convention method. If the asset falls into the five-year recovery class of the ACRS, the recovery period the lessor must use is eight years. Since the bulk of TBT leases fall into this class, eight years are used throughout this paper. Any depreciable asset, whether or not it is the subject of a safe harbor lease, cannot be fully depreciated if the owner of the asset takes the full tax credit permitted by law. The tax basis must be reduced by one-half the amount of the credit taken. Alternatively, the taxpayer may elect to take only a prescribed portion of the tax credit and fully depreciate the asset. For an asset in the five, ten or fifteen-year recovery class, electing an 8 percent ITC rather than the full 10 percent entitles the owner to depreciate the asset by 100 percent.

⁸ TEFRA mandates that any tax credit for an asset subject to a safe harbor lease be spread evenly over a five year period. The ITC is the most important but not the only tax credit which may be available to the lessor.

TBT lease, that the rental annuity R paid by the lessee exactly cancels the loan annuity at the rate i paid by the lessor, the original wash loan balance L can be written as a discounted value of that annuity

$$L = R \frac{1}{i} \left[1 - \frac{1}{(1+i)^n} \right]$$

implying the following expression for R

$$R = L \left[\frac{i}{1 - (1+i)^{-n}} \right] \quad (1)$$

Interest payments. The equal loan installments R paid by the lessor consist of an accelerated repayment of principal and a decelerated payment of interest, of which only the latter is recognized as an expense for tax purposes. Interest expense from the second year on is first generally stated in terms of interest expenses in preceding years

$$I_1 = iL$$

$$I_2 = i(L + I_1 - R)$$

$$I_3 = i(L + I_1 + I_2 - 2R)$$

$$\vdots$$

$$I_n = i[L + I_1 + I_2 + \dots + I_{n-1} - (n-1)R]$$

and then spelled out only in terms of the original loan balance L and the interest rate i , by repeatedly substituting I -values from preceding years and the R -value based on (1)

$$I_1 = Li(1+i)^0 \left[\frac{(1+i)^n - 1}{(1+i)^n - 1} \right]$$

$$I_2 = Li(1+i)^1 \left[\frac{(1+i)^{n-1} - 1}{(1+i)^n - 1} \right]$$

$$I_3 = Li(1+i)^2 \left[\frac{(1+i)^{n-2} - 1}{(1+i)^n - 1} \right]$$

$$\vdots$$

$$I_n = Li(1+i)^{n-1} \left[\frac{(1+i)^1 - 1}{(1+i)^n - 1} \right]$$

(2)

Appropriate discount rate. The wash loan taken by the lessor contains a non-recourse stipulation and its payments are fully offset by the rental payments; therefore it has no independent effect on the lessor's financial leverage. The

impact of this loan on the lessor's risk is fully accounted for by focusing on the net cash flows generated by the TBT lease. As seen by the lessor, these flows are insensitive to profit fluctuations and, due to the flexibility to carry forward, only slightly sensitive to temporary losses. These considerations indicate a negative displacement of debt, calling for the use of a discount rate lower than the cost of capital.⁹ Nonetheless, the discount rate used by the lessor should reflect risks emanating from three sources: the lessor, the lessee, and the government.

Originating with the lessor, there is a risk of the kind always attached to future income items such as depreciation tax shield—the effective marginal tax rate may decrease due to unexpected losses. The lessor can find some protection in sharing this risk with the lessee, by adding a tax indemnification clause to the contract.¹⁰

The lessee is a second source of risk since certain actions taken by the lessee may strip the lease of its safe harbor status, forcing recapture of depreciation and/or investment tax credit by the lessor. Actions which could trigger a loss of status are transfers of interest in the lease and voluntary or involuntary transfer of the title to the leased property.¹¹ This is a risk which can be shared by again making an indemnification clause part of the lease contract.

The government is a third source of risk since there is always the possibility of an unexpected change in the tax law or its application. Specifically, there is risk of loss to the lessor due to retroactive modification or new interpretation of the safe harbor provisions, or a possible decrease in corporate tax rates—risk which can be shared with the lessee in a contractual manner, as indicated above.

In sum, these considerations seem to suggest the use of a discount rate lower than the lessor's cost of capital, but higher than the risk-free rate.

Lease value to the lessor. The value of the TBT lease to the lessor is calculated by discounting the cash flow components at the relevant interest rate, r ¹²

$$V = -P + \sum_{t=1}^5 C_t(1+r)^{1-t} + \tau \sum_{t=1}^8 D_t(1+r)^{1-t} - \tau \sum_{t=1}^n R(1+r)^{-t} + \tau \sum_{t=1}^n I_t(1+r)^{-t} \quad (3)$$

Interpretation of this formula is straightforward. The first term is the down payment made by the lessor; the second term, the discounted stream of the investment tax credit; the third term, the discounted tax shield of depreciation allowances; the fourth term, the negative value of tax payments on phantom rental income; the fifth term, the discounted tax shield of phantom interest expense.

As explained in footnote 7, under TEFRA there is a trade-off between the amount of ITC and the total amount depreciated. In the case of a TBT lease, the

⁹ The awkward term “negative displacement of debt” denotes the reverse of the term “displacement of debt,” often used to indicate the introduction of risk analogous to that of additional borrowing. Note that the TBT lease has no financial side effects on the lessee.

¹⁰ For a discussion of the tax indemnification provisions see Fabozzi [1, pp. 69–71].

¹¹ See Fabozzi [1, Supplement], or Nevitt and Fabozzi [7]. Remember that the TBT lease is a *lease only for tax purposes*—the lessor does not have a claim against the leased asset in the event of bankruptcy or similar proceedings.

¹² Two cost items are omitted from the analysis: the cost of legal documentation of the lease, and the brokerage fee paid to the intermediary for bringing together buyer and seller of tax benefits.

lessor may take the full 10 percent ITC and depreciate 95 percent of the asset cost *or* take an 8 percent ITC and depreciate 100 percent of the cost. It is assumed that the lessor chooses the option producing the highest combined present value of ITC and depreciation tax shield.

Based on (1), the fourth term of (3) can be restated in closed form

$$- \tau L \left[\frac{i}{1 - (1 + i)^{-n}} \right] \left[\frac{1 - (1 + r)^{-n}}{r} \right] \quad (4)$$

Similarly, based on (2), the fifth term becomes

$$\begin{aligned} & \frac{\tau Li}{(1 + i)^n - 1} \sum_{t=0}^{n-1} [(1 + i)^{n-t} - 1(1 + i)^t(1 + r)^{-t-1}] \\ &= \tau L \left[\frac{i}{1 - (1 + i)^{-n}} \right] \left[\frac{1 - (1 + r)^{-n}}{r} \right] \end{aligned} \quad (5a)$$

$$- \tau L \left[\frac{i}{(1 + i)^n - 1} \right] \left[\frac{1 - (1 + i)^n(1 + r)^{-n}}{r - i} \right] \quad (5b)$$

The first component, (5a), is identical to (4) but in the opposite sign, allowing substitution of the second component, (5b), for the fourth and fifth terms in (3) (Note: $L = 1 - P$).

$$V = -P + C^* + \tau D^* - \tau(1 - P) \left[\frac{i}{(1 + i)^n - 1} \right] \left[\frac{1 - (1 + i)^n(1 + r)^{-n}}{r - i} \right] \quad (6)$$

where C^* and D^* are the discounted values of the ITC and depreciation allowances, respectively, assuming optimal ITC/depreciation policy on the part of the lessor. This formula for the value of the TBT lease as seen by the lessor, is surprisingly simple considering the cumbersome derivation of its last term. This term, which stands for the conflicting real effects of the unreal rental income and interest expense, is negative under the non-binding constraints $r > 0$ and $i > 0$.

To demonstrate the application of the model, consider the hypothetical example of the previous section, where $P = .16$, $\Sigma C_t = .10$, $i = .18$, and $\tau = .46$. If it is assumed that $r = .15$, then¹³

$$C^* = \sum_{t=1}^5 C_t(1 + r)^{1-t} = .0771 \quad \text{and} \quad D^* = \sum_{t=1}^8 D_t(1 + r)^{1-t} = .6155$$

and by substitution in (6)

$$V = -.16 + .0771 + .46(.6155) - .46(1 - .16)(.0524)(8.6944) = .0242$$

In dollar terms, since the cost of the equipment is \$1 million, the value of this lease is \$24,200. (The reader may confirm this result by discounting at 15 percent the cash flow in Table 1.)

¹³ The combined present value of the depreciation tax shield and ITC is greater if the full 10 percent credit is taken and the depreciation basis is reduced by 5 percent.

III. Pricing the TBT lease

The lessor's viewpoint. The price paid by the lessor for the tax benefits entailed in a TBT lease consists entirely of the down payment. It is apparent from (6) that an increase of a dollar in the price paid for the lease costs the lessor less than a dollar. Given the asset cost, any increase in P is associated with an equivalent decrease in the size of the loan taken by the lessor, bringing a partially offsetting benefit to the lessor by causing an identical decrease in rental receipts and loan payments, of which the former change has a greater tax impact. That is, $0 > \partial V / \partial P > -1$, where

$$\frac{\partial V}{\partial P} = -1 + \tau \left[\frac{i}{(1+i)^n - 1} \right] \left[\frac{1 - (1+i)^n(1+r)^{-n}}{r-i} \right]$$

The maximum price payable, or the down payment so high as to render the lessor indifferent to the deal, is derived by setting at zero the value given by (6) and solving for P

$$P = 1 - \frac{1 - C^* - \tau D^*}{1 - \tau \left[\frac{i}{(1+i)^n - 1} \right] \left[\frac{1 - (1+i)^n(1+r)^{-n}}{r-i} \right]} \quad (7)$$

Application of (7) to the numerical example of section I yields the maximum price

$$P = 1 - \frac{1 - .0771 - .46(.6155)}{1 - .46(.0524)(8.6944)} = .1906$$

In view of the legal requirement $P \geq .10$ currently restricting safe harbor leases, the down payment in the hypothetical lease of a \$1 million asset must be at least \$100,000, but no more than \$190,600.

Joint benefit—the loss of tax revenue. Let it be assumed for convenience that the lessee currently pays no income tax and is expected to remain in that position for the foreseeable future. This implies that the gross and net benefit to the lessee is entirely in the down payment made by the lessor. But since a dollar down payment costs directly a dollar to the lessor, the joint benefit to both parties, V_j , or the net loss of tax revenue to the Treasury can be obtained by dropping the down payment term from (6)

$$V_j = C^* + \tau D^* - \tau(1 - P) \left[\frac{i}{(1+i)^n - 1} \right] \left[\frac{1 - (1+i)^n(1+r)^{-n}}{r-i} \right] \quad (8)$$

This value is increasing in the price paid by the lessor to the extent indicated by

$$\frac{\partial V_j}{\partial P} = \tau \left[\frac{i}{(1+i)^n - 1} \right] \left[\frac{1 - (1+i)^n(1+r)^{-n}}{r-i} \right]$$

The maximum joint benefit consistent with no loss to either side is attained at a price stated by (7), with zero benefit to the lessor.

Dividing the tax benefit. If financial transactions between lessee and lessor were not at arm's length and fully disclosed, while tax margins differed, the two sides would seek the highest joint tax benefit. According to (8), this requires payment equal to the full asset price, implying $P = 1$. But such a relationship between lessee and lessor is inconsistent with the existence of unequal tax margins in the first place. Underlying the analysis in this paper is an alternative assumption of separate utility functions and full disclosure, whereby the two sides may choose to share the joint benefit based on some pre-determined formula. To demonstrate how the valuation model developed above can be used to set the price consistently with such a formula, let it be assumed that the lessee is to receive a known fraction w of the joint benefit. Here, the correct price is found by substituting (6) and (8) in $V = (1 - w)V_j$, and solving for P

$$P = 1 - \frac{1 - wC^* - \tau D^*}{1 - w\tau \left[\frac{i}{(1+i)^n - 1} \right] \left[\frac{1 - (1+i)^n(1+r)^{-n}}{r - i} \right]}$$

IV. Setting Other Terms of the Lease

The nominal nature of the relationship between lessee and lessor under the TBT lease dictates that the arbitrary terms of the lease, consisting of i and n , be set to maximize the joint tax benefit derived from the arrangement.

Setting the rate of interest. At first glance, it may appear that the rate of interest i charged by the lessee on the phantom credit extended to the lessor should be a matter of indifference to both parties. For the lessee the case is clear: any increase in interest income would be cancelled out by an equivalent increase in rental expense, both changes having no tax effect. Should the same conclusion apply to the lessor with additional tax consequences? The answer is negative. For the lessor, an identical increase in total interest expense and rental income would result in a net tax benefit due to the concentration of interest expense in the earlier years. It follows that the tax benefit to the lessor, and therefore to both parties, is increasing in the phantom rate of interest. (A proof of this claim is furnished in Appendix A.) This conclusion provides a rationale for the legal requirement that this rate not exceed the current interest rate used by the IRS to reward overpayment and penalize underpayment of taxes.

Setting the term of the lease. Due to the concentration of interest payments in the earlier years, any increase in the term of the lease would have a greater ameliorating effect on the tax exposure of rental income than on the tax shield of interest expense. Consequently, the tax benefit to the lessor and to both parties is increasing in the term of the lease. (For a proof of this statement see Appendix B.) This conclusion explains why under present law the term of the lease, plus extensions, may not exceed the greater of (a) 90 percent of the extended recovery

period of the leased asset, or (b) 120 percent of the Asset Depreciation Range midpoint class life.

V. The TBT Lease and the Conventional Financial Lease

Better understanding of the valuation procedure proposed in section II and its implications discussed in sections III and IV can be gained by focusing on the differences between the TBT lease and the conventional financial lease.

The fundamental difference between the two types of leases is that the TBT lease is not a financial vehicle—the lessee does not use the lessor as a source of funds. The wash loan is not a loan. The TBT lease-loan package is not a tie-in of reciprocal economic services, since neither the lease nor the loan are true economic services. Rather, the two are *designed* to nullify each other, so as to leave both on paper only. It follows that the TBT lease cannot be treated as a special case of the conventional financial lease in which loan and lease payments happen to match. In particular, whatever the competitive pressures in the market for tax shields, it cannot be presumed that the terms of the wash loan reflect competitive conditions in the market for credit. As shown in section IV, unlike a true loan *both* lender (lessee) and borrower (lessor) have an incentive to raise the interest rate on the wash loan. This incentive is unlikely to be fully curbed by the legal constraint on that rate.

Thus, it is the arbitrary nature of its interest rate which justifies the explicit inclusion of the wash loan in the TBT lease valuation model. This is the *only* difference between valuation based on equation (3) or (6) and that developed by Myers [4] for the conventional financial lease. The two models give the same lease value only when the present value of the wash loan is zero, namely, when for some reason the interest rate charged on the loan, i , is set equal to the pre-tax rate of discount, $r/(1 - \tau)$. In this special case, equation (3) is reduced to

$$\begin{aligned} V &= -1 + \sum_{t=1}^5 C_t(1+r)^{1-t} + \tau \sum_{t=1}^8 D_t(1+r)^{1-t} + (1-\tau) \sum_{t=1}^n R(1+r)^{-t} \\ &= -1 + C^* + \tau D^* + (1-\tau)R \left[\frac{1 - (1+r)^{-n}}{r} \right] \end{aligned}$$

which is the value of the comparable financial lease.

VI. Summary

The main objective of this paper was to develop a simple valuation formula for the newly established safe harbor Tax Benefit Transfer lease. With the help of this formula, it was shown that tax benefits derived by the lessor depend in a complex way upon the price paid the lessee in purchasing those benefits. It was further shown how the lease should be priced to divide the overall benefit between the two parties based on any desirable sharing formula. The valuation formula was also used to demonstrate that the magnitude of the joint tax benefit—i.e., the loss of tax revenue to the Treasury—is affected by the way in which that benefit is divided, as well as by the choice of the term of the lease and the interest

rate charged on the attached wash loan. A closing discussion provided the rationale for inclusion of the wash loan in the TBT lease valuation.

Appendix A

The effect of i on V (or V_j) is confined to the last term of (6) [or (8)]. The direction and extent of this effect is determined below in two stages. First, the separate elasticities with respect to i of the two ratios comprising that term are calculated. Second, the sum of these elasticities is used to determine the sign of the derivative of V with respect to the same variable.

Let X denote the first ratio enclosed in brackets and Z its reciprocal, and Y the second ratio in brackets. Ratios Z and Y can be recast as polynomials

$$Z = \frac{(1+i)^n - 1}{i} = \sum_{t=1}^n (1+i)^{t-1};$$

$$Y = \frac{1 - (1+i)^n(1+r)^{-n}}{r-i} = \sum_{t=1}^n \frac{(1+i)^{t-1}}{(1+r)^t}$$

having the following elasticities with respect to i

$$\eta_{Zi} = \frac{i}{Z} \frac{dZ}{di} = i \sum_{t=1}^n (t-1)(1+i)^{t-2} \bigg/ \sum_{t=1}^n (1+i)^{t-1}$$

$$\eta_{Yi} = \frac{i}{Y} \frac{dY}{di} = i \sum_{t=1}^n (t-1)(1+i)^{t-2}(1+r)^{-t} \bigg/ \sum_{t=1}^n (1+i)^{t-1}(1+r)^t$$

which are positive under the non-binding constraints $r > 0$ and $i > 0$. To facilitate their comparison, the following positive transformations are performed: both elasticities are multiplied by $(1+i)/i$, and both the numerator and denominator of η_{Yi} are multiplied by $1+r$. Substitution of $1+m$ for $(1+i)/(1+r)$ throughout η_{Yi} yields

$$\frac{1+i}{i} \left[\frac{i}{Z} \frac{dZ}{di} \right] = \sum_{t=1}^n (t-1)(1+i)^{t-1} \bigg/ \sum_{t=1}^n (1+i)^{t-1}$$

$$\frac{1+i}{i} \left[\frac{i}{Y} \frac{dY}{di} \right] = \sum_{t=1}^n (t-1)(1+m)^{t-1} \bigg/ \sum_{t=1}^n (1+m)^{t-1}$$

It can be readily verified by differentiation that these ratios are increasing in i and m , respectively, such that the relationship $i > m$ causes $\eta_{Zi} > \eta_{Yi}$. However, the definition $X = Z^{-1}$ implies $\eta_{Xi} = -\eta_{Zi}$ and thus $\eta_{Xi} < 0$, forcing $|\eta_{Xi}| > |\eta_{Yi}|$ and therefore $\eta_{Xi} + \eta_{Yi} < 0$.

The last result has an immediate implication for the effect of a change in i on the lease value given by (6). The sum of the two elasticities can be written as

$$\eta_{Xi} + \eta_{Yi} = \frac{i}{X} \frac{dX}{di} + \frac{i}{Y} \frac{dY}{di} = \frac{i}{XY} \left[Y \frac{dX}{di} + X \frac{dY}{di} \right]$$

where the expression in brackets on the right-hand side is recognized as the

derivative with respect to i of the product XY . This derivative is clearly negative since the sum of these elasticities has been found negative and the value of $i/(XY)$ is positive.

Finally, the negative sign of the last term in (6) reverses the negative effect of i on the product XY , causing V to increase with i .

Appendix B

The effect of n on V is confined to the last term in (6) [or (8)], and can be readily determined by recasting the second expression enclosed in brackets.

Let m be a differential rate of interest defined by $1 + m = (1 + i)/(1 + r)$, such that the second expression in brackets can be restated as

$$\left[\frac{(1 + m)^n - 1}{m} \right] \frac{1 + m}{1 + i}$$

and the entire last term of (6) as

$$-\tau(1 - P) \left[\frac{i}{(1 + i)^n - 1} \right] \left[\frac{(1 + m)^n - 1}{m} \right] \frac{1 + m}{1 + i}$$

Since $r > 0$, and therefore $i > m$, the absolute value of the product of the two symmetrical expressions in brackets is inversely related to n . With a negative sign preceding the last term, V is clearly increasing in n .

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DISCUSSION

ALAN J. AUERBACH*: As is true in most countries where there is a corporate tax, the U.S. corporate tax system treats gains and losses asymmetrically. While

* Harvard University and the National Bureau of Economic Research