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Expanding Budgets via Strategic Use of Leasing

William McAndrew and Paul J. Speaker
College of Business and Economics, West Virginia University, Morgantown, West Virginia, USA

Abstract *An examination of the budgets of forensic laboratories reveals an unused or underused tool at the disposal of forensic laboratories. Equipment leasing offers an opportunity for a unilateral increase in the purchasing power of existing laboratory budgets and an immediate response to austerity measures. Rather than react to budget tightening with reductions in force, shared furloughs, or the forfeiture of unfilled positions, a laboratory director can forestall such measures and even see an effective increase in disposable income through a planned use of operating leases. If a public laboratory makes an equipment purchase, the cost to the laboratory will be the full list price from the equipment supplier. However, when a private laboratory makes the same equipment purchase, it pays the supplier the full list price, but is able to deduct the expense from its income when it calculates its corporate income tax and ends up with a final expense, net of taxes, that is considerably less than the cost to the public laboratory. Leasing offers the opportunity for a private entity to purchase equipment and pass on some of the tax savings to the public laboratory through an operating lease. In this manuscript the leasing gains are explained and accompanied by a detailed example to illustrate the potential magnitudes of the gains. In this example, a representative laboratory is shown to experience nearly a twenty-five percent gain from the lease compared to the expense of a direct purchase.*

Keywords Budgeting, cost efficiency, financial management, forensic laboratory, leasing

Introduction

If necessity is the mother of invention, perhaps sequestration fits the role of the wicked stepmother. The Great Recession of 2008 resulted in severe tax revenue reductions for governments around the world. As a result of the loss in revenues, governments have reacted with corresponding cutbacks in the allocations to agencies in the public sector. These austerity measures have been highlighted by the infectious damage centered in Portugal, Ireland, Greece, and Spain (the so-called PIGS[1]). Seemingly more stable countries have faced their own austerity measures, including the plight of the forensic sciences in the United Kingdom with the closure of Forensic Science Services (FSS) in 2010. In the United States the inability to find a political solution to declining revenues gave way to the distasteful agreement of sequestration[2] and the corresponding automatic cuts in most public sector areas, including funding for forensic science laboratories. Such cuts have exacerbated the funding strains felt across the forensic science industry.

The automatic across-the-board reductions in expenditures that came from sequestration left little room for laboratories to make choices. With personnel expenditures comprising roughly 70% of the budget for an average laboratory (Newman, Dawley, & Speaker, 2012), many laboratories have reluctantly looked to unpleasant choices, such as reductions in staffing as the logical response to a call for budget cuts. As demand for forensic laboratory services has grown, this simultaneous strain on the ability to supply services has stressed numerous laboratory systems.

But what if laboratory budget cuts could be avoided or lessened, regardless of national policy? An examination of the budgets of forensic laboratories in the FORESIGHT study (Houck, et al 2009) reveals that most laboratories have an unused or underused tool at their disposal, equipment leasing, which offers an opportunity for a unilateral increase in the purchasing power of existing budgets and an immediate response to austerity measures. Rather than react to sequestration with reductions in force, shared furloughs, or the forfeiture of unfilled positions, a laboratory director can forestall such measures and even see an

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Address correspondence to Paul J. Speaker, College of Business and Economics, West Virginia University, 1601 University Avenue Morgantown, WV 26506-6025, USA. E-mail: Paul.Speaker@mail.wvu.edu

effective increase in disposable income through a planned use of operating leases. Consider the net expenditure differences between a public laboratory and a private laboratory involving the purchase of an identical piece of laboratory equipment. If the public laboratory makes an equipment purchase, the cost will be the full list price from the equipment supplier. When the private laboratory makes the same equipment purchase, it pays the supplier the full list price, but is able to deduct the expense from its income when it calculates its corporate income tax and ends up with a final expense, net of taxes, that is considerably less than the cost to the public laboratory.

Although the public laboratory cannot receive the wealth transfer from the tax deduction, it can reap the same benefits of the lower after-tax net cost by finding a partner in the private sector, the lessor, who purchases and then leases the desired equipment to the public laboratory. Leasing offers an opportunity for a tax-paying private company to transfer tax benefits to a public sector laboratory through their lower net cost for equipment, while simultaneously keeping some of the benefits from the increased profit from a reduction in its tax base. These gains can be substantial. An example below shows potential capital budget savings of nearly 25%.

In addition, other benefits beyond the cost of capital equipment may be realized from the adoption of a leasing strategy. The operating lease can reduce equipment maintenance costs and improve quality as leases permit the laboratory to speed up replacement of dated equipment in favor of immediate adoption of technological improvements. Thus the laboratory may be able to employ more technologically advanced procedures and indirectly expand its budgets simultaneously.

In the sections to follow, the realities of corporate tax laws are presented and it is shown how laboratories in the private sector are able to acquire their equipment at a significantly lower net cost than public laboratories. Tax laws provide certain benefits to the individual business that result in additional benefits to the general economy through the enhancement of economic activity and the creation of additional employment. While the same incentives are not directly applicable to the public sector agency, leasing offers an opportunity for the public sector laboratory to effectively trade tax positions with a private sector lessor, thereby extending those benefits to, and stretching the budget of, the public laboratory. In the sections to follow, a brief introduction to the tax laws, including the specific laws that outline public sector agencies use of leasing and the qualifications of a lease agreement are presented. This is followed by an example for a lease versus purchase decision for a piece of laboratory equipment. While the example is based in the U.S. tax code, the principles may be easily extended to other countries with a consideration of the nuances of each country with respect to treatment of the lessee and the lessor. When the example is extended to the entire capital budget of the laboratory, the full magnitude of the lease option is revealed, and the extent of the indirect expansion of the budget may be realized.

Some Leasing Basics

The potential benefits from the tax deductibility of lease payments only accrue when the lease terms have met certain provisions. Leases generally fall into two broad categories, financial leases and operating leases.[3] Financial leases, alternatively termed capital leases, represent a method of financing equipment that provides a substitute for direct borrowing as a means to acquire equipment.

Operating leases, on the other hand, offer the use of capital assets for a time period that is less than the economic life of the asset, and such leases also include maintenance as the lessor is the owner of the equipment and bears the responsibility of upkeep. The lease contract may also include cancellation clauses before the end of the contract period. It is this latter category, the operating lease, which presents the laboratory with the potential budget gains as long as the terms of the lease meet Internal Revenue Service (IRS) guidelines.[4] These IRS guidelines determine which party, lessee or lessor,[5] is able to stake claim to the benefits of ownership, depreciation and/or investment tax credits. Guidelines specify:

- The term of the lease must be less than or equal to 80% of the engineering life of the equipment;
- At the end of the lease, the expected salvage value of the equipment must equal or exceed 20% of the starting value;
- No predetermined price may be established for the sale of the equipment from the lessor to the lessee at the end of the lease;
- The lessee's regular payments to the lessor may only include the lease payments; and
- The equipment cannot be so specialized that the lessee is the only potential customer for sale of the equipment when the lease ends.

If the lease contract meets the IRS guidelines, then there are several ways in which net benefits could accrue to the laboratory (lessee) as described by Lewellen et al. (1976). For each of the benefits to the lessor, the lessee gains through a contract in which the lessor passes on a portion of the gains to the lessee. These different potential transferable gains include:

- Effectively exchanging tax positions where the lessor (with the higher tax rate) receives a greater tax reduction from the expense;
- Aggressive use of depreciation and amortization (D&A) to experience tax benefits at a faster pace for the lessor;

- Market advantages to the lessor as a more frequent participant in the marketplace, where volume discounts may be negotiated for purchase price or the bundling of maintenance contracts;
- After market (resale) advantages to the lessor via releasing or sale of used laboratory equipment; and
- Differences in after-tax costs of borrowing to purchase laboratory equipment.

Each of these potential contributions to the lease versus purchase discussion is isolated and examined in turn in the succeeding sections. The discussion is supported by a numerical example to highlight the potential size of any net advantage to leasing over purchase. The magnitude of the leasing gains is provided in the text that follows with the detailed calculations relegated to the appendix.

Tax Laws, Incentive Systems, and Time Value of Money

Investments in capital assets provide services that are spread over several years. Accounting conventions provide the rules by which the initial investment expenditure may be assigned to each accounting year of potential use of the capital asset through the assignment of depreciation.[6] Among the alternative methods of depreciation is straight-line depreciation, where an equal portion of the cost is assigned over a term of years. Other depreciation methods accelerate the assignment of costs so that the tax advantages from depreciation deductions may be realized sooner rather than later. For the public laboratory, the method of depreciation chosen has little direct impact on the operation of the laboratory since tax deductibility of expenses is irrelevant to a tax-exempt organization. Depreciation offers a means to determine a book value of assets, but does not have a meaningful impact on the public sector laboratory's income statement since the public laboratory does not pay taxes. For a private laboratory, however, the choice of depreciation method has a direct impact on the value of the laboratory, where the value generally increases as more accelerated methods of depreciation are used (if permitted). This benefit occurs since there is a time value to money and, *ceteris paribus*, the earlier deductions are taken, the higher will be the value of those deductions at the time of the investment decision.

The magnitude of the benefit from depreciation may be realized through a consideration of the time value to money, where benefits received sooner may be reinvested to provide greater returns in the future. Consider first the public laboratory that purchases some equipment at a particular upfront price and plans to use that equipment over the following N years. Additionally, suppose that the laboratory purchases a maintenance contract for which it pays a contracted amount at the beginning of the year for each of those N years. Further, at the end of the N periods, the laboratory may choose to sell the equipment for the market value of that equipment, which represents a positive cash flow in the Nth period. Then the total cash flows for the public laboratory across all periods may be described as the cash outflow for the equipment expense at time 0, the maintenance contract at the beginning of each period $t = 1, \ldots, N$, and any cash inflow at the end of period N from the sale of the used equipment. Depreciation, whether straight-line, accelerated, or otherwise, will not affect the cash flow of the public laboratory since the public entity does not pay taxes.[7] Because the cash flows occur in different periods, a present value comparison is calculated to discount the cash flows to the present using a rate that reflects the financial market's interpretation of the risk-adjusted return for the political entity in which the laboratory operates. Such a discount rate is easily inferred from the trading of general obligation bonds for that political jurisdiction.

Alternatively, examine a private laboratory that considers the purchase of identical equipment and associated maintenance contracts, but which is assessed a positive tax rate on ordinary income and a positive tax rate on capital gains income. The cash flows for the private laboratory will be the same as the public laboratory for equipment and maintenance with a few exceptions. The private laboratory will have the upfront equipment expense and the beginning of period maintenance expenditure, but unlike the public sector laboratory, it will deduct depreciation at the end of each period and affect its after-tax net income.[8] That depreciation deduction provides a tax shield for each period t, which is effectively a subsidy via a reduction in tax liability.

The present value cost to the public laboratory represents the amount that the jurisdiction requires in today's currency to pay for the investment including the initial investment and annual maintenance contract, net of any resale of the equipment at the end of the contract period. The appendix contains the detailed formula for the representation of the present value cost. Additionally, the appendix includes a series of examples with detailed calculations of the potential gains from leasing over purchase.

For the private entity, expenses are tax deductible. As a result of the tax effects, the present value cost for the private entity is offset by reductions in their tax bill. The private entity, whether it is a laboratory, bank, or leasing company, ends up paying less for equipment and maintenance than is experienced by the public laboratory. The tax benefits to the maintenance charge are taken each year when maintenance is paid, while the tax benefits from the equipment expense is spread over time through deductions for depreciation following applicable tax code. These gains are partially offset through potential capital gains on the resale of equipment after the lease term ends.

In a comparison of the present value cost for the public laboratory versus the private sector purchaser of equipment, the potential gains from leasing emerge. As noted in the previous section, if the present value cost is less for the private entity, then by making the equipment purchase in the private sector, the reduced cost from the tax deductibility of depreciation and maintenance can potentially be shared with the public sector laboratory through annual lease payments, which are lower than the annualized costs for a public laboratory.

There are legal requirements that keep the potential gains in check. In 1984 the U. S. federal government passed the Deficit Reduction Act (DEFRA), which limited this benefit of a leasing arbitrage opportunity. The limitation presents itself when a private lessor leases an asset to a tax-exempt entity such as a state or county in the form of a financial lease. Before this legislation, tax exempt entities would often pursue long-term projects using leases that at a local or agency level may have benefits greater than their costs, but at a societal level would be more expensive than traditional debt financing as a result of federal tax deductions being used to subsidize the asset acquisition of tax exempt entities.[9] If one assumes the lessor and the tax exempt lessee differ only in their income tax rate, then the value gained by leasing rather than debt financing for the lessor and lessee before 1984 is equal to the subsidy or loss that the government directly pays to the lessor and indirectly pays to the lessee through income tax deductions.

With the passing of DEFRA and subsequent laws that add more detail to the permissible lease activities involving tax-exempt entities, it is clear that the federal government attempted to stop some indirect subsidies to government and other tax exempt entities' investment through financial leases. Indeed before DEFRA often undesirable projects were undertaken through leasing, which cost taxpayers more money. However, there are still legally permissible ways for public forensic laboratories to take advantage of lease situations through disparate taxes with private lessors if certain IRS guidelines on leasing are followed advantageously. These situations are highlighted above as guideline leases that have met the criteria of performing as a lease with the ownership burden on the lessor, rather than a disguised loan that circumvents the intention of the law.

The Size of the Gains—Example

Consider the net expenditure differences between a public laboratory and a private laboratory involving the purchase of an identical piece of laboratory equipment and the associated maintenance contract for that equipment. To isolate each of the potential gains from leasing as detailed above, consider a series of scenarios, which isolate the contributions that make leasing a viable consideration for the public laboratory. (The detailed calculations, corresponding to each of these scenarios, appear in the Appendix.)

Suppose that a laboratory is considering the purchase of scientific instrumentation with a list price of $100,000. That list price is the same for either a public sector laboratory or a private sector laboratory. Additionally, the laboratory would purchase an annual maintenance contract on the capital equipment at a cost of $5,000 per year and with the maintenance contract payments due at the beginning of each year. The instrument falls into the Internal Revenue Service (IRS) 5-year depreciation class even though it has an engineering life of 10 years. Suppose further that the bonds of the public sector are issued with a rate of return that is the same as the rate for the private entity. Finally, suppose that the public laboratory or private entity is able to sell the equipment at the end of four years[10] for $20,000. Given this information consider the present value cost to the public laboratory versus the present value cost in the private sector for the purchase and maintenance of the scientific instrumentation for a four-year period.

Scenario 1

First consider the present value cost for a direct purchase of equipment and maintenance versus a leasing contract that includes use and maintenance under the following five assumptions. This baseline scenario suggests an environment without any of the conditions under which the aforementioned leasing advantages exist. This will help to isolate the gains evidenced in the subsequent scenarios.

Assumption 1 (tax rates): There are no taxes.
Assumption 2 (volume discounts): The price of equipment is the same for either the public or private entity.
Assumption 3 (maintenance contract): Maintenance contracts cost the same for either a public sector or private sector entity.
Assumption 4 (resale): Expected equipment resale values at time N are the same for either the public or private entity.
Assumption 5 (discount rate): The cost of debt is the same for either the public sector or private sector entity.

In this scenario, since the equipment price and maintenance contracts are the same, the cash flows to the public entity and the private entity are identical and there would be no advantage for leasing over purchase. The lack of a tax structure results in identical treatment for the public sector and the private sector. That is, the minimum price that the private entity could charge in a lease would just cover all costs and would have an identical present value to the purchase costs for the public laboratory. (See the Appendix for the details of the present value cost comparison.) In this baseline scenario, the present value cost of the equipment and associated maintenance at a discount

rate of 5.5% is $102,345 for either the public or private sector entity.

With this baseline established, the contributions from the tax structure, depreciation method, deductibility rules, and discount rates may be highlighted. The following scenarios attempt to isolate these contributions to the potential differences in equipment purchase versus leasing.

Scenario 2

Suppose that the tax rate assumption of this baseline scenario is relaxed and income taxes may exist at the national, state, and local levels. Potential gains emerge for leasing versus purchase of laboratory equipment. To demonstrate the potential gains, consider next a scenario where assumption 1 is relaxed.

Assumption 1 (tax rates): There are no taxes for the public entity, but an ordinary income tax rate $T_I > 0$ and a capital gains tax rate $T_C \geq 0$ are assessed to the private entity.
Assumption 2 (volume discounts): The price of equipment is the same for either the public or private entity.
Assumption 3 (maintenance contract): Maintenance contracts cost the same for either a public sector or private sector entity.
Assumption 4 (resale): Expected equipment resale values at time N are the same for either the public or private entity.
Assumption 5 (discount rate): The after tax cost of debt is the same for either the public sector or private sector entity.

The difference in the present value costs between leasing and ownership using the assumed tax rates in the appendix is $38,196, which represents the opportunity for gains from leasing and trading tax positions between the private and public sectors. Note that the final amount of the gains to the public laboratory is offset by the tax liability to the lessor as lease payments are received.

Scenario 3

While the trading of tax positions offers the greatest contribution to cost reduction and potential gains, other market advantages may provide room for additional gains. Consider the potential bargaining power for higher volume activity for a private firm that specializes in the leasing of laboratory equipment. The third scenario takes this volume activity into account.

Assumption 1 (tax rates): There are no taxes for the public entity, but an ordinary income tax rate $T_I > 0$ and a capital gains tax rate $T_C \geq 0$ are assessed to the private entity.
Assumption 2 (volume discounts): Equipment prices are x% lower for the private entity versus the public entity via volume discounts.
Assumption 3 (maintenance contract): Maintenance contracts costs are y% lower for the private entity versus the public entity via volume discounts.
Assumption 4 (resale): Expected equipment resale values at time N are the same for either the public or private entity.
Assumption 5 (discount rate): The after tax cost of debt is the same for either the public sector or private sector entity.

To demonstrate the impact, begin with the conditions of scenario 2, where the laboratory is considering the purchase of some scientific instrument, but add the conditions where the private entity has negotiated an $x = 10\%$ discount in the equipment price for volume purchases and $y = 20\%$ discount for the maintenance contract by diversifying the risk across the high-volume purchases. The previous difference in the present value costs of $38,196 from scenario 2 grows to a difference of $47,066 and represents the reduction in present value costs from leasing, trading tax positions, and bargaining positions between the private and public sectors.

Scenario 4

Relax the assumptions further with the following scenario. Suppose that an infrequent seller of used equipment has less expertise to identify potential purchasers of used equipment while a regular seller in the resale (or re-lease market) may possess an informational advantage to secure a higher resale price. This is analogous to the differences in the used car market where dealer sales of used cars command a higher price than that obtained by individual sellers. Assume the private entity is able to command a higher salvage value along with the other assumptions from Scenario 3.

Assumption 1 (tax rates): There are no taxes for the public entity, but an ordinary income tax rate $T_I > 0$ and a capital gains tax rate $T_C \geq 0$ are assessed to the private entity.
Assumption 2 (volume discounts): Equipment prices are x% lower for the private entity versus the public entity via volume discounts.
Assumption 3 (maintenance contract): Maintenance contracts costs are y% lower for the private entity versus the public entity via volume discounts.
Assumption 4 (resale): Salvage values at time N are z% higher for the private entity versus the public laboratory.

Assumption 5 (discount rate): The after tax cost of debt is the same for either the public sector or private sector entity.

Such an advantage in the resale market could emerge for a frequent participant to the resale market. Frequent participants could include specialized leasing companies or even the equipment manufacturer. The present value cost for the private entity falls and the difference in the present value costs from leasing jumps to $53,637 if a 50% salvage value advantage for the private sector is assumed.

Scenario 5

In the fifth scenario all of the assumptions are relaxed. Consider the potential advantages for the private sector lessor versus the public sector entity with respect to the cost of borrowing. Suppose that the discount rate assumption is relaxed and the after-tax cost of borrowing for the private entity was lower than the cost of borrowing to the public jurisdiction.[11]

Assumption 1 (tax rates): There are no taxes for the public entity, but an ordinary income tax rate $T_I > 0$ and a capital gains tax rate $T_C \geq 0$ are assessed to the private entity.
Assumption 2 (volume discounts): Equipment prices are x% lower for the private entity versus the public entity via volume discounts.
Assumption 3 (maintenance contract): Maintenance contracts costs are y% lower for the private entity versus the public entity via volume discounts.
Assumption 4 (resale): Salvage values at time N are z% higher for the private entity versus the public laboratory.
Assumption 5 (discount rate): The cost of debt is lower for the private sector entity than it is for the public sector entity.

Suppose that the pre-tax interest rate for the private entity is 4.5% compared to the 5.5% rate for the public sector entity. In this case, since the interest payments on debt are tax deductible, the after-tax cost of debt, given the tax rates used previously for local, state, and federal levels, is lower for the private entity. The present value cost for the private entity falls and the difference in the present value costs from leasing jumps to $54,501.

Negotiations and Realized Gains

Granof (1984) notes that when a lease contract is executed, there is an explicit agreement that the costs, risks, and benefits of the asset in question are to be split up in a specific fashion between the lessor and lessee. A leased asset will always represent a basket of these costs, risks, and benefits that must be distributed in some combination to the two parties in the lease contract. If one party receives a specific unit of benefit, the other cannot consume that same benefit. In the preceding paragraphs, an explanation of how the total basket of net benefits (benefits minus costs and risks) can be maximized through an advantageous use of tax law was given. However there are other ways either the lessor or lessee may be able to increase their present value of the lease contract, which may or may not affect the net benefit of the lease contract.

While the preceding scenarios isolate the rationale for potential gains via leasing, the magnitude of the gains will depend upon several factors. To appreciate the potential for gain to either party to the lease, first consider the limits to the size of the lease payment. For the lessee, the lease payment must be consistent with a present value cost that is less than the present value cost of ownership. Likewise, the lease payment must be sufficient to yield a positive net present value of ownership to the lessor. That net present value of ownership includes the present value costs highlighted in the preceding scenarios and includes a present value of the benefits from the taxable leasing income. To illustrate the size of the gains, consider scenario 5. In that scenario, the present value cost to the public laboratory is consistent with an annual lease payment of $27,676, which covers operational use of the equipment and maintenance. Thus any lease terms must have a lease payment below $27,676 for the lease to be attractive to the public laboratory. For the lessor, an annual lease payment of $20,805 is consistent with a return that covers the after-tax cost of borrowing to purchase the equipment and maintenance contract. Any lease payment must be at least as high as $20,805.

The distribution of the gains to the lessee and the lessor will be determined by factors that affect any exchange. These factors include assessments of risk, required returns, resale markets, and the competitive nature of the markets for leasing. For example, the more specialized the equipment, the greater the risk to the lessor and the higher the lease payment. However, the ability of the public sector to tax and/or borrow will temper much of the risk and should provide negotiating power to the public laboratory.

Concluding Remarks

The increased demands for forensic laboratory services coupled with calls for austerity across the public sector have forced laboratories to explore means to better optimize service delivery. Most laboratories will continue to explore process improvements, consider the efficacy of all investigative services, defer long-term investments, reduce investment in human capital, and perhaps leave

open positions unfilled. The present analysis suggests that laboratories may be able to increase the spending power of their budgets through a strategic use of leasing. Project FORESIGHT data submissions suggest that leasing is an underused financial vehicle for many laboratories. As shown in the example, there may be as much as 25% of the cost of capital investment that may be a shared gain between the lessee laboratory and a lessor. When considered against alternative cost-cutting measures, the extension of leasing may save and potentially expand the number of positions for bench scientists, thus expanding the services rendered by the laboratory.

Appendix—Lease Versus Purchase Savings Technical Details

Investment in capital assets involves an upfront expenditure with the expectation of future cash flows that will be received over a number of years. For inter-temporal decisions, alternatives such as lease versus purchase require a mechanism to adjust for the time period in which the laboratory spends cash. To illustrate the potential savings from leasing versus the purchase of laboratory equipment, consider first the corrections for the time value of money. Consider an allowance for the time value of money through conversion to the present value cost (PVC) in which all future cash flow is converted to the present. The general descriptions of the PVC for the public laboratory and the private laboratory are presented in equations (1) and (2), respectively.

$$PVC_{pub} = \sum_{t=1}^{N} C\,F_t \frac{1}{(1+r_{pub})^t} \tag{1}$$

$$PVC_{priv} = \sum_{t=1}^{N} C\,F_t \frac{1}{(1+r_{priv})^t}, \tag{2}$$

where CF_t = cash flow at time t; N = total number of periods for which the equipment is maintained; r_{pub} = interest rate on bonds of the public sector jurisdiction; r_{priv} = interest rate after tax on bonds of the private corporation.

Consider both a public laboratory and a for-profit private laboratory that are faced with the same equipment and maintenance expenses, but a tax rate on ordinary income and a tax rate applied to capital gains income applies to the for-profit entity. The cash flows for the private laboratory will be the same as the public laboratory for equipment and maintenance with a few exceptions. The private laboratory will have the upfront equipment expense and the beginning of period maintenance expenditure, but it will also deduct depreciation in each period before consideration of their tax liability. That depreciation deduction offers a tax shield for each period t that is effectively a subsidy via a reduction in tax liability.

The present value cost to the public laboratory, PVC_{pub}, represents the amount that the jurisdiction requires in present dollars to pay for this investment.

$$PVC_{pub} = \sum_{t=0}^{N} C\,F_t \frac{1}{(1+r_{pub})^t} = -EQUIP_{pub} - MAINT_{pub} \sum_{t=0}^{N-1} \frac{1}{\left(1+r_{pub}\right)^t} + PVCG_{pub} \tag{3}$$

CF_t is the cash flow in each period t, and r_{pub} represents the cost of debt or discount rate for the public jurisdiction. The cash flows for the public laboratory are comprised of the initial cost of the equipment at time zero ($EQUIP_{pub}$) and the annual maintenance fee ($MAINT_{pub}$) paid at the beginning of each period of operation. The final term, $PVCG_{pub}$, represents the present value of any capital gain from the sale of used equipment at the end of the project at time N.

For the private entity, expenses are tax deductible. As a result, the present value cost to the private laboratory (PVC_{priv}) is offset by reductions in the tax bill, and the private entity ends up paying less for equipment and maintenance. The tax benefits to the maintenance charge are taken each year that maintenance is paid, while the tax benefits from the equipment is spread over time through deductions for depreciation in each period t (D_t), following applicable tax code.

$$PVC_{priv} = \sum_{t=0}^{N} C\,F_t \frac{1}{\left(1+r_{priv}\right)^t} = -EQUIP_{priv} - MAINT_{priv} \times (1-T_I) \sum_{t=0}^{N-1} \frac{1}{\left(1+r_{priv}\right)^t} + \sum_{t=1}^{N} \frac{T_I\,D_t}{\left(1+r_{priv}\right)^t} + PVCG_{priv} \tag{4}$$

The final term, $PVCG_{priv}$, is the present value of the capital gains net of taxes. In a comparison of equations (3) and (4), the potential gains from leasing emerge. As noted in the previous section, if the present value cost is less for the private entity, then by making the equipment purchase in the private sector, the reduced cost from tax deductibility of depreciation and maintenance can potentially be shared with the public sector laboratory through annual lease payments that are lower than the annualized costs for a public laboratory as represented by the present value cost in equation (3).

The CF_t for each period t for either (3) or (4) may be described as

$$CF_t = -EQUIP_{jt} - \left(MAINT_{jt} + D_t\right) \times (1-T_I) + SV_{jt} + \left(SV_{jt} - BV_t\right) \times (1-T_C) + D_t \tag{5}$$

where $EQUIP_{jt}$ = Price of the laboratory equipment for entity j at time t; $MAINT_{jt}$ = Cost of a maintenance contract for entity j at time t; D_t = Depreciation taken at time t; T_I = Tax rate on ordinary income from combined local, state, and federal taxes; T_C = Tax rate on capital gains from combined local, state, and federal taxes; SV_{jt} = Salvage value for entity j at time t, $SV_{jt} = 0$ for t = 1 . . . N-1; and BV_t = Book value at time t, if t = N, 0 otherwise.

To illustrate the source of the gains from leasing in place of ownership, first assume that the terms of the operating lease meet the guidelines of the IRS. The five example scenarios and the corresponding present value costs are detailed below.

Scenario 1

In this scenario, the cash flows to the public entity and the private entity are identical and there would be no advantage for leasing over purchase.

- x = 0%; y = 0%, z = 0%
- $EQUIP_{pub} = EQUIP_{priv} = \$100{,}000$
- $MAINT_{pub\,t} = MAINT_{priv\,t} = \$5{,}000$ for t = 0, . . . , 3
- $T_I = 0\%$, $T_C = 0\%$
- $r_{pub} = r_{priv} = 5.5\%$
- $SV_{pub} = SV_{priv} = \$20{,}000$

The cash flows that would be inserted into (3) and (4) above are:

TIME	0	1	2	3	4
CF_{pub}	−$105,000	−$5,000	−$5,000	−$5,000	$20,000
CF_{priv}	−$105,000	−$5,000	−$5,000	−$5,000	$20,000
CF_{priv} - CF_{pub}	$0	$0	$0	$0	$0
PVC_{priv} - PVC_{pub}	$0	$0	$0	$0	$0

Note that in scenario 1, the cash flows to the public entity and the private entity are identical in each and every period. Further, from the discount rate assumption, the cash flows are discounted at the same rate. Thus, there would be no advantage for leasing over purchase since the net present cost would be identical.

Scenario 2

There are no taxes for the public entity, but an ordinary income tax rate $T_I > 0$ and a capital gains tax rate $T_G > 0$ are applied to the private entity. The ordinary income tax rates include taxes at the national ($T_{IN} = 35\%$), state ($T_{IS} = 7\%$), and local ($T_{ILS} = 1\%$) level. Additionally there are capital gains taxes at each level of government ($T_{CN} = 20\%$, $T_{CS} = 7\%$, and $T_{CL} = 1\%$).

- x = 0%; y = 0%, z = 0%
- $EQUIP_{pub} = EQUIP_{priv} = \$100{,}000$
- $MAINT_{pub\,t} = MAINT_{priv\,t} = \$5{,}000$ for t = 0, . . . , 3
- $T_I = 40.2\%$, $T_C = 26.4\%$[12]
- $r_{pub} = r_{priv} = 5.5\%$
- $SV_{pub} = SV_{priv} = \$20{,}000$

While positive tax rates on corporate profits might seem to have a negative connotation, it is the impact on cost reduction that is emphasized here. Tax deductibility of expenses, combined with the depreciation tax shield, offers an advantage that the private entity has over the public sector laboratory.

In Scenario 2, tax deductibility begins to show effects immediately with the initial period. That is, each entity is charged the same price for the equipment and maintenance contract but the private entity is able to deduct the annual maintenance charge and its effective cost is reduced by the tax rate times that annual cost. It becomes an indirect subsidy for their operations that continues in each period (through time N-1) that it pays its maintenance fee. In subsequent periods the private entity receives another indirect subsidy as it is able to depreciate the initial investment and deduct the depreciation expense prior to the calculation of its tax bill. This reduces their effect cost further by $T_I * D_t$ for each subsequent period.

TIME	0	1	2	3	4
CF_{pub}	−$105,000	−$5,000	−$5,000	−$5,000	$20,000
CF_{priv}	−$102,990	$5,050	$5,050	$5,050	$28,040
CF_{priv} - CF_{pub}	$2,010	$10,050	$10,050	$10,050	$8,040
PVC_{priv} - PVC_{pub}	$2,010	$9,629	$9,226	$8,841	$8,491

Given this information, consider the present value cost to the public laboratory (PVC_{pub}) versus the present value cost in the private sector (PVC_{priv}) for the purchase and maintenance of the equipment for a four-year period. From (3) the present value cost to the public laboratory for the equipment and the maintenance contract is $102,345. From (4) the present value cost to the private entity is only $64,149. The difference in these present value costs of $38,196 represents the gains to the private sector over the public sector. Potential gains via leasing arise from the present value of reductions in tax collections of the federal government, state government, and local government. The gains to the individual laboratory, and its political jurisdiction, depend upon the tax jurisdiction of the leasing entity. Regardless, there are involuntary revenue transfers taking place.

Scenario 3

There are no taxes for the public entity, but an ordinary income tax rate $T_I > 0$ and a capital gains tax rate $T_G > 0$ are applied to the private entity. The ordinary income tax rates include taxes at the national ($T_{IN} = 35\%$), state ($T_{IS} = 7\%$), and local ($T_{IL} = 1\%$) level for both ordinary and capital gains taxes ($T_{CN} = 20\%$, $T_{CS} = 7\%$, and $T_{CL} = 1\%$). Additionally, the private entity is able to negotiate equipment prices that are x% lower for the private entity versus the public entity via volume discounts and maintenance contracts costs which are y% lower for the private entity versus the public entity from diversification of repair risk.

- $x = 10\%$; $y = 20\%$, $z = 0\%$
- $EQUIP_{pub} = \$100{,}000$; $EQUIP_{priv} = \$90{,}000$
- $MAINT_{pub\,t} = \$5{,}000$ for $t = 0, \ldots, 3$, $MAINT_{priv\,t} = 4{,}000$ for $t = 0, \ldots, 3$
- $T_I = 40.2\%$, $T_C = 26.4\%$
- $r_{pub} = r_{priv} = 5.5\%$
- $SV_{pub} = SV_{priv} = \$20{,}000$

While the most dramatic transfers occur from the trading of tax positions, the private sector negotiation advantages may be shared with a public sector lessee.

TIME	0	1	2	3	4
CF_{pub}	−$105,000	−$5,000	−$5,000	−$5,000	$20,000
CF_{priv}	−$92,392	$4,844	$4,844	$4,844	$26,732
CF_{priv} - CF_{pub}	$12,608	$9,844	$9,844	$9,844	$6,732
PVC_{priv} - PVC_{pub}	$12,608	$9,429	$9,033	$8,654	$7,342

Given this information, consider the present value cost to the public laboratory (PVC_{pub}) versus the present value cost in the private sector (PVC_{priv}) for the purchase and maintenance of the equipment for a four-year period. From (3) the present value cost to the public laboratory for the equipment and the maintenance contract is $102,345. From (4) the present value cost to the private entity is only $55,280. The difference in these present value costs of $47,066 represents the gains to the private sector over the public sector. Potential gains via leasing arise from the present value of reductions in tax collections of the federal government, state government, and local government. The gains to the individual laboratory, and its political jurisdiction, depend upon the tax jurisdiction of the leasing entity. Regardless, there are involuntary revenue transfers taking place.

Scenario 4

There are no taxes for the public entity, but an ordinary income tax rate $T_I > 0$ and a capital gains tax rate $T_G > 0$ are applied to the private entity. The ordinary income tax rates include taxes at the national ($T_{IN} = 35\%$), state ($T_{IS} = 7\%$), and local ($T_{IL} = 1\%$) level for both ordinary and capital gains taxes ($T_{CN} = 20\%$, $T_{CS} = 7\%$, and $T_{CL} = 1\%$). The private entity is able to negotiate equipment prices that are x% lower for the private entity versus the public entity via volume discounts and maintenance contracts costs which are y% lower for the private entity versus the public entity from diversification of repair risk. The private entity also has an advantage in the resale market at the end of the lease and is able to sell the equipment at a salvage value that is z% higher than received by the public laboratory.

- $x = 10\%$; $y = 20\%$, $z = 50\%$
- $EQUIP_{pub} = \$100{,}000$; $EQUIP_{priv} = \$90{,}000$
- $MAINT_{pub\,t} = \$5{,}000$ for $t = 0, \ldots, 3$, $MAINT_{priv\,t} = 4{,}000$ for $t = 0, \ldots, 3$
- $T_I = 40.2\%$, $T_C = 26.4\%$
- $r_{pub} = r_{priv} = 5.5\%$
- $SV_{pub} = \$20{,}000$; $SV_{priv} = \$30{,}000$

The advantage in the after-market offers a realistic advantage for a lessor. This is particularly true when the equipment manufacturer takes on the role of lessor.

TIME	0	1	2	3	4
CF_{pub}	−$105,000	−$5,000	−$5,000	−$5,000	$20,000
CF_{priv}	−$92,392	$4,844	$4,844	$4,844	$34,212
CF_{priv} - CF_{pub}	$12,608	$9,844	$9,844	$9,844	$14,212
PVC_{priv} - PVC_{pub}	$12,608	$9,429	$9,033	$8,654	$13,914

Given this information consider the present value cost to the public laboratory (PVC_{pub}) versus the present value cost in the private sector (PVC_{priv}) for the purchase and maintenance of the equipment for a four-year period. From (3) the present value cost to the public laboratory for the equipment and the maintenance contract is $102,345. From (4) the present value cost to the private entity is only $48,708. The difference in these present value costs of $53,637 represents the gains to the private sector over the public sector. Potential gains via leasing arise from the present value of reductions in tax collections of the federal government, state government, and local government. The gains to the individual laboratory, and its political jurisdiction, depend upon the tax jurisdiction of the leasing entity. Regardless, there are involuntary revenue transfers taking place.

Scenario 5

The final example accounts for the difference between the public jurisdiction's borrowing power and that of the private entity. The after-tax cost of debt may be higher or lower for the private sector and hence can increase or decrease the present value cost. In this scenario, the discount rate reflects a higher pre-tax rate for the private entity, but an after-tax discount rate lower than the public jurisdictions discount rate. The higher the after-tax cost of debt, the lower is the present value net costs from future periods.

Begin with the conditions of scenario 4 where the laboratory is considering the purchase of the scientific instrument, but add the conditions where the private entity has a pre-tax cost of debt that is an additional 1% lower than the public jurisdiction. Since the interest payments on debt are tax deductible, the after-tax cost of debt, given the tax rates used previously for local, state, and federal levels, is lower for the private entity.

- $x = 10\%$; $y = 20\%$, $z = 50\%$
- $EQUIP_{pub} = \$100{,}000$; $EQUIP_{priv} = \$90{,}000$
- $MAINT_{pub\,t} = \$5{,}000$ for $t = 0, \ldots, 3$, $MAINT_{priv\,t} = 4{,}000$ for $t = 0, \ldots, 3$
- $T_I = 40.2\%$, $T_C = 26.4\%$
- $r_{pub} = 5.5\%$; r_{priv} (pre-tax) $= 4.5\%$; r_{priv} (after-tax) $= 2.69\%$
- $SV_{pub} = \$20{,}000$; $SV_{priv} = \$30{,}000$

The present value cost for the private entity falls to \$47,844 and the potential gains are derived partly from lower taxes and the remainder from purchasing power/resale savings to the private sector.

TIME	0	1	2	3	4
CF_{pub}	−\$105,000	−\$5,000	−\$5,000	−\$5,000	\$20,000
CF_{priv}	−\$92,392	\$4,844	\$4,844	\$4,844	\$34,212
PVC_{priv} - PVC_{pub}	\$12,608	\$9,456	\$9,086	\$8,731	\$14,620

Endnotes

1. The acronym PIGS was applied to Portugal, Ireland (and sometimes Italy), Greece, and Spain as these were the first European countries for which the cracks in the global economy appeared. Each country began to show the strain of budgets where national deficits exceeded the annual gross domestic product.
2. The origination of the term *sequestration* as it is currently known is a result of the Gramm-Rudman-Hollings Balance Budget Act of 1985, in which sequesters are defined as a form of automatic spending cuts when deficit targets are missed.
3. There are a broader set of categories for leases that include characteristics of both the operating lease and the financial lease, such as combination leases, sale-and-leaseback arrangements, and synthetic leases.
4. IRS allowances for leases provide guidelines to ensure that the lease is a true lease and not just a means to circumvent rules on the deductibility of expenses. So-called 'guideline' leases are described in the text to follow.
5. The lessee is the party that takes control of the asset or equipment for its intended use, whereas the lessor is the party that purchases the asset or equipment and for a fee gives control of the asset to the lessee.
6. In addition to the standards established by the accounting profession, legal standards also impose guidelines for the permissible depreciation affiliated with capital equipment. In the United States, for example, several laws restrict the lessor's use of investment tax credits and accelerated depreciation when the lessee is a tax-exempt organization.
7. Depreciation is a non-cash expense that is acknowledged each period for the calculation of taxes, but does not represent an actual cash outflow.
8. The depreciation deduction is a non-cash expense to the laboratory. They deduct the amount in the calculation of their tax bill, but do not pay it out. The determination of cash flow for any operating period includes the after-tax operating profit plus the depreciation added back.
9. One example of abusing leasing undertaken before DEFRA by a tax exempt entity at the detriment to the federal government's budget is presented by Blose et al. (1989), where they discuss the Navy's financing of 13 cargo ships in 1982. At this time the Navy could have purchased these cargo ships at an estimated cost of \$178.2 million per ships, but instead they leased them as the present value cost to the Navy of using these same cargo ships for their useful life was only \$141.2 million per ship for a cost savings of \$37 million per ship or \$481 million dollars total. On the surface this seems like a good deal, and for the Navy it was indeed preferable to purchase through retained earnings or debt financing given the law. The tax benefits received and shared between the private lessor and Navy were estimated to be \$57.8 million dollars per ship, which is exactly the per ship loss experienced by the U.S. Treasury. Thus the societal per ship cost of the lease is equal to \$141.2 million plus \$57.8 million, which equals \$199 million. This cost is greater than the cost of direct purchase by \$20.8 million which displays well why DEFRA was enacted by Congress.
10. The sale at the end of four years is merely for simplicity of the calculations. The authors realize that laboratories generally keep equipment in operation for a much longer period of time. IRS guidelines restrict the lease to a period that is 80% or less of the useful life, not the length of the depreciation class. In this example, a 10-year engineering life would have permitted the lease to have lasted up to eight years.
11. Note that the discount rate for a local or state entity has advantages in the tax law that make them tax-exempt from federal taxes and may lead to lower pre-tax rates than the public sector. On the other hand, lessors tend to be high tax rate and low-risk providers who benefit from lower risk and lower rates. The net effect of these factors may result in

rates for the private entity that are higher or lower than the public sector laboratory. This scenario is merely exemplary of a reduction.

12. Since payments to state and local taxing authorities are deductible from federal taxes, then the effective tax rate from all sources includes the allowance for these deductions at the federal level.

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