

Retrospective Capital Gains Taxation

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This paper presents a new approach to the taxation of capital gains that eliminates the deferral advantage of realization-based systems, along with the lock-in effect and tax-arbitrage possibilities associated with this deferral advantage. The new method still taxes capital gains only upon realization but, effectively by charging interest on past gains when realization finally occurs, eliminates the incentive to defer such realization. Unlike a similar scheme suggested previously by Vickrey, the present method does not require knowledge of the potentially unobservable pattern of gains over time. It thus is applicable to a very broad range of capital assets. (JEL 320, 520)

Virtually every country that taxes income imposes a capital gains tax only upon the realization of gains rather than on accrual. Though countries vary with respect to indexing for inflation and the relative tax rates on capital gains and ordinary income, the realization-based tax system sets capital gains taxation apart from other forms of taxation and is associated with a variety of economic distortions.

The most frequently discussed problem arising from taxing capital gains upon realization is the “lock-in” effect, the desire to hold appreciated assets in order to defer taxes on gains already accrued. This effect leads investors to accept a lower before-tax rate of return than they would for new investments without such accrued gains, resulting in a distorted allocation of capital and inefficient portfolio selection.

As an illustration of the lock-in effect, consider a simple two-period example with-

out uncertainty in which an investor, having accrued a first-period gain, g , must decide whether to realize the gain and reinvest at the rate of return, i , or hold the asset for an additional rate of return r . Assuming all capital income is taxed at the same rate, t , then the investor’s terminal wealth under the first strategy is

$$\begin{aligned} (1) \quad W_R &= [1 + g(1 - t)][1 + i(1 - t)] \\ &= (1 + g)(1 + i) \\ &\quad - t\{g[1 + i(1 - t)] + (1 + g)i\}. \end{aligned}$$

In second-period units, total taxes equal those paid in the first period, accumulated at the net-of-tax interest rate, plus those due in the second period.

If the investor chooses to hold rather than sell, the terminal wealth is

$$\begin{aligned} (2) \quad W_H &= (1 + g)(1 + r) \\ &\quad - t[(1 + g)(1 + r) - 1] \\ &= (1 + g)(1 + r) - t[g + (1 + g)r] \end{aligned}$$

so that the tax on the first-period gain is deferred, *without interest*, to the second period. This makes the investor willing to hold even for a range of returns $r < i$. The larger is g , the larger the deferral advantage and, hence, the lower r must be to induce the investor to sell.

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Closely related to the lock-in effect is the general problem of tax avoidance facilitated by the voluntary nature of realization. Because losses as well as gains have their tax burdens deferred until realization, investors have the incentive to realize losses immediately, to maximize the associated tax reductions. Aggressive application of the simple rule of holding winners and realizing losers potentially permits individuals to generate tax reductions without incurring major transaction costs (George M. Constantinides, 1983; Joseph E. Stiglitz, 1983).

This arbitrage possibility has led to a second major distortion arising from the present system of capital gains taxation. To prevent investors from generating capital losses to offset ordinary income, tax systems typically limit the allowable annual deduction for such losses. While perhaps representing an effective response to the problem of tax arbitrage, this loss-offset limitation also distorts the choice of investment away from the risky assets which are more likely to produce losses (e.g., Stiglitz, 1969).

Given such problems, there is great appeal to the prospect of switching to a tax on accrued capital gains. Though proposals to adopt accrual taxation have received serious scholarly attention (e.g., David Shakow, 1986), there seems to be little chance that such a system will be adopted on a broad scale.¹ Beyond the criticism that accrual taxation would increase annual taxpayer compliance costs, perhaps the most significant arguments against it are that some assets are hard to value except when they are sold and that liquidity constraints could force the premature sale of indivisible assets simply to pay the accruing taxes.

A potential solution to the problems of both present law and accrual taxation is a realization-based tax that offsets the deferral advantage of holding gains by imposing a higher tax rate on gains held for longer periods of time. The effect is to simulate a

system under which capital gains taxes are computed on an accrual basis but collected, with interest, only upon realization. From a comparison of (1) and (2), it is clear that charging tax-deductible interest on the taxes accruing on unrealized gains would eliminate the deferral advantage. Such an approach was originally conceived by William Vickrey (1939). By construction, it would eliminate the lock-in effect and the tax-arbitrage possibilities generated by selective realization, because of its equivalence to an accrual tax. At the same time, it would also remedy the liquidity problem of accrual taxation by collecting the tax only when sales actually occurred.

Unfortunately, this "cumulative averaging" approach is plagued by the second problem of accrual taxation mentioned above, that of valuation. For assets that are hard for the government to value except when sold, it will be unclear upon sale what the time pattern of accrual of the realized gain was. This will make it impossible to compute retrospectively the tax liability equal in present value to an annual tax on the asset's accrued gains (Jerry R. Green and Eytan Sheshinski, 1978). For example, if an asset has increased in value over a ten-year period, the tax rate on the realized gain needed to simulate accrual taxation would be the ordinary tax rate if the gain occurred entirely in the tenth year, but this tax rate compounded by one plus the relevant interest rate to the ninth power if the entire gain occurred during the first year of ownership. Simply to assume, for tax purposes, that a realized gain accrued smoothly at a constant annual rate would not solve the problem. Assets achieving above-normal rates of return initially would still be subject to a lock-in effect, because an investor anticipating only normal returns from the asset in the future would be able to spread the accrual pattern retrospectively imputed for this gain over several years by holding on to the asset. Likewise, an asset that had declined in value would offer its owner the incentive to sell. Thus, basic arbitrage transactions involving the holding of winners and the sale of losers would still be attractive, though perhaps less so than under a pure realization-based tax.

¹The tax system already has elements that effect accrual taxation, such as the mark-to-market requirements instituted in the 1981 Economic Recovery Tax Act to reduce tax-arbitrage activity involving commodity straddles.

Clearly, many capital assets, such as common shares of large companies, could be marked to market each year to avoid the valuation problem. However, an effective method of dealing with hard-to-value assets would still be necessary to make a switch to accrual taxation or accrual-equivalent realization taxation practical. This paper presents such a method.

The new approach does not require any information on the past pattern of accrued gains and yet eliminates the lock-in effect and the benefits of deferral-based tax arbitrage. In place of the private information on the accrued gains of individual assets, the scheme uses public information, the market interest rate, combined with the assumption of optimal portfolio choice by investors. It does not impose a uniform effective tax rate on accrued gains, *ex post*, but it does impose the same tax rate, *ex ante*, adjusted for risk.

The next section formalizes the criterion that a capital gains tax must satisfy in order not to distort the holding-period decision or allow deferral-based arbitrage. To provide the basic intuition about the new scheme and how it works, Section II presents the results for a special class of assets (such as precious metals) that generate no cash flows or tax liabilities until they are sold. Section III presents the solution for the general class of assets, while Section IV discusses certain limitations of the approach. Section V offers some concluding remarks.

I. Holding-Period Neutrality

The present system of taxation upon realization distorts behavior because the rate at which it taxes the income arising from an asset depends on the size of the asset's previous unrealized gains. This induces both the lock-in effect and deferral-related tax arbitrage.

Suppose that the risk-free interest rate is i ,² and the investor's tax rate on all forms of

²If the tax system is not indexed for inflation, then this rate should be viewed as a nominal interest rate. Moreover, in the absence of a risk-free asset, one may reinterpret the paper's results in terms of a "zero-beta" asset that carries no risk premium.

income, including realized capital gains, is t . As shown in the example above, an investor holding an appreciated asset will require a before-tax return less than i from that asset to achieve his after-tax opportunity cost of $i(1-t)$, because the tax rate t applied to new gains is offset by the continued deferral, without interest, of taxes payable on the gains already generated but not yet realized.

This distortion would not be present under an accrual tax, which would tax additional income at the same rate regardless of unrealized appreciation or holding period. The result would be a required rate of return independent of these other characteristics. It is this result that we refer to as "holding-period neutrality."

Definition: A realization-based tax system is *holding-period neutral* if it leads each investor in an asset to require a before-tax return having a certainty-equivalent value that is not a function of the length of holding period or the asset's past pattern of returns.

As will be shown below, Vickrey's system of cumulative averaging satisfies this criterion. The challenge is to identify another system with weaker informational requirements that does so as well.

II. Retrospective Taxation

Beginning with a simple case will be helpful. The asset treated in this section is one that generates no cash flows or tax liabilities until it is sold and is taxed only upon sale. Henceforth, the analysis will be in continuous time.

At each date s , the investor (though not necessarily the government) is assumed to know the value of the asset, but not the asset's instantaneous return. Let $V(\cdot)$ be a valuation operator at each date that converts that date's distribution of uncertain returns into their certainty equivalents, from the investor's perspective.³

³One can derive the function $V(\cdot)$ from a number of models for the valuation of risky returns, but the model

Consider the class of tax schemes that impose a tax T_s on realization (with $T_0 = 0$). A Vickrey-type tax system would satisfy

$$(3) \quad \dot{T}_s = i(1-t)T_s + tg_s A_s$$

where t is the rate of tax, i is the risk-free interest rate, g_s is the actual, *ex post*, rate of return on the asset at time (after purchase) s , and A_s is the asset's value at date s . As already indicated, though, the tax system described in (3) cannot be imposed retrospectively without knowledge of the time pattern of gains g_s . However, this expression is not a *necessary* condition for a holding-period-neutral tax. The fact that individual decisions are influenced by *ex ante* distributions of returns rather than by *ex post* returns allows us to pursue a weaker condition.

As the scheme in (3) is holding-period neutral (this will be shown formally below) and imposes the rate of tax t on newly accrued capital gains, the investor will require the same before-tax return on the capital asset and the safe asset, adjusting for risk: the certainty-equivalent value of the capital gain g_s will simply equal the investor's before-tax opportunity cost, $V(g_s) = i$. Applying $V(\cdot)$ to both sides of (3) yields

$$(4) \quad V(\dot{T}_s) = i(1-t)T_s + tiA_s.$$

Expression (4) says that the investor faces an increase in the realization-tax liability equal to the interest on the unpaid liability plus the additional tax on the asset based on a rate of return equal to the risk-free rate. Since any scheme satisfying (4) leads the investor to anticipate the same increase in tax liability (adjusting for risk) as would be imposed by the scheme in (3), intuition suggests that the potentially weaker condition (4) will also lead to holding-period neutrality.

itself is not relevant to the paper's remaining discussion. For the interested reader, an appendix to an earlier version of this paper that presents a discussion of the derivation of $V(\cdot)$ is available upon request.

PROPOSITION 1: *Condition (4) is necessary and sufficient for the achievement of holding-period neutrality for the class of assets considered in this section.*

PROOF:

At any date s , the net-of-tax value of an asset to the investor is the value of the asset A_s less the accumulated tax liability T_s . To continue to hold the asset for another instant, the investor requires a certainty-equivalent rate of return equal to the after-tax interest rate $i(1-t)$. Thus, in portfolio equilibrium:⁴

$$(5) \quad V(\dot{A}_s - \dot{T}_s) = (A_s - T_s)i(1-t).$$

Combined with equation (4), (5) implies that $V(\dot{A}_s) = iA_s$, regardless of A_s or s . Hence, (4) implies holding-period neutrality. Combined with the requirement that $V(\dot{A}_s) = iA_s$ for holding-period neutrality, (5) implies (4).

Since the certainty-equivalent value of the before-tax asset return g will equal i when an accrual-equivalent tax is imposed, it is clear that the Vickrey-type tax system described in (3) satisfies (4) and hence is holding-period neutral. As mentioned above, the challenge is to find some other tax scheme also satisfying (4) that has weaker informational requirements. One such tax system exists.

PROPOSITION 2: *Suppose the realization-tax liability at date s is*

$$(6) \quad T_s = (1 - e^{-tis})A_s.$$

Then, the tax system satisfies (4) for all s and hence is holding-period neutral.

⁴ It might be argued that the investor may not achieve an interior solution to the portfolio-choice problem in the case of assets subject to capital gains taxes. For example, one cannot freely buy and sell assets that are indexed by having already been held for a specified time period. However, the focus here is on the case in which the holding period becomes irrelevant to the portfolio-choice problem. A fortiori, the assumption of portfolio balance is justified.

PROOF:

Taking the time derivative of (6), one obtains

$$\begin{aligned} \dot{T}_s &= (1 - e^{-tis})\dot{A}_s + tie^{-tis}A_s \\ &= (1 - e^{-tis})\left(\frac{\dot{A}}{A}\right)_s A_s - (1 - e^{-tis})tiA_s + tiA_s \\ &= (1 - e^{-tis})\left[\left(\frac{\dot{A}}{A}\right)_s - ti\right]A_s + tiA_s. \end{aligned}$$

By Proposition 1, $V(\dot{A}/A) = i$ if (4) is satisfied. The strategy will be to assume $V(\dot{A}/A) = i$. Once it is proved that (4) is satisfied, the assumption will prove correct.⁵

If $V(\dot{A}/A) = i$, then $\dot{A}/A = i + \varepsilon$, where ε is a random return satisfying $V(\varepsilon) = 0$. (Note that, in general, $E(\varepsilon) \neq 0$; it is the risk premium on the risky asset). Hence,

$$\dot{T}_s = (1 - e^{-tis})(i(1 - t) + \varepsilon_s)A_s + tiA_s$$

which, by (6), may be written

$$(7) \quad \dot{T}_s = i(1 - t)T_s + tiA_s + (1 - e^{-tis})\varepsilon_s A_s.$$

Since, by construction, $V(\varepsilon) = 0$, application of $V(\cdot)$ to both sides of (7) yields (4).

A. Interpretation

Clearly, the evolution of the tax liability T_s described by (7) differs from that of the Vickrey-type system based on *ex post* returns described by (3). Since the gain $g = i + \varepsilon$, (7) differs from (3) in taxing the excess return ε at rate $(1 - e^{-tis})$ rather than t . This is a tax rate that starts at 0 and approaches 1 as s approaches ∞ . The tax rate on the excess return has no effect on the investor's welfare, however, because by construction the excess return has zero value to

⁵It is straightforward to show that this solution for required holding-period yields is unique. That is, there exists no other rate of return $j \neq i$ for which the implied tax rule corresponding to (7) is in fact consistent with the portfolio-balance condition (5) and the assumed rate of return j .

him (e.g., Roger H. Gordon, 1985; Agnar Sandmo, 1985).⁶

A specific example is useful in demonstrating how this tax system works to eliminate the lock-in effect. Suppose an investor purchases an asset at some date 0 and will dispose of it with certainty at some future date s_2 . At each date s_1 between 0 and s_2 , he has the option of holding the asset or selling it for its date- s_1 value, A_1 , and buying it back. The asset's price at s_2 , A_2 , is uncertain at s_1 but is not influenced by the investor's decision.

Under the realization strategy, the investor pays a tax of $A_1(1 - e^{-its_1})$ at s_1 and $A_2(1 - e^{-it(s_2-s_1)})$ at s_2 . Under the alternative strategy, he pays $A_2(1 - e^{-its_2})$ at s_2 . A comparison of the two cases shows that the choice is between a tax payment of $e^{-its_2}(e^{its_1} - 1)A_1 e^{it(s_2-s_1)}$ at s_1 versus $e^{-its_2}(e^{its_1} - 1)A_2$ at s_2 . The certainty-equivalent value of A_2 at s_1 is just $A_1 e^{it(s_2-s_1)}$, however, so the investor is indifferent, *ex ante*. The two cases differ only in the *ex post* treatment of the asset's risk premium: by realizing at date s_1 , the investor prepays part of the tax that would be due at date s_2 , with the earlier payment equal in present value to the future tax it replaces.

Proposition 2 offers a very simple system of capital gains taxation. Computation of the tax burden when an asset is sold requires knowledge of the risk-free interest rate, the investor's marginal tax rate, the holding period of the asset, and the final sales price. (Nothing in the proof depends on either i or t being constant, so variations over time in rates of interest and marginal taxation present no difficulty). The initial purchase price, the pattern of accrued gains,

⁶In fact, as Gordon (1985) shows, the same general equilibrium outcome results from tax systems differing only in their treatment of excess returns, if private risk-pooling is efficient. Differences in the riskiness of after-tax returns are offset by differences in the risk characteristics of individual endowments.

If private risk-pooling is not efficient, taxes on excess returns that have no value to investors may be pooled by the government, creating value and reducing aggregate risk. In this event, the tax rate on risk premia influences the equilibrium outcome, even though the investor's holding-period decision is not distorted.

and the asset's stochastic properties are irrelevant to the calculation. The tax itself is expressed as a time-dependent fraction of the asset's value at sale, with this fraction going from 0 at $s=0$ to 1 as s approaches ∞ .⁷

To interpret the tax formula (6), consider again the Vickrey-type tax system described in (3). For a terminal asset value of A_s , a holding period of s , and a rate of capital gain always equal to the risk-free rate (implying an initial cost of $A_s e^{-is}$), that system would impose a realization-tax liability of

$$(8) \quad T_s = \int_0^s e^{i(1-t)(s-z)} ti(A_s e^{-i(s-z)}) dz$$

$$= A_s(1 - e^{-its}).$$

Thus, the tax schedule (6) treats investors as if they had arrived at their current position by investing at the risk-free rate. Since in terms of certainty-equivalence this is precisely what they did, the tax system "works" in the same way that a Vickrey-type system would.⁸

Proposition 2 demonstrates that the tax system given in (6) is holding-period neutral. It is natural to ask whether there are other tax systems achieving holding-period neutrality based on the same information. However, Proposition 3 shows that the tax system already discussed is unique.

PROPOSITION 3: *The tax system described in (6) is the only one based on the information set (t, i, s, A_s) that satisfies the condition for holding-period neutrality, (4).*

⁷Since the tax liability is bounded by the asset's value, the liquidity problem is absent under this tax system. Such an accumulating tax liability over time works to remove the lock-in effect only if the tax is eventually imposed. A provision that eliminates capital gains tax liability at death, for example, might cause the lock-in effect to be exacerbated by a move to such a tax system, since investors would have an even greater incentive to hold "to the end."

⁸The admissibility of *ex ante* equivalence in the design of a tax system is discussed in Section IV.

PROOF:

Consider a tax rule based on the admissible information set:

$$(9) \quad T_s = F(t, i, s, A_s).$$

Differentiating (9) with respect to s yields

$$(10) \quad \dot{T}_s = F_s + F_A \dot{A}_s = F_s + F_A A_s (i + \epsilon_s)$$

$$= F_s + F_A i A_s + F_A \epsilon_s.$$

Applying $V(\cdot)$ to (10) and combining the result with (4) and (9) to eliminate $V(\dot{T}_s)$ and T_s , one obtains the partial differential equation

$$(11) \quad \frac{1}{i(1-t)} F_s + \frac{A_s}{1-t} F_A = F + \frac{tA_s}{1-t}.$$

Since the division of assets is arbitrary, it must be the case that F is homogeneous of degree one with respect to A_s . That is, dividing an asset into two pieces and realizing each half separately can have no effect on the capital gains tax liability. Thus, there must exist some function $F^1(\cdot)$ such that

$$(12) \quad F(i, t, s, A_s) = F^1(i, t, s) \cdot A_s.$$

Substituting the expression for F_s and F_A obtained from (12) into (11), one obtains the ordinary differential equation

$$(13) \quad \left(\frac{1}{i(1-t)} \right) \left(\frac{dF^1}{ds} \right) + \frac{1}{1-t} F^1$$

$$= F^1 + \frac{t}{1-t}$$

which, combined with the initial condition $F^1(i, t, 0) = 0$, yields the unique solution $F^1(i, t, s) = (1 - e^{-its})$ and hence $T_s = F(i, t, s, A_s) = F^1(i, t, s) \cdot A_s = (1 - e^{-its}) A_s$.

The information set specified in Proposition 3 does not include the asset's initial price, though knowledge of this is required even by the current system of taxation. One's intuition might suggest that adding this piece

of information would offer an alternative rule that would also “work,” similar to that given in (6) but based on the initial purchase price plus imputed interest, $A_0 e^{it_s}$, rather than the sale price A_s . However, it is easy to show that this scheme would fail to satisfy condition (4). This alternative system would still encourage the holding of assets that to date had appreciated at a rate exceeding the interest rate i , since it would be imputing a normal rate of return on too low a base and, hence, would not fully eliminate the deferral advantage.

B. Extensions

One of the arguments often made for the preservation of a realization-based system of capital gains taxation is that the preferential tax treatment provided by the advantage of deferral has social value. Without judging such desirability directly, one can dispose of this argument on logical grounds by observing that the system described in (6) does not require a uniform effective tax rate on the income from all assets. A tax benefit for capital assets need not be provided via a distortionary deferral advantage.

Let t' be the tax rate on interest-bearing assets and let t be the desired effective tax rate on capital assets, perhaps lower than t' . In this case, the preceding analysis holds if one replaces the before-tax opportunity cost i with $i(1-t')/(1-t)$. That is, replacing (6) with

$$(6') \quad T_s = \left\{ 1 - \exp \left[-ti \left(\frac{1-t'}{1-t} \right) s \right] \right\} A_s$$

taxes income over time according to the rule

$$(7') \quad \dot{T}_s = i(1-t')T_s + ti \left(\frac{1-t'}{1-t} \right) A_s + \left\{ 1 - \exp \left[ti \left(\frac{1-t'}{1-t} \right) s \right] \right\} \varepsilon_s A_s.$$

Once again, the investor is charged the relevant after-tax interest rate $i(1-t')$ on the

outstanding tax liability and is taxed on the certainty-equivalent accruals of income at the capital asset's tax rate t .

Indeed, the system can be applied even if investors vary with respect to $(1-t)/(1-t')$, the ratio of their relative after-tax returns on the safe and risky assets. As long as each investor is in portfolio equilibrium, with his after-tax risk-adjusted return equal to his opportunity cost, application of the tax system in (6') implies that the investor will require a certainty-equivalent before-tax return of $i[(1-t')/(1-t)]$, even if the ratio $(1-t')/(1-t)$ varies across the population. By construction, the risk premium ε equals the total return g minus the required, risk-adjusted before-tax return $i[(1-t')/(1-t)]$, so differences in $(1-t')/(1-t)$ imply different risk premia on the same asset for different investors. However, this is precisely what gives rise to portfolio sorting and clientele formation, with investors holding diversified portfolios but gravitating toward those assets in which they obtain a relatively favorable trade-off between risk and return (Auerbach and Mervyn A. King, 1983). In equilibrium, each investor will require the available risk premium to hold each risky asset, assuming there is an interior solution to the portfolio-choice problem.⁹

III. The General Tax System

Most assets presently subject to capital gains taxes generate cash flows and are subject to tax charges before disposition of the assets themselves. In the case of corporate

⁹Such a solution will not exist, for example, if assets with different tax characteristics have the same return distributions, as in the case of perfect certainty. In such cases, constraints on investors' positions (on borrowing or short sales, perhaps) are required for any equilibrium to exist, and corner solutions for individual portfolios will arise. Here, the equivalence among after-tax returns holds only if shadow prices on the binding constraints are taken into account (see Auerbach and King, 1983). If, for example, an investor held no taxable debt, only tax-exempt municipal bonds, the appropriate after-tax opportunity cost would be the interest rate on municipal bonds.

equities, shareholders receive dividends and pay taxes on them. For other assets, taxes and cash flows may not be so closely tied. For real estate investments qualifying for accelerated depreciation allowances, for example, investors might in some years receive positive cash flows and tax refunds at the same time, and in later years they might pay taxes equal to a substantial fraction of cash flows. This section extends the previous results to the general class of assets with arbitrary patterns of cash flows and tax payments.

Let D_s be the cash distribution received at date s , and let τ_s be the tax payment made at date s . For some assets, one might impose a restriction relating τ_s to D_s , but this is unnecessary for the derivation. To the extent that there are transaction costs associated with purchasing, selling, or holding the asset, these can be treated as negative distributions.

I follow the same strategy as in Section II, first discussing the evolution of the tax liability T that is necessary to ensure holding-period neutrality. As before, I assume initially that the government wishes to tax all asset income at a single rate t .

PROPOSITION 4: *For the general class of assets just described, the following condition is necessary and sufficient for a tax to be holding-period neutral:*

$$(14) \quad V(\dot{T}_s) = i(1-t)T_s + tiA_s - \tau_s.$$

PROOF:

Following the proof of Proposition 1, note that the yield on the net of tax asset value $A - T$ must equal $i(1-t)$. This yield consists of the cash return on the asset D plus the net capital gain $\dot{A} - \dot{T}$ minus the tax payment τ ; thus,¹⁰

$$(15) \quad V(\dot{A}_s - \dot{T}_s) + D_s - \tau_s = (A_s - T_s)i(1-t).$$

Combined with equation (14), (15) implies

¹⁰The derivation assumes for simplicity that D_s and τ_s are known at date s , but this does not affect the results.

that $V(\dot{A}_s) + D_s = iA_s$, regardless of A_s or s . Hence (14) implies holding-period neutrality. Alternatively, combined with the requirement for holding-period neutrality that $V(\dot{A}_s) + D_s = iA_s$ (i.e., that the before-tax return required in the asset be independent of A_s or s), (15) implies (14).

Expression (14) says that, in computing their increase in tax liability \dot{T} , investors should be given credit for taxes paid currently. Again, such a provision is present in Vickrey's original scheme. As before, the rule described in (14) is less restrictive in that it applies to the valuation of returns *ex ante* rather than actual *ex post* returns in each state of nature. Once again, there is a tax system that will satisfy (14) without requiring information on the pattern of an asset's growth in value.

PROPOSITION 5: *Suppose the realization tax liability is*

$$(16) \quad T_s = (1 - e^{-tis})A_s - e^{i(1-t)s} \times \left[\int_0^s (e^{-iz} - e^{-i(1-t)z}) D_z dz + \int_0^s e^{-i(1-t)z} \tau_z dz \right].$$

Then, the tax system satisfies (14) for all s and hence is holding-period neutral.

PROOF:

Taking the time derivative of (16) and substituting the resulting expression back into (16) yields

$$\begin{aligned} \dot{T}_s &= (1 - e^{-tis})\dot{A}_s + tie^{-tis}A_s \\ &\quad + i(1-t)[T_s - (1 - e^{-tis})A_s] \\ &\quad - e^{i(1-t)s}[(e^{-is} - e^{-i(1-t)s})D_s + e^{-i(1-t)s}\tau_s] \\ &= (1 - e^{-tis}) \left[\left(\frac{\dot{A}}{A} \right)_s - i \right] A_s + tiA_s \\ &\quad + i(1-t)T_s + (1 - e^{-tis})D_s - \tau_s \\ &= (1 - e^{-tis}) \left[\left(\frac{\dot{A}}{A} \right)_s + D_s - i \right] A_s \\ &\quad + tiA_s + i(1-t)T_s - \tau_s. \end{aligned}$$

Again, without restriction (see the proof of Proposition 2) one may assume that the risk-adjusted, before-tax required return $V(\dot{A}/A) + D = i$, so that $(\dot{A}/A) + D = i + \varepsilon$ with $V(\varepsilon) = 0$. Thus,

$$(17) \quad \dot{T}_s = i(1-t)T_s + tiA_s - \tau_s + (1 - e^{-tis})\varepsilon_s A_s.$$

Since, by construction, $V(\varepsilon) = 0$, application of $V(\cdot)$ to both sides of (17) yields (14).

As in the previous case, the solution involves taxing the asset's risk premium at a rate $(1 - e^{-tis})$ rather than t . A way of interpreting (16) is to rewrite it as

$$(16') \quad T_s = (1 - e^{-tis}) \left(A_s + \int_0^s e^{i(s-z)} D_z dz \right) - \left(\int_0^s e^{i(s-z)} D_z dz - \int_0^s e^{i(1-t)(s-z)} D_z dz \right) - \int_0^s e^{i(1-t)(s-z)} \tau_z dz.$$

The term $(A_s + \int_0^s e^{i(s-z)} D_z dz)$ is the present value, at date s , of the asset plus all previous distributions. Thus, the tax scheme begins by treating this entire value as subject to the tax rate $(1 - e^{-tis})$, as in Section II. Had all distributions been received tax-free and reinvested in the asset itself, this would be appropriate, for then the asset would be of the type analyzed there. However, because taxes have been paid in the past and the distributions invested elsewhere, two corrections are necessary for taxes already paid. The last term in (16') is a credit for taxes already paid directly on the asset, while the middle term in (16') is an imputation for taxes paid on the income generated by distributions invested in other assets facing an income tax rate t . That is, the treatment of distributions as having been reinvested in the same asset assumes that they continue to generate income at the before-tax rate of return i , adjusted for risk. Since they were actually invested in other assets, which we may assume to face an accrual-equivalent income tax rate t , we are therefore ignoring the subsequent in-

come taxes attributable to such reinvested distributions. The present value of these imputed taxes at date s is $(\int_0^s e^{i(s-z)} D_z dz - \int_0^s e^{i(1-t)(s-z)} D_z dz)$. Thus, the tax system in (16) can be interpreted as treating all distributions as being reinvested and then applying the tax scheme described in Section II but giving credit for taxes paid along the way.

Yet another interpretation of expression (16) is obtained from the following logic. As is well known, share repurchases and dividends are equivalent except for their tax treatment, and in this case, even the tax treatment is the same. Thus, one should be able to view each distribution as a share repurchase. Since each such repurchase amounts to the investor's realization of part of his assets, consistent treatment based on Proposition 1 ought to suffice. If each "partial" asset sale receives such treatment, there ought to be no deviation needed when the remainder of the asset is sold. Indeed, this conjecture is correct. Collecting terms in (16), one obtains

$$(16'') \quad T_s = (1 - e^{-tis}) A_s + \int_0^s e^{i(1-t)(s-z)} [(1 - e^{-tiz}) D_z - \tau_z] dz$$

which says that the household's tax liability at date s equals the normal tax due on assets without previous distributions or tax payments plus the accumulated deficit in tax payments on previous "realizations" (i.e., distributions).¹¹

Thus, one very simple approach to the achievement of holding-period neutrality is to tax every distribution from a capital asset at the rate $(1 - e^{-tis})$, where s is the time since the asset's purchase. In this event, the informational requirements are no worse than in the previous case without distributions.

More generally, expression (16) is more complex than expression (6), but its infor-

¹¹ It is particularly clear from (16'') why the initial purchase price does not appear in the tax calculation. One could view this initial cost as a negative distribution at date zero, but the appropriate tax on this negative distribution would be zero.

mational requirements are still minimal. In addition to what was needed in the previous case, the government now must also know the flows of previous taxes and distributions on the asset.

A record of previous taxes can be obtained from past tax returns. In many instances, as with common stock, the taxes are directly based on the distributions, so records of the distributions themselves are just as easily available. Even in cases for which the taxes τ and distributions D are not so simply related (real estate investments, for example), the law requires taxpayers to supply enough information so that the distributions can be calculated. For example, a real estate investor would add interest payments and depreciation deductions back to reported profits in order to calculate the distribution from a property in a given year.

As before, the tax rule can be extended to the case of different tax rates on capital assets (t) and other income (t') by replacing the interest rate i with the required before-tax return $i(1-t')/(1-t)$. For cases in which t is known, this is a simple change. There are more complicated cases, though, in which tax preferences are given not via a reduction in t but through tax credits or accelerated depreciation, each of which affects the present value of τ . In this case, it is necessary to determine what effective tax rate t is desired and to base the calculation in (16) on this value. Once this has been done, the continued presence or absence of tax credits or accelerated depreciation becomes irrelevant, for variations in these are simply offset by changes in the last term of (16).

IV. Qualifications

The system derived in the preceding sections for taxing capital gains on realization has obvious benefits, but there are potential limitations as well, some of which are discussed in this section.

A. *Ex Ante versus Ex Post Taxation*

One potential objection to the tax system developed in this paper is that its equiva-

lence to accrual taxation is on an *ex ante* basis; at each date s investors are indifferent between the increase in tax liability \hat{T}_s and accrual taxation of additional income, before they know what their income will be. However, on an *ex post* basis, the tax liabilities are not the same. In particular, it is possible for an investor to lose money continuously (A_s declining monotonically with s) and still be liable for taxes on an asset sale.

There are several responses to this criticism. First, even a system of accrual taxation, if deferred with interest as proposed by Vickrey, could lead to a positive tax liability on a capital loss.¹² Second, there are many other examples in which *ex ante* equivalence has been relied upon in the tax literature: for example, in the discussion of the conditional equivalence of consumption and wage taxes (see U.S. Treasury, 1977). Finally, the perception that this tax is unfair to those with below-normal rates of return is quite dependent on the frame of reference of a tax on *ex post* income. If, for example, one used a tax on *ex post* wealth as the frame of reference, the opposite result would hold: the tax scheme would discriminate *against* those with relatively favorable experience.

To see this, note first that a tax at rate t on an imputed rate of return i on an asset is equivalent to a wealth tax at rate ti . Thus, one may reinterpret the scheme in (6) and (16) as simulating an annual wealth tax on an asset whose value is unknown to the government. Given this interpretation, the asset whose value has risen slowly over time will have past values of wealth used for imputation [see (8)] that are too low; they will be assumed to have grown more rapidly in value over time than they actually have. The opposite will be true of assets that have appreciated rapidly.

The issue of fairness, then, involves wealth taxation to an even greater extent than

¹²For example, suppose an asset is purchased for 1 dollar, increases in value to 2 dollars and then decreases to 99 cents. The initial capital gain of 1, with interest, will exceed in absolute value the subsequent capital loss of 1.01 as long as the after-tax interest rate is greater than 1 percent.

ex ante income taxation. If the scheme considered in this paper is “unfair,” then so surely must be a system of *ex post* wealth taxation. Since such property taxation is a main source of revenue for state and local governments in the United States, one must question the conclusion or at least recognize that other factors, such as ease of administrability, may outweigh the concern for *ex post* fairness in the design of policy.

B. Closely Held Assets

The system evaluated here would work best for those assets held “at arm’s length,” in legal terminology. This obviously includes most common stock in public corporations and other similar assets. While most common stock would be relatively easy to value and, hence, could be administered even under a system of accrual taxation, many assets in whose management the typical investor does not play an active role are nevertheless not traded at readily observable (to the government) prices. Examples would include limited partnerships and other assets which the Tax Reform Act of 1986 classifies as “passive” investments.

An asset not in this category, for example an entrepreneur-owned enterprise, would be subject to two problems. First, it would be difficult to distinguish payments to capital [taxes on which, according to (16), would be credited against ultimate capital gains tax liability] from payments to labor (which could not be so credited). Second, part of the initial value of such enterprises represents the capitalized idea of the entrepreneur. The system of retrospective taxation would tax the *income* on such initial capital appropriately but would not tax the initial income associated with the capitalization of the successful idea.¹³ This can be

¹³To see this, note that the embodiment of the idea in the asset increases the asset’s value by the present value of the risk-adjusted returns that the idea is projected to yield in the future. When the investor ultimately sells the asset, the returns on the part due initially to the investor’s idea are effectively taxed at the same rate as the returns on the part of the asset purchased using after-tax funds: there is no distinction regarding the source of funds, only a distinction regarding when the asset was obtained. In the simplest

compared to the current system, which taxes the initial income only upon realization and, hence, at a low effective rate, thereby introducing a powerful lock-in effect (or an incentive to be taken over by another company in order to obtain a tax-free conversion into a more diversified company’s shares). In general, this is a relatively small class of assets which pose problems of administration even for the present tax system.

Just as entrepreneurs may avoid tax on labor income contributed to their enterprises under the new system, so may investors who devote labor effort to the choice of investments, in a sense producing a portfolio as the joint product of labor input and invested funds. However, this is a relatively insignificant issue for assets held at arm’s length. A major exception to this conclusion would seem to arise in the case of professional securities traders, who devote most of their labor input to this endeavor. However, such income is taxed as ordinary income without any deferral advantage, even under present law. Such treatment would presumably continue even if retrospective taxation were introduced for other investors.¹⁴

V. Conclusions

This paper has presented a scheme that taxes capital gains upon realization without inducing a lock-in effect or providing the opportunity for tax arbitrage. The scheme requires information that is either publicly available (such as interest rates) or present on previous tax returns (such as past tax payments) but not the private (or potentially

case, in which the entrepreneur adds the product of his human capital and then sells the augmented asset immediately (i.e., at $s = 0$), formal adherence to the rule would produce a tax liability of zero. However, one would presumably wish to apply special rules in such special and easily identifiable cases.

¹⁴If owner-occupied housing were subject to capital gains taxation, then a significant way of achieving untaxed labor income under the new scheme (rather than having labor income eventually included in the capital gains tax base) would be to work on one’s house. However, capital gains on houses are, even now, largely excluded from the tax base because of the provisions allowing the rollover of gains and the one-time exemption for individuals over age 55. Thus, even current law permits most such labor income to escape tax entirely.

even unavailable) information on the time pattern of an asset's accrued gains.

Nothing about the tax system described here requires that all asset income be taxed at the same rate for a particular investor. Purchases of certain assets can still be encouraged through a lower overall tax burden, without the need to resort to ad hoc measures such as accelerated depreciation or distortionary measures such as low rates of realization-based capital gains taxes that exacerbate the lock-in effect and the problem of tax arbitrage.

In achieving the economic benefits of accrual taxation without its associated liquidity or information problems, the new approach makes a less distortionary capital gains tax more feasible and eliminates the need for the additional distortions associated with compensating antiarbitrage provisions such as limited loss offsets.

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