2002

Little Boxes: Can Optimal Commodity Tax Methodology Save the Debt-Equity Distinction?

Herwig J. Schlunk

Little Boxes: Can Optimal Commodity Tax Methodology Save the Debt-Equity Distinction?

Herwig J. Schlunk*

I. Introduction

The tax law frequently taxes economically similar items in very different ways. This is generally the unintentional—but also unavoidable—result of evolution. First, two items that are commonly understood as being in some relevant way different are accorded different tax treatments. A corporation is double-taxed and a partnership is single-taxed. The gain from selling an asset is taxed while the gain from holding it is not. Corporate equity is taxed in one way and corporate debt in another. Nothing is per se wrong with the original tax distinction. After all, a corporation is not a partnership. A sale is not a retention. Equity is not debt.

Time passes and taxpayers become accustomed to the "legal line" and the differences in tax treatment that it accords. More important, they become accustomed to the benefits and burdens of the differences in tax treatments. Thus, taxpayers pine for corporations that are taxed as partnerships, or sales that are taxed as retentions, or equity that is taxed as debt. The pining leads to a reexamination by taxpayers of the original items. Why—or under what circumstances—was a corporation preferred to a partnership, a sale preferred to a retention, equity preferred to debt? What characteristics of the items led to the preferences? Can these characteristics be deconstructed and recombined?

If, as is frequently the case, the characteristics are capable of deconstruction and recombination, evolution occurs: new items are created that are not tax-characterizable in the obvious way of their predecessors. They may be limited partnerships or limited liability companies. They may be shorts-against-the-box, or swaps, or caps and collars. They may be junk bonds, contingent-payment "debt instruments," or MIPs. The tax law must react to these newly created items. At a first cut, the law must decide whether a limited partnership is a corporation or a partnership for tax purposes, whether a short-against-the-box constitutes a sale, or whether a given junk bond is tax debt.

---

* Assistant Professor, Vanderbilt University Law School. I want to thank David Weisbach both for the inspiration for this Article and for helpful comments with respect to it. I also want to thank the National Tax Association for giving me the opportunity to present an earlier version of this Article at their annual meeting in 2000. Finally, I want to thank Mark Gergen and Calvin Johnson for the opportunity to present this Article at the University of Texas School of Law's Morrison Symposium in 2001.

One way for income-tax law to react when confronted with newly created items is to tax such items in the same way as their closest substitutes, where substitutability is based on non-tax criteria. Such an approach is essentially an application of the methods of optimal commodity taxation to the income-tax world.[1] What optimal commodity tax methodology does is provide rules showing how to structure a set of commodity taxes in a way that maximizes social welfare. These rules can be applied subject to a variety of constraints including, for purposes of this Article, the constraints that exactly two rates of tax are available and that one specified commodity is taxed at one of those rates and a second specified commodity is taxed at the other. Under these predicates, optimal commodity tax methodology teaches that any new commodity should be taxed in the same way as its closest substitute. The reason is that such a tax structure leads to the least amount of shifting of consumption from high-taxed commodities to low-taxed commodities and hence to the smallest amount of lost social welfare (so-called deadweight loss).[2]

But, as is demonstrated below, *even* in the commodity world, some modest additional constraints convert the optimal commodity tax methodology into an engine that will occasionally yield results which from an ex post perspective are anything but "optimal." This does not, of course, mean that an optimal commodity tax methodology approach is not the best *available* approach to commodity taxation even in a world that conforms to my additional constraints. It surely is, because the taxing authorities are never blessed with anything remotely approaching perfect foresight. But it does mean that heightened attention should be focused on the constraints themselves and, in particular, on the seminal constraint that the two specified commodities must be taxed differently.

---

1. *See* David A. Weisbach, *An Efficiency Analysis of Line Drawing in the Tax Law*, 29 J. LEGAL STUD. 71 (2000).

2. Note that optimal commodity tax methodology is generally applied, not subject to the constraints in the text, but instead subject to the constraints that two specified commodities are taxed at different rates and that the commodity tax, as a whole, raises a specified amount of revenue. Thus, the actual differing tax rates are not fixed. It is generally impossible to reconcile those two constraints with my additional constraint: fixed tax rates. Suppose that a given tax structure in a two-commodity world raises the desired amount of tax. When a new commodity is introduced, it can either be taxed at the lower fixed rate or at the higher fixed rate. If at the lower rate, then so long as a single consumer shifts her consumption from the higher-taxed commodity to the new commodity, total tax revenues will fall. If at the higher rate, then so long as a single consumer shifts her consumption from the lower-taxed commodity to the new commodity (and preferences might dictate just such a shift, in spite of the tax), total tax revenue will rise. I have chosen to apply my alternative constraint and, hence, to dispense with the constraint of fixed revenue, since it appears to me to be a better description of short-term tax decision-making in the world that I ultimately examine—the income-tax world. That is, my ad hoc unscientific observation tells me that tax rates are rarely changed in direct response to the appearance of new income tax items (the "commodities" in this Article). Thus, as a practical matter, the introduction and classification of each such item must generally lead to a rise or fall of total tax revenue.

The income-tax world resembles the commodity-tax world in some ways, but not in others. Perhaps the key difference is that many income-tax items are separable and combinable in ways that commodities are not. That is, while there may be an apple inside every orange, it is generally cost-prohibitive to extract it. And while genetic engineering may be able to create a perfect hybrid of an apple and an orange, in general, it is currently cost-prohibitive to do so. In the income-tax world, however, income items are frequently nothing but cash flows: cash flows that can be (essentially) costlessly separated and recombined. As is demonstrated below—and is in any event well known—this can lead to the additional bad tax result that (essentially) perfect substitutes are taxed differently.[3] An attempted application of optimal commodity tax methodology can do nothing to remedy this.

My thesis is that all too frequently it is unhelpful to ask whether a new income-tax item is a better substitute for one or another existing item. If the existing items are themselves inconsistently taxed, the inquiry can only lead to ex post arbitrary tax results and/or to discontinuities.[4] At the end of the day, the most robust approach is simply to eliminate the inconsistent tax treatment of the existing items. I will illustrate my thesis with the single income-tax distinction to which it is surely most apt: the distinction between corporate debt and corporate equity. Under current law, these tax items are taxed inconsistently. But since they represent little more than rights to corporate cash flow, the most economically relevant characteristics of these tax items can freely be separated and recombined.

As a theoretical matter, there is no limit to the number of new instruments that can be created from the deconstruction and reconstruction of debt and equity instruments. Thus, there is no theoretical limit to the number of new instruments that can be created in an attempt to exploit the inconsistency in the tax treatment of corporate debt and equity. Indeed, recent years have seen a flood of new instruments that attempt to exploit the inconsistency. As financial engineers become more adept, and as financial markets become more sophisticated, there is no reason to believe anything but that this flood will accelerate. Faced with such a reality, legislators and tax administrators might want to consider what they have in the past felt unable to consider: whether, rather than trying to defend the line between debt and equity, they would simply be better served by abolishing it. Indeed, it is my belief that, even without such explicit legislative change, the elimination of the debt-equity distinction will inevitably occur *as a result of taxpayers' actions*. That is, as financial innovation becomes cheaper and

---

3. *See* Alvin C. Warren, Jr., *Financial Contract Innovation and Income Tax Policy*, 107 HARV. L. REV. 460 (1993).

4. *See generally*, Jeff Strnad, *Taxing New Financial Products: A Conceptual Framework*, 46 STAN. L. REV. 569 (1994).

cheaper (and in the limit becomes costless), the debt-equity distinction will be exploitable by taxpayers to such an extent that their choice of tax treatment will be effectively elective.

II. Of Fruit

A. *The Model*

Suppose that there exist, or will exist, four different fruits: apples, oranges, bananas, and kiwi fruit. Once a fruit is discovered, it is available in infinite, and infinitely divisible, supply at the unit price of $100. Suppose that consumers do not value the fruits per se but instead for their content of a single identifiable characteristic, *c*. Finally, suppose that *c* can be represented by a number in the interval [0,100]. For the sake of this example, suppose an apple has $c = 0$, a banana has $c = 35$, a kiwi fruit has $c = 60$, and an orange has $c = 100$.

Consumers in this world have a per-period endowment of $100. In order to allow for multiperiod analysis, suppose that some or all of each period's endowment can be invested at a rate of 9.9%. Further, suppose that each consumer has a utility function that is the discounted sum of a per-period utility function, in which a discount rate of 10% is applied. Finally, suppose the per-period utility function for each consumer is identical from period to period. Among other things, these assumptions imply that a 10% discount rate is the proper discount rate for evaluating the multiperiod effects on utility of any tax imposed in this world.

Suppose now that each consumer's preferences are fully specified by a number *x* on the interval [0,100]. Assume that the distribution of the characteristic *x* in the population is uniform over the interval. The per-period utility function for a consumer with characteristic *x* is $u = \sum_{i=1}^{n} \pi_i * (1 - t_i) * (100 - |x - c_i|)$, where π_i is the gross share of the consumer's dollar spent on commodity *i*, t_i is the tax rate imposed on commodity *i*, and c_i is the utility-determining characteristic of commodity *i*.[5] Thus, for example, if all tax rates are zero, and if oranges are available, a consumer with $x = 100$ will spend her entire endowment on oranges in each period. There can be no benefit from saving any part of the endowment, and setting $\pi_{oranges} = 1$ achieves the maximum possible per-period utility of 100.

Suppose now that this fictitious world initially contains only apples and oranges (bananas and kiwi fruit have not yet been discovered). Prior to the imposition of any tax, each consumer faces two choices in each period. First, she must decide whether to consume her endowment or to save some (or all)

5. For tractability of the algebra, the utility function assumes that a fractional fruit provides proportionately fractional utility (with no diminishing marginal returns).

of it. Second, assuming she chooses consumption, she must decide whether to eat apples or oranges. I will *always* finesse the first choice with the assumption that no consumer has reason to believe that subsequent periods will provide *sufficiently* enhanced consumption choices.[6] Thus, each consumer expects to suffer a small utility loss from saving any part of her endowment.[7] Accordingly, she will not save, but will consume her entire endowment currently.

But how does she decide what to consume? She simply maximizes her per-period utility function (where the π_i are her variables of choice). Performing this maximization, essentially every consumer will specialize in the consumption of either apples or oranges (*i.e.*, will set $\pi_i = 1$ for some i). That is, a consumer is indifferent between eating apples or oranges if and only if $\{100 - |x - c_{apples}|\} = \{100 - |x - c_{oranges}|\}$, *i.e.*, if and only if $100 - x = x$, or $x = 50$. Consumers with $0 \leq x < 50$ eat only apples; consumers with $50 < x \leq 100$ eat only oranges.[8]

Now suppose that an excise tax of 20% is imposed on the sales price of oranges and that no tax is imposed on apples. This creation of distinct little boxes—apples and oranges are no longer just *fruit* but are now *apples* and *oranges*—is conceptually unproblematic, for in a world with only apples and oranges, it is a trivial matter to tell them apart. But telling them apart is not where the problems will lie. Rather, assuming that these original little boxes are immutable (*i.e.*, that the historical accident distinguishing apples from oranges for tax purposes will never be undone), future questions without obvious answers will arise: Is a banana an apple? Is a kiwi fruit an orange? Should other fruits, whether naturally occurring or artificially created, be treated as apples or as oranges? Questions such as these are the focus of this Article.

But before multiplying the set of available fruit, it is instructive to examine consumer reaction to the initial tax on oranges. Again, so long as each consumer believes that the choice of fruit in subsequent periods is unlikely to improve in any sufficient way, *and so long as each consumer believes that tax rates are unlikely to change*, each consumer will continue to currently consume her entire endowment. And again, maximizing the per-period utility function produces specialization among essentially all

6. These are not necessarily *irrational* expectations. That is, consumers may know that enhanced choices appear with some probability, but have no reason to believe that such choices will systematically provide them with sufficient incremental utility to make saving an optimal choice.

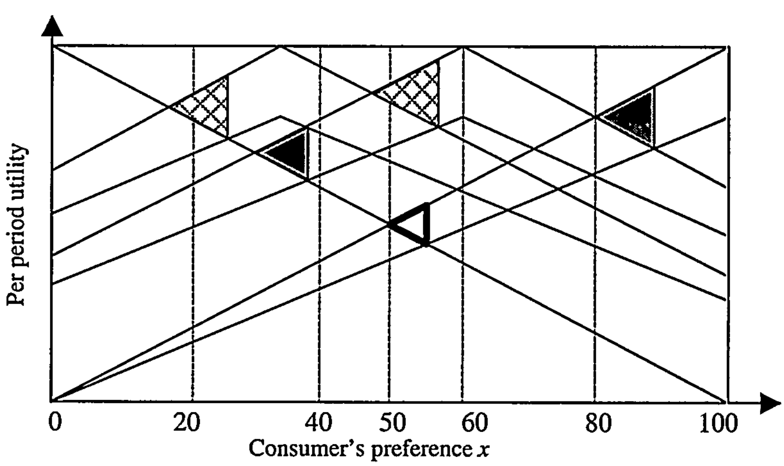
7. This follows since her savings earn interest at a 9.9% rate, while her future utility is discounted at a 10% rate. The disparity can, for example, be attributable to a transaction cost with respect to saving.

8. People with $x = 50$ may do either, but they are a set of measure zero and hence are unimportant to the analysis.

consumers. Now, however, the boundary line for specialization shifts. That is, a consumer is now indifferent between consuming apples and consuming oranges if and only if $\{1 - t_{apples}\}*\{100 - |x - c_{apples}|\} = \{1 - t_{oranges}\}*\{100 - |x - c_{oranges}|\}$, *i.e.*, if and only if $(100 - x) = (1 - 0.2)*x$, or $x = 55.56$. Consumers with $0 \leq x < 55.56$ eat only apples; consumers with $55.56 < x \leq 100$ eat only oranges. Thus, the imposition of the tax on oranges leads to a substitution from oranges to apples for consumers satisfying $50 \leq x < 55.56$.

Measuring the per-period deadweight loss resulting from the imposition of the tax on oranges is relatively straightforward. It is necessary to add up the lost utility resulting from the *changes* in consumption occasioned by the tax. For each former orange-eater who switches to apples, this loss is the excess of the utility that would have been achieved by consuming only oranges in a tax-free world over the utility actually achieved by consuming only apples. The reason for basing the comparison on the possibilities in the tax-free world is that these are fully replicable in the world with taxes. That is, the taxing authority could expend all of its tax receipts on oranges and distribute them to consumers who paid taxes in proportion to such taxes. If the taxing authority followed this strategy, no one would actually suffer a loss of utility as a result of paying taxes. Hence, there is no deadweight loss with respect to consumers who continue to consume oranges and accordingly pay the tax. Instead, deadweight loss only results when consumers substitute away from their ideal consumption mix as a result of the tax. For those consumers, there is no fount of tax revenues that can be deployed to make whole the utility loss. Ergo, this is the deadweight loss. This per-period deadweight loss is represented by the area of the bold triangle near the center of Figure 1, or $\int_{50}^{55.56}[x - (100 - x)]dx$, or 31.

Figure 1.



1. Path #1.—Into this world, with its immutable tax on oranges and its equally immutable non-tax on apples, comes the first kiwi fruit. The taxing authority must decide whether to tax kiwis as oranges, with $t_{kiwis} = 20\%$, or as apples, with $t_{kiwis} = 0\%$. Note that I critically assume that tax rates will not change in response to the discovery of kiwi fruit. Thus, a decision to lump kiwis and oranges together will not lead to a lower tax rate than $t = 20\%$, nor will a decision to lump apples and kiwis lead to a higher tax rate than $t = 20\%$. This assumption is based on my perception that there is generally no short-term budget equality (annual expenditure equals annual *tax* revenue). Thus, there is generally no immediate or direct tax-rate response to windfalls or deficits arising as a consequence of the discovery or creation of a new income tax "commodity." Moreover, even longer term budget responses tend not to involve nominal tax rates on the items leading to the windfall or deficit. For example, most governmental responses to the perceived threat of over-leveraging on corporate-tax collections either decree that certain instruments will be treated as equity or, equivalently, will disallow corporate-interest deductions with respect to certain instruments.[9] Following my example, government responses address the question of whether a kiwi is an apple or an orange. Conceptually, nothing prevents the government from adjusting the Internal Revenue Code ("I.R.C.") section 11 tax rate imposed on items affected by the corporate-interest deduction. Nor does anything prevent the government from adjusting the relative tax rates imposed on the high-taxed items (such as equity) and the low-taxed items (such as debt). But this is simply not observed in practice.

To develop a baseline, note first that the same type of algebra already employed above shows that, absent taxes, consumers in the three-commodity world would line up as follows: apples would be eaten by consumers with $0 \leq x < 30$, kiwis would be eaten by consumers with $30 < x < 80$, and oranges would be eaten by consumers with $80 < x \leq 100$. Thus, absent taxes, more consumers switch from oranges to kiwis than from apples to kiwis. That is a shorthand way of saying that kiwis seem to be a better substitute for oranges than for apples. This in turn suggests that kiwis should be taxed as oranges are. Optimal commodity tax methodology allows for the confirmation of this intuition: the optimal commodity tax structure is that which produces the lowest deadweight loss.[10]

9. *See, e.g.*, I.R.C. §§ 279(a), 163(j), 163(*l*) (2001); I.R.S. Notice 94-47, 1994-1 C.B. 357. Also see I.R.C. § 163(e)(5) (2001), which more subtly and effectively divides certain high-yield debt into a debt component and an equity component (equivalent to deciding that a kiwi is in part an apple and in part an orange). Even this section, however, does not adjust the tax rates imposed on debt or equity generally. It does, however, effectively create an intermediate tax rate for a certain class of instruments.

10. *See* Weisbach, *supra* note 1, at 77–78.

Consider first the case where kiwis are taxed at $t_{kiwis} = 0.2$, just like oranges. This tax scheme yields consumer choices of apples for $0 \leq x < 37.78$, kiwis for $37.78 < x < 80$, and oranges for $80 < x \leq 100$. Thus, consumption choices are distorted relative to those prevailing in the tax-free world only for consumers with $30 \leq x < 37.78$, or 7.78% of the population. For these consumers, the aggregate utility loss—the deadweight loss—is the area of the left shaded triangle in Figure 1, or $\int_{30}^{37.78}[(40+x)-(100-x)]dx$, or 60.

Conversely, if kiwis are untaxed—*i.e.*, treated like apples—apples are chosen by consumers satisfying $0 \leq x < 30$, kiwis by consumers satisfying $30 < x < 88.89$, and oranges by consumers satisfying $88.89 < x \leq 100$. Thus, consumption choices are distorted relative to those prevailing in the tax-free world only for consumers with $80 \leq x < 88.89$, or 8.89% of the population. For these consumers, the aggregate utility loss—the deadweight loss—is the area of the right shaded triangle in Figure 1, or $\int_{80}^{88.89}[x-(160-x)]dx$, or 79.

Since taxed kiwis lead to a smaller deadweight loss than do untaxed kiwis, the intuition that kiwis *should* be taxed like oranges has been confirmed.[11] So assuming the taxing authorities are applying an optimal commodity tax approach, kiwis will be taxed. I assume such a tax is indeed imposed.

Subsequently, bananas are discovered. Now the taxing authorities must decide whether bananas are apples or kiwi-oranges. Note that I critically assume that the question of how to tax *kiwis* is not revisited in light of the discovery of bananas. This assumption is not invariably supported by direct observation: taxing authorities occasionally reverse prior legal lines. But the assumption nevertheless has considerable force, since it generally takes a very long time for prior legal lines to be reversed. For example, in the debt-equity context, it took twelve years for I.R.C. section 163(*l*) to largely reverse Revenue Ruling 85-119,[12] which held that an instrument mandatorily payable in issuer stock could nonetheless qualify as tax debt. And it took twenty-four years for Notice 94-47[13] to effectively reverse *Monon Railroad v. Commissioner*,[14] which held that an instrument with a fifty-year maturity could qualify as tax debt.[15]

---

11. Note here and with the addition of each new fruit that deadweight loss actually increases. The reason is that each new fruit enhances consumer choice in a relevant way: increasing potential aggregate utility. The amount of this potential utility that is lost due to the imposition of taxes is the deadweight loss. Thus, even as aggregate utility increases, the wedge between actual utility (in the presence of taxes) and potential utility (in the absence of taxes) also increases.

12. Rev. Rul. 85-119, 1985-2 C.B. 60–61.

13. Notice 94-47, 1994-1 C.B. 357.

14. Monon R.R. v. Comm'r, 55 T.C. 345, 362 (1970).

15. Indeed, the history of the debt-equity distinction is one of a gradual but inexorable tightening of restrictions on what it means to be unequivocally debt (or, equivalently, to be an

Note that absent any taxes, the baseline consumer choices are apples for consumers with $0 \le x < 17.5$, bananas for consumers with $17.5 < x < 47.5$, kiwis for consumers with $47.5 < x < 80$, and oranges for consumers with $80 < x \le 100$. Thus, at first blush, bananas appear to be better substitutes for kiwis than for apples, since they displace the prior choice of kiwis made by 17.5% of the population and also the prior choice of apples made by 12.5% of the population. Now consider taxes. If bananas are taxed as kiwi-oranges, a little algebra shows that the ouly change in consumption pattern from that prevailing in the tax-free world is for the 9.17% of consumers satisfying $17.5 \le x < 26.67$; these consumers substitute their ideal choice of bananas with untaxed apples. Making this choice results in a deadweight loss represented by the area in the left cross-hatched triangle in Figure 1, or $\int_{17.5}^{26.67}[(65+x)-(100-x)]dx$, or 84.

If, on the other hand, bananas are untaxed like apples, the only consumers adjusting their consumption pattern from that prevailing in the tax-free world are those satisfying $47.5 \le x < 57.22$, who substitute their preferred kiwis with untaxed bananas. This is 9.72% of the population, and their substitution results in a deadweight loss represented by the area in the right cross-hatched triangle in Figure 1, or $\int_{47.5}^{57.22}[(40+x)-(135-x)]dx$, or 94. Since the smaller deadweight loss arises in the former case, the optimal commodity tax is the one that taxes bananas as kiwi-oranges.

2. *Path #2*.—Alas, everything would have been different had bananas been discovered *before* kiwi fruit. For in a world with only apples, bananas, and oranges, bananas are a better substitute for apples than for oranges. In such a world, if bananas are taxed, consumers with $17.5 \le x < 26.67$ switch from their preferred but taxed bananas to untaxed apples, resulting in a deadweight loss of 84.[16] In contrast, if bananas are not taxed, consumers with $67.5 \le x < 75$ switch from their preferred but taxed oranges to untaxed bananas, resulting in a deadweight loss of 56. Because the latter deadweight loss is smaller, an optimal commodity tax leaves bananas untaxed. This is, of course, inconsistent with the result obtained immediately above in Path #1.

Finally, to play the game out to its bitter end, untaxed bananas lead to untaxed kiwis, when kiwis finally appear. Again, optimal commodity tax methodology requires a comparison of deadweight loss. If kiwis are taxed, consumers satisfying $47.5 \le x < 57.22$ switch from their preferred but taxed kiwis to untaxed bananas, with an aggregate deadweight loss of 94. On the

---

instrument that produces corporate-interest deductions). *See, e.g.*, I.R.C. §§ 163(c)(5), 163(j), 163(*l*), 279, 385 (2001); Treas. Reg. § 1.385 (withdrawn in 1983); Notice 94-47, 1994-1 C.B. 357.

16. Since the methodology of arriving at these numbers is by now familiar and is always the same, I will dispense with presenting it on each occasion.

other hand, if kiwis are not taxed, consumers satisfying $80 \leq x < 88.89$ switch from their preferred but taxed oranges to untaxed kiwis, with an aggregate deadweight loss of 79. Since the latter deadweight loss is smaller, the correct result is indeed not to tax kiwis. And, once again, this is inconsistent with the result obtained in Path #1.

3. Comparing the Paths.—Thus, optimal commodity tax methodology, together with some modest (but I believe generally realistic) assumptions, leads to path-dependent tax results. There is nothing the least bit surprising in this. All sequential decision-making, including all law-giving, and thus all tax-law-giving, potentially suffers from such path-dependence, provided only that decisions made early in the sequence cannot be revisited based on subsequently acquired information. Such is life. Still, this fact may be somewhat disconcerting, particularly when, as here, one can easily discern the "correct" steady-state tax outcome. That is, once all four commodities exist, and assuming no other commodities will ever exist (a generally dangerous assumption in the "real" world), the twin requirements that oranges are taxed but apples are untaxed leads to deadweight-loss minimization by taxing *neither* bananas nor kiwis. This result was obtained in Path #2, but not in Path #1.

Moreover—and now the reason for my multiperiod parameters will become clear—it is not the case that minimizing deadweight loss on a period-by-period basis necessarily minimizes multiperiod deadweight loss. Thus, under Path #1, suppose kiwis appear in year 1 and bananas in year 2. Taxing kiwis results in year 1 deadweight loss of 60, while not taxing them results in a deadweight loss of 79 in year 1. The chosen path—taxing kiwis—"forces" the subsequent imposition of tax upon bananas, with deadweight loss in year 2 and all future years of 84.[17] The unchosen path—not taxing kiwis—would leave open the option of not taxing bananas and, assuming this option were chosen, would result in deadweight loss in year 2 and all future years of 79. Taking the net present value of these sequences of deadweight losses (discounting at the relevant 10% rate) produces the result that the chosen path's multiperiod loss is actually 824, while the unchosen path's loss is only 790! Thus, a path that appears to be optimal when the first decision is made may not turn out to be optimal in hindsight.

Of course, if the taxing authority knew that bananas were coming (and, as important, *when* they were coming), it would undoubtedly take that knowledge into account in calculating how to minimize deadweight loss and would, therefore, choose the better path. But it is unlikely to enjoy such

17. If kiwis are taxed but for some reason bananas are not, the deadweight loss in year 2 and all future years rises to 94 instead.

prescience. Instead, it is likely to act, as persons so frequently do, under the myopic belief that the status quo will be maintained into the blue yonder. For while that belief may be wrong—and almost always *is* wrong—acting on it may nonetheless be rational, particularly if the discount rate is high and if there is considerable uncertainty as to the nature of the stochastic process producing innovations.

Moreover, even assuming the taxing authority recognizes that there may be a benefit to deferring its classification decision with respect to kiwis, it may find it difficult to exercise its option to wait. That is, a decision to defer a decision may—depending on its form—constitute a decision. For example, in the instant case, not deciding how to tax kiwis when kiwis first appear may become the functional equivalent of deciding not to tax kiwis at all, since presumably no consumer will voluntarily offer up a tax on kiwi consumption. This is likely to be truer the longer the taxing authority persists in waiting: after a sufficient period in which kiwis have not been taxed—due solely to inaction—it may be very hard to reverse course.[18]

But there is another form that formal inaction can take. The taxing authorities could leave it to the tax collectors to decide whether or not to attempt to collect a tax on kiwi consumption. That is, tax collectors would audit the returns of some kiwi consumers and would assert that kiwi consumption is taxable (under the theory that kiwis are oranges) in some subset of such audits. The usual procedures for resolving disputes would follow. Some cases would settle, and some would proceed to litigation with either victory or defeat for the tax collector. Ultimately, legal opinions would proliferate and would classify kiwis as apples or oranges, but not until considerable time has passed. Indeed, such opinions might, when finally rendered, have no prospective effect whatsoever if subsequent events—such as a legislative determination of the tax character of kiwis (whether or not in response to the discovery of bananas)—have overtaken the litigation.

Before the ultimate resolution of the tax character of kiwis, the net effect of the foregoing type of "formal inaction" is to tax kiwis, albeit in a probabilistic way and hence at a lower effective rate than the statutory rate imposed on oranges. If consumers are risk-neutral, if the contest process is costless, and if there are rational expectations as to the effective tax rate, it is possible to calculate the deadweight loss during a period of such formal inaction. For example, suppose that 50% of kiwis (chosen on a random basis) will be taxed. This is equivalent to temporarily imposing a 10% effective tax rate on kiwis. Because I have assumed consumers are risk-

18. For example, debt convertible into equity has long been treated as debt for tax purposes. While this is glaringly inconsistent with recent developments, such as I.R.C. § 163(*l*) (2001), it is too late in the day for Congress or the taxing authorities to easily reverse this result.

neutral, they will be indifferent between consuming apples and kiwis if and only if $\{1 - t_{\text{apples}}\}*\{100 - |x - 0|\} = \{1 - t_{\text{kiwis}}\}*\{100 - |x - 60|\}$, or $1*(100 - x) = 0.9*(40 + x)$, or $x = 33.68$. Similarly, consumers will be indifferent between consuming kiwis and oranges if and only if $\{1 - t_{\text{kiwis}}\}*\{100 - |x - 60|\} = \{1 - t_{\text{oranges}}\}*\{100 - |x - 100|\}$, or $0.9*(160 - x) = 0.8*x$, or $x = 84.71$. The effect of these choices is that the "policy" of not deciding how to tax kiwis will cause not just one large distortion of consumption decisions but will, instead, cause two smaller ones. That is, consumers satisfying $30 \leq x < 33.68$ will substitute apples for their preferred but more heavily taxed kiwis, and consumers satisfying $80 \leq x < 84.71$ will substitute kiwis for their preferred but still more heavily taxed oranges. Under these particular facts, the deadweight loss from formal inaction is the sum of $\int_{30}^{33.68}[(40+x)-(100-x)]dx$, or 13, and $\int_{80}^{84.71}[x-(160-x)]dx$, or 23, for a net deadweight loss of 36. Under these facts, waiting to formally classify kiwis turns out to be an optimal strategy, with a lower deadweight loss than either a decision to tax or not to tax. But recall that this optimality crucially depends on a host of assumptions, including prominently the 10% effective tax rate on kiwis and the absence of transaction costs associated with the imposition of such a "tax." But under another set of assumptions, waiting—*i.e.*, exercising the option to wait—could very well be suboptimal.[19]

4. *An Infinite Number of Paths.*—Just as there is no reason to assume that the third fruit to appear will be the last, there will generally not be any reason to assume (other than that I declared it to be so) that the fourth fruit to appear will be the last. Thus, suppose, in time, a fruit will appear that perfectly satisfies every single consumer—that is, a fruit will appear for every c in the interval [0,100]. In a world without taxes, that means that every consumer can achieve the maximum per-period utility of 100, simply by choosing the fruit with the proper "c" to match her "x."

For any consistent tax—*i.e.*, a tax imposed on any fruit if and only if such fruit satisfies $c > C$ for some C—it is possible to compute the deadweight loss. Accordingly, it is possible to determine what the ideal fruit tax looks like in the limit: the steady state in which all fruit have appeared. This knowledge, in turn, could lead the taxing authorities to determine tax policy ex ante (before fruits even appear) rather than ex post (as so far illustrated). An ex ante determination may or may not be the optimal

---

19. Given the utility function in the text, the deadweight loss will vary continuously from 60 (when $t_{kiwis} = 20\%$) to 79 (when $t_{kiwis} = 0\%$), with a value of 36 (when $t_{kiwis} = 10\%$) and a minimum for some tax rate t in the interval [0%,20%]. Among other things, this means that if t_{kiwis} is sufficiently close to 0%—*e.g.*, if the audit rate is low—the resulting deadweight loss will be far closer to 79 than to 36. Accordingly, inaction—exercising the option to wait, but with a different effective tax rate—may not minimize short-term (or for that matter long-term) deadweight loss.

strategy, of course, depending largely on the timing of the appearance of the various fruits, and thus on the temporal sequence of per-period deadweight losses. But an ex ante determination would at least have the feature that tax classifications would *not* be path-dependent. And this feature may be significant when it is theoretically possible for tax policy to take any one of an *infinite* number of different paths, and in fact to culminate in any one of an infinite number of different tax regimes.[20]

To calculate deadweight loss in the limit, when all fruits have appeared, suppose first that $t = 20\%$ is imposed if and only if $c > C$ for some legislated $C \leq 80$. A consumer with $C < x \leq 100$ is indifferent between eating her preferred but taxed fruit with $c = x$ or the untaxed fruit with $c = C$, if and only if $(1 - 0.2)*(100 - |x - c_{preferred}|) = (1 - 0)*(100 - |x - C|)$, or $(0.8)*(100 - |x-x|) = 100 + C - x$, or $x = C + 20$. Thus, consumers satisfying $C + 20 < x \leq 100$ purchase their preferred fruit ($c = x$), dutifully pay tax, and achieve utility of 80. Consumers satisfying $C < x < C + 20$ jettison their preferred fruit and instead purchase the fruit with $c = C$, pay no tax, and achieve utility between 80 and 100. And consumers with $0 \leq x < C$ purchase their preferred fruit ($c = x$), pay no tax, and achieve utility of 100. The deadweight loss from this consumption pattern is $\int_{C}^{C+20}[100-(100-|x-C|)]dx = \int_{C}^{C+20}[x-C]dx = 200$. Note that this deadweight loss does not depend on C (so long as $C \leq 80$). This means that it does not matter where the line for imposing tax is drawn (so long as it is drawn at some $C \leq 80$), for each such line has the same deadweight loss![21]

This might appear to support the conclusion that it does not matter which path—of the infinite possible number of paths—is chosen, since all such paths lead to nirvana (or, in any event, to the same deadweight loss). Sadly, this conclusion is false for at least three reasons. First, the indifferent result in the prior paragraph depends critically on the chosen uniform distribution of consumer preferences.[22] Second, as demonstrated above in

---

20. It is quite easy to show, for example, that proper sequences of fruit discovery can lead to the most disparate tax regimes imaginable: the regime that taxes only oranges, and the regime that taxes every fruit except apples.

21. It does matter where the line is drawn, however, if the optimal commodity tax methodology is applied, not with the usual constraint of raising a fixed amount of revenue, but with the alternative constraint of raising the maximum amount of revenue for any specified amount of deadweight loss. If this constraint were added, the optimal tax would be to tax all fruits except apples (that is, $C = 0$).

22. Suppose, in the alternative, that consumers satisfied the density function $2 - 0.4x$ for $0 < x < 50$ and $0.4x - 2$ for $50 < x < 100$ (so that preferences peaked for fruits with $c = 0$, *i.e.*, apples, and $c = 100$, *i.e.*, oranges). In that case, it *would* matter where the line for imposing tax is drawn (again, subject to the assumption that the line is drawn at some $C \leq 80$). The deadweight loss for such distribution of consumer preferences is as follows:

$$\int_{c}^{50}[x-C]*[2-0.4x]dx + \int_{50}^{c+20}[x-C]*[0.4x-2]dx$$

the discrete case, different paths result in different temporal sequences of deadweight loss with, in turn, different present values of such loss.

Third, the deadweight loss is in fact dependent on C, provided there is no requirement that $C \leq 80$. For what happens if the ultimate tax line is not restricted to $C \leq 80$? In that case, deadweight loss is $\int_C^{100}[100-(100-|x-C|)]dx = \int_C^{100}[x-C]dx = \frac{(C-100)^2}{2}$, which steadily declines as C tends to 100, from its maximum value of 200 at $C = 80$ to a minimum of zero if nothing is taxed but the original orange. Moreover, this result does not depend on any particular distribution of consumer preferences (except that such distribution is continuous). This result is not, of course, unexpected, for it is the equivalent of stating that there is no deadweight loss if there is no tax. Thus, it is somewhat difficult to infer any useful (nontrivial) line-drawing prescriptions from it.

Despite its limitations, the foregoing example illustrates two features that will invariably be present when a two-rate tax structure is imposed on a world where all theoretically possible commodities exist. First, there will be some commodities which, despite their existence, will never be consumed. In the example, these are the fruits with $C < c < C + 20$. Second, there will be a bunching of consumers on the tax borderline. In the example, fully 20% of all consumers choose the fruit satisfying $c = C$. This bunching, of course, is likely to have the appearance—at least to the taxing authorities—of tax avoidance, with concomitant pressure to lower the tax threshold to something below C. And of course it *is* tax avoidance. But it is wholly rational, wholly inevitable tax avoidance. And reducing the tax threshold will accomplish nothing, except a new bunching at the new threshold. And so it goes.

Finally, it is worth repeating that an infinite number of possible commodities can lead, in the more realistic world of serial government response to the introduction of such commodities, to an infinite number of tax policy paths and in turn to an infinite number of consistent ultimate tax regimes. In the world of fruit, one such tax regime would tax every fruit other than the apple. This world arises if each new fruit that is discovered is, at the time of its discovery, a better substitute for the orange than for the apple, and so becomes part of the little, but ever increasing, box of fruit denominated "orange." A second such tax regime would tax no fruit other than the orange. This world arises if each new fruit that is discovered is, at the time of its discovery, a better substitute for the apple than for the orange, and so becomes part of the little, but ever increasing, box of fruit denominated "apple."

This deadweight loss is minimized when $C = 36$. Thus, under these alternative preferences, there is a unique optimal tax satisfying the criterion that tax be imposed on fruits if and only if such fruits satisfy $c > C$ for some $C \leq 80$.

There is nothing surprising about this. Again, it is a natural consequence of any sequential decision-making process that does not allow for the subsequent alteration of any prior decision. Still, there is a lesson to be drawn from it in the specific case of taxation. If it is in fact the case that any new commodity can, but for fortune, end up either in the apple or the orange box, then it cannot be the case that those boxes have any platonic content. Legislators, however, behave as if they do. Would legislators persist in such behavior if they understood that the ultimate content of their little boxes is—except for the original commodities placed within them—solely the result of fortune or, more pejoratively, totally arbitrary? It strikes me as possible that legislators armed with such understanding might be persuaded to consider the otherwise unthinkable: to alter the constraint that apples and oranges be taxed differently. (They could also, of course, abandon the constraint that prior decisions are not subject to alteration. But the limiting case of such abandonment, and the only one that eliminates the problem of ultimately arbitrary boxes entirely, is the abandonment of the very first decision—the one to tax apples and oranges differently.)

B. Hybrid Fruit and Perfect Substitutes

Under certain circumstances it is possible for the taxing authority to find itself confronted with the "continuous" case outlined above, even if there are not an infinite number of fruits. All that is required is that consumers be able to extract the utility-producing attribute from each fruit and to recombine that attribute in any way desired. Thus, for example, it is possible to imagine that a kiwi fruit, with $c = 60$, is utterly equivalent from each consumer's perspective to 4/10ths of an apple, with $c = 0$, and 6/10ths of an orange, with $c = 100$.[23] While this equivalence may seem far-fetched in the case of fruit, it is surely less far-fetched in the case of income-tax items, since the utility-producing attributes of such items are generally, at bottom, cash flows which can be separated and recombined in ways that are limited only by the imagination. For while genetic engineering may be impossible or at least cost-prohibitive, financial engineering is generally possible and is becoming less expensive with every passing day.

To capture the consumer's ability to extract and recombine the utility-producing attribute of fruit, I alter the utility function for a consumer with preferences x—still spread uniformly over the interval [0,100]—to

$$u = \left(1 - \sum_{i=1}^{n} \pi_i t_i\right)\left(100 - \left|x - \frac{\sum_{i=1}^{n} \pi_i (1 - t_i) c_i}{1 - \sum_{i=1}^{n} \pi_i t_i}\right|\right),$$

23. The magic behind the equivalence is that $0.4*0 + 0.6*100 = 60$.

where once again π_i is the gross share of the consumer's dollar spent on commodity i, t_i is the tax rate imposed on commodity i, and c_i is the utility-determining characteristic of commodity i. This utility function is fundamentally the same one as before, except that it now allows for the creation of "hybrids." The final term in the function is the value of the characteristic c yielded by the consumer's hybridization effort.

Suppose first that there are no taxes. In this case, the utility function reduces to $u = \left(100 - \left| x - \sum_{i=1}^{n} \pi_i c_i \right| \right)$. Applying this when the only available fruits are apples, kiwis, and oranges, a consumer with $x = 90$ can maximize her utility at 100 by consuming (*i.e.*, by purchasing) the hybrid consisting of 10% apples and 90% oranges. Or she can maximize her utility at 100 by consuming the hybrid consisting of 25% kiwis and 75% oranges. Or she can maximize her utility at 100 by consuming any of an infinite variety of more complicated hybrids involving all three fruits. In other words, certain combinations of fruits are perfect substitutes for one another.[24]

Whenever perfect substitutability obtains, optimal commodity tax methodology has little to offer with respect to drawing tax lines, other than to say that—whenever possible—perfect substitutes should be taxed alike. But that can be achieved under the instant assumptions—where apples are untaxed and oranges are taxed at $t = 20\%$—only if bananas and kiwis are each taxed at the same rate as the combinations of apples and oranges that can effectively replicate them. Thus, bananas must be taxed at 7%, *i.e.*, identically to the sum of 65/100ths of an apple and 35/100ths of an orange (0.65*0% + 0.35*20% = 7%). And kiwis must be taxed at 12%, *i.e.*, identically to the sum of 4/10ths of an apple and 6/10ths of an orange (0.4*0% + 0.6*20% = 12%). But this scheme is anathema to the project confronting the taxing authority, which is to place bananas, kiwis, and other

24. Perfect substitution arises in hybridization contexts *only if* the process of hybridization is costless. If, more realistically, transaction costs eat away at least some of the endowment of any consumer attempting to create a hybrid, the hybrid will not be a perfect substitute to the fruit it is mimicking. Moreover, if transaction costs are a function of the number of fruits used to create a hybrid, then a hybrid made from three fruits will not be a perfect substitute for a hybrid made from two fruits.

Note also that imposing transaction costs on the creation of hybrids is not the equivalent, from the perspective of modeling, to imposing a commodity tax of the type discussed in the text. Rather, it is the equivalent of imposing a lump sum tax on the privilege of hybridizing. This would have consequences on consumption patterns and, hence, on optimal tax structure. In particular, it could encourage some level of all-or-nothing type consumption, of the type discussed in the prior section. Indeed, in the limit, where hybridization is not merely subject to transaction costs but is actually cost-prohibitive, it would yield all-or-nothing type consumption patterns that are identical to those discussed above. In either case, whether merely costly or whether cost-prohibitive, imposing transaction costs on the creation of hybrids would reintroduce a measure of possible path-dependence to tax rules arising under circumstances of sequential commodity discovery—a problem that, as will be seen below, does not otherwise generally plague the pure-hybrid world.

newly discovered fruits either into the little box called "apples" or into the little box called "oranges."

How does a rigid attempt to apply optimal commodity tax methodology actually play out in this world of consumer hybridization? Consider first the baseline where there are only apples and oranges, and no taxes. A consumer with preference x maximizes utility at 100 by choosing $\pi_{apples} = (100 - x)/100$ and $\pi_{oranges} = x/100$. Thus, such a consumer consumes the hybrid consisting of apples and oranges in the ratio $(100 - x)/x$. If a tax rate of $t\%$ is now imposed on the gross price of oranges, the consumer can continue to consume her "ideal" hybrid if and only if she adjusts her shares of gross expenditure on apples and oranges to $\pi_{apples} = [(1 - t)*(100 - x)]/[(1 - t)*100 + tx]$ and $\pi_{oranges} = x/[(1 - t)*100 + tx]$, respectively.[25]

Given that the tax on oranges makes the cost of orange consumption relatively higher than it was in the tax-free world, the logical surmise is that the consumer may form a new hybrid with a somewhat lower proportion of oranges, and thus with $c_{new} < x$. Stated differently, one might expect $0 \leq \pi_{oranges} < x/[(1 - t)*100 + tx]$. This is possible to check. Since $\pi_{apples} = 1 - \pi_{oranges}$, $t_{apples} = 0$, and $c_{apples} = 0$, the consumer's utility on this interval is

$$u = (1 - \pi_{oranges}* t_{oranges})*\{100 - |x - [\pi_{oranges}*(1 - t_{oranges})*100/(1 - \pi_{oranges}* t_{oranges})]|\}$$
$$= (1 - \pi_{oranges}* t_{oranges})*(100 - x) + \pi_{oranges}*(1 - t_{oranges})*100.$$

Differentiating with respect to $\pi_{oranges}$ would yield $\frac{\partial u}{\partial \pi_{oranges}} = -t_{oranges}*(100-x)+(1-t_{oranges})*100$, which is uniformly positive for all relevant parameters so long as $t \leq 50\%$. Thus, for the tax rates under consideration, $t_{oranges} = 20\%$, utility is maximized by continuing to consume exactly the same hybrid as in the tax-free world.[26] The intuition is that the marginal impact on utility from choosing a suboptimal hybrid is greater than the marginal impact on utility from consuming slightly less (as a result of paying the tax). Of course, this lack of impact of taxation on relative consumption patterns is not generally realistic (albeit extremely desirable when it occurs) and is solely an artifact of the chosen utility function and tax rates.[27] It means, among other things, that the tax on oranges is efficient. The taxing

25. Note that the numerators are the amounts that must be purchased, prior to paying taxes, to yield the optimal consumption ratio—$(100 - x)/x$—after paying taxes. The denominators are just the sum of the numerators (as is necessary to ensure that the shares of the various fruits purchased sum to 1—that is, to ensure that each consumer spends her entire endowment).

26. This assertion actually requires a second bit of arithmetic. It is also necessary to conclude that the consumer will not, counter to intuition, consume a hybrid with relatively more oranges (*i.e.*, with $c_{new} > x$). This is indeed the case, because the derivative of the consumer's utility function with respect to $\pi_{oranges}$ is uniformly negative on the interval $x/[(1 - t)*100 + tx] < \pi_{oranges} \leq 1$ (now irrespective of t). This establishes that utility is declining on this interval. Thus, maximum utility is indeed achieved at $\pi_{oranges} = x/[(1 - t)*100 + tx]$, or equivalently, at $c_{new} = x$. (Pictorially, the utility function peaks at $x/[(1 - t)*100 + tx]$, but is not smooth at this point.)

27. As noted in the text, $t > 50\%$ will begin to induce distortions.

authority could trivially take the tax revenue collected from any consumer, purchase apples and oranges in the proportion actually consumed by such consumer, and return such acquired fruits to the consumer. If it did so, each consumer would achieve exactly the utility achieved in the tax-free world. Ergo, no deadweight loss.

Now what happens if the taxing authority attempts to apply an optimal commodity tax approach when this admittedly unusual world confronts its first kiwi? The intuition might be—observing that $c_{kiwis} = 60$ is "closer" to $c_{oranges} = 100$ than to $c_{apples} = 0$—that kiwis should be taxed at the same 20% rate as oranges. But the reality is that imposing such a tax will have the effect that *no one* eats kiwis. The reason is simple. The moment the tax classification of kiwis as oranges is announced, kiwis are uniformly replaced by their lower-taxed perfect substitute: a hybrid consisting of 4/10ths of an apple and 6/10ths of an orange (which is taxed at a 12% effective tax rate rather than at a 20% tax rate).[28] Thus, the world with taxed kiwis and taxed oranges is identical to the world with no kiwis and taxed oranges. Given the observation in the prior paragraph—that a 20% tax imposed solely on oranges in this two-commodity world induces no changes in consumption relative to that prevailing in the tax-free world—it follows that imposing a tax on kiwis also induces no relevant changes in relative consumption patterns. Thus, the tax is efficient: it results in no deadweight loss.

Suppose, instead, that kiwis are not taxed. In that case, consumers with $60 < x \leq 100$ replace their pre-kiwi combinations of apples and oranges (with $\pi_{oranges} = x/[(1 - t)*100 + tx]$) with more lightly taxed combinations of kiwis and oranges (with $\pi_{oranges} = (x - 60)/[40 - 100*t + tx]$) that inherently provide the same utility (*i.e.*, the same hybrid level of "c"). A little bit of arithmetic—of the same type used above—shows that under the given parameters these combinations of kiwis and oranges are the same combinations that consumers might choose[29] in a tax-free, three-commodity world.[30] Thus, in particular, they involve no deadweight loss. Similarly, consumers with $0 \leq x < 60$ replace their pre-kiwi combinations of apples and oranges with untaxed combinations of apples and kiwis. Trivially, these are also the same combinations that they might have chosen in a tax-free, three-commodity world, so these combinations entail no deadweight loss. Thus,

28. Stated differently, the lowest-tax-cost way of forming any given hybrid with $c = x$ involves the use of solely the untaxed fruit with the highest level of c—here apples—and the taxed fruit with the highest level of c—here oranges.

29. I say "might" because consumers have a multiplicity of perfect substitutes from which to choose.

30. This is a closer call than when only apples and oranges existed. That is, distorted consumption patterns will appear at tax rates beginning just above 28%.

the net effect of not taxing kiwis involves a rather large revenue loss, but without any attendant deadweight loss.

Since no deadweight loss resulted either from taxing kiwis or from not taxing kiwis, optimal commodity tax methodology provides no guidance to the taxing authority, provided, as I have been assuming throughout, that the taxing authority does not care about the amount of revenue raised by this particular tax (because, for example, it has no short-term budget constraint and/or has other sources of revenue).[31] But it need not have been so, even under the instant stylized assumptions. That is, there is a level of "c" that a new fruit—call it the tangerine—could have which *would* provide determinate analysis.

It is possible to find this c, for it is the largest c at which no consumer choice is distorted. So consider a consumer with $c_{tangerines} < x \leq 100$. In a tax-free world, this consumer might choose the hybrid formed solely from oranges and tangerines, with $\pi_{oranges} = (x - c_{tangerines})/(100 - c_{tangerines})$ and $\pi_{tangerines} = (100 - x)/(100 - c_{tangerines})$. If only oranges were taxed, and if the same hybrid of oranges and tangerines were consumed, such a consumer would need to choose $\pi_{oranges} = (x - c_{tangerines})/(100 - c_{tangerines} - 100t + tx)$ and $\pi_{tangerines} = (1 - t)*(100 - x)/(100 - c_{tangerines} - 100t + tx)$.[32] Does this choice necessarily maximize utility? Writing $\pi_{tangerines} = 1 - \pi_{oranges}$, the consumer's utility function is $u = (1 - \pi_{oranges}*t)*(100 - x) + [(1 - \pi_{oranges})* c_{tangerines} + \pi_{oranges}*(1 - t)*100]$. Differentiating with respect to $\pi_{oranges}$ yields $\frac{\partial u}{\partial \pi_{oranges}} = -t*(100 - x) - c_{tangerines} + (1 - t)*100$, which is positive, indicating that utility is rising over the relevant range of $0 \leq \pi_{oranges} < (x - c_{tangerines})/(100 - c_{tangerines} - 100t + tx)$ if and only if $c_{tangerines} \leq 100 - 200t + tx$. For $t = 20\%$, this expression reduces to $c_{tangerines} \leq 60 + 0.2x$. Thus, for example, if $c_{tangerines} \leq 75$, then for any consumer with $c_{tangerines} < x \leq 100$—that is, for any consumer who might want to create a hybrid of oranges and tangerines—this inequality is satisfied. Thus, every such consumer will continue to consume the same hybrid, irrespective of tax. But the same cannot be said if $c_{tangerines} > 75$. Thus, for example, if $80 < c_{tangerines} < 100$, the consumer with $x = 100$ will shift her choice of hybrid. Or if $76 < c_{tangerines} < 80$, the consumer with $x = 80$ will shift her choice of hybrid.

The foregoing is in fact a general result under the instant assumptions. The lowest tax way for any consumer who may be subject to tax to create a

31. As noted in the prior footnote, if kiwis are not taxed, distorted consumption patterns will appear if the tax rate rises to approximately 28%. In contrast, if kiwis are taxed, distorted consumption will first be manifest when tax rates rise to over 50%. Thus, the "better" indeterminate result—if one ignores the amount of revenue raised but factors in the possibility of future tax increases—is to tax kiwis.

32. This is merely a generalization of the discussion of apples and oranges at the beginning of this section.

hybrid satisfying $c = x$ always involves a combination of only two fruits: oranges and the untaxed fruit with the highest value of c. Under the assumed tax rate of $t = 20\%$, so long as that untaxed fruit has $c \leq 75$, the choices of each consumer will be identical in the taxed and the untaxed world. Thus, focusing on bananas and kiwis, optimal commodity tax methodology produces indeterminate results for both (since bananas and kiwis each satisfy $c \leq 75$). Accordingly, as previously derived for kiwis, there is no deadweight loss whether bananas are taxed or not. (Of course, it would be silly to tax bananas but not kiwis. Such inconsistent taxation allows for an "arbitrage" that effectively eliminates the tax on bananas. Arbitrage is discussed below.)

1. An Infinite Number of Hybrids.—Suppose in a world with hybrid preferences that every possible fruit—every c in the interval [0,100]—actually exists. Thus, absent taxes, every consumer can find a single fruit that maximizes her utility. Suppose a consistent tax (*i.e.*, a tax of $t\%$ on each fruit with $c > C$ for some C) is to be imposed on this world. Now a consumer affected by the tax (*i.e.*, one with $C < x \leq 100$) can recreate her ideal fruit (that is, one with $c = x$) in a number of ways that have a lower tax cost than simply buying the fruit with $c = x$. As noted above, the lowest tax way of achieving $c = x$ is by purchasing only oranges ($c = 100$) and the fruit with characteristic C in gross shares of $\pi_{oranges} = (x - C)/(100 - C - 100t + tx)$ and $\pi_{fruit(C)} = 1 - \pi_{oranges}$, respectively. Among other things, this means that no fruit with $C < c < 100$ will be consumed.

It is relatively straightforward for the taxing authority to find an optimal level at which to set C. Following the immediately preceding analysis, every $C \leq 75$ is as good as any other: none of them have any distorted consumption or any deadweight loss associated with them. If $C > 75$, distortion sets in. The closer C gets to 100, the greater will be the desire by persons with x sufficiently close to C to distort their consumption pattern. But the closer C gets to 100, the smaller the fraction of the population that will potentially engage in distorted consumption. Thus, there will be a maximum level of distortion somewhere in the interval $75 < C < 100$. But my interest is in minima, not in maxima. In that light, any choice of $C \leq 75$ is superior to any choice of C with $75 < C < 100$.[33]

2. Passing Off Hybrids as New Fruit.—Suppose that the fiction of discrete commodities other than apples and oranges is dispensed with. And suppose, for example, that a kiwi fruit is nothing other than a man-made combination of 4/10ths of an apple and 6/10ths of an orange. Suppose

33. Since levels of $C \leq 75$ also raise more revenue than those with $75 < C < 100$, they are truly superior choices in every way.

further that the creators of these hybrid fruit make them appear sufficiently inseparable such that the taxing authority decides to take an "all-or-nothing" approach to their taxation. It follows that a commodity can be created for every c in the interval [0,100]. That is, such "genetic engineering" leads to a world that is identical to the one discussed immediately above in which every possible commodity exists. Thus, optimal taxation in this world is identical to optimal taxation in the world just discussed. In other words, the optimal tax will locate a point C in the interval [0,75][34] such that hybrids with $c > C$ are taxed and those with $c \leq C$ are not.

Note that this rule is not in any relevant way path-dependent. That is, if consumers value hybrids, and if they have the engineering skills necessary to create them, all possible hybrids will immediately appear. Ergo, no paths. Of course, in the real world it takes time to recognize that hybrids are desirable and possible. Thus, hybrids are initially likely to appear in a stochastic fashion, and they are likely to be categorized for tax purposes one at a time. Moreover, even after the first hybrids appear and are categorized, the technology necessary to hybridize more generally is unlikely to be costless. If such transaction costs are taken into account, pure commodities (or hybrids that are costless to produce) will continue to be superior choices to their otherwise "perfect" substitutes. Indeed, in the case where transaction costs are very high—for example, when the technology allowing hybridization is first being developed—pure commodities may be so superior that *no one* would be willing to pay to consume a hybrid. That world is the very world described in the first section of this Article, where path-dependent tax rules reign. But even with improved technology and less costly hybridization, some path-dependence would arise. Thus, the mere possibility of hybridization by no means eliminates the relevance of the path-dependence discussion.

3. *Arbitrage.*—Suppose, in a world where hybridization is possible, that the taxing authorities have at some point categorized an item inconsistently. This is an eminently understandable possibility, for as just noted, neither the desirability of hybrids nor the ability to create them may be obvious for a very long time. Thus, to return to fruit, suppose the world initially contains only apples and kiwis. Consumer preferences are as set forth above. Thus, consumers choose combinations of fruit that yield the desired weighted average x of the characteristic c. Prior to the imposition of any taxes, persons with $60 \leq x \leq 100$ are somewhat out of luck: they consume only kiwis. In contrast, persons with $0 \leq x < 60$ consume optimal combinations of apples

34. Of course, this assumes the given utility function and a 20% tax rate.

and kiwis. If a tax of 20% is levied on kiwis, for the reasons set forth above, consumption patterns will not initially change.[35]

Suppose now that oranges are discovered, and for whatever reason are not considered by the taxing authorities to be a fruit at all. Thus, oranges are taxed at 0%; the fruit tax does not apply. What result? Once consumers recognize that oranges indeed lie on the same continuum as apples and kiwis (a realization that may not occur for a very long time), kiwis will be deconstructed. For, from the consumer's perspective, a kiwi is identical to 4/10ths of an apple and 6/10ths of an orange. But from a tax perspective, the former is taxed and the latter is not! Thus, kiwis will eventually be driven from the marketplace, and tax revenues from fruit will dry up.

The problem here is one of inconsistent taxation, not in the sense that two functionally identical items are taxed differently (that already happened in the discussion of hybrids), but in the sense that the tax function $t(c)$ is now neither uniformly nondecreasing in c nor uniformly nonincreasing in c. When this occurs, and when the two points c_1 and c_2 are not taxed, arbitrage inevitably and inexorably leads to the effective nontaxation of all points c such that $c_1 < c < c_2$. In a case such as the one presented here, where c_1 and c_2 are the endpoints of the relevant continuum, all tax revenues from the items described in the continuum will eventually disappear.[36]

III. The Debt-Equity Distinction

A. *A Model*

Suppose investor *I* wishes to engage in a project that can only be consummated in corporate solution. The project requires $100 of invested capital and will produce a single cash flow in year 5. Such a cash flow is $500 with a probability of 10%, $400 with a probability of 20%, $250 with a probability of 40%, $100 with a probability of 20%, and $0 with a probability of 10%. Thus, the expected pre-corporate-tax return on the project is approximately 20%. If *I* forms corporation *X* to undertake the project, if *X* is financed entirely with equity, and if the corporate-tax rate is 35%, the following chart illustrates *I*'s returns in the various states of the world. In particular, the expected return to *I*'s equity investment is approximately 14.5%.

35. The crucial reason is that $c_{kiwis} - c_{apples} \geq 25$.

36. As always, transaction costs will to some extent mitigate the full achievement of this conclusion. That is, if hybridization is costly, not all taxed fruits will be driven from the marketplace. However, consumption of such fruits will be (possibly dramatically) reduced.

		Probability	Taxable Income	Tax	Return to Equity
State 1	V = 500	10%	400.00	140.00	360.00
State 2	V = 400	20%	300.00	105.00	295.00
State 3	V = 250	40%	150.00	052.50	197.50
State 4	V = 100	20%	000.00	000.00	100.00
State 5	V = 000	10%	000.00	000.00	000.00
Expected Value			160.00	056.00	194.00

Suppose, in this world, that a "straight" debt instrument with a 10% rate of complete default must provide an expected yield of 12% (or, equivalently, have a coupon of 14.5%). If *I* seeks a debt investor to make half the investment in *X* (*i.e.*, an investment of 50), then, taking the corporate-interest deduction into account, the following returns obtain:

		Probability	Return to Debt	Taxable Income	Tax	Return to Equity
State 1	V = 500	10%	098.00	352.00	123.20	278.80
State 2	V = 400	20%	098.00	252.00	088.20	213.80
State 3	V = 250	40%	098.00	102.00	035.70	116.30
State 4	V = 100	20%	098.00	000.00	000.00	002.00
State 5	V = 000	10%	000.00	000.00	000.00	000.00
Expected Value			088.20	126.40	044.24	117.56

The main thing to observe is how poor straight debt is at reducing the aggregate level of corporate tax (at least under facts such as these with hypervolatile cash returns to the project). That is, expected tax payments only decline from $56 to $44.24—an expected savings of $11.76. This may lead *I* and *X* to attempt to create an instrument every bit as volatile as the equity, but with the moniker "debt." Assuming such instrument were actually classified as debt for tax purposes, the following returns would obtain:

		Probability	Return to Debt	Taxable Income	Tax	Return to Equity
State 1	V = 500	10%	207.58	242.42	084.85	207.58
State 2	V = 400	20%	168.18	181.82	063.64	168.18
State 3	V = 250	40%	109.09	090.91	031.82	109.09
State 4	V = 100	20%	050.00	000.00	000.00	050.00
State 5	V = 000	10%	000.00	000.00	000.00	000.00
Expected Value			108.03	096.97	033.94	108.03

Such "debt," if it were classified as tax debt, is clearly much more efficient at reducing corporate taxable income, and therefore corporate tax, than is straight debt. Here, for example, the replacement of half of *X*'s equity with such "debt" leads to a decline of expected tax payments from $56 to $33.94, yielding expected savings of $22.06. Indeed, using such instruments, all corporate taxable income, and therefore all corporate tax, could theoretically be eliminated.[37] Of course, since this instrument has returns identical to those of *X*'s equity, it is unlikely that a tax classification as debt would in fact be sustained. If nothing else, I.R.C. section 163(*l*)(3)(B) would surely see to that. But the example should nonetheless make taxpayer incentives clear.

B. Corporate Capital as Fruit

To apply my prior discussion of optimal commodity tax methodology to debt and equity, it is helpful to "map" corporate capital onto the fruit of the prior discussion. Thus, one might equate "platonic" debt—current-pay straight debt with a reasonably short maturity—with the low-taxed apple ($c = 0$) and "platonic" equity—plain vanilla common stock—with the high-taxed orange ($c = 100$). One could then imagine every innovation—preferred stock, convertible bonds, zero-coupon bonds, contingent-payment debt instruments, high-yield bonds, MIPs, and other similar financial instruments—as falling somewhere in the interval [0,100]. The problem for the taxing authorities—and for optimal commodity tax methodology—is to classify each innovation: is the new instrument to be treated like tax debt, or is it to be treated like tax equity?

The courts—when they are the ones confronted with the problem—apply a methodology that is superficially akin to optimal commodity tax methodology (although no court would ever use the term). That is, they ask themselves something quite like the substitutability question: is the new instrument more like platonic tax debt (or things that have previously been categorized as tax debt) or more like platonic tax equity (or things that have previously been categorized as tax equity)? To answer this question, they do what courts do best: they evaluate a long list of factors (most of which are unfortunately irrelevant to the utility function of most of the "consumers" holding the instruments) and weigh them.[38] Out of the weighing comes an

---

37. Under the simple assumptions of this model, it is possible to perfectly describe the payment to *X*'s debt as $D = \{(1 - t)*V + t*(1 - \alpha)*I\}/(2 - t)$, where D is the aggregate payment to debtholders, t is the corporate-tax rate (35%), V is the total return to *X*'s investment, α is the fraction of *X* capitalized with debt, and I is the total initial capitalization of *X*. Letting α approach 1 results in progressively less corporate taxable income (and no such income in the limit).

38. *See, e.g.*, Laidlaw Transportation, Inc., 75 T.C.M. (CCH) 2598, 2617–24 (1998). The definitive discussion of factors is probably still William T. Plumb, Jr., *The Federal Income Tax Significance of Corporate Debt: A Critical Analysis and a Proposal*, 26 TAX L. REV. 369 (1971).

answer—and sadly, almost invariably a precedent that future consumers can use in unforeseen ways.

Legislatures—when they are confronted with innovations—tend to follow one of two courses. They either do nothing, leaving classification decisions to tax administrators and ultimately the courts,[39] or they legislate a classification (or instruct the tax administrators to legislate a classification), creating in effect a new little box.[40] In the latter case, the new classification is likely to be informed at least nominally by policy (or public choice) considerations that do not necessarily have anything to do either with superficial "similarity" or with economic substitutability. In particular, there is no *a priori* reason to expect that such new classifications will in any systematic way reflect an optimal commodity tax approach.

C. Path-Dependence

As just noted, it is far from clear that U.S. federal-income-tax authorities (taken as a whole) attempt to apply anything remotely akin to optimal commodity tax methodology in setting debt-equity classifications. Thus, it is not possible to give any concrete examples of a historic path-dependent evolution of debt-equity rules that is clearly attributable to an application of such methodology. Nonetheless, that such path-dependent evolution would result if optimal commodity tax methodology were applied is scarcely to be doubted.[41]

Note that by taking factors into consideration that consumers do not value—that are irrelevant to their utility functions—courts deviate from an *actual* application of optimal commodity tax methodology. Their process is superficially similar, but actually different.

39. They may even memorialize their failure to resolve matters in legislation. I.R.C. § 385 (2001) is a prime example of this.

40. Among the little boxes addressing the instruments listed in the text are as follows: I.R.C. §§ 305–306, 351(g) (2001) (preferred stock); I.R.C. § 249 (2001), Rev. Rul. 72-265, 1972-1 C.B. 222–23, and Rev. Rul. 69-135, 1969-1 C.B. 198 (convertible debt); I.R.C. §§ 1271–1274 (2001) (zero-coupon bonds); I.R.C. § 1275 (2001) and Treas. Reg. § 1.1275-4 (2001) (contingent-payment debt instruments); I.R.C. § 163(e)(5) (2001) (high-yield debt); I.R.C. § 7701(*l*) (2001) and I.R.S. Notice 94-47 to 94-48, 1994-1 C.B. 357–58 (MIPs and certain other financing arrangements).

41. Moreover, unlike in the case of fruit, where the path would result from a stochastic process (the discovery of new fruit), the path in the case of debt and equity could be influenced by more or less strategic behavior of financial innovators. That is, if the world initially contains only platonic debt ($c = 0$) and platonic equity ($c = 100$), one would expect the first innovation—once the ability to innovate is acknowledged—to be an instrument that strays as far from debt towards equity as possible without incurring an unacceptable risk of being classified as equity. Thus, if the ability to innovate is immediately complete (so that any c can be produced), and if the taxing authorities predictably perform optimal commodity tax analysis without any errors, one would expect a fruit with $c = 49$. If, as expected, the first fruit is classified as debt, one would expect that the next fruit to appear would have $c = 74$. It, too, would be classified as debt. And so on. In this manner, the desire on the part of taxpayers to always "push the envelope" as far as possible will result in the path that taxes nothing but the originally taxed item: platonic equity.

Consider, for example, instruments designated as debt but that feature "participation"—*i.e.*, high upside price correlation with instruments designated as equity. The paradigm instrument is convertible debt. Economically, convertible debt is like equity when equity performs well (because the debt will be converted), but is like debt when equity performs badly (and the conversion feature is not exercised). It is possible to replicate this set of features quite closely with other instruments or combinations of instruments. Thus, convertible debt is very nearly the same thing as the combination of a debt instrument mandatorily convertible into the issuer's equity and a put option, where the counterparty of the put option is the issuing corporation itself. Given this substantial similarity, if not identity, an application of optimal commodity tax methodology would almost surely require that (1) "regular" convertible debt and (2) "mandatorily convertible" debt plus a put option be taxed identically, both as to holders and as to issuers.

Indeed, under current tax law, holders (who are not generally the focus of this piece) are generally taxed identically: payments received other than upon redemption are characterized as interest; payments received on redemption or on a sale via exercise of the put option result in capital gain or loss. Issuers, however, are treated differently. In the case of regular convertible debt, issuers get a hybrid tax treatment. That is, convertible debt is debt for purposes of the corporate-interest deduction but not for purposes of deductibility of redemption premium.[42] In the case of mandatorily convertible debt plus a put option, however, the issuers receive no corporate-interest deduction, nor do they receive any deduction on redemption or exercise of the put option.[43]

Thus, the current tax rules are not those one would expect from applying optimal commodity tax methodology. But this discussion should nonetheless demonstrate how applying such methodology would produce path-dependent results. Suppose, as was indeed the case, that "regular" convertible debt was created and hence was classified first and that it was classified as it is in fact classified by the tax law. This would force a similar classification of mandatorily convertible debt, with an allowance of at least a partial corporate-interest deduction. On the other hand, suppose mandatorily convertible debt had been created and classified first and that it had been classified as it in fact has been classified by the Code. This would force a similar classification of regular convertible debt, with a complete disallowance of the corporate-interest deduction. Thus, whichever instrument is

42. *See, e.g.*, Rev. Rul. 72-265, 1972-1 C.B. 222–23; Rev. Rul. 69-135, 1969-1 C.B. 198; I.R.C. § 249 (2001).

43. I.R.C. §§ 163(*l*), 1032 (2001).

classified first would dictate the classification of the instrument that is classified second. The results would be path-dependent.

D. Hybrids and Intermediate Tax Rates

As noted above, optimal commodity tax methodology has little to offer when consumers are able to costlessly hybridize the taxed commodities, other than to say that, if possible, hybrids should be taxed identically to the sum of their disaggregated components. Disregarding for the moment the question of what might constitute an appropriate metric, it is noteworthy that the tax law does indeed currently contain instances of what might be termed hybrid tax rules in the debt-equity area. Thus, as noted above, convertible debt, which is a type of hybrid, is subject to a combination of debt-like tax treatment (with the allowance of a corporate-interest deduction) and equity-like tax treatment (with the disallowance of any deduction with respect to redemption premium). Similarly, I.R.C. section 163(e)(5) applies a hybrid tax rule to certain high-yield debt obligations issued at a discount by disallowing the corporate-interest deduction when the yield exceeds a certain threshold. Finally, although it has not had any practical effect, I.R.C. section 385(a) gives the Treasury Department the authority to treat corporate instruments as part stock and part debt, again achieving a hybrid result. All of these are, however, exceptions to what must still be considered the general federal income tax rule, which is that a given corporate instrument is classified either entirely as debt or entirely as equity.

E. Hybrids and the Phenomenon of Disappearing Commodities

The discussion of the enactment of tax rules in a world with hybridization technology makes the prediction that certain tax rules—by imposing a higher tax rate on certain hybrid commodities than on the sum of the commodities that can replicate them—will have the effect of driving such hybrid commodities out of the market. While it is difficult to verify empirically whether this in fact has occurred with respect to hybrid corporate financial instruments, it is the sense of the author that certain tax rules, such as I.R.C. section 163(*l*), do not in fact apply to any instruments. That is, any person desiring the economics of an instrument to which such a Code provision could apply creates instead a substitute that more or less comports to the desired economics but that does not fall within the terms of the provision. Thus a certain type of commodity—an I.R.C. section 163(*l*) debt instrument—disappears from the financial landscape.

F. Made of Ticky-Tacky

Any attempt to apply optimal commodity tax methodology to create a more or less coherent set of classifications in the debt-equity area will falter in the face of arbitrage. This reality is most easily demonstrated by revising my prior illustration. Suppose that the risk-free interest rate in that world is 8%. Thus, ignoring for the moment that *X* cannot—without more—credibly promise a return of 8% in State 5, *X* could *try* to issue $50 of *risk-free* debt promising a fixed 8% return. What is the necessary "more"? *X* could (simultaneously) enter into a swap under which it would receive $73.47 in *every* state of the world (*i.e.*, the required payment on the risk-free debt) in exchange for certain payments. *X* could maximally offer variable payments of $207.58, $168.18, $109.09, $50, and $0, respectively, in the five states of the world. Ignoring counterparty risk of default (which can certainly be done if the debtholder and the swap counterparty are the same person), this swap succeeds in making the debt risk-free. Because, in general, taxable income is increased by receipts from swaps issued at par, and is decreased by payments made with respect to swaps issued at par,[44] the net effect of the two transactions is to yield the following returns to *X*'s various capital instruments:

		Probability	*Return to Debt*	*Swap*	*Taxable Income*	*Tax*	*Return to Equity*
State 1	V = 500	10%	073.47	134.11	242.42	084.85	207.58
State 2	V = 400	20%	073.47	094.71	181.82	063.64	168.18
State 3	V = 250	40%	073.47	035.62	090.91	031.82	109.09
State 4	V = 100	20%	073.47	–23.47	000.00	000.00	050.00
State 5	V = 000	10%	073.47	–73.47	000.00	000.00	000.00
Expected Value			073.47	034.56	096.97	033.94	108.03

Thus, with the use of an additional piece of paper—the swap—*I* and *X* have perfectly replicated the debt that I.R.C. section 163(*l*)(3)(B) prohibited.[45] Arbitrage—the replication of a debt instrument classified as tax equity with (1) a debt instrument classified as tax debt and (2) a swap—has rendered the Code provision nugatory. Its enactment, except perhaps as an interim measure, was pointless. It has merely driven a simple method of

44. *See* Treas. Reg. §§ 1.446-3 (1993), 1.446-4 (1994).

45. Of course, the real world is not quite so simple, and *perfect* substitutes can rarely be created. Thus, if the debt and the swap were issued together, the IRS would likely try to integrate them. Perhaps it would be successful; perhaps not. But the risk would be sufficient to lead careful taxpayers to rely on less than perfect substitutes. Persons in the market for I.R.C. § 163(*l*)-type debt might thus acquire straight debt from one issuer and a swap from a second. A corporation desiring to issue § 163(*l*)-type debt would likely issue one or more swaps that less than perfectly track its equity. And so on. But in a world with a large supply of issuers, a large supply of holders, and an endless ability to dissect and repackage cash flows, results like the foregoing can ultimately be approximated arbitrarily closely (and in time, if not quite yet, arbitrarily costlessly).

achieving a set of tax and economic results from the marketplace in favor of a more complicated (but in several years—given the rate of financial innovation—equally cost-efficient) method.[46]

G. Fixing the Arbitrage Problem

It is possible to formally model corporate capital instruments as single-attribute commodities. All that is needed is a single attribute that consumers value: the "*c*" in the discussion of fruit. The most obvious such possible attribute, and the one that I shall use, is the "beta" of the instrument. While modern portfolio theory paints a somewhat more complicated picture of capital-instrument pricing than the picture that relies solely on beta, nothing that I say below depends on the more complicated picture. Thus, it is convenient to pretend that consumers really do not care about anything but an instrument's beta. And I will so pretend.

Before launching into how the taxing authorities could make use of beta to classify corporate capital instruments (assuming beta were easily measurable), it is instructive to ask whether there is any evidence that they currently make any such use. Clearly, the taxing authorities have never made any explicit use of beta in their analysis. That is, beta is neither listed in I.R.C. section 385 nor is it mentioned in any debt-equity opinions. But it is still possible that the factors courts use, and the factors legislatures use (when they are not falling prey to greater policy or public choice), are a good proxy for getting at an instrument's beta. Arguably some of them are. Thus, I.R.C. section 385 looks to factors like a fixed rate of interest (which generally denotes a low beta) and the ratio of debt to equity (which generally denotes a higher beta), as well as to factors such as the relationship between debt and equity holdings (which should be irrelevant to beta). But there is also much tax law that is clearly inconsistent with beta, including the classification of convertible debt generally as debt and the classification of straight preferred stock generally as stock.

---

46. David M. Schizer, *Frictions as a Constraint on Tax Planning*, 101 COLUM. L. REV. 1312 (2001), argues that various types of frictions impede, and in certain cases eliminate, the ability to hybridize perfectly. Thus, in some cases, tax rules that can theoretically be bypassed by hybridization may in fact have real effects on taxpayer choice. This is surely correct, at least in the short term. But in the long term, it merely ups the ante for financial innovation and intermediation. Thus, if an accounting rule makes a certain hybrid unpalatable, one can perhaps create a different set of hybrids with the same tax treatment, but with better accounting. Or if counterparty financial risk makes a swap undesirable, one can imagine financial intermediaries offering various types of insurance to blunt that risk. At the end of the day, the success of frictions in combating hybridization is an empirical question. And it is the opinion of this author that the success is likely to be short-lived, because the rate of financial innovation appears to be accelerating, and because the sophistication of financial markets appears to be increasing. That, in the end, makes all things possible.

Nonetheless, despite taxing authorities' past failures to do so, I proceed under the assumption that an enlightened taxing authority will henceforth attempt to use beta to rationalize the classification of corporate capital instruments and in particular to define debt and equity. Given the general ability to hybridize beta,[47] it follows that an optimal commodity tax type rule, if one were to exist, must have the form that an instrument will be taxed as equity (*i.e.*, at the higher tax rate) if and only if $\beta > C$ for some C. Thus, assuming away measurement problems, suppose the taxing authority enacts the following law: corporate capital instruments, however denominated, with $\beta \leq 0.3$ are tax debt; those with $\beta > 0.3$ are tax equity.[48] Will this classification scheme preserve the corporate-income-tax base? The answer, of course, is no, unless the notion of what constitutes a corporate capital instrument is made robust.

A further example—expressed in terms of beta—will drive home the point. Suppose that corporation *Y* is initially capitalized solely with equity. Suppose further that the β of *Y*'s equity is 1 and, hence, that the β of *Y*'s assets is 1. To use concrete numbers, suppose that *Y*'s assets annually produce pre-corporate-tax cash flows with an expected value of $15 and that the tax rate is 33.33%, such that *X*'s annual post-corporate-tax cash flows have an expected value of $10. If the risk-free interest rate R_f is 5% and the excess of the expected market return over the risk-free interest rate $(R_m - R_f)$ is also 5%, the expected return to *Y*'s shareholders must be 10%, since $ER = R_f + \beta^*(R_m - R_f)$. Using this discount rate on *Y*'s expected cash flows yields an initial market value for *Y* of $100. Using the same discount rate on the cash flows produced by *Y*'s assets yields a value of $150. Thus, the assets would, if held outside corporate solution, have an incremental value of $50.

Suppose that *Y* is on a mission to reduce its tax bill. First, *Y* issues $60 of debt and redeems a portion of its equity. Suppose that, in light of the tax law, *Y* creates debt with a β of 0.2 and, hence, an expected return of 6%. Since $60 of debt is created, the expected interest payments must be $3.60 per year. Such interest payments will be accompanied by expected foregone tax payments of $1.20 per year. These tax payments will have identical risk to the interest payments themselves, so they will have a β of 0.2. It follows that the value of the foregone tax payments, and hence the value of the "tax shield" *Y* has created, is $20. Assuming away any costs associated with the incremental risks of financial distress and bankruptcy, the debt has thus

47. Holders of corporate instruments can hybridize completely. Issuers of corporate instruments are nominally constrained in their hybridization by the beta of their aggregate assets. Per the discussion below, my use of the word "nominally" is not accidental.

48. *See* RICHARD A. BREALEY & STEWART C. MYERS, PRINCIPLES OF CORPORATE FINANCE 230 (6th ed. 2000). Currently, "quality" corporate debt typically has a β of around 0.2; junk debt typically has a somewhat higher β.

increased the fair market value of all of *Y*'s capital instruments (*i.e.*, of *Y*) by $20 to $120. It follows that the value of *Y*'s post-redemption equity must be $60. If—to take the extreme case—all of *Y*'s debt and equity are held by the very same persons in the very same proportions, nothing has in fact happened as a result of the "recapitalization" other than an expropriation by such persons of the fisc.

Suppose that *Y* is not satisfied with the first reduction of its tax bill. So the newly recapitalized *Y* enters into a swap pursuant to which it exchanges its annual cash flow less interest payments for a cash payment equal to 150% of the interest *Y* actually pays to its debtholders in the given year. This scheme may seem arbitrary, but there is method to the madness.[49] If nothing else has changed in the world, *Y* has merely exchanged a relatively risky set of cash flows with a $90 value for a relatively safe set of cash flows with a $90 value. On an annual basis, since receipts from the swap are taxable and payments made with respect to the swap are deductible, *Y* has exchanged risky cash flows in an expected amount of $11.40 for much less risky cash flows in an expected amount of $5.40. Thus, *Y*'s post-swap annual cash flows distributable to its equity holders appear to be in an expected amount of $3.60 ($5.40 received pursuant to the swap less corporate tax at a 33.33% rate). These receipts have a β of 0.2 (by design, since the equity's cash flows mirror those of the debt, and the debt has a β of 0.2). Thus, the post-swap equity appears to have a value of $60, identical to that of the pre-swap equity.

But something else has changed as a result of the swap—not under current tax rules, but under the proposed new debt-equity definition. The β of *Y*'s "equity" instrument is now 0.2, and thus below the threshold for the definition of tax debt. In other words, the swap has converted all of *Y*'s nominal equity into debt. Accordingly, payments on such equity are, for tax purposes, a deductible corporate-interest expense. Thus, they will *not* be reduced by taxes. This means that the expected annual payments to *Y*'s equity holders are not $3.60, as stated above, but rather $5.40. Given that these payments have a β of 0.2, the "equity" now has a market value of $90. And the corporation pays no tax![50]

---

49. Note that the swap is a fair swap. To see this, recall that the value of the cash flows produced by *Y*'s assets is $150. Since the value of the interest payment stream (*i.e.*, *Y*'s debt instruments) is $60, it must be the case that the value of the remaining cash flows produced by *Y*'s assets—*i.e.*, the payments that *Y* makes under the swap—is $90 (*i.e.*, $150 - $60). In return, *Y* receives payments with risk identical to the risk of the interest payments *Y* makes to its debtholders, but in an amount equal to 150% of the amount of such payments. It follows that these receipts also have a value of $90.

50. Note that if a single person owns all of *Y*'s "instruments"—the equity, the debt, *and the swap*—such person's "portfolio" is identical to direct ownership of *Y*'s assets. In particular, such person's "portfolio" has a value of $150 and a β of 1. To properly envision the potential scale on

Thus, the attempt to make the debt-equity definition robust through the use of beta has foundered on the shoals of derivatives. Any amount of "excess" beta can, as a theoretical matter, be sucked out of any corporation by means of a zero-value swap that is not—at least under current law—recognized as a corporate capital instrument. What has happened? Nothing other than the type of arbitrage that I described above in my discussion of commodities! That is, high-taxed "equity" is like kiwi fruit. It sits on a continuum, one end of which is low-taxed debt, like apples. At the other end is something else that is low-taxed: swaps, like oranges. The reason for this is the usual one: it has not generally been recognized that swaps are capital instruments at all.

Therefore, any new decision by the taxing authority to place a mysterious new instrument in the little box of tax debt or the little box of equity—typically the equity box, of course—is a lot like putting a thumb in a leaking dike. For as consumers and producers of corporate capital instruments become increasingly sophisticated, the relevance of instruments that pose this classification dilemma—those that "lie between" platonic debt and platonic equity—will, at an ever-increasing rate, disappear. The instruments will be replicable with debt and suitable swaps. This does not, of course, mean that equity will entirely disappear from the financial landscape. Equity does and likely always will provide a liquidity advantage over its component parts because, unlike the swap component, the value of equity is generally not dependent on its holder.[51] Nonetheless, there are persons who can and will be able to engage in the replication.[52] Their existence and availability to engage in equity-destroying transactions will, over time, lead to less new equity formation and—the other side of the same coin—to more equity redemption. Thus, equity will inevitably become a less significant piece of the capitalization picture. And corporate-tax collections will concomitantly become a less important piece of the fisc's revenue picture.

The fix is straightforward. It makes no sense to add incrementally to the learning on the debt-equity distinction, whether by means of optimal commodity tax methodology or otherwise. And it makes no sense to apply a device such as beta to attempt to forge a coherent distinction—at least not in a vacuum. What is needed is a recognition that more is encompassed in the concept of corporate capital than just debt and equity. That is, swaps—

---

which such transactions can be conducted, it is helpful to think of such person as being a hedge fund.

51. The value of a swap depends on the financial strength of the counterparty, since the swap's payoff is negative in certain states of the world. Thus, absent further innovation to reduce the relevance of the bankruptcy risk of persons holding such instruments, there is no reason to expect that Mom and Pop will ever be able to exchange their AT&T stock for an AT&T debt instrument and an AT&T swap.

52. These include hedge funds, mutual funds, pension funds, and the like.

notional principal contracts—are themselves a form of capital, "junior" to equity. Tax rules must be structured to take this into account. Any lesser approach cannot forestall the wholesale erosion of the double-taxed portion of the corporate-income-tax base.[53]

IV. Conclusion

Care must be taken when one attempts to perpetuate or rationalize income-tax distinctions. One approach to such rationalization, that of optimal commodity tax theory, generally promises the "best" results. Nevertheless, even this approach may lead to a variety of ills, such as path-dependent tax results. And in a host of other situations, it simply cannot provide any real assistance at all. These are situations, illustrated in the text by means of the debt-equity distinction, where the existing income-tax distinction is subject to hybridization and arbitrage. In such situations, it is incumbent on legislators, first, to recognize the inherent weakness of the distinctions they are seeking to perpetuate and, second, to use this recognition as a wedge to revisit the original distinctions. Perhaps, on revisiting, some sacred cows can be slaughtered.

---

53. Even in the presence of derivatives, the fisc will continue to collect tax with respect to my hypothetical *Y*, but such collections will, in the limit, be solely from *Y*'s shareholders. Thus, when *Y* was all equity, the fisc collected an annual tax payment in an expected amount of $5 from *Y*. This payment had a β of 1 and was thus part of a stream with a value of $50. The fisc also expected some measure of shareholder taxes. Assuming shareholder rates identical to the corporate rate and full payout of dividends, it would garner an additional payment with an expected amount of $3.33. Having identical risk to the equity, the value of this stream of payments is $33.33. Of course, this stream—being under control of shareholders as to timing and other issues—could be (and is) worth a lot less.

The recapitalization with debt changed the calculus. It reduced the expected amount of the fisc's payment from *Y* to $3.80. It also increased the risk of this payment stream, with the net effect that the stream has a present value of $30. In addition, the fisc would garner an expected tax payment in the amount of $1.20 from *Y*'s bondholders (33.33% of the expected interest payments). The value of this stream of payments is $20. Finally, the fisc may garner additional payments from *Y*'s equity holders, which will be capped in value at $20. The difference, then, between the world before and after recapitalization is that the fisc has irretrievably lost the opportunity to collect some incremental taxes from *Y*'s equity holders.

Finally, the swap changes the calculus again. It reduces the fisc's expected take from *Y* to $0. However, the fisc would receive expected tax payments of $1.20 from *Y*'s debtholders and $1.80 from *Y*'s shareholders, which streams would be worth $20 and $30, respectively. It would also receive an expected payment of $2 from the counterparty to the swap (33.33% of the excess of the expected payment received by the counterparty, or $11.40, over the expected payment made by the counterparty, or $5.40). This payment stream would have no net value, however. Finally, the fisc would have no expectation to ever receive an incremental tax from *Y*'s shareholders—that second level of tax has been irretrievably lost.

The calculus for the fisc may, because of the existence of tax clienteles, be considerably worse. As in the case of debt, a swap does not necessarily suck corporate income from the corporate-tax world—with its effectively single tax level—to the individual-tax world—with its hopefully roughly equivalent tax level. Rather, the effective tax rate is likely to fall, both because individual tax rates are lower, on average, and because certain persons—in particular tax-exempt organizations—pay no tax on the swap income at all. *See* Treas. Reg. § 1.512(b)-1(a)(1) (2001).

* * *