

Handout for Session on
TAX INCENTIVES IN A CAPITAL THEORY CONTEXT

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I. Main points of this paper.

Economists often develop the "wrong" instincts by concentrating on a particular "wrong" subset of models.

For today's presentation, that "wrong" subset is either a) one with an infinitely lived capital stock or b) one with a capital stock in which all assets depreciate at the same rate.

Under a) there simply is no depreciation of the capital stock, so the user cost of an asset - $(\rho + \delta)P_{t-1}$ is equal to its net return, ρP_{t-1} .

Under b) there is depreciation but it is at the same rate across all assets. Thus an incentive (or tax) striking "user cost" at a given rate is equivalent to an incentive (or tax) that strikes "net return" only, but at a higher rate.

Under either a) or b), then, one does not fall into error by talking about incentives to user cost when we really mean incentive to net return.

But in fact it is a big mistake to confuse user cost with net return in a real-world context.

You can do your own checking as you read the literature -- old and new. How many times do you find the term "user cost" being employed where it makes no sense to do so, except in the context of a model which assumes our problem away?

Point #1 There is no tendency and there never was nor will be any tendency

to equalize the user cost of capital across its many different uses in an economy. On the other hand there is a strong tendency in any market economy to equalize the expected net rate of return to capital across uses.

As among net rates of return, only risk premia produce lasting differences across uses.

As among user costs the big difference that will never disappear is depreciation rates.

Trucks and cars may depreciate at 20% per year, machines at 10%, and buildings at less than 2% per year. In an equilibrium in which all net rates of return were 6%, the equilibrium user cost rate would be 26% for trucks, 16% for machines, and less than 8% for buildings.

Point #2 It makes no sense to subsidize the depreciation of capital assets. A subsidy to user cost would do just that, side by side with subsidizing net returns. Economists should be shocked by the idea of subsidizing depreciation.

Point #3 The market price of an asset tends to be equal to the present value of its future user cost. The user cost can be considered the gross-of-depreciation flow of benefits attributable to the asset. Figure 1 shows how the benefit flow is divided between depreciation D and net return Y for assets with different patterns of depreciation. It also shows how the purchase price of the asset can be divided into two components, PVD (present value of depreciation) and PVY (present value of net return).

Point #4 A tax credit which subsidizes the purchase price of an asset is equivalent to one which subsidizes PVD and PVY at the same rate. It therefore is subject to the complaint registered in Point #2.

a. The following example shows how a tax credit can convert an investment

whose economic rate of return is negative into one whose private rate of return is amply positive.

year	0	1	2	3
Cash Flow without Tax Credit } 30% Tax Credit	-1000 +300	+300	+300	+300
F_t - Cash Flow with Tax Credit }	-700	+300	+300	+300
Accumulated Old Capital at Charge - $1.1 K_{t-1}$ }	0	-770	-517	-238.7
K_t - New Capital at Charge - $F_t + 1.1 K_{t-1}$ }	-700	-470	-217	+61.3
Net Present Value Accumulated to end 3 }				61.3

b. A simple mental exercise concerning government bonds gives a striking example of why tax credits in the usual form violate simple economic principles and common sense.

Example Suppose the government passed a law granting a subsidy of 7 percent of the purchase price to everybody buying a newly-issued government obligation. Suppose that the available government obligations were

- 1) perpetuities
- 2) 20-year bonds
- 3) 5-year bonds
- 4) 1-year bonds
- 5) 90 day notes

What would happen? Everybody would rush to buy 90-day notes. If the interest

rate were 1 percent per month this would give people a yield of 10 percent every 90 days. No one would buy a 1-year bond (let alone a 5-year or a 20-year or perpetual bond) for 93 under these circumstances. This shows how a subsidy to the purchase price of an asset is biased in favor of short-lived assets. This occurs because the subsidy covers not only the present value of net return but also the present value of depreciation (amortization in the case of bonds) of the asset.

Point #5 Tax incentives which strike at an equal rate the net-of-depreciation income from all investments in a given class have the property of giving a well-calibrated stimulus to all such investments. The nature of the stimulus is as follows.

For noncovered investments an expected marginal productivity of $\rho\%$ marks the dividing line between projects which are acceptable *ex ante* and those which are not.

The characteristic of what I call well-calibrated incentives is that they modify the critical level of expected marginal productivity in a very "orderly" way, reducing it by a constant amount for all activities subject to the same incentive scheme.

Thus it would be possible for a government to have a normal tax regime in which the cutoff gross-of-tax rate of return was 20% per annum, plus a "preferred" category in which this rate was 16% per year, plus a "super-preferred" category in which this cutoff rate was 10 percent per annum.

Each such category would be free from "anomalous" cases in which the incentive structure leads to the acceptance of an inferior alternative (say with a 14% rate of return) while other alternatives covered by the same incentive

structure are rejected, even though they have a higher (say 17%) rate of return.

An incentive which strikes only Y at a given percentage rate is well-calibrated (neutral within a given incentive category) in the above sense.

Samuelson (1964) showed that a proportional income tax based on true economic depreciation reduces the rate of return to all assets in the same proportion, not discriminating among them according to length of life, shape of benefit profiles, etc.

In our context, if we just multiply each element of the flow Y by the amount $(1 - t)$, we reduce the internal rate of return of the investment in question from ρ to $\rho(1 - t)$.

If we consider a subsidy at the rate of s , we have that standard investments yielding r will have $\rho^* = r/(1 - t)$ while the ones subject to subsidy will have $\rho_j = r/(1 - t + s_j)$.

With $r = 0.1$, $t = 0.5$, $\rho^* = 0.2$

When $s_j = 0.1$, $\rho_j = 0.167$

When $s_j = 0.25$, $\rho_j = 0.133$

II. Different propositions about taxes, tax incentives, and other fiscal "tricks" can be demonstrated easily within the framework developed here.

1. Musgrave neutrality Musgrave (1959) showed that to allow full expensing of investment outlays is equivalent to abolishing the corporation income tax.

We have $PVY + PVD = PV(Y + D)$

Expensing allows instantaneous depreciation of assets at the moment of purchase. The investing entity gains:

a) $t(PVY + PVD)$.

Now, however, it has nothing to depreciate in the future. Hence it pays tax on $Y+D$ each period. The investing entity thus loses on this account.

b) $PV(-tY - tD)$

Overall, in present value terms a) cancels b).

2. Non-Neutrality of Standard Investment Tax Credit ITC involves a credit at the rate γ to the amount invested. Investing entity gains

a) $\gamma(PVY + PVD)$

This is non-neutral as long as the ratios PVD/PVY differ among investments.

3. Neutrality of a Credit to Net Investment Cary Brown suggested many years ago that the ITC be granted on net, not gross investment. Each year, the credit would be given on gross investment for the year, minus the true economic depreciation of the existing capital stock (generated by past investments). If we follow a single project, there arises a tax credit of $\gamma(PVD + PVR)$ at the time of the investment, followed by a later "anti-credit" equal to $-\gamma D$. Taking present values, the net outcome is a credit of

$$\gamma(PVD + PVY) + PV(-\gamma D) = \gamma PVY.$$

This meets the condition of striking Y at the same rate across all covered investments.

4. The Jorgenson-Auerbach Scheme This scheme was proposed as a way of insulating the tax treatment of investments from the effects of inflation. It entailed estimating the fraction that PVD bore to the purchase price of an asset ($= PVY + PVD$), and allowing this fraction to be expensed immediately, at the time the asset was purchased.

Under this scheme the investor receives a tax offset of $-tPVD$ at the time of investment, then pays tax later on the full flow of $Y + D$. In present value terms the result is

$$-tPVD + PV(tY + tD) = tPVY.$$

This is equivalent to Samuelson neutrality under an income tax.

5. An Investment Incentive Based on Jorgenson-Auerbach. This would entail expensing (at the time of investment) of the full amount of PVD plus any desired fraction λ of PVY. If $\lambda = 1.0$, we have Musgrave neutrality. If $0 < \lambda < 1.0$, we have Harberger-Bradford neutrality (see below). The key is that depreciation is handled neutrally, being granted a full tax offset of its present value at the time of investment, then having true economic depreciation fully taxed as it occurs. The treatment of Y is full taxation as it accrues over the life of the project, offset by the expensing of part (λ) of PVY at the time of investment. Y ends up being taxed at the rate $t(1 - \lambda)$.

6. Harberger-Bradford Neutrality This scheme (independently developed by each of its two authors) consists of allowing the expensing of λ percent of an investment's cost, with a provision that over the life of the investment depreciation will be allowed for tax purposes at the fraction $(1 - \lambda)$ of the true economic depreciation.

$$PVD + PVY = PV(D + Y)$$

Normal tax treatment applies t to $(D + Y)$ and allows expensing (i.e., $-tD$), of D leaving a net taxation of tY .

Musgrave neutrality offsets this by applying $-t$ to $(PVD + PVY)$, later applying t to $(D + Y)$.

Samuelson neutrality does nothing to $(PVD + PVY)$, leaving the net tax of tY , which is Samuelson-neutral.

Harberger-Bradford neutrality gives an initial offset of $-\lambda t(PVD + PVY)$ then later taxes in the amount $t(D + Y)$ with expensing of $(1 - \lambda)D$. This leads to a tax offset of $(1 - \lambda)tD$.

The net impact in D is $-\lambda t(PVD) + PV[tD - (1 - \lambda)tD] = 0$.

The net tax impact on Y is $-\lambda t(PVY) + PV(tY) - PV(1 - \lambda)tY$.

Effectively, the applicable tax rate is lowered by the fraction λ .

7. Most Accelerated Depreciation Schemes are Non-Neutral Expensing of capital outlays is neutral (= Musgrave neutrality) so long as the full service yield is later taxed at the same rate.

Partial expensing of capital outlays is neutral (= Harberger-Bradford neutrality) so long as the non-expensed portion $(1 - \lambda)$ is depreciated in the regular pattern of true economic depreciation and the resulting income flows are then taxed at the same rate.

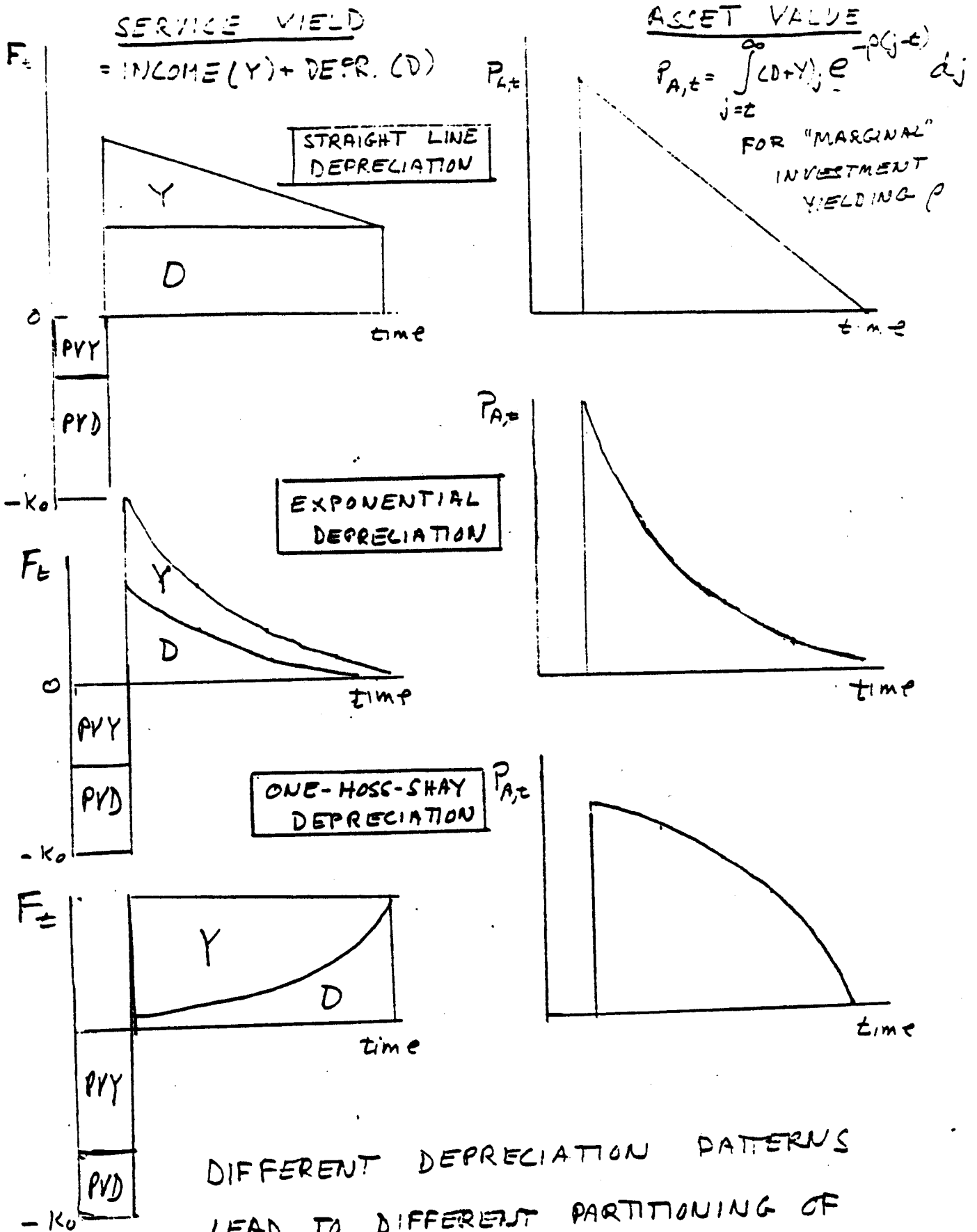
Any other scheme will be non-neutral. Such schemes include:

- a. Depreciating assets in a specified fraction of the time (e.g., twice as fast as dictated by true economic depreciation).
- b. Depreciating assets over a specified number of years N (e.g., five years), regardless of their true economic life (if $\geq N$).
- c. Allowing assets of different depreciation patterns all to be depreciated according to a specified pattern (e.g., exponential).

REFERENCES

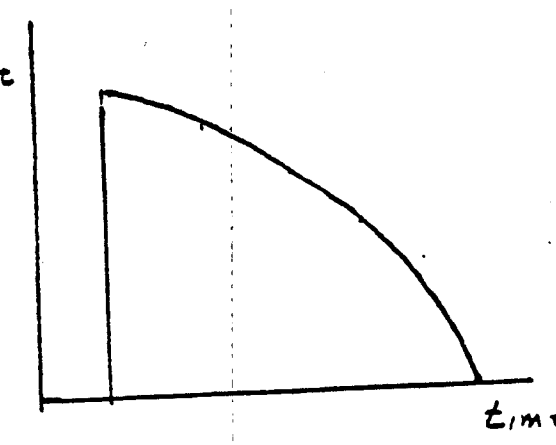
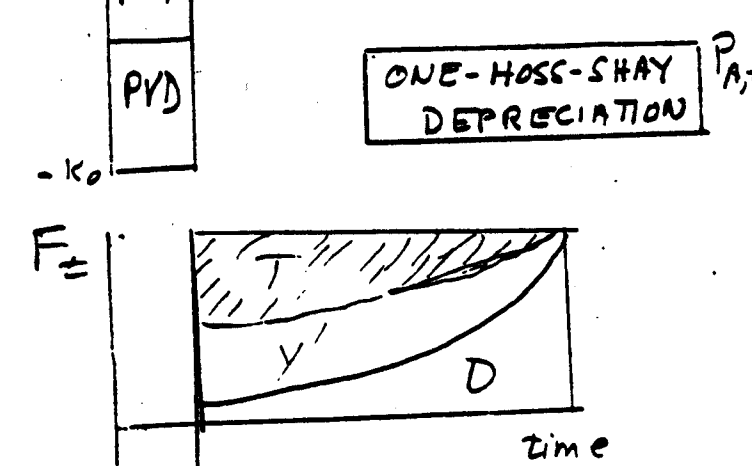
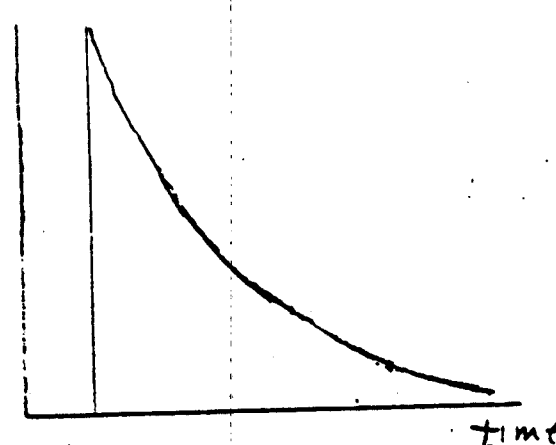
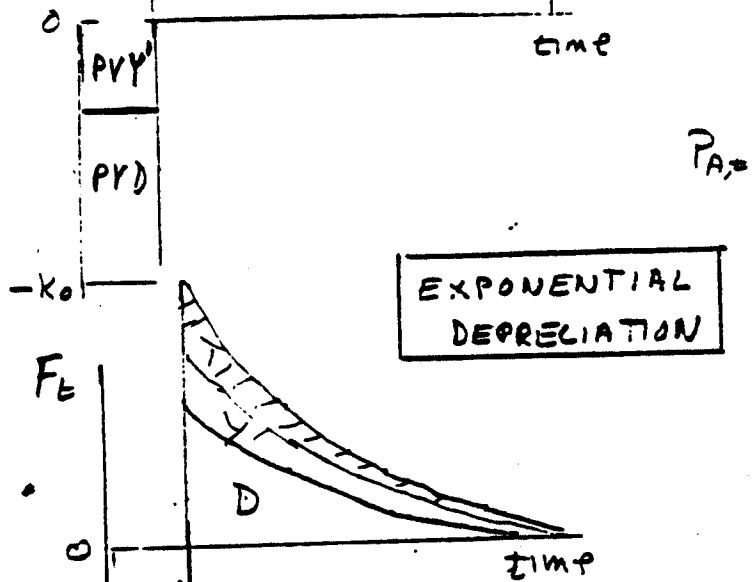
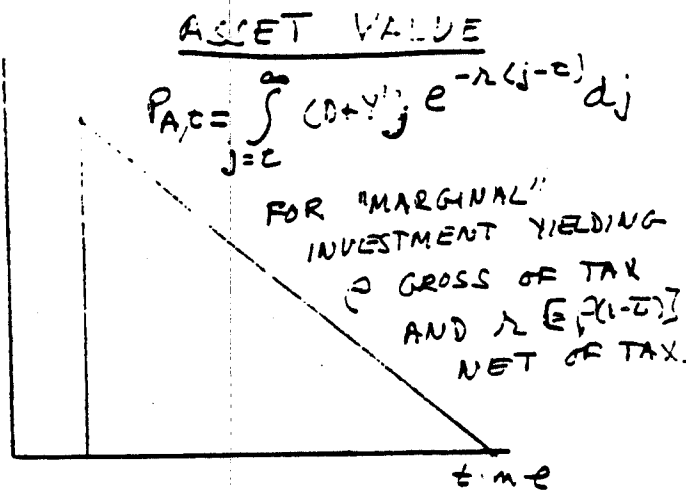
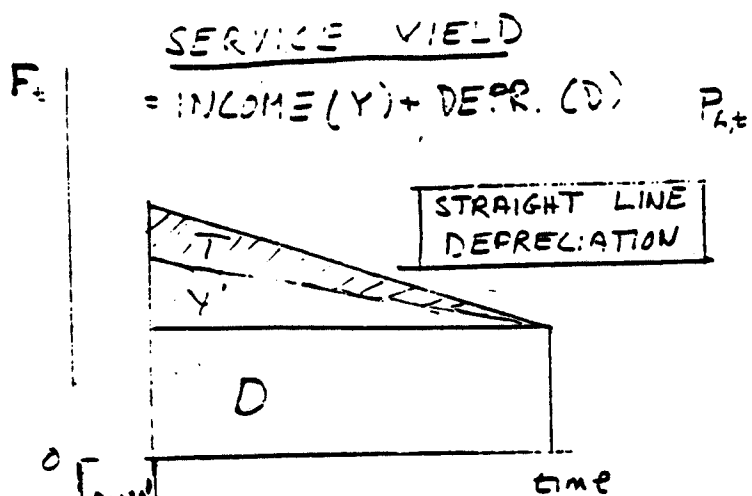
- Alan J. Auerbach and Dale W. Jorgensen. "Inflation-Proof Depreciation of Assets," *Harvard Business Review* 58 (5), (September-October 1980): 113-18.
- David F. Bradford. "Tax Neutrality and the Investment Tax Credit," in Henry J. Aaron and Michael J. Boskin, eds., *The Economics of Taxation* (Washington, DC, The Brookings Institution), 1980, pp. 281-298.
- Arnold C. Harberger. "Tax Neutrality and Investment Incentives," in Henry J. Aaron and Michael H. Boskin, eds., *The Economics of Taxation* (Washington, DC, The Brookings Institution), 1980, pp. 299-316.
- Richard Musgrave. *The Theory of Public Finance: A Study in Public Economy*, (New York: McGraw Hill, 1959) p. 343.
- Paul A. Samuelson. "Tax Deductibility of Economic Depreciation to Insure Invariant Valuations," *Journal of Political Economy* 72 (December 1964): 604-06.

FIGURE 1



DIFFERENT DEPRECIATION PATTERNS
LEAD TO DIFFERENT PARTITIONING OF
PURCHASE PRICE OF AN ASSET INTO
COMPONENTS PVY AND PVD

FIGURE 2



A TAX AT THE RATE τ leaves $T = \tau Y$ and $Y' = (1-\tau) Y$. WHERE INCOME USED TO BE $P_{A,t-1}$ (FIG. 1) IT IS NOW $\lambda P_{A,t-1}$, WHERE $\lambda = \rho(1-\tau)$. IF FIRMS USE λ FOR DISCOUNTING THE FLOW $Y' + D$, THEY WILL ... THE SAME TIME PATH FOR $P_{A,t}$ AS BEFORE