SLOWING DEPRECIATION TO PAY FOR CORPORATE TAX RATE REDUCTION

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INTRODUCTION

A COMMON FEATURE OF SEVERAL RECENT proposals to reform the corporate and business tax systems is broadening the tax base to pay for a lower corporate tax rate. One of the major base broadeners considered by these plans is replacing accelerated depreciation with slower, less generous depreciation allowances. For example, the 2007 U.S. Department of the Treasury Report, *Approaches to Improve the Competitiveness of the U.S. Business Tax System for the 21st Century*, proposes using base broadeners totaling about $1.3 trillion over ten years to pay for a "revenue neutral" reduction in the corporate tax rate to about 28 percent. About one-half ($670 billion) of the revenue increase from broadening the tax base comes from slowing depreciation.

Using slower depreciation to pay for corporate tax rate reduction, however, has raised concerns about the long-run fiscal sustainability of such a policy. While tax rate cuts permanently reduce tax revenue, the revenue gained from slowing depreciation can be larger immediately following the policy change than it is later, once the policy is fully phased in. Consequently, a tax reform that cuts the corporate rate and slows depreciation might be revenue neutral over the typically used ten year budget window, but could lose substantial revenue in the long run.

Slowing depreciation can have a transitory effect on annual tax revenue because, for a given investment, slowing depreciation affects the timing of tax payments, but not the total amount of tax paid over an investment's lifetime. Deductions are lower (and taxes higher) early in the investment's life, but deductions are higher (and taxes lower) later on, compared to more accelerated (faster) depreciation. The situation is slightly more complicated for the economy, because each year new investments are made. Immediately following the switch to slower depreciation, tax revenue will increase, but eventually, as successive vintages age and their associate tax flow change reverses in sign, the revenue pick-up for the economy can peak, and then decline. In the simply case in which the stock of capital is not growing, slowing depreciation raises no tax revenue in the long run because higher taxes paid on the cash flow from younger vintages of assets are exactly offset by lower taxes on the cash flows generate by older vintages of assets. In contrast, when the capital stock is growing, slowing depreciation can raise revenue in the long run, but the amount that it raises can be substantially smaller than suggested by the revenue pick up over the first few years following the policy shift.

In the rest of the paper, I first explain why changing depreciation deductions does not change the (undiscounted) flow of tax revenue from a single investment. Next, I consider how the analysis changes when considering a continuous stream of investments, as would occur in the real economy, and I discuss some factors that affect the relationship between the short-run revenue change and long-run revenue change. Next, I construct a more realistic example based on investment weights from Treasury's revenue estimating models. In this example, the long-run revenue increase from going from current law's Modified Accelerated Depreciation System (MACRS) to the slower Alternative Depreciation System (ADS) is about two-thirds (or less) of the short-run revenue increase.

DEPRECIATION AND TAX CHANGES OVER THE LIFE OF A SINGLE INVESTMENT

This section illustrates that slowing depreciation affects the timing of tax payments, but not the total (undiscounted sum) of tax payments from a single investment.

Consider an investment that costs $100, as in table 1. Under the initial (hypothetical) tax rules, it can be depreciated over four years using the straight-line method so that depreciation deductions are $25 each year. Now, suppose that the tax rules change so that asset is depreciated over 10 years using the straight-line method; depreciation deductions are $10 each year.

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Table 1

Temporary Revenue Increase from Slowing Depreciation on a Single $100 Investment

	1	2	3	4	5	6	7	8	9	10	Total
Old deductions (OD)	$25.00	$25.00	$25.00	$25.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$100.00
New deductions (ND)	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$100.00
Change in deductions (CD = ND-OD)	-$15.00	-$15.00	-$15.00	-$15.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$0.00
Change in tax (-0.35*CD)	$5.25	$5.25	$5.25	$5.25	-$3.50	-$3.50	-$3.50	-$3.50	-$3.50	-$3.50	$0.00
					turnaround						

Under the new, slower, depreciation rules, deduction are $15 smaller in each of the first four years, but are $10 larger in each of the six following years[1]. The change in deductions turns around or reverses in sign in year five. If the tax rate is 35 percent, then slowing depreciation increases taxes by $5.25 in each of the first four years, but reduces taxes $3.50 in each of the next six years. The tax increasing effect of slower deprecation turns around in the fifth year, when deductions turn around. Because, over the life of the investment, deductions add up to the price of the investment ($100) under both the fast and the slow depreciation systems, the change in deductions and the change in tax (for a constant tax rate) sum to zero. For this single investment, the tax increase from slowing deprecation is temporary and, over the life of the investment, total tax paid does not change.[2]

DEPRECIATION CHANGES AND TAX FLOWS WITH NEW INVESTMENT EVERY YEAR

We turn now to what happens for a firm that makes investments each year, or for an economy in which new investments occur every year. With new investments each year, will the revenue gain from slowing depreciation for new investment[3] be permanent, rather than temporary? The answer turns out to be yes, there can be a permanent revenue gain, but that gain can be smaller than over the ten year budget period.

The analysis is developed with the aid of tables 2 and 3. Table 2 is an example of how aggregate annual deductions (and hence taxes) change in response to adopting slower depreciation rules for new investment, when annual investment is constant, in this case at $100 per year. For new investments, depreciation lives are lengthened from four years to ten years. One important feature illustrated by the example is that under either depreciation system, for a period of time, total annual deductions grow as new vintages of investment are made. This growth continues until the recovery period is reached, i.e., until four years under the accelerated system and until ten years under the slower system. After that point, total depreciation each year remains constant, and equal to the unchanging level of investment, i.e. $100 in the example of table 2. Deductions level off sooner under the accelerated system than

Table 2

Temporary Revenue Increase from Slowing Depreciation: Multiple Vintages

Year		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*Average, Years 1-10*
	Annual Investment											
						Old Depreciation System, Deductions						
1	$100.00	$25.00	$25.00	$25.00	$25.00							
2	$100.00		$25.00	$25.00	$25.00	$25.00						
3	$100.00			$25.00	$25.00	$25.00	$25.00					
4	$100.00				$25.00	$25.00	$25.00	$25.00				
5	$100.00					$25.00	$25.00	$25.00	$25.00			
6	$100.00						$25.00	$25.00	$25.00	$25.00		
7	$100.00							$25.00	$25.00	$25.00	$25.00	
8	$100.00								$25.00	$25.00	$25.00	
9	$100.00									$25.00	$25.00	
10	$100.00										$25.00	
	Total annual deductions (OD)	$25.00	$50.00	$75.00	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	$100.00	
						New Depreciation System, Deductions						
1	$100.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	
2	$100.00		$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	
3	$100.00			$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	
4	$100.00				$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	
5	$100.00					$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	
6	$100.00						$10.00	$10.00	$10.00	$10.00	$10.00	
7	$100.00							$10.00	$10.00	$10.00	$10.00	
8	$100.00								$10.00	$10.00	$10.00	
9	$100.00									$10.00	$10.00	
10	$100.00										$10.00	
	Total annual deductions (ND)	$10.00	$20.00	$30.00	$40.00	$50.00	$60.00	$70.00	$80.00	$90.00	$100.00	
Change in deductions (CD = ND-OD)		-$15.00	-$30.00	-$45.00	-$60.00	-$50.00	-$40.00	-$30.00	-$20.00	-$10.00	$0.00	
Change in tax (-0.35*CD)		$5.25	$10.50	$15.75	$21.00	$17.50	$14.00	$10.50	$7.00	$3.50	$0.00	$10.50

Table 3
Revenue Increase from Slowing Depreciation: Multiple Vintages, 5% Growth

Year		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*Average, Years 1-10*
	Annual Investment												
						Old Depreciation System, Deductions							
1	$100.00	$25.00	$25.00	$25.00	$25.00								
2	$105.00		$26.25	$26.25	$26.25	$26.25							
3	$110.25			$27.56	$27.56	$27.56	$27.56						
4	$115.76				$28.94	$28.94	$28.94	$28.94					
5	$121.55					$30.39	$30.39	$30.39	$30.39				
6	$127.63						$31.91	$31.91	$31.91	$31.91			
7	$134.01							$33.50	$33.50	$33.50	$33.50		
8	$140.71								$35.18	$35.18	$35.18	$35.18	
9	$147.75									$36.94	$36.94	$36.94	
10	$155.13										$38.78	$38.78	
11	$162.89											$40.72	
	Total annual deductions (OD)	$25.00	$51.25	$78.81	$107.75	$113.14	$118.80	$124.74	$130.97	$137.52	$144.40	$151.62	
						New Depreciation System, Deductions							
1	$100.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00	$10.00		
2	$105.00		$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	$10.50	
3	$110.25			$11.03	$11.03	$11.03	$11.03	$11.03	$11.03	$11.03	$11.03	$11.03	
4	$115.76				$11.58	$11.58	$11.58	$11.58	$11.58	$11.58	$11.58	$11.58	
5	$121.55					$12.16	$12.16	$12.16	$12.16	$12.16	$12.16	$12.16	
6	$127.63						$12.76	$12.76	$12.76	$12.76	$12.76	$12.76	
7	$134.01							$13.40	$13.40	$13.40	$13.40	$13.40	
8	$140.71								$14.07	$14.07	$14.07	$14.07	
9	$147.75									$14.77	$14.77	$14.77	
10	$155.13										$15.51	$15.51	
11	$162.89											$16.29	
	Total annual deductions (ND)	$10.00	$20.50	$31.53	$43.10	$55.26	$68.02	$81.42	$95.49	$110.27	$125.78	$132.07	
Change deductions (CD = ND-OD)		-$15.00	-$30.75	-$47.29	-$64.65	-$57.88	-$50.78	-$43.32	-$35.48	-$27.26	-$18.62	-$19.55	
Change in tax (-0.35*CD)		$5.25	$10.76	$16.55	$22.63	$20.26	$17.77	$15.16	$12.42	$9.54	$6.52	$6.84	$13.69
Change in tax, scaled by growth		$5.25	$10.25	$15.01	$19.55	$16.67	$13.93	$11.31	$8.83	$6.46	$4.20	$4.20	$11.14

under the slower system, and that is important to understanding the time pattern of the change in taxes that occurs from changing depreciation rules.

When depreciation is slowed, aggregate annual deductions initially decline by a larger (in magnitude) amount each year, as more and more investment comes under the new system. In table 2, the change in deductions in year 1 is $15, than it is $30 in year 2, then $45 in year 3, etc. This growth continues until investment equals depreciation under the old (accelerated) system, which happens in year 4 and is determined by the recovery period under the old depreciation system. From year 4 onward, aggregate annual deductions on the undepreciated basis of the new vintages of investment would have been a constant $100 under the accelerated depreciation rules. However, because aggregate deductions continue to grow under the new, slower depreciation rules, the difference in deductions between the two depreciation systems gradually declines each year, from $60 in year 4 to $50 in year 5, to $40 in year 6, etc. The difference in deductions reaches $0 in year 10, which is the recovery period under the new, slower system. At his point, the new depreciation system is fully phased in. Thereafter the difference in aggregate deductions between the two systems stays at $0 because aggregate deductions remain constant, and equal to investment, i.e., $100, under both depreciation systems. As shown in the final row of table 2, the change is taxes parallels the change in deductions, first rising, then reaching a maximum, then falling to $0, when it remains in future years.

This example illustrates why there is concern over the permanence of revenue gains from slowing depreciation allowances. Slowing depreciation picks up an average of $10.50 per year in additional revenue over the first 10 years following its implementation, but it raises no additional revenue in the long run, once fully phased in. The intuition is that, until the new depreciation system is fully phased in, the tax increases from smaller deductions early in the tax life of each successive investment vintage outweigh the tax reductions from the greater tax deductions for older vintages of investments. Once the new depreciation rules are fully phased in, which happens in year 10,[4] the greater revenue from the early years of the younger vintages' lifetimes is exactly offset by the lower revenue from older vintages that have passed the turnaround point, so that, overall, there is no change in the annual amount of tax collected.

The result that slowing depreciation raises no revenue in the long run is depends on the assumption that investment does not grow over time. With annual growth, younger vintages of investments are larger than older vintages. Thus, the revenue gain from smaller depreciation deductions on younger vintages is only partially offset by the revenue loss from larger deductions on older vintages. This is illustrated in table 3, which modifies the example of table 2 by assuming a 5 percent annual rate of investment growth. With growth, the annual revenue gain initially rises over time and then gradually tapers off,[5] but it remains positive once the new depreciation rule is fully phased in (year 10 and beyond). In the long run, annual revenue is higher than under the old deprecation system, because, considering all vintages of investment, annual deductions are lower, and once the new rules are fully phased in, the increase in revenue grows with the capital stock, at 5 percent per year.[6]

For the hypothetical asset in the example in table 3, slowing depreciation would pick up $6.52 in year 10, compared to an average amount of $13.69 over the first 10 years. The long-run revenue gain is 48 percent of the budget period gain if unadjusted dollar flows are used, or 38 percent of the short-run gain if adjusted for the growth in the size of the tax base over time.[7] The size of the difference depends on several factors, including the assumed growth rate and the asset's lifetime or recovery period under current law and under the slower depreciation system.

SOME FACTORS THAT AFFECT THE RELATIONSHIP BETWEEN THE LONG-RUN AND THE BUDGET PERIOD REVENUE GAIN FROM SLOWING DEPRECIATION DEDUCTIONS

The larger is the assumed growth rate, the larger the share of budget period revenue that also is picked up in the long term. This is because the larger the growth rate, the larger are the

Table 4

Revenue Increase from Slowing Depreciation: Multiple Vintages, Long-Lived Asset and 5% Growth

Year		1	2	3	4	5	10	15	20	30	40	Average, Years 1-10
	Annual Investment											
						Old Depreciation System, Deductions						
1	$100.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00			
2	$105.00		$5.25	$5.25	$5.25	$5.25	$5.25	$5.25	$5.25			
3	$110.25			$5.51	$5.51	$5.51	$5.51	$5.51	$5.51			
4	$115.76				$5.79	$5.79	$5.79	$5.79	$5.79			
5	$121.55					$6.08	$6.08	$6.08	$6.08			
10	$155.13						$7.76	$7.76	$7.76			
15	$197.99							$9.90	$9.90			
20	$252.70								$12.63			
	Total annual deductions (OD)	$5.00	$10.25	$15.76	$21.55	$27.63	$62.89	$107.89	$165.33	$269.30	$438.67	
						New Depreciation System , Deductions						
1	$100.00	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	
2	$105.00		$2.63	$2.63	$2.63	$2.63	$2.63	$2.63	$2.63	$2.63	$2.63	
3	$110.25			$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	$2.76	
4	$115.76				$2.89	$2.89	$2.89	$2.89	$2.89	$2.89	$2.89	
5	$121.55					$3.04	$3.04	$3.04	$3.04	$3.04	$3.04	
10	$155.13						$3.88	$3.88	$3.88	$3.88	$3.88	
15	$197.99							$4.95	$4.95	$4.95	$4.95	
20	$252.70								$6.32	$6.32	$6.32	
30	$411.61									$10.29	$10.29	
40	$670.48										$16.76	
	Total annual deductions (ND)	$2.50	$5.13	$7.88	$10.78	$13.81	$31.44	$53.95	$82.66	$166.10	$302.00	
Change deductions (CD = ND-OD)		-$2.50	-$5.13	-$7.88	-$10.78	-$13.81	-$31.44	-$53.95	-$82.66	-$103.21	-$136.67	
Change in tax (-0.35*CD)		$0.88	$1.79	$2.76	$3.77	$4.83	$11.01	$18.88	$28.93	$36.12	$47.83	
Change in tax, scaled by growth		$0.88	$1.71	$2.50	$3.26	$3.98	$7.09	$9.54	$11.45	$8.78	$7.13	$4.19

new, younger, vintages of investment, on which there is a revenue gain, compared to the older vintages, on which there is a revenue loss. If the example in table 3 was modified to have a 10 percent growth rate, then the revenue gain in year 10 would be 91 percent of the average of the revenue gain over the first ten years of the policy, or 60 percent if adjusted for growth in the tax base.

The relationship between the long-run revenue gain and the budget period revenue gain also depends on the assets' recovery period or longevity. Slowing depreciation on assets with long recovery periods under the old (accelerated) depreciation regime can have a long-run revenue gain that is a larger fraction of the gain during the 10 year budget period than is the case for shorter lived assets. Surprisingly, even with a reasonable growth rate, the long-run increase in revenue can exceed the budget period increase. For long-lived assets, annual depreciation is only a small part of the investment's cost, so the change in depreciation deductions starts out small and then grows for many years as new vintages of investment are placed into service, before tapering off to its long-run value.[8] For assets whose recovery period is much longer than the budget period, a sufficiently small amount of new investment can be put in place over the 10 year budget period that the average annual change in the tax base is not large, relative to the long-run change. This is illustrated in table 4 for a hypothetical asset whose initial recovery period is 20 years, lengthened to 40 years under the new depreciation rules. In this example, the annual long-run revenue gain ($7.13) is about 170 percent of the average annual budget period gain ($4.19), when scaled by growth.

MORE DETAILED "REPRESENTATIVE" EXAMPLES

The long-run vs. budget period revenue comparison is highly fact specific. As the discussion above suggests, it depends on the growth rate, the mix of assets, and the specific depreciation rules. Varying tax rates across investors could matter as well, e.g., if assets with relatively large long-run revenue gains are held by low tax rate investors and assets with relative large budget period revenue gains are held by high tax rate investors.

This section develops more realistic (but still stylized) examples by tying the calculations somewhat more closely to real tax rules and data. These examples slow depreciation by going from the current MACRS system to depreciation allowances based on the tax code's ADS. For two reasons, MACRS depreciation deductions are accelerated relative to ADS. First, for many assets, the method of deprecations allowed by MACRS (e.g., double declining balance, with an optimal switch to straight line) front loads deductions compared to the straight line method used by ADS. Second, for many assets, MACRS allows a shorter recovery period than does ADS.

These examples focus on five MACRS asset classes that account for about 90 percent of investment. According to the data used in Treasury's depreciation model, about 30 percent of investment is in 5 year property, 20 percent in 7 year property, 10 percent in 15 year property, 17 percent in 27.5 year property, and 13 percent in 39 year property. Table 5 compares recovery rules under MACRS and ADS[9] for each MACRS asset class used in the example.

Results are presented in table 6. With a 5 percent nominal growth rate, going from MACRS to ADS

Table 5
Recovery Rules Under MACRS and ADS

MACRS		*ADS*	
Recovery Period	*Method*	*Recovery Period*	*Investment Share*
5	200% DB, switch to SL	7	30%
7	200% DB, switch to SL	10	20%
15	150% DB, switch to SL	25	10%
27.5	SL	40	17%
39	SL	40	13%

Table 6
Comparing Long-Run and Short Run Revenue Effects: Switching From MACRS to ADS Depreciation

	LR Revenue as % of SR Revenue
Common tax rate (35%)	
5% nominal growth	66%
2% nominal growth	37%
Heavier weight on longest-lived asset (28%)	67%
Heavier weight on shortest-lived assets (66%)	52%
Lower tax rate (25%) for residential real property (27.5 year MACRS property)	64%

depreciation would raise about two-thirds as much revenue in the long run as it raises in the 10 year budget window. Table 6 also has some sensitivity analysis. If the growth rate was 2 percent, then long-run revenue would be well below one-half of budget period revenue. Doubling the investment weight on the longest lived asset has only a small effect on the results. This occurs in part because the depreciation change for this asset is very small (it goes from straight-line over 39.5 years to straight-line over 40 years). Doubling the weight on the shortest lived asset substantially reduces long-run revenue. Lowering the tax rate from 35 percent to 25 percent on residential real property, to reflect the large share of that asset held by noncorporate businesses, has only a small effect on the long-run/budget period revenue comparison.

CONCLUSIONS

Although depreciation changes alter only the timing of tax payments, because of growth in the economy, it seems likely that slowing depreciation would raise substantial tax revenue even in the long run. The precise relationship between long-run and budget period revenue is highly fact specific. The simple examples we considered suggest that replacing MACRS depreciation rules with ADS rules could generate between one-half and two-thirds as much revenue in the long run as it does in the 10 year budget window. This means, for example, that if the depreciation slow down could pay for a 3 percentage point cut in the corporate tax rate in the budget period, then it could pay for between a 1.5 and 2 percentage point cut in the corporate tax rate in the long run.

It is important to note that base broadening corporate tax reform is likely to include many tax changes in addition to slowing depreciation and lowering the tax rate. These would complicate the comparison between long-run revenue and budget period (short-run) revenue, as would including in the analysis firms with negative income and net operating losses, and the birth and death of businesses. For a detailed tax reform package, the relationship between short-run/budget period revenue neutrality and long-run revenue neutrality can be very difficult to gauge.

Notes

1 Deductions are unchanged for the rest of the investment's economic life, should that life exceed 10 years.

2 The discounted present value of taxes would change, but we are looking at undiscounted flows.

3 Depreciation of the remaining basis of undepreciated capital in place at the time of tax law change is not considered in the example because it does not affect the main points. Most real world tax policy changes allow undepreciated basis to be recovered under the old depreciation rules.

4 The new depreciation system is fully phased in once the annual growth rate of depreciation deductions equals the annual growth rate of investment. When investment growth is smooth, this occurs once the new recover period is reached. When there is no growth (including no inflation), the new depreciation system is fully phased in when investment equals depreciation (and the growth rate is zero).

5 The tapering off begins when the number of years since the policy change equals the recovery period under old law; e.g., in year 4 for the example of table 3. This is the analogue of the turnaround point discussed above in the no growth case. With growth, the change in the tax flow does not reverse in sign at the turnaround point, but rather begins to decline in (growth adjusted) size from year to year.

6 As can be seen by comparing the revenue increase in year 11 ($6.84) with the revenue increase in year 10 ($6.52).

[7] This calculation divides revenue in year t by $(1.05)^{(t-1)}$.

[8] In growth adjusted terms, the annual revenue increase rises from year to year until t = the recovery period under old law, i.e. until the turnaround point.

[9] ADS lifetimes can vary within a MACRS asset class. The lifetimes chosen here are intended to be no more than roughly representative.