CAPITAL INCOME TAXES AND THE BENEFIT OF PRICE STABILITY

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Professor of Economics, Harvard University, and President of the National Bureau of Economic Research. I am grateful for comments on the earlier paper and for discussions about the current work with participants in the 1997 NBER conference on Reducing Inflation, to the authors of papers in the current project who served as members of the project working group, and to Erzo Luttmer and Larry Summers. This paper is part of NBER's research programs in Economic Fluctuations and Growth, Monetary Economics and Public Economics. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

Going from low inflation to price stability involves a short term loss (associated with the higher unemployment rate required to reduce the inflation) and results in a series of welfare gains in all future years. The primary source of these gains is the reduction in the distortions that result from the interaction of tax rules and inflation. The paper quantifies the gains associated with reducing the distortion in favor of current consumption rather than future consumption and in favor of the consumption of owner occupied housing. These tax effects are much larger than the effect on the demand for money that is generally emphasized in studies of the distorting effect of inflation. The seignorage gains are also small in comparison to other effects of the tax-inflation interaction. The estimates imply that the annual value of the net benefits of going from two percent inflation to price stability are about one percent of GDP. Discounting this growing stream of benefits at a real discount rate of five percent implies a net present value of about more than 30 percent of GDP. All estimates of the short-run cost of going from low inflation to price stability are less than this.

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Capital Income Taxes and the Benefit of Price Stability

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The fundamental policy question of whether to go from a low inflation rate to price stability requires comparing the short-run cost of disinflation with the permanent gain that results from a sustained lower rate of inflation.[1] Since that permanent gain is proportional to the level of GDP in each future year, the real value of the annual gain grows through time at the rate of growth of real GDP.[2]

If this growing stream of welfare gains is discounted by a risk based discount rate like the net rate of return on equities, the present value of the future gain is equal to the initial annual value of the net gain (G) divided by the difference between the appropriate discount rate (r) and

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[1] The current paper builds on my earlier study, The Costs and Benefits of Going from Low Inflation to Price Stability" that was distributed as NBER Working Paper 5469 and published in C. Romer and D. Romer, Reducing Inflation: Motivation and Strategy (Chicago: University of Chicago Press, 1997).

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[2] This assumes that going from low inflation to price stability does not permanently affect the rate of economic growth. The unemployment and output loss associated with achieving a lower rate of inflation were discussed in section 1 of Feldstein (1996). That analysis assumed that there is a short-run Phillips curve but not a long-run Phillips curve. Both of those assumptions have been called into question and will be discussed in more detail in papers presented at the conference. I will return to my own view of this controversy in the introduction to the volume.

the growth rate of total GDP (g): thus PV = G /[r - g]. With a value of r equal to 5.1 percent (the real net-of-tax rate of return on the Standard and Poors portfolio of equities from 1970 to 1994) and a projected growth rate of 2.5 percent, the present value of the gain is equal to almost 40 times the initial value of the gain.[3]

The analysis developed below implies that the annual gain that would result from reducing inflation from 2 percent to zero would be equal to between about 0.76 percent of GDP and 1.04 percent of GDP. The present value of this gain would therefore be between 30 percent and 40 percent of the initial level of GDP. The evidence cited in Ball (1994) implies that inflation could be reduced from 2 percent to zero with a one-time output loss of about 6 percent of GDP. Although these estimates of the benefits and costs are subject to much uncertainty, the difference between benefits and costs leaves little doubt that the aggregate present value benefit of achieving price stability substantially exceeds its cost.

The paper begins by estimating the magnitude of the two major favorable components of the annual net gain that would result if the true inflation rate[4] were reduced from two percent to zero: (1) the reduced distortion in the timing of consumption and (2) the reduced distortion in the demand for owner-occupied housing. Each of these calculations explicitly recognizes that the change in inflation not only alters household behavior but also that it alters tax revenue. Those revenue effects are important because any revenue gain from lower inflation permits a reduction in

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[3]In an earlier analysis of the gain from reducing inflation (Feldstein, 1979), I noted that with a low enough discount rate the present value of the gain would increase without limit as the time horizon was extended.

[4]I assume that the official measure of the rate of inflation overstates the true rate by two percentage points. The text thus evaluates the gain of going from a four percent rate of increase of the consumer price index to a two percent rate of increase.

other distortionary taxes while any revenue loss from lower inflation requires an increase in some other distortionary tax.[5]

Even a small reduction of inflation (from two percent to zero) can have a substantial effect on economic welfare because inflation increases the tax-induced distortions that would exist even with price stability. The deadweight loss associated with a two percent inflation is therefore not the traditional "small triangle" that would result from distorting a first-best equilibrium but is the much larger "trapezoid" that results from increasing a large initial distortion.

These adverse effects of the tax-inflation interaction could in principle be eliminated by indexing the tax system or by shifting from our current system of corporate and personal income taxes to a tax based only on consumption or labor income. As a practical matter, however, such tax reforms are extremely unlikely. Section 7 of Feldstein (1996) discusses some of the difficulties of shifting to an indexed tax system in which capital income and expenses are measured in real terms. Although such a shift has been advocated for at least two decades, there has been no legislation along those lines.[6] It is significant, moreover, that no industrial country has fully (or even substantially) indexed its taxation of investment income. Moreover, the annual gains from shifting to price stability that are identified in this paper exceed the costs of the transition within a very few years. Even if one could be sure that the tax-inflation distortions would be eliminated by changes in the tax system ten years from now, the present value gain from price stability until then

[5]Surprisingly, such revenue effects are generally ignored in welfare analyses on the implicit assumption that lost revenue can be replaced by lump sum taxes.

[6] Most recently, the indexing of capital gains was strongly supported by the Republican majority in the House of Representatives in the 1997 tax legislation but was opposed with equal vigor by the White House and was not part of the final legislation.

would probably exceed the cost of the inflation reduction.

There are also some countervailing disadvantages of having price stability rather than continuing a low rate of inflation. The primary advantage of inflation that has been identified in the literature is the seigniorage that the government enjoys from the higher rate of money creation. This seigniorage revenue reduces the need for other distortionary taxes and therefore eliminates the deadweight loss that such taxes would entail. This seigniorage gain in money creation must of course be measured net of the welfare loss that results from the distortion in money demand. In addition, the real cost of servicing the national debt varies inversely with the rate of inflation (because the government bond rate rises point for point with inflation but the inflation premium is then subject to tax). Both of these effects are explicitly taken into account in the calculations presented in this paper.

As I noted in the introduction to this volume, there are several papers in this volume that go beyond the original analysis of Feldstein (1996). The paper by Glenn Hubbard et. al. presented in Chapter 5 estimates how reducing inflation affects the efficiency of business's choices among different types of capital investments (structures and equipment of different durabilities). The paper by James Hines and Mahir Desai (chapter 6) shows how the closed-economy analysis of this paper can be extended to an open economy with flows of trade and capital. The study by Groshen and Schweitzer (chapter 7) discusses the behavior of the labor market at low inflation and the research by Andres and Hernando (chapter 8) examines the effect of reducing inflation on the sustained rate of growth.

Absolute price stability, as opposed to merely a lower rate of inflation, may bring a qualitatively different kind of benefit. A history of price stability may bring a "credibility bonus" in dealing with inflationary shocks. People who see persistent price level stability expect that it will persist in the future and that the government will respond to shocks in a way that maintains the price level. In contrast, if people see that the price level does not remain stable, they may have less confidence in the government's ability or willingness to respond to inflation shocks in a way that maintains the initial inflation rate. If so, any given positive demand shock may lead to more inflation and may require a greater output loss to reverse than would be true in an economy with a history of stable prices.

A stable price level is also a considerable convenience for anyone making financial decisions that involve future receipts and payments. While economists may be very comfortable with the process of converting nominal to real amounts, many people have a difficult time thinking about rates of change, real rates of interest, etc. Even among sophisticated institutional investors, it is remarkable how frequently projections of future returns are stated in nominal terms and based on past experience over periods with very different rates of inflation.

I will not attempt to evaluate these benefits of reducing inflation even though some of them may be as large as the gains that I do measure. For the United States, the restricted set of benefits that I quantify substantially exceed (in present value at any plausible discount rate) the cost of getting to price stability from a low rate of inflation.

Table 1 summarizes the four types of welfare changes that are discussed in the remaining sections of the paper. The specific assumptions and parameters values will be discussed there. With the parameter values that seem most likely, the overall total effect of reducing inflation from two percent to zero, shown in the lower right corner of the table, is to reduce the annual deadweight loss by between 0.76 percent of GDP and 1.04 percent of GDP.

Table 1

The Net Welfare Effect of Reducing Inflation from 2 Percent to Zero*
(Changes as percent of GDP)

Source of Change		Direct Effect of Reduced Distortion	Welfare Effect of Revenue Change		Total Effect	
			$\lambda = 0.4$	$\lambda = 1.5$	$\lambda = 0.4$	$\lambda = 1.5$
Consumption Timing	**$\eta_{Sr} = 0.4$**	**1.02**	**– 0.07**	**– 0.26**	**0.95**	**0.76**
	$\eta_{Sr} = 0$	0.73	– 0.17	– 0.64	0.56	0.08
	$\eta_{Sr} = 1.0$:	1.44	0.09	0.33	1.53	1.77
Housing Demand		0.10	0.12	0.45	0.22	0.55
Money Demand		0.02	–0.05	–0.19	– 0.03	– 0.17
Debt Service		-- NA --	– 0.10	–0.38	– 0.10	– 0.38
Totals	**$\eta_{Sr} = 0.4$**	**1.14**	**– 0.10**	**– 0.38**	**1.04**	**0.76**
	$\eta_{Sr} = 0$:	0.85	– 0.20	– 0.76	0.65	0.08
	$\eta_{Sr} = 1.0$:	1.56	0.06	0.21	1.62	1.77

NA: Not applicable

* A 2 percent inflation rate corresponds to a rise in the CPI at 4 percent a year. The welfare effects reported here are annual changes in welfare.

1. Inflation and the Intertemporal Allocation of Consumption

Inflation reduces the real net of tax return to savers in many ways. At the corporate (or, more generally, the business) level, inflation reduces the value of depreciation allowances and therefore increases the effective tax rate. This lowers the rate of return that businesses can afford to pay for debt and equity capital. At the individual level, taxes levied on nominal capital gains and nominal interest also cause the effective tax rate to increase with the rate of inflation.

A reduction in the rate of return that individuals earn on their saving creates a welfare loss by distorting the allocation of consumption between the early years in life and the later years. Since the tax law creates such a distortion even when there is price stability, the extra distortion caused by inflation causes a first-order increased deadweight loss.

As I emphasized in an earlier paper (Feldstein, 1978), the deadweight loss that results from capital income taxes depends on the resulting distortion in the timing of consumption and not on the change in saving per se. Even if there is no change in saving (i.e., no reduction in consumption during working years), a tax-inflation induced decline in the rate of return implies a reduction in future consumption and therefore a deadweight loss. The current section calculates the general magnitude of the reduction in this welfare loss that results from lowering the rate of inflation from two percent to zero.[7]

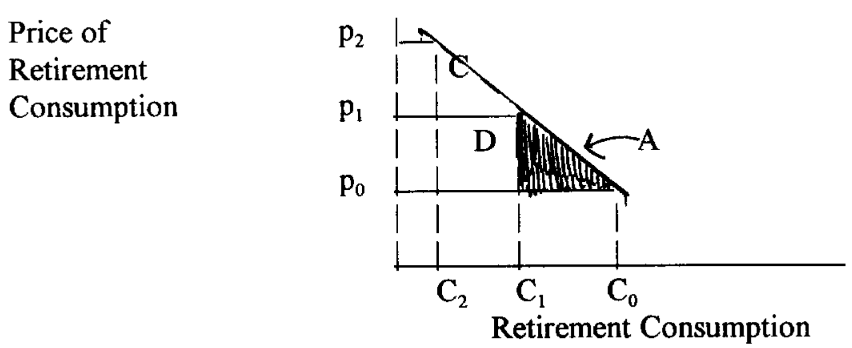
To analyze the deadweight loss that results from a distortion of consumption over the individual life cycle, I consider a simple two-period model of individual consumption. Individuals

[7]Fischer (1981) used the framework of Feldstein (1978) to assess the deadweight loss caused by the effect of inflation on the return to savers. As the current analysis indicates, the problem is more complex than either Fischer or I recognized in those earlier studies.

receive income when they are young. They save a portion, S, of that income and consume the rest. The savings are invested in a portfolio that earns a real net-of-tax return of r. At the end of T years, the individuals retire and consume $C = (1+r)^T S$. In this framework, saving can be thought of as the expenditure (when young) to purchase retirement consumption at a price of $p = (1+r)^{-T}$.

Even in the absence of inflation, the effect of the tax system is to reduce the rate of return on saving and therefore to increase the price of retirement consumption. As inflation increases, the price of retirement consumption increases further. Before looking at specific numerical values, I present graphically the welfare consequences of these changes in the price of retirement consumption. Figure 1 shows the individual's compensated demand for retirement consumption C as a function of the price of retirement consumption at the time that saving decisions are made (p).

Figure 1: Retirement Consumption



$$\Delta \text{ DWL} = (p_1 - p_0)(C_1 - C_2) + 0.5\ (p_2 - p_1)(C_1 - C_2)$$
$$\Delta \text{ REV} = (p_1 - p_0)(C_1 - C_2) - (p_2 - p_1)\ C_2$$

In the absence of both inflation and taxes, the real rate of return implies a price of p_0 and the individual chooses to save enough to generate retirement consumption of C_0. With no inflation, the existing structure of capital income taxes at the business and individual levels raises the price of retirement consumption to p_1 and reduces retirement consumption to C_1. This increase in the price of retirement consumption causes the individual to incur the deadweight loss shown as the shaded area A, i.e., the amount that the individual would have to be compensated for the rise in the price of retirement consumption in order to remain at the same initial utility level exceeds the revenue collected by the government by an amount equal to the area A. Raising the rate of inflation from zero to two percent increases the price of retirement consumption to p_2 and reduces retirement consumption to C_2. The deadweight loss now increases by the trapezoidal area C + D $= (p_1 - p_0)(C_1 - C_2) + 0.5\ (p_2 - p_1)(C_1 - C_2)$.

The revenue effect of such tax changes are generally ignored in welfare analyses because it is assumed that any loss or gain in revenue can be offset by a lump sum tax or transfer. More realistically, however, we must recognize that offsetting a revenue change due to a change in inflation involves distortionary taxes and therefore each dollar of revenue gain or loss has an additional effect on overall welfare. The net welfare effect of reducing the inflation rate from two percent to zero is therefore the combination of the traditional welfare gain (the trapezoid C + D) and the welfare gain (loss) that results from an increase (decrease) in tax revenue. I begin by evaluating the traditional welfare gain and then calculate the additional welfare effect of the changes in tax revenue.

1.1 *The Welfare Gain from Reduced Intertemporal Distortion*

The annual welfare gain from reduced intertemporal distortion is $(p_1 - p_0)(C_1 - C_2) + 0.5\ (p_2 - p_1)(C_1 - C_2) = [(p_1 - p_0) + 0.5\ (p_2 - p_1)](C_1 - C_2.)$ The change in retirement consumption can be approximated as $C_1 - C_2 = (dC/dp)\ (p_1 - p_2) =$

$C_2\ (p_2 / C_2)\ (dC/dp)\ (p_1 - p_2)/ p_2 = C_2\, \varepsilon_{Cp}\ [(p_1 - p_2)/ p_2]$ where $\varepsilon_{Cp} < 0$ is the compensated elasticity of retirement consumption with respect to its price (as evaluated at the observed initial inflation rate of two percent). Thus the gain from reduced intertemporal distortion is:[8]

(1) $G_1 = [(p_1 - p_0) + 0.5\ (p_2 - p_1)]\ C_2\, \varepsilon_{Cp}\ [(p_1 - p_2)/ p_2]$

$= [(p_1 - p_0)/p_2 + 0.5\ (p_2 - p_1)/p_2]p_2\, C_2\, \varepsilon_{Cp}\ [(p_1 - p_2)/ p_2]$.

Note that if there were no tax induced distortion when the inflation rate is zero ($p_1 = p_0$), G_1 would simplify to the traditional triangle formula for the deadweight loss of a price change from p_1 to p_2 .

To move from equation 1 to observable magnitudes, note that the compensated elasticity ε_{Cp} can be written in terms of the corresponding uncompensated elasticity η_{Cp} and the propensity to save out of exogenous income σ as[9]

(2) $\varepsilon_{Cp} = \eta_{Cp} + \sigma$.

Moreover, since saving and retirement consumption are related by $S = pC$, the elasticity of retirement consumption with respect to its price and the elasticity of saving with respect to the price of retirement consumption are related by $\eta_{Cp} = \eta_{Sp} - 1$. Thus

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[8]This could be stated as the difference between the areas of the two deadweight loss triangles corresponding to prices p_1 and p_2 but the expression used here presents a better approximation.

[9]This follows from the usual Slutsky decomposition: $dC/dp = \{dC/dp\}_{COMP} - C\ (dC/dy)$ where dC/dy is the increase in retirement consumption induced by an increase in exogenous income. Multiplying each term by p/C and noting that $p(dC/dy) = dpC/dy = dS/dy = \sigma$ yields equation (2).

(3) $\varepsilon_{Cp} = \eta_{Sp} + \sigma - 1.$

and

(4) $G_1 = [(p_1 - p_0)/p_2 + 0.5\ (p_2 - p_4)/p_2][(p_2 - p_1)/p_2]\ S_2\ (1 - \eta_{Sp} - \sigma)$

where $S_2 = p_2 C_2$, the gross saving of individuals at the early stage of the life cycle.

To evaluate equation 4 requires numerical estimates of the price of future consumption at different inflation rates and without any tax, as well as estimates of gross saving, of the saving elasticity and of h the propensity to save out of exogenous income.

1.1.1 *Inflation Rates and the Price of Retirement Consumption*

To calculate the price of retirement consumption, I assume the time interval between saving and consumption is 30 years; e.g., the individual saves on average at age 45 and then dissaves at age 75. Thus $p = (1+r)^{-30}$ where the value of r depends on the tax system and the rate of inflation. From 1960 through 1994, the pretax real return to capital in the U.S. nonfinancial corporate sector average 9.2 percent.[10] Ignoring general equilibrium effects and taking this as the measure of the discrete-time return per year that would prevail in the absence of taxes implies that the orresponding price of retirement consumption is $p_0 = (1.092)^{-(30)} = 0.071$.[11]

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[10]This 9.2 percent is the ratio of profits before all taxes (including property taxes as well as income taxes) plus real net interest payments to the replacement value of the capital stock. Feldstein, Poterba and Dicks-Mireaux (1983) describe the method of calculation and Rippe (1995) brings the calculation up to date. Excluding the property taxes would reduce this return by about 0.7 percentage points; see Poterba and Samwick (1995).

[11]An increase in the capital stock would depress the marginal product of capital (ρ) from its currently assumed value of 0.092. That means a smaller gain from the reduced intertemporal distortion. The effect however is so small that, given the approximations used throughout the analysis, it does not seem worth taking this into account. The following calculation shows that with an elasticity of saving with respect to the real interest rate of 0.4 (i.e., $\eta_{sr} = 0.4$) and a Cobb-Douglas technology, the marginal product of capital only falls from 0.092 to 0.089.

Taxes paid by corporations to federal, state and local governments equaled about 41 percent of the total pretax return during this period, leaving a real net return before personal taxes of 5.4 percent (Rippe, 1995). I will take this yield difference as an indication of the combined effects of taxes and inflation at 2 percent (i.e., measured inflation at 4 percent) even rthough tax rules, tax rates and inflation varied over this 35 year interval.[12] The net of tax rate of return depends not only on the tax at the corporate level but also on the taxes that individuals pay on that after-corporate-tax return, including the taxes on interest income, dividends and capital gains. The effective marginal tax rate depends on the form of the income and on the tax status of the individual. I will summarize all of this by assuming a marginal "individual" tax rate of 25 percent. This reduces the net return from 5.4 percent to 4.05 percent. The analysis of the gain from reducing the equilibrium rate of inflation is not sensitive to the precise level of this return or the precise difference between it and the 9.2 percent pretax return since our concern is with the effect

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To see this, note that (as shown later in the text) the net return to savers at 2 percent inflation when the pretax yield is 9.2 percent is 0.4425 (0.092) = 0.0407. The analysis in the text also shows that reducing inflation to zero raises the net return to 0.4425 ρ + 0.0049 where ρ is the marginal product of capital at the higher saving rate.

If the saving rate (s) is a constant elasticity function of the expected net real return equal to 0.4, then $s_1 / s_0 = \{[.4425\ \rho + 0.0049]/0.0407\}^{0.4}$ where s_1 is the saving rate with price stability and s_0 is the saving rate at a two percent rate of inflation.

A Cobb-Douglas technology implies $y = k^b$ and therefore that $\rho = bk^{b-1}$. In long-run equilibrium, sy = nk where s is the saving rate and n is the growth of population and technology. Thus $\rho = b\ n\ s^{-1}$. More specifically, the observed marginal product of capital is 0.092 and satisfies $0.092 = b\ n\ s_0^{-1}$ while $\rho = b\ n\ s_1^{-1}$ defines the marginal product of capital with the saving rate that prevails when there is price stability.

It follows that $0.092 / \rho = s_1 / s_0 = \{[.4425\ \rho + 0.0049]/0.0407\}^{0.4}$. Solving this gives ρ = 0.0889 or only about 3 percent below the value of 0.092 with the initial capital stock. Even with a savings response elasticity of 1, the marginal product of capital is 0.0866.

[12]The average rate of measured inflation during this period was actually 4.7 percent, implying an average "true" inflation rate of 2.7 percent.

of a difference in inflation rates on effective tax rates. Similarly, the precise level of the initial effective tax rate is not important to the current calculations since our concern is with the change in the effective tax rate that occurs as a result of the change in the equilibrium rate of inflation.[13] The price of retirement consumption that corresponds to this net return of 4.05 percent is $p_2 = (1.0405)^{-30} = 0.304$ where the subscript 2 on the price indicates that this represents the price at an inflation rate of two percent.

Reducing the equilibrium inflation rate from two percent to zero lowers the effective tax rate at both the corporate and individual levels. At the corporate level, changes in the equilibrium inflation rate alter the effective tax rate by changing the value of depreciation allowances and by changing the value of the deduction of interest payments. Because the depreciation schedule that is allowed for calculating taxable profits is defined in nominal terms, a higher rate of inflation reduces the present value of the depreciation and thereby increases the effective tax rate.[14] Auerbach (1978) showed that this relation can be approximated by a rule of thumb that increases taxable profits by 0.57 percentage points for each percentage point of inflation. With a marginal corporate income tax rate of 35 percent, a two percentage point decline in inflation raises the net of tax return through this channel by 0.35(0.57)(0.02) = 0.0040 or 0.40 percentage points.[15]

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[13]Some explicit sensitivity calculations are presented below.

[14]See Feldstein, Green and Sheshinski (1978) for an analytic discussion of the effect of inflation on the value of depreciation allowances.

[15]It might be argued that Congress changes depreciation rates in response to changes in inflation in order to keep the real present value of depreciation allowances unchanged. But although Congress did enact more rapid depreciation schedules in the early 1980s, the decline in inflation since that time has not been offset by lengthening depreciation schedules and has resulted in a reduction in the effective rate of corporate income taxes.

The interaction of the interest deduction and inflation moves the after tax yield in the opposite direction. If each percentage point of inflation raises the nominal corporate borrowing rate by one percentage point,[16] the real pretax cost of borrowing is unchanged but the corporation gets an additional deduction in calculating taxable income. With a typical debt-capital ratio of forty percent and a statutory corporate tax rate of 35 percent, a two percent decline in inflation raises the effective tax rate by 0.35(0.40)(0.02) = 0.0028 or 0.28 percentage points.

The net effect of going from a two percent inflation rate to price stability is therefore to raise the rate of return after corporate taxes by 0.12 percentage points, from the 5.40 percent calculated above to 5.52 percent.[17]

Consider next how the lower inflation rate affects the taxes at the individual level. Applying the 25 percent tax rate to the 5.52 percent return net of the corporate tax implies a net yield of 4.14 percent, an increase of 0.09 percentage points in net yield to the individual because of the changes in taxation at the corporate level. In addition, because individual income taxes are levied on nominal interest payments and nominal capital gains, a reduction in the rate of inflation

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[16]This famous Irving Fisher hypothesis of a constant real interest rate is far from inevitable in an economy with a complex non-neutral tax structure. For example, if the only non-neutrality were the ability of corporations to deduct nominal interest payments and all investment were financed by debt at the margin, the nominal interest rate would rise by $1/(1-\tau)$ times the change in inflation where τ is the statutory corporate tax rate. This effect is diminished however by the combination of historic cost depreciation, equity finance, international capital flows and the tax rules at the level of the individual. (See Feldstein 1983, 1995a and Hartman, 1979) Despite the theoretical ambiguity, the evidence suggests that these various tax rules and investor behavior interact in practice in the United States to keep the real pretax rate of interest approximately unchanged when the rate of inflation changes; see Mishkin (1992).

[17]Note that although the margin of uncertainty about the 5.5 percent exceeds the calculated change in return of 0.12 percent, the conclusions of the current analysis are not sensitive to the precise level of the initial 5.5 percent rate of return.

further reduces the effective tax rate and raises the real after-tax rate of return.

The portion of this relation that is associated with the taxation of nominal interest at the level of the individual can be approximated in a way that parallels the effect at the corporate level. If each percentage point of inflation raises the nominal interest rate by one percentage point, the individual investors' real pretax return on debt is unchanged but the after tax return falls by the product of the statutory marginal tax rate and the change in inflation. Assuming the same forty percent debt share at the individual level as I assumed for the corporate capital stock[18] and a 25 percent weighted average individual marginal tax rate implies that a two percent decline in inflation lowers the effective tax rate by 0.25(0.40)(0.02) = 0.0020 or 0.20 percentage points.

Although the effective tax rate on the dividend return to the equity portion of individual capital ownership is not affected by inflation (except, of course, at the corporate level), a higher rate of inflation increases the taxation of capital gains. Although capital gains are now taxed at the same rate as other investment income (up to a maximum capital gain rate of 28 percent at the federal level), the effective tax rate is lower because the tax is only levied when the stock is sold. As an approximation, I will therefore assume a 10 percent effective marginal tax rate on capital gains. In equilibrium, each percentage point increase in the price level raises the nominal value of the capital stock by one percentage point. Since the nominal value of the liabilities remains unchanged, the nominal value of the equity rises by 1/(1-b) percentage points where b is the debt to capital ratio. With b = 0.4 and an effective marginal tax on nominal capital gains of $\theta_g = 0.1$, a two percentage point decline in the rate of inflation raises the real after tax rate of return on equity

[18]This ignores individual investments in government debt. Bank deposits backed by noncorporate bank assets (e.g., home mortgages) can be ignored as being within the household sector.

by θ_g $[1/(1-b)]d\pi = 0.0033$ or 0.33 percentage points. However, since equity represents only 60 percent of the individuals' portfolio, the lower effective capital gains tax raises the overall rate of return by only 60 percent of this 0.33 percentage points or 0.20 percentage points.[19]

Combining the debt and capital gains effects implies that reducing the inflation rate by two percentage points reduces the effective tax rate at the individual investor level by the equivalent of 0.40 percentage points. The real net return to the individual saver is thus 4.54 percent, up 0.49 percentage points from the return when the inflation rate is two percentage points higher. The implied price of retirement consumption is $p_1 = (1.0454)^{-30} = 0.264$.

Substituting these values for the price of retirement consumption into equation 4 implies[20]

(5) $$G_1 = 0.092\ S_2\ (1 - \eta_{Sp} - \sigma).$$

1.1.2 *The Saving Rate and Saving Behavior*

The value of S_2 in equation 5 represents the saving during preretirement years at the existing rate of inflation. This is, of course, different from the national income account measure

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[19]The assumption that the share of debt in the individuals' portfolio is the same as the share of debt in corporate capital causes the 1/(1-b) term to drop out of the calculation. More generally, the effect of inflation on the individuals' rate of return depends on the difference between the shares of debt in corporate capital and in the individuals portfolios.

[20]To test the sensitivity of this result to the assumption about the pretax return and the effective corporate tax rate, I recalculated the retirement consumption prices using alternatives to the assumed values of 9.2 percent for the pretax return and 0.41 for the combined effective corporate tax rate. Raising the pretax rate of return from 9.2 percent to 10 percent only changed the deadweight loss value in equation 5 from 0.092 to 0.096; lowering the pretax rate of return from 9.2 percent to 8.4 percent lowered the deadweight loss value to 0.090. Increasing the effective corporate tax rate from 0.41 to 0.50 with a pretax return of 9.2 only shifted the deadweight loss value in equation 5 from 0.092 to 0.096. These calculations confirm that the effect of changing the equilibrium inflation rate is not sensitive to the precise values assumed for the pretax rate of return and the effective baseline tax rate.

of personal saving since personal saving is the difference between the saving of the younger savers and the dissaving of retired dissavers.

One strategy for approximating the value of S_2 is to use the relation between S_2 and the national income account measure of personal saving in an economy in steady state growth. In the simple overlapping generations model with saving proportional to income, saving grows at a rate of n + g where n is the rate of population growth and g is the growth in per capita wages. This implies that the saving of the young savers is $(1+n+g)^T$ times the dissaving of the older dissavers.[21]

Thus net personal saving (S_N) in the economy is related to the saving of the young (S_y) according to:

$$(6) \qquad S_N = S_y - (1+n+g)^{-T} S_y .$$

The value of S_2 that we need is conceptually equivalent to S_y. Real aggregate wage income grew in the United States at a rate of 2.6 percent between 1960 and 1994. Using $n + g = 0.026$ and $T = 30$ implies that $S_y = 1.86\, S_N$. If we take personal saving to be approximately 5 percent of GDP[22], this implies that $S_2 = 0.09$ GDP.[23]

If the propensity to save out of exogenous income (σ) is the same as the propensity to

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[21]Note that the spending of the older retirees includes both the dissaving of their earlier saving and the income that they have earned on their saving. Net personal saving is only the difference between the saving of the savers and the dissaving of the dissavers.

[22] Some personal saving is of course exempt from personal income taxation, particularly savings in the form of pensions, IRAs and life insurance. What matters however for deadweight loss calculations is the full volume of saving and not just the part of it that is subject to current taxes. Equivalently, the deadweight loss of any distortionary tax depends on the marginal tax rate even if some of the consumption of the taxed good is exempt from tax or is taxed at a lower rate.

[23]This framework can be extended to recognize that the length of the work period is roughly twice as long as the length of the retirement period without appreciably changing this result.

save out of wage income, $\sigma = S_2 / (\alpha * GDP)$ where α is the share of wages in GDP. With $\alpha =$ 0.75, this implies $\sigma = 0.12$.

The final term to be evaluated in order to calculate the welfare gain described in equation 5 is the elasticity of saving with respect to the price of retirement consumption. Since the price of retirement consumption is given by $p = (1+r)^{-T}$, the uncompensated elasticity of savings with respect to the price of retirement consumption can be restated as an elasticity with respect to the real rate of return: $\eta_{Sr} = -rT\, \eta_{Sp}/(1+r)$. Thus equation 5 becomes

(7) $G_1 = 0.092\ S_2\ (1 + (1+r)\, \eta_{Sr}/rT - \sigma)$.

Estimating the elasticity of saving with respect to the real net rate of return has proven to be very difficult because of the problems involved in measuring changes in expected real net-of-tax returns and in holding constant in the time series data the other factors that affect savings. The large literature on this subject generally finds that a higher real rate of return either raises the saving rate or has no affect at all.[24] In their classic study of the welfare costs of U.S. taxes, Ballard, Shoven and Whalley (1985) assumed a saving elasticity of $\eta_{Sr} = 0.40$. I will take this as the benchmark value for the current study. In this case, equation 7 implies (with $r = 0.04$)

(8) $G_1 = 0.092\ S_2\ (1 + (1+r)\, \eta_{Sr}/rT - \sigma)$.

$= 0.092\ (0.09)\ (1 + 0.42/1.2 - 0.12)\ GDP = 0.0102\ GDP$,

The annual gain from reduced distortion of consumption is equal to 1.02 percent of GDP. This figure is shown in the first row of Table 1.

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[24]See among others Blinder (1975), Boskin (1978), Evans (1983), Feldstein (1995b), Hall (1987), Makin (1987), Mankiw (1987) and Wright (1969).

To assess the sensitivity of this estimate to the value of η_{Sr}, I will also examine two other values. The limiting case in which changes in real interest rates have no effect on saving, i.e., that $\eta_{Sr} = 0$, implies:[25]

(9) $G_1 = 0.092 \ S_2 \ (1 + (1+r) \eta_{Sr} / rT - \sigma).$

$= 0.092 \ (0.09) (1 - .12) \text{ GDP} = 0.0073 \text{ GDP},$

i.e., an annual welfare gain equal to 0.73 percentage points of GDP.

If we assume instead that $\eta_{Sr} = 1.0$, i.e., that increasing the real rate of return from 4.0 percent to 4.5 percent (the estimated effect of dropping the inflation rate from two percent to zero) raises the saving rate 9 percent to 10.1 percent, the welfare gain is $G_1 = 0.0144$ GDP.

These calculations suggest that the traditional welfare effect on the timing of consumption of reducing the inflation rate from two percent to zero is probably bounded between 0.73 percentage points of GDP and 1.44 percent of GDP. These figures are shown in the second and third rows of Table 1.

1.2 *The Revenue Effects of a Lower Inflation Rate Causing a Lower Effective Tax on Investment Income*

As I noted earlier, the traditional assumption in welfare calculations and the one that is implicit in the calculation of section 1.1, is that any revenue effect can be offset by lump sum taxes and transfers. When this is not true, as it clearly is not in the U.S. economy, an increase in tax revenue has a further welfare advantage because it permits reduction in other distortionary taxes

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[25]This is a limiting case in the sense that empirical estimates of η_{Sr} are almost always positive. In theory of course it is possible that $\eta_{Sr} < 0$.

while a loss of tax revenue implies a welfare cost of using other distortionary taxes to replace the lost revenue. The present section calculates the effect on tax revenue paid by the initial generation of having price stability rather than a two percent inflation rate and discusses the corresponding effect on economic welfare.

Reducing the equilibrium rate of inflation raises the real return to savers and therefore reduces the price of retirement consumption. The effect of this on government revenue depends on the change in retirement consumption. Calculating how the higher real net return on saving affects tax revenue requires estimating how individuals' respond to the higher return. In particular, it requires deciding whether the individuals look ahead and take into account the fact that the government will have to raise some other revenue (or reduce spending) to offset the lower revenue collected on the income from savings.

I believe that the most plausible specification assumes that individuals recognize the real after-tax rate of return that they face but that those individuals do not take into account the fact that the government will in the future have to raise other taxes to offset the revenue loss that results from the lower effective tax on investment income. They in effect act as if "someone else" (the next generation?) will pay the tax to balance the loss of tax revenue that results from the lower inflation rate. This implies that the response of saving that is used to calculate the revenue effect of lower inflation should be the uncompensated elasticity of savings with respect to the net rate of return (η_{Sr}.)[26]

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[26]If individuals believed that they faced a future tax liability to replace the revenue that the government loses because of the decline in the effective tax rate, the savings response would be estimated by using the compensated elasticity. This was the assumption made in the earlier version of these calculations presented in Feldstein (1996).

At the initial level of retirement consumption, reducing the price of future consumption from p_2 to p_1 reduces revenue (evaluated as of the initial time) by $(p_2 - p_1) C_2$. If the fall in the price of retirement consumption causes retirement consumption to increase from C_2 to C_1, the government collects additional revenue equal to $(p_1 - p_0)(C_1 - C_2)$. Even if $C_2 < C_1$, the overall net effect on revenue, $(p_1 - p_0)(C_1 - C_2) - (p_2 - p_1) C_2$, can in theory be either positive or negative.

In the present case, the change in revenue can be calculated as:

$$(10) \quad d\,REV = (p_1 - p_0)(C_1 - C_2) - (p_2 - p_1) C_2$$

$$= (p_1 - p_0)(dC/dp)(p_1 - p_2) - (p_2 - p_1) C_2$$

$$= (p_1 - p_0)(p_1 - p_2)(dC/dp)(p_2 / C_2)(C_2 / p_2) - (p_2 - p_1) C_2$$

$$= (p_1 - p_0)(p_1 - p_2)\, \eta_{Cp} (C_2 / p_2) - (p_2 - p_1) C_2$$

Replacing $p_2 C_2$ by S_2 and recalling from equation (3) that $\eta_{Cp} = \eta_{Sp} - 1$ yields

$$(11) \quad d\,REV = S_2 \{[(p_1 - p_0) / p_2)] [(p_2 - p_1) / p_2)](1 - \eta_{Sp}) - (p_2 - p_1)/p_2 \}.$$

Substituting the prices derived in the previous section (p_0=0.071; p_1 = 0.264; and p_2=0.304) implies

$$(12) \quad d\,REV = S_2 \{0.0836 (1 - \eta_{Sp}) - 0.1316\}$$

$$= S_2 \{0.0836 (1 + (1+r)\, \eta_{Sr} / rT) - 0.1316\}.$$

The benchmark case of $\eta_{Sr} = 0.4$ implies dREV = – 0.019 S_2 or, with S_2 = 0.09 GDP as derived above, dREV = – 0.0017 GDP.

The limiting case of $\eta_{Sr} = 0$ implies dREV = – 0.0043 GDP while $\eta_{Sr} = 1.0$ implies d REV = 0.0022 GDP.

Thus, depending on the elasticity of saving with respect to the rate of interest, the revenue effect of shifting from two percent inflation to price stability can be either negative or positive.

1.3 *The Welfare Gain from the Effects of Reduced Inflation on Consumption Timing*

We can now combine the traditional welfare gain (G_1 of equations 8 and 9) with the welfare consequences of the revenue change (dREV of equations 11 and 12). If each dollar of revenue that must be raised from other taxes involves a deadweight loss of λ, the net welfare gain of shifting from two percent inflation to price stability is

(13a) $G_2 = [0.0102 - \mathbf{0.0017}\ \lambda]$ GDP if $\eta_{Sr} = 0.4$.

Similarly,

(13b) $G_2 = [0.0073 - \mathbf{0.0043}\ \lambda]$ GDP if $\eta_{Sr} = 0$

and

(13c) $G_2 = [0.0144 + 0.0022\ \lambda]$ GDP if $\eta_{Sr} = 1.0$.

The value of λ depends on the change in taxes that is used to adjust to changes in revenue. Ballard, Shoven and Whalley (1985) used a computable general equilibrium model to calculate the effect of increasing all taxes in the same proportion and concluded that the deadweight loss per dollar of revenue was between 30 cents and 55 cents, depending on parameter assumptions. I will represent this range by $\lambda = 0.40$. Using this implies that the net welfare gain of reducing inflation from two percent to zero equals 0.95 percent of GDP in the benchmark case of $\eta_{Sr} = 0.4$. The welfare effect of reduced revenue (-0.07 percent of GDP) is shown in the second column of Table 1 and the combined welfare effect of 0.95 percent of GDP is shown in column 4 of Table 1.

In the other two limiting cases, the net welfare gain corresponding to $\lambda = 0.4$ are 0.56 percent of GDP with $\eta_{Sr} = 0$ and 1.53 percent of GDP with $\eta_{Sr} = 1.0$. These are shown in the second and third rows of column 4 of Table 1.

The analysis of Ballard et. al.(1985) estimates the deadweight loss of higher tax rates on the basis of the distortion in labor supply and saving. No account is taken of the effect of higher tax rates on tax avoidance through spending on deductible items or receiving income in nontaxable forms (fringe benefits, nicer working conditions, etc.). In a recent paper (Feldstein, 1995c), I showed that these forms of tax avoidance as well as the traditional reduction of earned income can be included in the calculation of the deadweight loss of changes in income tax rates by using the compensated elasticity of taxable income with respect to the net of tax rate. Based on an analysis of the experience of high income taxpayers before and after the 1986 tax rate reductions, I estimated that elasticity to be 1.04 (Feldstein, 1995d). Using this elasticity in the NBER TAXSIM model, I then estimated that a ten percent increase in all individual income tax rates would cause a deadweight loss of about $44 billion at 1994 income levels; since the corresponding revenue increase would be $21 billion, the implied value of λ is $\lambda = 2.06$.

A subsequent study (Feldstein and Feenberg, 1995) based on the 1993 tax rate increases suggests a somewhat smaller compensated elasticity of about 0.83 instead of the 1.04 value derived in the earlier study. Although this difference may reflect the fact that the 1993 study is based on the experience during the first year only, I will be conservative and assume a lower deadweight loss value of $\lambda = 1.5$.

With $\lambda = 1.5$, equations 13a through 13c imply a wider range of welfare gain estimates: reducing inflation from two percent to zero increases the annual level of welfare by 0.63 percent of GDP in the benchmark case of $\eta_{Sr} = 0.4$. With $\eta_{Sr} = 0$, the net effect is a very small gain of 0.08 percent of GDP while with $\eta_{Sr} = 1.0$ the net effect is a substantial gain of 1.77 percent of GDP. These values are shown in columns three and five of Table 1.

These are of course just the annual effects of inflation on savers' intertemporal allocation of consumption. Before turning to the other effects of inflation, it is useful to say a brief word about nonsavers.

1.4 *Nonsavers*

A striking fact about American households is that a large fraction of households have no financial assets at all. Almost 20 percent of U.S. households with heads aged 55 to 64 had no net financial assets at all in 1991 and 50 percent of such households had assets under $8,300; these figures exclude mortgage obligations from financial liabilities.

The absence of substantial saving does not imply that individuals are irrational or unconcerned with the need to finance retirement consumption. Since Social Security benefits replace more than two-thirds of after tax income for a worker who has had median lifetime earnings and many employees can anticipate private pension payments in addition to Social Security, the absence of additional financial assets may be consistent with rational life-cycle behavior. For these individuals, zero saving represents a constrained optimum.[27]

In the presence of private pensions and social security, the shift from low inflation to price

[27]The observed small financial balances of such individuals may be precautionary balances or merely transitory funds that will soon be spent. It would be desirable to refine the calculations of this section to recognize that some of the annual national income account savings are for precautionary purposes. Since there is no satisfactory closed form expression relating the demand for precautionary saving to the rate of interest, I have not pursued that calculation further.

stability may cause some of these households to save and that increase in saving may increase their welfare and raise total tax revenue. Since the welfare gain calculated that I reported earlier in this section is proportional to the amount of saving by pre-retirement workers, it ignores the potential gain to current nonsavers.

Although the large number of nonsavers and their high aggregate income imply that this effect could be important, I have no way to judge how the increased rate of return would actually affect behavior. I therefore leave this out of the calculations, only noting that it implies that my estimate of the gain from lower inflation is to this extent undervalued.

1.5 *The Relation Between Observed Saving Behavior and the Compensated Elasticity*

Section 1.1 estimate the compensated elasticity of demand for retirement consumption with respect to its price in terms of foregone preretirement consumption (ε_{cp}) from the relation between the "observable" elasticity of saving with respect to the net of tax rate (η_{sr})and the value of ε_{cp} implied by utility theory in a life cycle model. More specifically, the analysis uses a life cycle model in which income is received in the first period of life and is used to finance consumption during those years and during retirement.

This is of course not equivalent to assuming that all income is received at the <u>beginning</u> of the working years. The assumption in the calculations is that the time between the receipt of earnings and the time when retirement consumption takes place is T = 30 years, essentially treating income as if it occurs in the middle of the working life at age 45 and dissaving as if it occurs in the middle of the retirement years at age 75. These may be reasonable approximations to the "centers of gravity" of these life cycle phases.

It can be argued, however, that many individuals also receive a significant amount of exogenous income during retirement (social security benefits) and that taking this into account changes the relation between the "observed" η_{sr} and the implied value of ε_{cp}. In thinking about this, it is important to think about the group in the population that generates the deadweight losses that we are calculating. This group excludes those who do no private saving and depend just on their social security retirement benefits to finance retirement consumption. More generally, in deciding on the importance of social security benefits relative to retirement consumption (the key parameter in the adjustment calculation that follows), we should think about a "weighted average" with weights proportional to the amount of regular saving that the individuals do. This implies a much lower value of benefits relative to retirement consumption than would be obtained by an unweighted average for the population as a whole. I have not done such a calculation but think that an estimate of social security benefits being 25 percent of total retirement consumption may be appropriate for this purpose.

To see how this would affect the results, we use the basic Slutsky equation ($\varepsilon_{cp} = \eta_{cp} + \sigma$ where ε_{cp} is the compensated elasticity of retirement consumption with respect to its price in terms of foregone consumption during working years, η_{cp} is the corresponding uncompensated elasticity and σ is the propensity to save) and the retirement period budget constraint © = S/p + B where C is the retirement consumption, S is the saving during working years, p is the price of retirement consumption in terms of foregone consumption during the working years, and B is social security benefits.) Taking derivatives of the retirement period budget constraint with respect to the price of retirement consumption implies $[(C-B)/C]\ \eta_{sp} = \eta_{cp} + [(C-B)/C]$.[28]

[28]When there are no social security benefits, this reduces to the familiar relation $\eta_{sp} = \eta_{cp} + 1$.

Combining this with the Slutsky equation implies $\varepsilon_{cp} = [(C-B)/C] [\eta_{sp} - 1] + \sigma$.

Shifting from the price elasticity to the interest rate elasticity using $\eta_{sp} = - (1 + r) \eta_{sr} / rT$ leads finally to

$$-\varepsilon_{cp} = [(C-B)/C] [(1 + r) \eta_{sr} / rT + 1] - \sigma .$$

To see how taking this exogenous income into account alters the implied estimate of ε_{cp}, consider the following values based on the standard assumptions that r = 0.04, T = 30 and σ = 0.12:

Benefit to Consumption Ratio	Implied value of $-\varepsilon_{cp}$ with $\eta_{sr} = 0$	Implied value of $-\varepsilon_{cp}$ with $\eta_{sr} = 0.4$
zero	0.88	1.227
0.25	0.63	0.89

Thus the assumption that the individual receives exogenous income during retirement that finances twenty five percent of retirement consumption reduces the implied value of the compensated elasticity of demand by about one-fourth.

This reduces the implied welfare gain in one category of Table 1, the Direct Effect of Reduced Consumption Distortion. To see the magnitude of this reduction, rewrite equation 7 as

(7') $G_1 = 0.092 \; S_2 \{[(C-B)/C] [1 + (1+r) \eta_{Sr} /rT] - \sigma \}$.

With B/C = 0.25 and $\eta_{Sr} = 0.4$, this implies $G_1 = 0.0074$ GDP instead of the value of 0.0102 GDP obtained for B = 0. Similarly, with $\eta_{Sr} = 0$ the value of G_1 declines from 0.0073 GDP to 0.0052 GDP while with $\eta_{Sr} = 1$ the decline is from 0.0144 GDP to 0.0106 GDP. These results are summarized in Table 2 which corresponds to the three summary lines at the bottom of Table 1.

Table 2

The Net Welfare Effect of Reducing Inflation with Exogenous Retirement Income*
(Changes as percent of GDP)

Source of Change		Direct Effect of Reduced Distortion	Welfare Effect of Revenue Change		Total Effect	
			$\lambda = 0.4$	$\lambda = 1.5$	$\lambda = 0.4$	$\lambda = 1.5$
Totals	η_{Sr} **= 0.4**	**0.86**	**– 0.10**	**– 0.38**	**0.76**	**0.48**
	$\eta_{Sr} = 0$:	0.64	– 0.20	– 0.76	0.44	-0.12
	$\eta_{Sr} = 1.0$:	1.18	0.06	0.21	1.24	1.39

* Calculations relate to reducing inflation from two percent to price stability (i.e., from a four percent annual increase in the CPI to a two percent annual increase.)

The exogenous retirement income is 25 percent of retirement consumption among the relevant group of individual savers.

2. Inflationary Distortion of the Demand for Owner Occupied Housing[29]

Owner occupied housing receives special treatment under the personal income tax. Mortgage interest payments and local property taxes are deducted but no tax is imposed on the implicit "rental" return on the capital invested in the property. This treatment would induce too much consumption of housing services even in the absence of inflation.

Inflation reduces the cost of owner occupied housing services in two ways. The one that has been the focus of the literature on this subject (e.g., Rosen, 1985) is the increased deduction of the nominal mortgage interest payments. Since the real rate remains unchanged while the tax deduction increases, the subsidy increases and the net cost of housing services declines. In

[29]This section benefits from the analysis in Poterba (1984 and 1992) but differs from the framework used there in a number of ways.

addition, inflation increases the demand for owner occupied housing by reducing the return on investments in the debt and equity of corporations.

Reducing the rate of inflation therefore reduces the deadweight loss that results from excessive demand for housing services. In addition, a lower inflation rate reduces the loss of tax revenue; if raising revenue involves a deadweight loss, this reduction in the loss of tax revenue to the housing subsidy provides an additional welfare gain.

2.1 *The Welfare Gain from Reduced Distortion of Housing Consumption*

In the absence of taxes, the implied rental cost of housing per dollar of housing capital (R_0) reflects the opportunity cost of the resources:

(14) $$R_0 = \rho + m + \delta$$

where ρ is the real return on capital in the nonhousing sector, m is the cost of maintenance per dollar of housing capital and δ is the rate of depreciation. With $\rho = 0.092$ (the average pretax real rate of return on capital in the nonfinancial corporate sector between 1960 and 1994), $m = 0.02$ and $\delta = 0.02$,[30] $R_0 = 0.132$; the rental cost of owner occupied housing would be 13.2 cents per dollar of housing capital.

Consider in contrast the corresponding implied rental cost per dollar of housing capital under the existing tax rules for a couple who itemize their tax return:

(15) $$RI = \mu\,(1-\theta)\,i_m + (1-\mu)(r_n + \pi) + (1-\theta)\,\tau_p + m + \delta - \pi$$

where RI indicates that it is the rental cost of an itemizer; μ is the ratio of the mortgage to the value of the house; θ is the marginal income tax rate; i_m is the interest rate paid on the mortgage;

[30] These values of m and δ are from Poterba (1992).

r_n is the real net rate of return available on portfolio investments; τ_p is the rate of property tax;[31] m and δ are as defined above; and π is the rate of inflation (assumed to be the same for goods in general and for house prices). This equation says that the annual cost of owning a dollar's worth of housing is the sum of the net of tax mortgage interest payments $\mu [(1-\theta) i_m]$ plus the opportunity cost of the equity invested in the house $[(1 - \mu) (r_n + \pi)]$ plus the local property tax reduced by the value of the corresponding tax deduction $[(1-\theta) \tau_p]$ plus the maintenance [m] and depreciation $[\delta]$ less the inflationary gain on the property $[\pi]$.

In 1991, the year for which other data on housing used in this section were derived, the rate on conventional mortgages was $i_m = 0.072$ and the rate of inflation was $\pi = 0.01$.[32] The assumption that $d\, i_m / d\pi = 1$ implies that i_m would be 0.082 at an inflation rate of $\pi = 0.02$.[33] Section 2 derived a value of $r_n = 0.0405$ for the real net return on a portfolio of debt and equity securities when $\pi = 0.02$. With a typical mortgage-to-value ratio among itemizers of $\mu = 0.5$,[34] a marginal tax rate of $\theta = 0.25$, a property tax rate of $\tau_p = 0.025$, $m = 0.02$ and $\delta = 0.02$, the rental cost per dollar of housing capital for an itemizer when the inflation rate is two percent is

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[31]Following Poterba (1992) I assume that $\tau_p = 0.025$.

[32]The CPI rose by 3.1 percent from December 1990 to December 1991, implying a "true" inflation rate of 1.1 percent. While previous rates were higher, subsequent inflation rates have been lower.

[33]The assumption that $di/d\pi = 1$ is the same assumption made in section 2. See footnote 24 above for the reason that I use this approximation.

[34]The relevant μ ratio is not that on new mortgages or on the overall stock of all mortgages but on the stock of mortgages of itemizing taxpayers. The Balance Sheets for the US Economy indicate that the ratio of home mortgage debt to the value of owner-occupied real estate has increased to 43 percent in 1994. I use a higher value to reflect the fact that not all homeowners are itemizers and that those who do itemize are likely to have higher mortgage-to-ague rations. The results of this section are not sensitive to the precise level of this parameter.

$RI_2 = 0.0998$. Thus the combination of the tax rules and a two percent inflation rate reduces the rental cost from 13.2 cents per dollar of housing capital to 9.98 cents per dollar of housing capital.

Consider now the effect of a decrease in the rate of inflation on this implicit rental cost of owner occupied housing:

(16) $dRI/d\pi = \mu (1-\theta) di_m / d\pi + (1-\mu) d(r_n + \pi) / d\pi - 1.$

Section 4 showed that if each percentage point increase in the rate of inflation raises the rate of interest by one percentage point, the real net rate of return on a portfolio of corporate equity and debt decreases from $r_n = 0.0454$ at $\pi = 0$ to $r_n = 0.0405$ at $\pi = 0.02$, i.e., $dr_n / d\pi = -0.245$ and $d(r_n + \pi) / d\pi = 0.755$. Thus with $\theta = 0.25$, $dRI/d\pi = 0.75\mu + 0.755(1-\mu) - 1$. For an itemizing homeowner with a mortgage to value ratio of $\mu = 0.5$, $dRI/d\pi = -0.25$. Since $RI_2 = 0.0998$ at two percent inflation, $dRI/d\pi = -0.25$ implies that $RI_1 = 0.1048$ at zero inflation. The lower rate of inflation implies a higher rental cost per unit of housing capital and therefore a smaller distortion.

Before calculating the deadweight loss effects of the reduced inflation, it is necessary to derive the corresponding expressions for homeowners who do not itemize their deductions. For such nonitemizers mortgage interest payments and the property tax payments are no longer tax deductible, implying that[35]

(17) $RN = \mu i_m + (1-\mu)(r_n + \pi) + \tau_p + m + \delta - \pi.$

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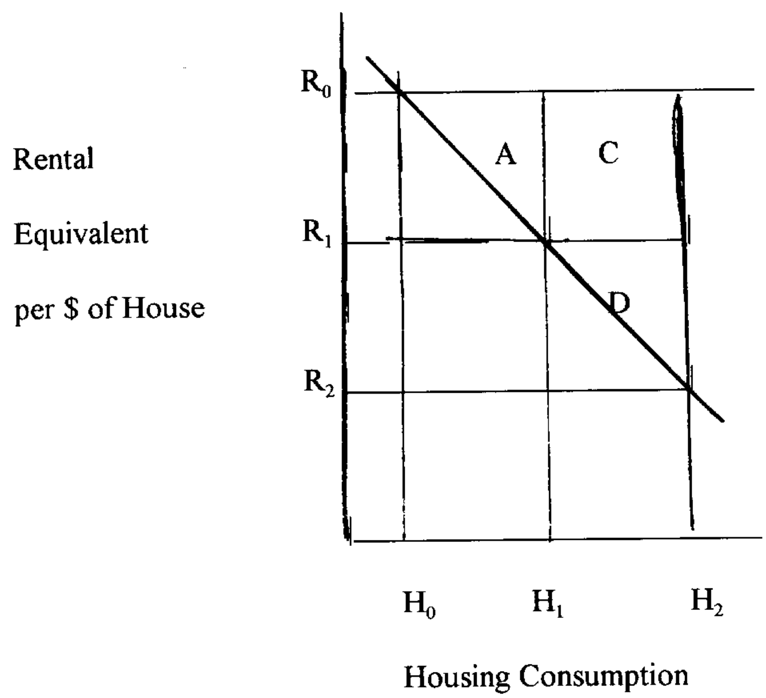
[35]This formulation assumes that taxpayers who do not itemize mortgage deductions do not itemize at all and therefore do not deduct property tax payments. Some taxpayers may in fact itemize property tax deductions even though they no longer have a mortgage.

The parametric assumptions made for itemizers, modified only by assuming a lower mortgage to value ratio among nonitemizers of $\mu = 0.2$, implies $RN_2 = 0.1098$ and $RN_1 = 0.1137$. Both values are higher than the corresponding values for itemizers but both imply substantial distortions that are reduced when the rate of inflation declines from two percent to zero.

Figure 2 shows the nature of the welfare gain from reducing inflation for taxpayers who itemize. The figure presents the compensated demand curve relating the quantity of housing capital demanded to the rental cost of such housing. With no taxes, $R_0 = 0.132$ and the amount

Figure 2: Homeownership Investment



of housing demanded is H_0. The combination of the existing tax rules at zero inflation reduces the rental cost to $RI_1 = 0.1048$ and increases housing demand to H_1. Since the real pretax cost of providing housing capital is R_0, the tax-inflation combination implies a deadweight loss shown by area A, i.e., the area between the cost of providing the additional housing and the demand curve. A rise in inflation to two percent reduces the rental cost of housing further to RI_2 = 0.0998 and increases the demand for housing to H_2. The additional deadweight loss is the area C + D between the real pretax cost of providing the increased housing and the value to the users as represented by the demand curve.

Thus, the reduction in the deadweight loss that results from reducing the distortion to housing demand when the inflation rate declines from two percent to zero is

(18) $G_3 = (R_0 - R_1)(H_2 - H_1) + 0.5\,(R_1 - R_2)(H_2 - H_1).$

With a linear approximation,

(19) $G_3 = (R_0 - R_1)(dH/dR)(R_2 - R_1) + 0.5\,(R_1 - R_2)(dH/dR)(R_2 - R_1)$

$= -(R_2/H_2)(dH/dR)\{[(R_0 - R_1)/R_2][(R_1 - R_2)/R_2] + 0.5\,(R_1 - R_2)^2 R_2^{-2}\} R_2 H_2.$

Writing $\varepsilon_{HR} = -(R_2/H_2)(dH/dR)$ for the absolute value of the compensated elasticity of housing demand with respect to the rental price (at the observed values of observed values of R_2 and H_2) and substituting the rental values for an itemizing taxpayer yields

(21) $GI_3 = \varepsilon_{HR}\,\{(0.273)(0.050) + 0.5\,(0.050)^2\}\,RI_2\,HI_2.$

$= 0.0149\,\varepsilon_{HR}\,RI_2\,HI_2.$

a similar calculation for nonitemizing homeowners yields

(22) $GN_3 = 0.0065\,\varepsilon_{HR}\,RN_2\,HN_2.$

Combining these two on the assumption that the compensated elasticities of demand are the same for itemizers and nonitemizers gives the total welfare gain from the reduced distortion of housing demand that results from reducing equilibrium inflation from two percent to zero:

(23) $G_3 = \varepsilon_{HR}$ [0.0149 RI_2 HI_2 + 0.0065 RN_2 HN_2.]

Since the calculations of the rental rates take into account the mortgage to value ratios, the relevant measures of HI_2 and HN_2 are the total market values of the owner occupied housing of itemizers and nonitemizers. In 1991, there were 60 million owner occupied housing units and 25 million taxpayers who itemized mortgage deductions.[36] Since the total 1991 value of owner occupied real estate of $6,440 billion includes more than just single family homes (e.g., two family homes and farms), I take the value of owner occupied homes (including the owner-occupiers' portion of two-family homes) to be $6,000 billion. The Internal Revenue Service reported that the tax revenue reductions in 1991 due to mortgage deductions were $42 billion, implying approximately $160 billion of mortgage deductions and therefore about $2,000 billion of mortgages. The mortgage to value ratio among itemizers of m/v=0.5 implies that the market value of housing owned by itemizers is HI_2 = $4,000 billion. This implies that the value of housing owned by nonitemizers is HN_2 = $2,000 billion.

Substituting these estimates into equation 22 (with $RI_2 = 0.0998$ and $RN_2 = 0.1098$) implies that

(24) G_3 = $7.4 ε_{HR} billion.

Using Rosen's (1985) estimate of $\varepsilon_{HR} = 0.8$ implies that this gain from reducing the inflation rate is $5.9 billion at 1991 levels. Since the 1991 GDP was $5,723 billion, this gain is 0.10 percent of

[36] The difference between these two figures reflects the fact that many homeowners do not itemize mortgage deductions (because they have such small mortgages that they benefit more from using the standard deduction or have no mortgage at all) and that many homeowners own more than one residence.

GDP.

2.2 *The Revenue Effects of Lower Inflation on the Subsidy to Owner Occupied Housing*

The G_3 gain is based on the traditional assumption that changes in tax revenue do not affect economic welfare because they can be offset by other lump sum taxes and transfers. The more realistic assumption that increases in tax revenue permit reductions in other distortionary taxes implies that it is important to calculate also the reduced tax subsidy to housing that results from a lower rate of inflation.

The magnitude of the revenue change depends on the extent to which the reduction in inflation shifts capital from owner occupied housing to the business sector. To estimate this I use the compensated elasticity of housing with respect to the implicit rental value,[37] $\varepsilon_{HR} = 0.8$. The 5 percent increase in the rental price of owner occupied housing for itemizers from $RI_2 = 0.0998$ at $\pi = 0.02$ to $RI_1 = 0.1048$ at zero inflation implies a 4 percent decline in the equilibrium stock of owner-occupied housing, from \$4,000 billion to \$3,840 billion (at 1991 levels). Similarly, for nonitemizers, the 3.6 percent increase in the rental price from $RN_2 = 0.1098$ at $\pi = 0.02$ to $RN_1 = 0.1137$ at zero inflation implies a 2.9 percent decline in their equilibrium stock of owner-occupied housing, from \$2,000 billion to \$1,942 billion (at 1991 levels).

Consider first the reduced subsidy on the \$3,840 billion of remaining housing stock owned

[37]The use of the compensated elasticity is a conservative choice in the sense that the uncompensated elasticity would imply that reduced inflation causes a larger shift of capital out of housing and therefore a larger revenue gain for the government. The compensated elasticity is appropriate because other taxes are adjusted concurrently to keep total revenue constant. This is different from the revenue effect of the tax on saving where the revenue loss takes place in the future and can plausibly be assumed to be ignored by taxpayers at the earlier time when they are making their consumption and saving decisions.

by itemizing taxpayers. Maintaining the assumption of a mortgage to value ratio of $\mu = 0.5$ implies total mortgages of $1,920 billion on this housing capital. The two percentage point decline in the rate of inflation reduces mortgage interest payments by $38.4 billion and, assuming a 25 percent marginal tax rate, increases tax revenue by $9.6 billion.

The shift of capital from owner occupied housing to the business sector affects revenue in three ways. First, the itemizers lose the mortgage deduction and property tax deduction on the $160 billion of reduced housing capital. The reduced capital corresponds to mortgages of $80 billion and, at the initial inflation rate of two percent, of mortgage interest deductions of 8.2 percent of this $80 billion or $6.6 billion. The reduced stock of owner occupied housing also reduces property tax deductions by 2.5 percent of $160 billion of foregone housing, or $4 billion. Combining these two reductions in itemized deductions ($10.6 billion) and applying a marginal tax rate of 25 percent implies a revenue gain of $2.6 billion.

Second, the increased capital in the business sector ($160 billion from itemizers plus $58 billion from nonitemizers) earns a pretax return of 9.2 percent but provides a net-of-tax yield to investors of only 4.54 percent when the inflation rate is zero. The difference is the tax collections of 4.66 percent on the additional $218 billion of business capital or $10.2 billion of additional revenue.

Third, the reduced housing capital causes a loss of property tax revenue equal to 2.5 percent of the $218 billion reduction in housing capital or $5.4 billion.

Combining these three effects on revenue implies a net revenue gain of $16.9 billion or 0.30 percent of GDP (at 1991 levels).

2.3 *The Welfare Gain from the Housing Sector Effects of Reduced Equilibrium Inflation*

The total welfare gain from the effects of lower equilibrium inflation on the housing sector is the sum of (1) the traditional welfare gain from the reduced distortion to housing consumption, 0.10 percent of GDP; and (2) the welfare consequences of the $16.9 billion revenue gain, a revenue gain of 0.30 percent of GDP. If each dollar of revenue raised from other taxes involves a deadweight loss of λ, this total welfare gain of shifting from four percent inflation to two percent inflation is

(24) $G_4 = [0.0010 + .0030\,\lambda]\,GDP.$

The conservative Ballard, Shoven and Whalley (1985) estimate of $\lambda = 0.4$ implies that the total welfare gain of reducing inflation from two percent to zero is 0.22 percent of GDP. With the value of $\lambda = 1.5$ implied by the behavioral estimates for the effect of an across the board increase in all personal income tax rates, the total welfare gain of reducing inflation from two percent to zero is 0.55 percent of GDP. These are shown in row 4 of Table 1.

Before combing this with the gain from the change in the taxation of savings and comparing the sum to the cost of reducing inflation, I turn to two other ways in which a lower equilibrium rate of inflation affects economic welfare through the government's budget constraint.

3. Seigniorage and the Distortion of Money Demand

An increase in inflation raises the cost of holding non-interest-bearing money balances and therefore reduces the demand for such balances below the optimal level. Although the resulting deadweight loss of inflation has been the primary focus of the literature on the welfare effects of inflation since Bailey's (1956) pioneering paper, the effect on money demand of reducing the inflation rate from two percent to zero is small relative to the other effects that have been discussed in this paper.[38]

This section follows the framework of sections 1 and 2 by looking first at the distortion of demand for money and then at the revenue consequences of the inflation "tax" on the holding of money balances.

3.1 *The Welfare Effects of Distorting the Demand for Money*

As Milton Friedman (1969) has noted, since there is no real cost to increasing the quantity of money, the optimal inflation rate is such that it completely eliminates the cost to the individual of holding money balances, i.e., the inflation rate should be such that the nominal interest rate is zero. In an economy with no taxes on capital income, the optimal inflation rate would therefore be the negative of the real rate of return on capital: $\pi^* = -\rho$. More generally, if we recognize the existence of taxes, the optimal inflation rate is such that the nominal after-tax return on alternative financial assets is zero.

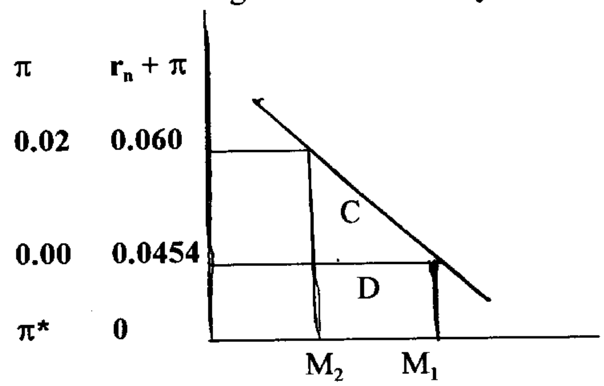
Recall that at $\pi = 0.02$ the real net return on the debt-equity portfolio is $r_n = 0.0405$ and that $dr_n / d\pi = -0.245$. The optimal inflation rate in this context is such that $r_n + \pi = 0$.[39] Figure 3 illustrates the reduction in the deadweight loss that results if the inflation rate is reduced

[38]Although the annual effect is extremely small, it is a perpetual effect. As I argued in Feldstein (1979), in a growing economy a perpetual gain of even a very small fraction of GDP may outweigh the cost of reducing inflation if the appropriate discount rate is low enough relative to the rate of aggregate economic growth. In the context of the current paper, however, the welfare effect of the reduction in money demand is very small relative to the welfare effects that occur because of the interaction of inflation and the tax laws.

[39]If $dr_n / d\pi$ remains constant, the optimal rate of inflation is $\pi^* = -0.060$. Although this assumption of linearity may not be appropriate over the entire range, the basic property that $r_n > \pi^* > -\rho$ is likely to remain valid in a more exact calculation, reflecting the interaction between taxes and inflation.

from $\pi = 0.02$ to zero, thereby reducing the opportunity costs of holding money balances from $r_n + \pi = 0.0605$ to the value of r_n at $\pi = 0$, i.e., $r_n = 0.0454$. Since the opportunity cost of supplying money is zero, the welfare gain from reducing inflation is the area C + D between the money demand curve and the zero opportunity cost line:

Figure 3: **Money Demand and Seigniorage**



Money Demand

$$(25) \quad G_5 = 0.0454\,(M_1 - M_2) + 0.5\,(0.0605 - 0.0454)\,(M_1 - M_2)$$

$$= 0.0530\,(M_1 - M_2)$$

$$= -\,0.0530\,[dM/d\,(r_n + \pi)]\,(0.0151)$$

$$= 0.00080\,\varepsilon_M\,M\,(r_n + \pi)^{-1}$$

where ε_M is the elasticity of money demand with respect to the nominal opportunity cost of holding money balances and $r_n + \pi = 0.0605$.

Since the demand deposit component of M1 is now generally interest bearing, non-interest-bearing money is now essentially currency plus bank reserves. In 1994, currency plus reserves were 6.1 percent of GDP. Thus, M = 0.061 GDP. There is a wide range of estimates of the elasticity of money demand, corresponding to different definitions of money and different economic conditions. An estimate of $\varepsilon_M = 0.2$ may be appropriate in the current context with money defined as currency plus bank reserves.[40] With these assumptions, $G_5 = 0.00016$ GDP. Thus even when Friedman's standard for the optimal money supply is used, the deadweight loss due to the distorted demand for money balances is only 0.0002 GDP.

3.2 *The Revenue Effects of Reduced Money Demand*

The decline in inflation affects government revenue in three ways. First, the reduction in the inflation "tax" on money balances results in a loss of seigniorage and therefore an associated welfare loss of raising revenue by other distortionary taxes (Phelps, 1973). In equilibrium, inflation at rate π implies revenue equal to π M. Increasing the inflation rate raises the seigniorage revenue by

$$(26) \quad d\,\text{Seigniorage}/d\pi = M + \pi\,(dM/d\pi)$$

$$= M + \pi\,[dM/d(r_n + \pi)][d(r_n + \pi)/d\pi]$$

$$= M\,\{1 - \varepsilon_M\,[d(r_n + \pi)/d\pi]\,\pi\,(r_n + \pi)^{-1}\}$$

With $M = 0.061$ GDP, $\varepsilon_M = 0.2$, $d(r_n + \pi)/d\pi = 0.755$, $\pi = 0.02$ and $r_n + \pi = 0.0605$, equation 26 implies that $d(\text{Seigniorage})/d\pi = 0.058$ GDP. A decrease of inflation from $\pi = 0.02$ to $\pi = 0$

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[40] In Feldstein (1979) I assumed an elasticity of one-third for non-interest-bearing M1 deposits. I use the lower value now to reflect the fact that the non-interest-bearing money is now just currency plus bank reserves. These are likely to be less interest sensitive than the demand deposit component of M1. The assumption that $\varepsilon_M = 0.2$ when the opportunity cost of holding money balances is approximately 0.06 implies that a one percentage point increase in $r_n + \pi$ reduces M by approximately .2 (0.01)/0.06 = 0.033, a semi-elasticity of 3.3. Since the Cagan (1956) estimates of this semi-elasticity ranged from F = 3 to F = 10, the selection of $\varepsilon_M = 0.2$ In the current context may be quite conservative.

causes a loss of seigniorage of 0.116 percent of GDP.

The corresponding welfare loss is 0.116λ percent of GDP. With $\lambda = 0.4$, the welfare cost of the lost seigniorage is 0.046 percent of GDP. With $\lambda = 1.5$, the welfare cost of the lost seigniorage is 0.174 percent of GDP.

The second revenue effect is the revenue loss that results from shifting capital to money balances from other productive assets. The decrease in business capital is equal to the increase in the money stock, $M_1 - M_2 = [dM/d(r_n + \pi)] (0.0151) = 0.0151 \; \varepsilon_M M (r_n + \pi)^{-1} = 0.30$ percent of GDP. When these assets are invested in business capital, they earn a real pretax return of 9.2 percent but a net of tax return of only 4.54 percent. The difference is the corporate and personal tax payments of 4.66 percent. Applying this to the incremental capital of 0.30 percent of GDP implies a revenue loss of 0.0466(0.30) = 0.014 percent of GDP. The welfare gain from this extra revenue is 0.014λ percent of GDP. With $\lambda = 0.4$, the welfare loss from this source is 0.006 percent of GDP while, with $\lambda = 1.5$, the loss is 0.021 percent of GDP.

The final revenue effect of the change in the demand for money is the result of the government's ability to substitute the increased money balance of $M_1 - M_2$ for interest bearing government debt. Although this is a one time substitution, it reduces government debt service permanently by $r_{ng} (M_1 - M_2)$ where r_{ng} is the real interest rate paid by the government on its outstanding debt net of the tax that it collects on those interest payments. A conservative estimate of r_{ng}, based on the observed 1994 ratio of interest payments to national debt of 0.061, an assumed tax rate of 0.25 and a 1994 inflation rate of 2.7 percent is $r_{ng} = 0.75(0.061) - 0.027 = 0.018$. The reduced debt service cost in perpetuity is thus $0.018 (M_1 - M_2) = 0.000054$ GDP.

The corresponding welfare gains are 0.002 percent of GDP at $\lambda = 0.4$ and 0.008 percent of GDP at $\lambda = 1.5$.

Combining these three effects yields a net welfare loss due to decreased revenue of 0.05 percent of GDP if $\lambda = 0.4$ and of 0.19 percent of GDP if $\lambda = 1.5$.

Although all of the effects that depend on the demand for money are small, the welfare loss from reduced seigniorage revenue is much larger than the welfare gain from the reduced distortion of money demand and the shift of assets to taxpaying business investments. When considering this small reduction in inflation, the Phelps revenue effect dominates the Bailey money demand effect.

4. Debt Service and the Government Budget Constraint

The final effect of reduced inflation that I will consider is the higher real cost of servicing the national debt that results from a reduction in the rate of inflation. This higher debt service cost occurs because inflation leaves the real pretax interest rate on government debt unchanged while the inflation premium is subject to tax at the personal level. A lower inflation rate therefore does not change the pretax cost of debt service but reduces the tax revenue on the government debt payments. This in turn requires a higher level of other distortionary taxes.[41]

To assess the effect of inflation on the net cost of debt service, note that the increase in the outstanding stock of government debt (B) can be written as

(27) $$\Delta B = (r_g + \pi) B + G - T - \theta_i (r_g + \pi) B,$$

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[41]Note that the effect of inflation on business tax revenue (through the tax-inflation interaction on depreciation and corporate debt) has been counted in the above discussion of taxes and saving. This ignores the role of retained earnings and the effect of changes in the mixture of corporate investment on the overall tax revenue.

where $(r_g + \pi)$ is the nominal pretax interest rate of government debt and θ_i is the effective rate of tax on such interest payments. Thus $(r_g + \pi)$ B is the gross interest payment on the government debt and $(1 - \theta_i)(r_g + \pi)$ B is the net interest on that debt. G is all other government spending and T is all tax revenue other than the revenue collected from taxing the interest on government debt.

In equilibrium, the stock of government debt must grow at the same rate as nominal GDP, i.e., $\Delta B = B(n + g + \pi)$ where n is the rate of growth of population and g is the rate of growth per capita output. Combining this equilibrium condition with equation 27 implies

$$(28) \quad T/GDP = G/GDP + [\,(1-\theta_i)\,r_g - n - g - \theta_i\,\pi\,]\,B/GDP.$$

Thus, $d(T/GDP)/\,d\pi = -\,\theta_i\,(B/GDP)$.

Reducing the inflation rate from two percent to zero increases the real cost of debt service (i.e., increases the level of taxes required to maintain the existing debt/GDP ratio) by 0.02 θ_i B. With $\theta_i = 0.25$ and the current debt to GDP ratio of B/GDP = 0.5, the two percentage point reduction would reduce tax revenue by 0.25 percent of GDP and would therefore reduce welfare by 0.25 λ percent of GDP. The welfare cost of increased net debt service is therefore between 0.10 percent of GDP and 0.38 percent of GDP, depending on the value of λ. These figures are shown in row 6 of Table 1.

5. The Net Effect of Lower Inflation on Economic Welfare

Before bringing together the several effects of reduced inflation that have been identified and evaluated in sections 1 through 4, it is useful to comment on some changes in income that should not be counted in evaluating the welfare gain.

First, if lower inflation causes an increase in saving, there will be more retirement consumption. Although it is tempting to count all of this extra income as a benefit of lower inflation, part of it is just a shift along an intertemporal indifference curve. It is only because we start from a second best situation in which taxes distort consumption timing that a shift to more retirement consumption constitutes a gain in well-being. Moreover, it is only this welfare gain and not the portion of the extra income that is just a shift along the indifference curve that should be counted. Section 1.1 correctly counts the welfare gain and does not include the additional retirement income that is just balanced by lower preretirement consumption.

Second, the increase in the capital stock that results if savings rise causes the marginal product of labor to rise and labor incomes to increase. This should not be counted because, at least to a first order approximation, it is balanced by a corresponding decrease in capital income. To see this, consider again the Cobb-Douglas assumption of the previous section ($y = k^b$ and $sy = nk$ where s is the saving rate and n is the growth of population and technology). This implies that $y = (s/n)^{b/(1-b)}$. The level of national income therefore rises in the same proportion as the ratio of the saving rates raised to the power b/(1-b). With $\eta_{sr} = 0.4$, the level of real income in equilibrium rises by a factor of $(1.035)^{.333} = 1.0115$ or by 1.15 percent. This includes both labor and capital income.

Consider first the extra labor income. With a Cobb Douglas technology and a labor coefficient of b = 0.75, the extra labor income (pretax) that results as the increased capital stock raises the marginal product of labor is 75 percent of the 1.15 per cent of GDP or 0.008625 GDP. But now consider what happens to the preexisting capital income as the increased capital intensity drives down the marginal product of capital. That pre-existing capital income was 25 percent of

GDP. Footnote 11 showed that the marginal product of capital falls from 0.0920 to 0.0889. This reduces the pretax capital income on the existing capital stock by 0.0031/0.0920 of its original value, i.e., by (0.0031/0.092)0.25 GDP = 0.00842 GDP. Except for rounding errors, this just balances the extra labor income.

I return now to Table 1 which summarizes the four effects assessed in sections 1 through 4, distinguishing the direct effects of reduced distortion and the indirect effects that occur through the change in revenue. Separate values are given for the alternative savings demand elasticities ($\eta_{Sr} = 0.4$, $\eta_{Sr} = 0$ and $\eta_{Sr} = 1.0$) and for the alternative estimates of the deadweight loss per dollar of revenue raised through alternative distorting taxes ($\lambda = 0.4$ and $\lambda = 1.5$).

These relatively large gains from reduced inflation reflect primarily the fact that the existing system of capital taxation imposes large deadweight losses even in the absence of inflation and that these deadweight losses are exacerbated by inflation.

Reducing these distortions by lowering the rate of inflation produces annual welfare gains of 1.14 percent of GDP in the benchmark saving case where there is a very small positive relation between saving and the real net rate of interest ($\eta_{Sr} = 0.4$). The deadweight loss distortions in the other two cases, also shown at the bottom of column 1, are 0.85 percent of GDP and 1.56 percent of GDP.

The additional welfare effects of changes in revenue, summarized at the bottom of columns 3 and 4) can be either negative or positive but on balance are smaller than the direct effects of reduced distortion. In the benchmark case of $\eta_{Sr} = 0.4$, the total revenue effects reduce welfare but the reductions are relatively small (between – 0.10 at $\lambda = 0.4$ and – 0.38 at $\lambda = 1.5$).

The total welfare effect of reducing inflation from two percent to zero is therefore a gain in the benchmark saving case of between 0.76 percent of GDP a year and 1.04 percent of GDP a year. A higher saving response increases the net gain while a lower saving response reduces it.

If the cost of reducing the inflation rate from two percent to zero is a one-time cumulative loss of six percent of GDP, as Ball's (1995) analysis discussed in section 1 of Feldstein (1996) implies, the estimated gains in the benchmark case would offset this cost within six to eight years. If savings are more responsive, the gain from price stability would offset the cost even more quickly. Only if saving is completely interest inelastic and revenue raising has a high deadweight loss does the estimated total effect imply that the welfare gains would take more than a decade to exceed the lost GDP that is required to achieve price stability. Even in this case, the present value of the annual benefits of eliminating inflation exceeds 10 percent of the initial GDP if the growing benefit stream is discounted by the historic real return on the Standard and Poors portfolio.

6. Summary and Conclusion

The calculations in this paper imply that the interaction of existing tax rules and inflation cause a significant welfare loss in the United States even at a low rate of inflation. More specifically, the analysis implies that shifting the equilibrium rate of inflation from two percent to zero would cause a perpetual welfare gain equal to about one percent of GDP a year. The deadweight loss of two per cent inflation is so large because inflation exacerbates the distortions that would be caused by existing capital income taxes even with price stability.

To assess the desirability of achieving price stability, the gain from eliminating this loss has to be compared to the one-time cost of disinflation. The evidence summarized in Feldstein (1996) implies that the cost of shifting from two percent inflation to price stability is estimated to be about six percent of GDP. Since the one percent of GDP annual welfare gain from price stability continues forever and grows at the same rate as GDP (i.e., at about 2.5 percent a year), the present value of the welfare gain is very large. Discounting the annual gains at the rate that investors require for risky equity investments (i.e., at the 5.1 percent real net-of-tax rate of return on Standard and Poors portfolio from 1969 to 1994) implies a present value gain equal to more than 35 percent of the initial level of GDP. The benefit of achieving price stability therefore substantially exceeds its cost.

This welfare gain could in principle also be achieved by eliminating all capital income taxes or by indexing capital income taxes so that taxes are based only on real income and real expenses. Feldstein (1996, section 7) discusses the technical and administrative difficulties that are likely to keep such indexing from being adopted, an implication borne out by recent legislative experience. The magnitude of the annual gain from reducing inflation is so large that the expected present value of the gain from disinflating from two percent inflation to price stability would be positive even if there were a 50 percent chance that capital income taxes would be completely eliminated or the income tax completely indexed after ten years.

The analysis of this paper does not discuss the distributional consequences of the disinflation or of the reduced inflation. Some readers may believe that the output loss caused by the disinflation should be weighted more heavily than the gain from low inflation because the output loss falls disproportionately on lower income individuals and does so in the form of the large individual losses associated with unemployment. It would however take very large weights to overcome the difference between the five percent of GDP output loss of disinflation and the 35-plus percent of GDP present value gain from lower inflation.

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