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THE MACROECONOMIC EFFECTS OF A PAYROLL TAX ROLLBACK

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In late 1977, the U.S. Congress passed social security legislation that included a series of increases in the payroll tax. These increases, which began in 1979 and carry on into the 1980's, substantially raise the projected levels of the social security trust funds.[1/] Since the amendments were passed, there has been some discussion and several proposals to roll back part of the tax. It is highly likely that additional rollback proposals will be made in the near future. The purpose of this paper is to shed some light on some of the macroeconomic effects of a payroll tax rollback.

One of the major rationales underlying rollback proposals is the acceptance of the notion that payroll tax increases are inflationary. If true, it follows that a rollback would tend to at least partially relieve some of the current inflationary pressure in the economy. Presumably, the price reducing effect of a rollback is implied by a model in which prices are determined by costs of production. A cut in the employer portion of the payroll tax, a component of production costs, *ceteris paribus*, leads to a drop in prices. But the *ceteris paribus* condition is violated if other cost components are affected by the tax rollback. These other effects depend on the method used to finance the rollback and the shifting pattern of taxes.

A payroll tax cut can be financed by increased debt issue (which may or may not be monetized), by increases in other taxes, or by a decrease in government spending. Attention should be focused on the payroll tax cut-financing device package. With some financing devices, such as the value-added tax, other components of production costs are directly increased, offsetting the cost-reducing effect of the payroll tax cut. Since production costs and thus prices are likely to be sensitive to changes in aggregate demand, the demand effects of the package must also be considered.

The shifting pattern of taxes is also relevant in an analysis of the effect of a payroll tax rollback on costs and prices. If the rollback is shifted back to employees in the form of higher nominal earnings or fringe benefits, then the cost reducing effect is offset. The shifting pattern of the financing instrument may also lead to these indirect cost changes.

Our paper has three parts. First, we utilize an aggregate demand-aggregate supply model to more carefully delineate the channels that the payroll tax rollback package can take to affect the major macroeconomic variables: the price level and real output. Next, to quantify these effects we discuss simulation results obtained from two large scale econometric models. These simulations are conditional on a set of imposed tax shifting assumptions. In order to obtain the largest negative impact on the price level from the rollback, we assume no backward shifting of the employer portion of the payroll tax. Finally, we use U.S. time series data to directly estimate the extent of backward shifting of the payroll tax. Our results indicate that after three years about 80% to 90% of a payroll tax reduction is shifted back to labor in the form of higher nominal earnings and fringe benefits. Hence, the direct cost (and price) reducing effect of a rollback appears to be quite small.

I. Simple Theoretical Considerations

A useful point of departure for the analysis of the effects of a payroll tax rollback is the general theoretical framework of aggregate supply and aggregate demand. To keep the discussion as simple as possible, we work with a linearized version of the standard textbook model.[2/] While most macro policy analyses emphasize aggregate demand channels, we also discuss supply channels. These supply channels are especially relevant when considering the consequences of alternative tax shifting assumptions.

A. The Model

The supply-demand model we consider consists of three equations: an aggregate demand function given in (1); an aggregate supply (or price) equation given in (2); and an equilibrium condition given in (3):

(1) $Y^d = a(x,z) - b(x,z)\cdot P$

(2) $P = c(x,z) + d(x,z)\cdot Y^s$

(3) $Y^s = Y^d$

where

Y^d = real aggregate demand

Y^s = real aggregate supply

P = price level

x = vector of government policy instruments[3/]

z = vector of other exogenous variables.

Let us consider the demand and supply equations in turn.

1. Aggregate Demand

In figure 1, DD depicts the normal downward sloping aggregate demand curve from (1). Holding x and z fixed, real aggregate demand rises as the price level falls because of the standard expansionary effects of a rise in the real money supply. Policy changes, denoted by dx, and other exogenous variable changes, denoted by dz, operate on demand through the functions a and b by shifting and rotating DD in figure 1. To keep things simple, we assume that b is constant. Thus policy changes affect demand by causing shifts only. The differential of a, holding z constant, is the impact of a policy change on aggregate demand:

(4) $da = a_x \cdot dx$

The vector of partial derivatives, a_x, has long been a central focus of economic research. It includes work on the relative importance of monetary vs. fiscal policy in explaining movements in aggregate demand as well as studies on the wealth effect of government debt. It also includes, for example, the work by Feldstein (1974) and others on the effect of changes in the social security program on current consumption demand.

To catalog the net demand effect of a policy change, we use the terms expansionary ($da>0$), neutral ($da=0$), and contractionary ($da<0$). An expansionary demand effect, for example, is shown in figure 1 as a rightward movement of DD to D'D'.

2. Aggregate Supply

Figure 1 also depicts equation (2), the aggregate

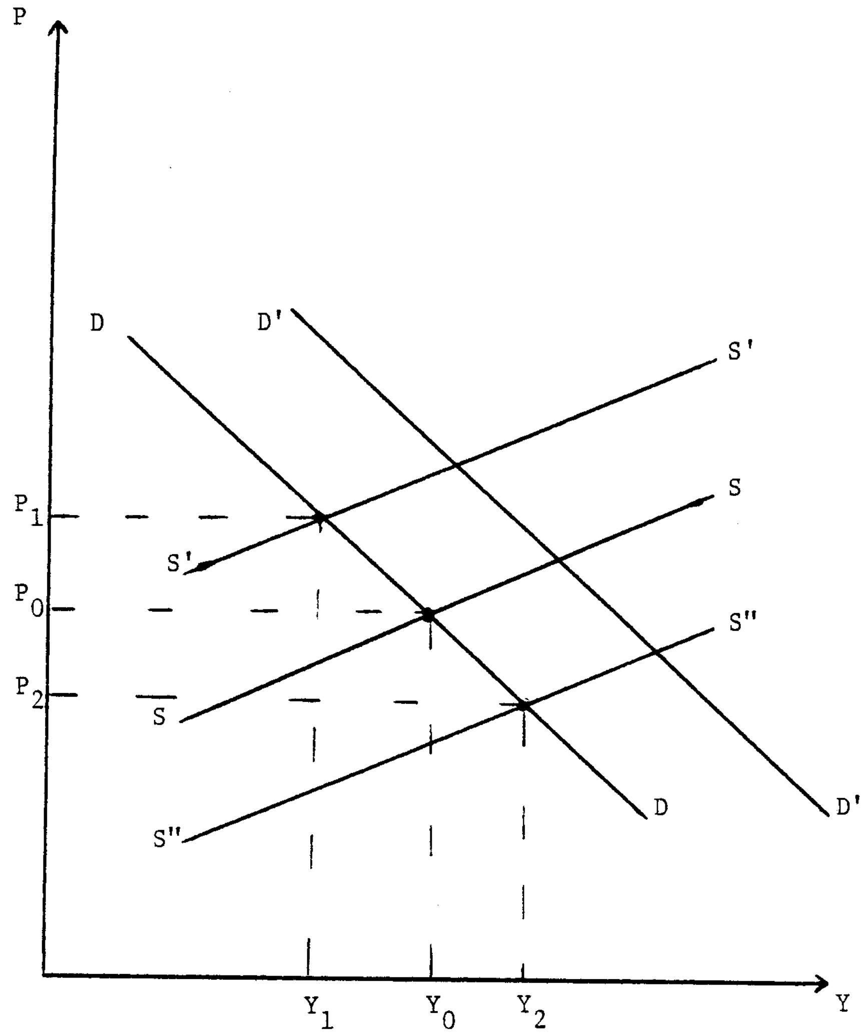

Figure 1

supply or price curve, SS. While a careful development of aggregate supply is beyond the scope of this paper, it is useful to briefly discuss this specification. We think of (2) as an average cost pricing model. The first component, c, is that part of average cost that is independent of output. The second component, $d \cdot Y^S$, varies positively with output supplied. This may be due to productivity decline, holding factor prices fixed, or to factor price increases necessary to increase the quantity of factors supplied needed for the extra production. In a completely classical world, of course, where all prices are perfectly flexible, where there is no money illusion, and where there is perfect foresight, the aggregate supply curve is vertical at potential output. If there is some price rigidity, some temporary money illusion and/or imperfect foresight, then the supply is upward sloping as in our model.[4/]

As with demand, policy changes (and other exogenous variable changes) operate on supply by shifting and rotating it via c and d. Again, to keep things simple, we assume that the slope of the supply curve is constant and policy changes only cause supply shifts. Thus, the differential of c, holding z fixed, is the impact of a policy change on supply:

(5) $dc = c_x \cdot dx$

The vector c_x has been the attention of the popular media and some scholarly research recently. For example, there has been much discussion of the cost (and price) increasing effect of government regulations and payroll taxes.[5/] As will be seen shortly, the time path of c_x must be fully considered if the price and output effects of policy changes are to be carefully evaluated. For now, we label the supply effect as inflationary when dc>0, neutral when dc=0, and deflationary when dc<0.

An inflationary supply effect is shown in figure 1 as the upward shift of SS to S'S'.

3. Equilibrium and Comparative Statics

By substituting (1) and (2) into (3), the equilibrium price and output levels are obtained. We can do comparative statics by analyzing the equilibrium price and output differentials:

$$(6) \quad dY = \frac{1}{1+bd} [a_x - b \cdot c_x] \; dx$$

$$(7) \quad dP = \frac{1}{1+bd} [d \cdot a_x + c_x] \; dx$$

By inspecting (6) we see that a policy change unambiguously raises output when the demand effect is expansionary ($a_x dx>0$) and the supply effect is deflationary ($c_x dx<0$). If the effects are expansionary and inflationary, then output rises only if the demand effect dominates the weighted supply effect, the weight being b, the price sensitivity of aggregate demand. On the other hand, if the policy change is contractionary ($a_x dx<0$) and deflationary ($c_x dx<0$), then output rises when the demand effect is dominated by the weighted supply effect.

A similar price level analysis follows from equation (7). Prices rise unambiguously from a policy change when it is both expansionary and inflationary. When the effects are contractionary and inflationary, prices rise if the inflationary effect dominates the supply slope (d) weighted contractionary effect.[6/] Note that a policy change could even raise prices when it is deflationary. This occurs when the weighted expansionary effect dominates.

4. Dynamic Effects

In figure 1 suppose DD and SS are initially relevant. Here (P_0,Y_0) is the initial equilibrium. Also suppose that Y_0 is potential or full employment output. Let us consider a policy change that has an inflationary supply effect (initially), shifting SS to S'S' and a neutral demand effect. Prices rise to P_1 and output falls to Y_1. If the policy change also reduces potential output to Y_1, then, in absense of further exogenous variable changes, the economy remains at (P_1,Y_1). Suppose, however, that potential output stays fixed at Y_0. Then there is excess supply in the factor markets at (P_1,Y_1) generating downward pressure on factor prices. As factor prices fall, average costs c fall bringing prices down. This process continues as long as output is below potential. Gradually (or rapidly) the economy moves along DD back to (P_0,Y_0) as S'S' shifts back down to SS. In other words, a policy change that is demand neutral and has no effect on capacity output only has a transitory effect on the price and output levels.

On the other hand, suppose the policy change is capacity increasing, pulling potential output up to Y_2. In this case, the initial inflationary effect (SS to S'S') is offset over time as factor prices fall in response to excess supply. Ultimately, the supply curve shifts down to S"S" resulting in lower prices and higher output at (P_2, Y_2).

5. Discussion

The time path of supply effects is a crucial ingredient of macro policy analysis. Unless a policy change causes a change in capacity output, supply effects are eventually neutral if factor markets tend to full employment over time. In other words, in absence of capacity effects, initial price increases resulting from dominant short run inflationary supply effects gradually are reversed. Needless to say, a policy change that validates the initial inflationary effect with an expansionary demand effect eliminates this reversal. We now use this simple framework to discuss a payroll tax rollback.

B. Payroll Tax Rollback

Let us now analyze a payroll tax rollback financed for the moment in an unspecified manner. We can split the policy vector x and non-output related average cost c into two components:

$$x = (x',t)$$

$$c = c'(x',t) + w^n(x',t)\cdot(1+t)$$

where

t = payroll tax rate

x' = all policy instruments other than t

w^n = non-payroll tax compensation rate

c' = non-labor average cost

The demand and supply effects of the payroll tax rollback ($dt<0$)

financed with a change in the other policy instruments (dx'), from (4) and (5), are:

$$da = a_{x'}dx' + a_t dt$$

$$dc = (c'_{x'} + (1+t)w^n_{x'})dx'$$
$$+ c'_t dt$$
$$+ (w^n + (1+t)w^n_t) dt$$

The demand effects are conceptually straightforward. The first term in the equation giving da is the effect of the instrument used to finance the rollback. The second term is the rollback effect. While the rollback effect is presumably positive, the instrument effect might be positive (an expansion of the money supply) or negative (an increase in other taxes or a reduction in spending). In this discussion we assume the overall effect of the package is demand neutral: da = 0.

The first term in the equation giving the supply effect, dc, is the effect of the financing instrument. If, for example, the value-added tax is used, then other production costs rise and $c'_x \cdot dx'$ is positive. The shifting pattern of the financing instrument may result in an altered compensation rate denoted by $(1+t)w^n_{x'}dx'$. The second and third terms indicate the supply effects of the rollback. The term $c'_t dt$ is the effect on non-labor average costs. The third term is the effect on average labor cost. If the cut simply results in higher non-payroll tax compensation, then the third term is zero. On the other hand, if part or all of the employer's share of the payroll tax cut is not passed back to labor, then average labor cost falls. It should be clear that the shifting patterns of the payroll tax as well as the financing instrument are crucial in determining the supply effect.

To illustrate this framework, let us consider the case where $c'_t = c'_{x'} = w^n_{x'} = 0$. The payroll tax has no effect on non-labor average costs and the policy instrument used to achieve the rollback has no supply effect. We continue to assume no demand effects. Figure 2 depicts the initial situation before the rollback with curves DD and SS. Let Y_0 be also equal to potential output. After the rollback the supply curve shifts down to S'S' denoting at most partial backward shifting initially. The economy moves to (P_1, Y_1) as prices drop and output rises due to the deflationary supply effect. If potential output remains at Y_0, say, because long run labor supply is inelastic, then Y_1 denotes a position of excess labor market demand putting upward pressure on non-payroll tax compensation w^n. Gradually, the rollback is shifted to labor as w^n rises shifting S'S' back up to SS in figure 2. The process stops once (P_0, Y_0) is attained.

If the rollback increases potential output to Y_2, say, because labor supply is wage elastic, then S'S' shifts upward until (P_2, Y_2) is attained. Here, as we noted earlier, the rollback ultimately has a price reducing effect as it raises capacity.

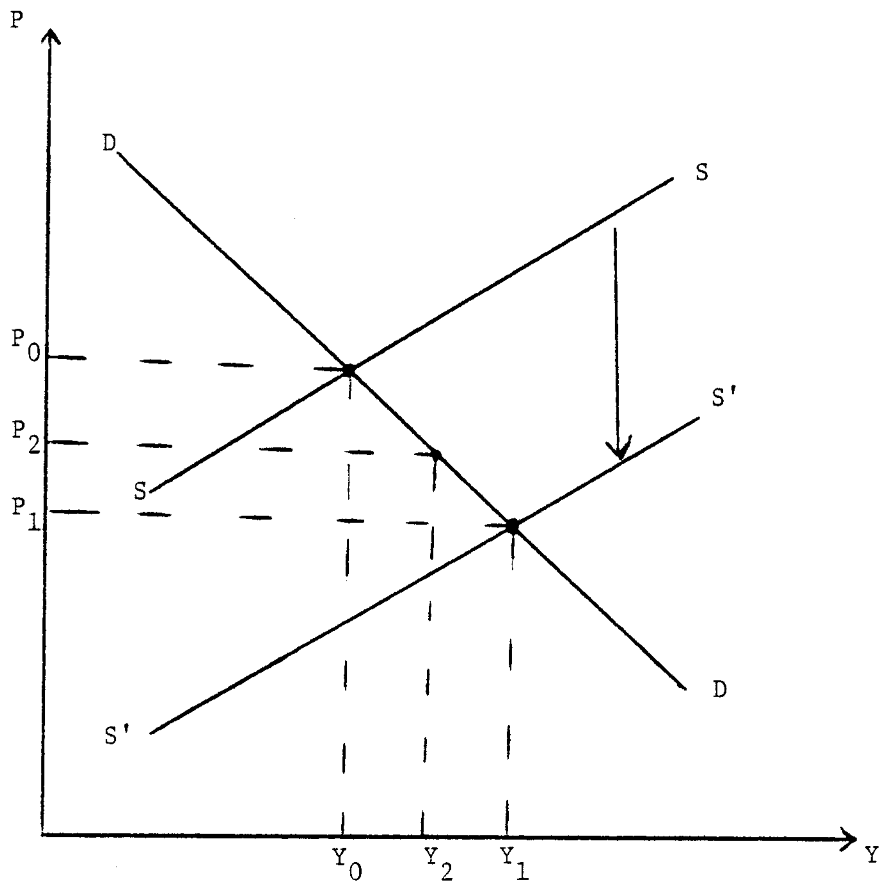

Figure 2

As a final note, suppose that the economy is initially at an output level below full employment. In absence of any policy change, market forces gradually shift the supply curve downward pushing the economy toward potential at a lower price level. In this case, a payroll tax rollback with neutral demand and deflationary supply effects can possibly help to speed the movement toward the lower price level with turnaround supply effects not arising.

C. Summary

The point of the preceding elementary survey was to identify what price and output effects we should look for, but it is of little interest itself without quantitative estimates of the parameters involved. In the next section we utilize two large-scale econometric models where at least some of the relevant parameters are estimated to simulate the effects of a rollback. Since these models treat payroll taxes in a rather primitive way, many of the parameters that govern the shifting pattern, central to the supply effects, must be imposed on them. In the final section, we discuss some empirical evidence on crucial parameters of the shifting pattern.

II. Simulation Comparisons

The objective of this section is to provide some rough estimates of the impact on output and the price level of alternative methods of financing a large payroll tax rollback. To achieve this objective, we run simulations on two large scale econometric models. The alternative financing methods we consider consist of increased federal debt and increases in various Federal taxes including the personal income tax, the corporation income tax, and a hypothetical value-added tax. We also consider an expenditure reduction as another financing method. Since there is some controversy over the degree and direction of shifting of the payroll tax, it would be desirable to provide alternative estimates of the effects conditional on imposed shifting assumption. This work is still in progress. In this paper we have chosen to impose the assumption that employer payroll taxes are not shifted back to labor. This assumption, which is not supported by our empirical results reported in the next section, allows us to estimate the largest price reducing effect of a payroll tax rollback. It should be noted, however, that the implementation of the no backward shifting assumption, as we briefly describe later, varies somewhat across the two models. Thus, the models' estimates vary because of slightly different imposed shifting assumptions as well as structural differences.

A. The Mikva-Nelson Proposal

The Mikva-Nelson proposal for payroll tax reduction is used for the analysis.[7/] It was chosen because it has been the subject of some public discussion during the past year, and is of substantial magnitude. The estimated amount of the tax cut provided by the proposal is indicated in Table 1 for the years 1979-1983. The analysis assumes the proposal is put into effect in January of 1979.

TABLE 1.--The magnitude of the Mikva-Nelson Tax Reduction Proposal, 1979-1983, billions of dollars

Year	Tax Cut Amount a/
1979	36.5
1980	40.8
1981	54.2 b/
1982	59.4
1983	64.6

a/ Based on taxable earnings estimates consistent with the central case economic assumptions in the Trustees Report (1978).

b/ The initial (1979) reduction due to Mikva-Nelson can be viewed as a lowering of the effective payroll tax rate. However, since there is a statutory rate increase scheduled for 1981, the Mikva-Nelson proposal would cause a second reduction in the effective rate in 1981. Thus, these simulations are like shocking the system twice (in 1979 and 1981) and the time paths of the variables reflect the second shock superimposed on the first rather than a pure dynamic multiplier time path.

B. The Models

The Chase Econometric Associates, Inc. (CEAI) and the Data Resources, Inc. (DRI) econometric forecasting models were used in the simulation exercises.[8/] Holding aside the implementation of the shifting assumptions for the moment, the exercise is straightforward. The payroll tax reduction-financing method package is introduced into the relevant equations, the model is solved, and a comparison is made of the simulated values of the key variables with the values of the same variables from a "baseline" solution (the Mikva-Nelson proposal is not introduced). We report the percentage difference of the two solutions as the estimate of the impact of the package.

Regarding the imposed shifting assumptions, we continue with CEAI's and DRI's treatment with respect to the personal income tax, the corporation income tax, and the value-added tax. We discuss these in the later sections. Regarding the employee payroll tax, we assume that it is borne by labor, while the employer payroll tax is assumed to be not shifted backward to labor. Due to model differences, however, we have been forced to treat the degree of forward shifting of the employer payroll tax in the form of price changes differently in the two models. In the CEAI model, the no backward shifting assumption is introduced into unit labor costs directly. The estimated parameters of the model then transmit changes in unit labor cost into changes in the aggregate price level. The estimated structure of the CEAI model implies only a partial effect on prices for changes in the employer payroll tax. Part of the tax is absorbed by nominal profits.

In the DRI model the no backward shifting assumption was implemented by adjusting the constant terms of the various price equations. This was necessary because payroll taxes are not generally among the cost variables included in the price equations in the DRI model.[9] Hence, the CEAI and DRI simulations differ regarding this shifting assumption to the extent that part of the tax is absorbed by profits in the CEAI model.

A simple example might clarify this difference. Consider the $36.5 billion payroll tax reduction for 1979 in the Mikva-Nelson proposal (see Table 1). As modeled by DRI, this is about a 2.4 percentage point reduction in the effective payroll tax rate.[10] Since payroll taxes are roughly evenly split between employee and employer, about 1.2 percentage points of the reduction in the effective rate are eligible for forward shifting. Since labor costs amount to about 2/3 of GNP, the potential effect on aggregate prices, ignoring any secondary wage-price spiral effects, is about a .8 percentage point reduction. In the DRI model, this estimate (.8 percentage points) was used to adjust the constant terms in the price equations. In the CEAI model, unit labor costs were lowered by the 1.2 percentage points and the model solution determined the amount of the price reduction ultimately achieved.

C. The Simulations

1. No output change

In our first simulation, we attempted to directly estimate the supply effect (using the GNP deflator) of the payroll tax reduction. Aggregate demand was therefore adjusted to keep output at its "baseline" value. The results are reported in Table 2. The ultimate effect (after 5 years) is a .7% lower price level according to the CEAI model and a larger (1.6%) reduction according to DRI.

The results reported in Table 2 illustrate the problem mentioned earlier in comparing model simulations. Based on the "back of the envelope" calculation described earlier, a .8 percentage point reduction in the price level was expected for this size tax cut (excluding secondary effects). The CEAI estimate barely reached .8 and thus, since this estimate includes some wage-price spiral effects, reflects some absorption of the employer tax by profits. The DRI results, on the other hand, are substantially above .8. Since the procedure for incorporating the no backward shifting assumption in the DRI model presumes full forward shifting onto prices, the possibility of partial absorption in profits is precluded. The differing strength of the wage-price spiral effects in the two models also causes differences in these results. We have not as yet been able to disentangle the differences resulting from different degrees of forward shifting and differing wage-price spiral effects.[11]

TABLE 2.--Cumulative Impact on the GNP Deflator of the Mikva-Nelson Proposal, 1979-1983, in percent holding the change in real GNP at zero.

Year	CEAI	DRI
1979	-.5	-.4
1980	-.7	-.9
1981	-.75	-1.3
1982	-.8	-1.4
1983	-.7	-1.6

2. Debt Financing

The second simulation allowed output to vary. Here the payroll tax cut was financed by an increase in government debt. The results for the two models are given in Table 3 and, as in Table 2, the entries represent the cumulative effect of the tax cut-debt financed package relative to the "baseline" simulation. The symbols used in Table 3 (and all following tables) are defined as: Y72, 1972 dollar GNP; and PY72, price deflator for GNP.

The impact on output (Y72) in the debt financing case is substantial in both models, peaking at 2% above "baseline" in CEAI and 2.2% above "baseline" for DRI. A deflationary expansion proceeds for the first two years. From 1981 onward, however, this trend is reversed as other inflationary supply effects arise causing output to drop back toward "baseline" and prices to move upwards. In the DRI simulation, prices are 1.6% above "baseline" by 1983 as the five-year expansionary demand effect on prices dominates the five-year deflationary supply effect. Comparing these results with the pure deflationary effects given in Table 2, we find that the expansionary demand effect on prices is 3.2% in DRI while only .55% in CEAI. This differing sensitivity of prices to aggregate demand changes is a major factor in comparing the simulations of the two models.

3. Personal Income Tax Financing

Our next experiment was to finance the payroll tax cut by an increase in the personal income tax. The results are reported in

TABLE 3.--Cumulative Output and Price Effects of the Mikva-Nelson Proposal with debt financing, 1979-1983, in percent

Year	CEAI		DRI	
	Y72	PY72	Y72	PY72
1979	.6	-.3	1.4	-.3
1980	1.5	-.5	2.2	-.2
1981	1.9	-.5	2.2	.2
1982	2.0	-.4	1.8	.9
1983	1.8	-.15	1.4	1.6

Table 4. The introduction of this package leads to a reduction of prices in both models. By 1983 CEAI indicates that the GNP deflator will be 1.6% below "baseline," while DRI predicts a 1.1% drop. The models diverge, however, in the output effects. CEAI predicts that real GNP will be .45% below "baseline," while DRI predicts a .4% increase by 1983. Since personal income taxes are assumed not to be forward shifted in price changes, the deflationary supply effects of this package are the same as those given in Table 2.

It is useful to compare Tables 3 and 4. The difference in results essentially measures the differential aggregate demand effect of income tax rather than debt financing of the payroll tax cut. In both models this financing switch is contractionary. For the CEAI model income tax financing by 1983 results in a 1.45% larger price drop than debt financing at the cost, however, of a 2.25% lower real GNP. For the DRI model income tax financing results in a 2.7% lower price level than with debt financing at a cost of 1% lower real GNP. As before, the differences in these tradeoffs arise because of the greater sensitivity of prices to output changes in the DRI model.

4. Financing by Expenditure Reduction

The impact on output and prices of the payroll tax cut financed by an expenditure reduction is given in Table 5. As with income tax financing, this package results in some price reduction. By 1983 the GNP deflator is 2.3% below "baseline" in both DRI and CEAI. Output drops below "baseline" in both models with a somewhat larger drop in the CEAI simulation.

TABLE 4.--Cumulative Output and Price Effects of the Mikva-Nelson Proposal financed by a personal income tax increase, 1979-1983, in percent

Year	CEAI		DRI	
	Y72	PY72	Y72	PY72
1979	-.3	-.3	.1	-.4
1980	-.5	-.7	.4	-.8
1981	-.6	-1.0	.4	-1.0
1982	-.5	-1.3	.5	-1.1
1983	-.45	-1.6	.4	-1.1

TABLE 5.--Cumulative Output and Price Effects of the Mikva-Nelson Proposal financed by a reduction in Federal Government expenditures, 1979-1983, in percent

Year	CEAI		DRI	
	Y72	PY72	Y72	PY72
1979	-1.2	-.5	-.6	-.5
1980	-1.0	-.9	-.1	-1.1
1981	-1.0	-1.4	-.2	-1.7
1982	- .9	-1.9	-.2	-2.0
1983	- .8	-2.3	-.1	-2.3

It is useful to compare Tables 4 and 5. The difference in results reflect the differential aggregate demand effect of financing the payroll tax cut by expenditure reduction rather than income tax increase. As expected, because of the balanced budget multiplier, this substitution is contractionary. By 1983 CEAI predicts it would result in a .7% lower price level at a cost of .35% lower output. DRI predicts a 1.2% lower price level with a cost of .5% lower real GNP.

This package yields the largest drops in both the price level and output level compared to "baseline" in all of our simulations. The 2.3% price drop by 1983 can be viewed as the most optimistic prediction in terms of price drop of the Mikva-Nelson Proposal. It hinges upon the assumption imposed in the models that the employer payroll tax is not shifted backward and on the use of the most contractionary financing method, an expenditure reduction. It should be noted that the deflationary supply effect of the payroll tax cut offsets to some extent the contractionary demand effect of the package in terms of output. If the employer payroll tax were shifted backward, then this deflationary supply effect is absent and the contractionary demand effect results in even larger output drop.

5. Value-Added Tax Financing

Our fifth simulation allowed for a value-added tax financing of the Mikva-Nelson payroll tax cut proposal. In both models it was assumed that the value-added tax is shifted forward in higher prices. Since only half of the payroll tax, the employer share, at most was assumed to be shifted forward, the differential supply effect of this package is inflationary. This simulation is reported in Table 6. Both CEAI and DRI forecast a rise in the price level. The effect on aggregate demand from this package is unclear. A priori, one would expect little effect. Apparently in DRI the package is slightly expansionary since by 1983 the expected fall in output from the inflationary supply effect does not occur. In CEAI, on the other hand, output is a relatively large 2.4% below "baseline" by 1983. Here the negative effect on output from the inflationary supply effect of the package is not offset by an expansionary demand effect. In fact, the demand effect could be contractionary in CEAI.

6. Corporate Income Tax Financing

Our final simulation was to finance the payroll tax cut by an increase in the corporate income tax. Our results are shown in Table 7. In this simulation the corporate income tax was assumed not to be shifted backwards to wages nor forward into prices. Hence, the supply effect of this package is deflationary (as in Table 2). If we had assumed that some or all of the tax is shifted forward in higher prices as some economists believe, then the supply effect would have been less deflationary (and possibly inflationary). In both models, the package is forecasted to reduce prices. By 1983 the GNP deflator is 1% below "baseline" in CEAI and .7% below

TABLE 6.--Cumulative Output and Price Effects of the Mikva-Nelson Proposal Financed by a Value-Added Tax Increase, 1979-1983, in percent

Year	CEAI		DRI	
	Y72	PY72	Y72	PY72
1979	-1.3	1.5	.5	.2
1980	-1.8	1.6	.4	.7
1981	-2.2	2.0	.1	.8
1982	-2.3	1.9	0	0
1983	-2.4	1.7	0	0

TABLE 7.--Cumulative Output and Price Effects of the Mikva-Nelson Proposal Financed by a Corporate Income Tax Increase, 1979-1983, in percent

Year	CEAI		DRI	
	Y72	PY72	Y72	PY72
1979	-.2	-.3	.6	-.4
1980	.1	-.6	.6	-.6
1981	-.1	-.8	.2	-.8
1982	-.4	-.9	0	-.8
1983	-.6	-1.0	.1	-.7

"baseline" in DRI. Since this package was predicted to have a smaller negative effect on prices than either the personal income tax financed package (see Table 4) or the package with expenditure reduction (see Table 5), we had expected the output effects to be less pessimistic. This turned out not to be the case. For CEAI our simulations imply that a switch from personal income tax to corporate income tax financing by 1983 generates a .6% higher price level and a .15% lower real GNP. The corresponding DRI projections are a .4% higher price level and a .3% lower output level.

D. Summary

The effects of the various packages as simulated by CEAI and DRI, given our assumptions about the shifting of the various taxes, are summarized in Table 8. While the two models differ markedly, some common qualitative results emerge. First, debt financing of the payroll tax reduction is most expansionary as one would expect. All other financing methods lead to a reduction in output in the CEAI model. In DRI the other methods lead to mostly insignificant output change. Second, financing the payroll tax reduction by a corresponding expenditure reduction generates the largest negative effect on prices. In both models the GNP deflator is 2.3% below "baseline" by 1983 with the expenditure reduction package. However, output is predicted to fall slightly below "baseline." Third,

TABLE 8.--The Cumulative Output and Price Effects of the Mikva-Nelson Proposal Financed by Alternative Methods, 1983, in percent

Financing Method	CEAI		DRI	
	Y72	PY72	Y72	PY72
Debt a/	1.8	-.15	1.4	1.6
PIT b/	-.45	-1.6	.4	-1.1
E c/	-.8	-2.3	-.1	-2.3
VAT d/	-2.4	1.7	0	.9
CIT e/	-.6	-1.0	.1	-.7

a/ An increase in Federal Debt, from Table 3.
b/ An increase in Personal Income Tax, from Table 4.
c/ A reduction in Federal Government Expenditures, from Table 5.
d/ An increase in a hypothetical Value-Added Tax, from Table 6.
e/ An increase in the corporate income tax, from Table 7.

personal income tax financing roughly lies between debt financing and expenditure reduction in terms of output and price effects. This package would cause prices to drop somewhat more than 1% below "baseline" with probably minimal output effects. Fourth, the value-added tax is an inferior financing method in terms of price and output effects. In CEAI all other methods lead to larger output and lower prices. In DRI both the personal and corporate income tax methods lead to higher output and lower prices. While DRI estimates that expenditure reduction is .1% more contractionary in terms of output, it is 3.2% more deflationary. Fifth, the corporate income tax as a financing method is dominated by the personal income tax in terms of price and output effects. This domination would be greater if part of the corporate income tax is shifted forward in higher prices.

III. The Shifting of the Payroll Tax

The simulations reported in the last section were conditional on the set of shifting assumptions imposed on the models. This section reports on empirical work using time series data on the shifting pattern of the payroll tax. We focus only on the effect of payroll tax changes on the time path of nominal compensation ignoring the question of how much of the tax results in higher prices.[12/] The approach we take follows other work in this area quite closely.[13/]

A. The Model

Disregarding taxes for the moment, the rate of change of nominal compensation, say $\overset{o}{w}$, is typically modeled as depending on excess labor market demand, ED, and expected price inflation, $\mathring{P}^e$. The linear form of this expectations-augmented Phillips Curve is:

(8) $\mathring{w} = \alpha_0 + \alpha_1 \, ED + \alpha_2 \, \mathring{P}^e$.

Coefficient α_0 measures real compensation growth, approximately equal to average labor productivity growth. Coefficient α_1 measures the sensitivity of compensation to excess demand in the labor market. If $\alpha_1=0$, then disequilibrium in the labor market has no effect--this is the rate of change equivalent to the Keynesian rigid wage assumption and it results in a flat Phillips Curve. As α_1 rises, the Phillips Curve steepens and labor markets move to equilibrium more rapidly. Coefficient α_2 is a measure of the degree of money illusion displayed in the labor market. If there is no money illusion, individuals being concerned with expected real compensation and its time path, then $\alpha_2=1$. If there is complete money illusion, then $\alpha_2=0$.

Other variables could be added to equation (8) to explain $\mathring{w}$. Some researchers have added measures of profits (or deviations from their trend), arguing that labor is more "militant" in its wage demands when profits are high. Others have added lagged wage changes $\mathring{w}_{-1}$ (instead of $\mathring{P}^e$) to capture relative wage effects. Dummy variables for guideline and control periods are sometimes used. In general, however, ED and $\mathring{P}^e$ tend to be the most significant explainers of wage inflation.[14/]

Measuring ED and $\dot{P}^e$ has been approached in a variety of ways. In its simplest form ED is measured by the negative of the unemployment rate. A desirable refinement is adding back in the equilibrium or natural unemployment rate. With respect to inflation expectations $\dot{P}^e$, more fundamental problems arise since there is no well developed, theoretically appealing method of measurement. Adaptive expectations models are commonly used where $\dot{P}^e$ is assumed to be a linear function of past observed inflation rates. It has been argued that the adaptive expectations model is based on irrational behavior because relevant information is not utilized. Friedman (1979), however, has recently defended the model.

Shifting of the payroll tax can be estimated using this Phillips Curve framework. As in section I, we split nominal compensation into non-payroll tax compensation, w^n, and payroll taxes (employer and employee), T:

$$w = w^n + T$$

Since employer and employee taxes are highly correlated, it is impossible to directly disentangle their separate effects. Hence, we proceed as if there is just one tax. Letting t be the effective payroll tax rate with base w^n:

$$t = T/w^n$$ [15]

we have

$$w = w^n(1+t)$$

In percentage changes this becomes:

(9) $\overset{o}{w} = \overset{o}{w}^n + \overset{o}{(1+t)}$

By substituting (9) into the expectations-augmented Phillips Curve in (8) we have:

$$\overset{o}{w}^n + \overset{o}{(1+t)} = \alpha_o + \alpha_1 \, ED + \alpha_2 \, \overset{o}{P}^e.$$

This specification is restrictive, however, because it does not allow for anything other than 100% backward shifting of the payroll tax. By relaxing the coefficient on $\overset{o}{(1+t)}$ and moving the term to the right-hand side of the equation, the amount of backward shifting can be estimated:

(10) $\overset{o}{w}^n = \alpha_o + \alpha_1 \, ED + \alpha_2 \, \overset{o}{P}^e + \beta \, \overset{o}{(1+t)}$

In (10) if $\beta = 0$, then a payroll tax change, say $\overset{o}{(1+t)}>0$, has no effect on non-payroll tax compensation, w^n. In other words, there is no backward shifting and nominal compensation, w, rises by the full amount of the tax increase. If $\beta = -1$, then w^n drops by the full amount of the tax increase and there is no change in the path of w, indicating complete backward shifting. In general, the absolute value of β measures the fraction of a payroll tax increase that is borne by labor in the form of lower non-payroll tax compensation.

To allow for lags in the shifting process,[16] we let the general form of (9) be:

(11) $\overset{o}{w}^n = \alpha_o + \alpha_1 \, ED + \alpha_2 \, \overset{o}{P}^e + \beta_o \, \overset{o}{(1+t)} + \beta_1 \, \overset{o}{(1+t)}_{-1} + \ldots + \beta_n \overset{o}{(1+t)}_{-n}$

The time path of the shifting process can be determined from the β_i's, while the cumulative fraction of a tax increase that results in lower w^n is the absolute value of the sum of the β_i's.

B. Empirical Results

We have estimated a variant of (11) using annual time series data for the period 1954-76. Our main objective was to provide some evidence on the nature of the β_i's.

Our results revealed a consistent though unusual pattern. The sum of the estimated β_i's indicated that most of the OASDHI payroll tax is backward shifted after three years. However, the coefficients on the lagged tax rates imply more than 100% backward shifting (about 130% of the combined employee and employer tax) after two years. A positive coefficient on taxes lagged two years reverses the process implying about 80% to 90% of the combined tax is backward shifted after three years. In addition, our results provide no evidence for backward shifting of the employer tax for unemployment insurance. The regressions that these conclusions are based upon are reported in Table 9 and the variables used are defined in the following glossary.

It is important to bear in mind the nature of the wage change measure used as the dependent variable in the regressions. It is, as defined in the glossary, a measure of a private non-farm wage rate including non-social insurance supplements. It is obtained by weighting the non-farm index of production worker wages adjusted for inter-industry shifts and overtime, by the ratio of aggregate wages, salaries and supplements (WSS) less government wages and salaries less aggregate social insurance contributions (TW) to aggregate wages and salaries (WS) less government wages and salaries. It is clearly an artificial construct which approximately equals private WSS less private TW. The numerator of the adjustment ratio is used as the tax base to construct three average tax rates: t = TW/base, the total social insurance tax rate; t_1 = TOASDHI/base, the OASDHI combined employer and employee tax rate; and t_2 = TUI/base, the employer unemployment insurance tax rate.

Equation (1) in Table 9 shows the basic Phillips curve equation with $\overset{o}{P}{}^e = a_1\overset{o}{P} + a_2\overset{o}{P}_{-1}$ as the inflation expectations specification and dummies for the 60's guideposts (DGP) and 70's Nixon controls (DNC). Only the components of the price expectations variables are statistically significant. All variables have expected signs.[17/] This specification of the Phillips curve, as indicated above, implicitly assumes that social insurance taxes are not backward shifted (employer and employee).[18/]

Equation (2) is the result when the total social insurance tax rate is added with two lagged values. All coefficients now are statistically significant. The sum of the β_i's indicates about 63% of combined employer and employee social insurance taxes are

Table 9 [a/]

	(1)	(2)	(3)	(4)
Constant	2.30	2.80	2.81	2.82
RU*	-.102 (-.9)	-.194 (-3.2)	-.228 (-4.5)	-.226 (-4.2)
$\overset{o}{P}$	.438 (4.3)	.441 (7.5)	.466 (9.3)	.467 (8.9)
$\overset{o}{P}_{-1}$	.381 (3.5)	.346 (6.0)	.322 (6.6)	.321 (6.3)
DGP	-.465 (-1.4)	-.669 (-3.9)	-.563 (-4.1)	-.566 (-3.8)
DNC	1.09 (1.9)	1.17 (4.2)	1.08 (4.5)	1.09 (4.0)
$\overset{o}{(1+t)}$		-.731 (-4.8)		
$\overset{o}{(1+t)}_{-1}$		-.315 (-2.2)		
$\overset{o}{(1+t)}_{-2}$		.417 (2.7)		
$\overset{o}{(1+t_1)}$			-.820 (-5.8)	-.821 (-5.6)
$\overset{o}{(1+t_1)}_{-1}$			-.429 (-3.1)	-.433 (-2.9)
$\overset{o}{(1+t_1)}_{-2}$			.359 (2.4)	.359 (2.3)
$\overset{o}{(1+t_2)}$				-.044 (-.1)
$\Sigma\beta_i$	0	-.629	-.890	-.895
$\bar{R}^2$	.923	.981	.987	.986
DW	2.26	2.37	2.68	2.68

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a/ The dependent variable is $\overset{o}{w}^n$. The numbers in parentheses are t-ratios. The sample period is 1954-76.

Glossary

RU = Unemployment rate.

NRU = Natural rate of unemployment (Gordon (1978)).

RU* = RU - NRU.

$\overset{o}{P}$ = % change in GNP deflator.

DGP = Kennedy-Johnson guidepost dummy equals one in 1962-1966.

DNC = Nixon controls dummy equals .25 in 1971 and one in 1972.

t = TW/WSS-WSG-TW

TW = Contributions for social insurance.

WSS = Wages, salaries and supplements.

t_1 = (TOASDHI-TSE)/WSS-WSG-TW.

TOASDHI = Employer plus employee contributions for OASDHI.

TSE = Self-employed contributions for OASDHI.

t_2 = TUI/WSS-WSG-TW.

TUI = Employer contributions for unemployment insurance.

$\overset{o}{w}{}^n$ = % change in w^n.

w^n = J·(WSS-WSG-TW)/(WS-WSG).

J = Index of private non-farm adjusted wage rate.

WS = Wages and salaries.

WSG = Wages and salaries of government workers.

backward shifted after three years. The shifting pattern described above is apparent in (2) and all subsequent regressions with the tax rates included. When $(1+\overset{\circ}{t})_{-3}$ is added (not reported), its coefficient is negative, but small with a t-ratio considerably less than one. The other coefficients are virtually unchanged. The introduction of the tax rate raises the $\bar{R}^2$ from .923 to .981 and enhances the fit of the Phillips curve variables, indicating that the equation is probably misspecified without taxes.[19]

Equations (3) and (4) are the result of separating the OASDHI tax (t_1) and unemployment insurance contributions (t_2) from total social insurance taxes (t). Equation (3) implicitly assumes all non-OASDHI taxes are potentially shifted forward in the first year.[20] OASDHI taxes are introduced with possible lags of up to two years as in (2). The lag pattern on OASDHI taxes is the same as in (2) for total taxes. About 89% of OASDHI taxes are shifted backward after 3 years. When lags of up to two years on t_2 are introduced (not reported), all coefficients on $(1+\overset{\circ}{t}_2)$ are insignificant. Only the equation with $(1+\overset{\circ}{t}_2)$ unlagged is reported (4) showing that the implicit constraint in (3), (zero coefficient on $(1+\overset{\circ}{t}_2)$) is valid.

The general results that emerge from Table 9 are as follows. First, adding social insurance taxes to our specification of the Phillips curve enhances the statistical properties of the estimated equation. Second, there is evidence of some potential forward shifting of social insurance taxes, though much less for OASDHI taxes. Finally, the lag pattern on OASDHI taxes is counterintuitive, though there may be a theoretical justification for such a pattern.[21/] We have estimated several other versions of the aggregate wage equation, using variants on the measures of wages, prices and tax rates, as well as dropping the 1974-76 observations from the sample. The same saw-tooth adjustment pattern was evident in virtually all of the alternative specifications.[22/] It is worth noting that Gordon (1971) found a similar pattern with quarterly data and a shorter sample period. Since we have no convincing explanation for this pattern, our results concerning the time pattern of the shifting of payroll taxes should be viewed cautiously.

IV. Conclusion

Our discussion of the macroeconomic effects of a payroll tax rollback should be viewed as an outline of the major issues which should be raised in analyzing such proposals. We have emphasized that aggregate supply effects and the method of financing the rollback are important considerations which often are barely mentioned when changes in the payroll tax are proposed. We have presented simulation results for a specific proposal to rollback OASDHI taxes under alternative financing methods. Although this analysis is not "clean" in the sense that it confirms to a textbook multiplier problem, it does shed some light on the relative size of the inflation and output effects of the proposal under an extreme incidence assumption. Finally, we have provided some additional evidence on the time path of payroll tax incidence.

Our empirical results provide tentative support for the hypothesis that OASDHI payroll taxes are backward shifted. They also indicate that other non-OASDHI social insurance contributions (primarily unemployment) are much less likely to be backward shifted. We are currently extending our empirical analysis of both of these issues.

At this stage our work indicates that a payroll tax rollback is unlikely to be a significant disinflationary policy. If the inflationary impact of the payroll tax is small, then other issues such as the distributional effects are clearly more relevant in the evaluation of a rollback.

FOOTNOTES

*We thank John Brittain, Peter Petri, and Wayne Vroman for their helpful comments on this work, and Rick Rosen for computer assistance. This paper was presented at the 1979 Eastern Economic Association meetings in Boston.

1/ For a summary of the legislation and its impact on the trust funds see Wendel (1978).

2/ For clear presentations, see Dornbusch and Fischer (1978) and Branson (1979)

3/ Christ (1968) has emphasized that policy instruments must be modeled as being mutually consistent (i.e., they satisfy a budget constraint). We assume that x is in the set of feasible instruments.

4/ See Dornbusch and Fischer (1978), chapter 11, for a simple and illuminating development of the price equation.

5/ Crandall (1978) has discussed the price increasing effect of many government policies.

6/ This point has been made by Hansen (1971), Blinder (1973), and Pitchford and Turnovsky (1976) and others.

7/ The Mikva-Nelson Bill (H.R.12719, S.2503, 95th Congress, 2nd Session) proposes financing the Hospital Insurance (HI) and Disability Insurance (DI) parts of OASDHI from general revenues. Its effect on payroll taxes is to lower the statutory rate by the amount allocated to these programs (approximately 1/3 of the total statutory rate). The proposal does not specify a method of financing this rate reduction.

8/ The DRI simulations were based on CONTROL5Y0578 and were done using the 1978A version of the Macro-model. The CEAI simulations were based on the Chase Econometrics Simulation System, Version 2, 1978.

9/ We have been informed by DRI that the current (1979) version of their Macro-model includes payroll taxes among the cost variables determining prices.

10/ In the DRI model, the effective payroll tax rate equals total social insurance contributions divided by total wages, salaries, and supplements.

11/ The 1.6% reduction in the price level for DRI does not imply a wage-price multiplier of two since it includes the effect of the second (1981) reduction in the effective payroll tax rate.

12/ The effect of the tax change on the time path of prices is also needed if the real incidence of the payroll tax is at issue. Then the time path of real compensation could be determined. For research on the real incidence of the payroll tax, see Brittain (1971, 1972a, 1972b), Feldstein (1972), and Vroman (1974a).

13/ For examples of estimating the shifting of the payroll tax using wage equations, see Perry (1970), Gordon (1971), Vroman (1974b), Taub, et al. (1977), and Schnabel and Schnabel (1978).

14/ For a recent survey on the Phillips curve, see Santomero and Seater (1978).

15/ This is only approximately correct since payroll taxes are not levied on employer contributions for fringe benefits which are included in w^n.

16/ There may also be adjustment lags for changes in ED and $\overset{o}{P}^e$.

17/ The coefficients on DGP and DNC can be interpreted as reflecting the relative effectiveness of wage vs. price controls during these two periods. A positive sign (as appears on DNC) means that price controls were more successful in reducing price increases than were wage controls in reducing the growth of earnings plus private fringes. If price controls were effective, they would impact negatively on wage changes through current price changes in our specification. A positive coefficient on the dummy variable offsets this negative effect if wages were not effectively controlled. When DNC was dropped from the equation, the coefficients on the other variables were unaffected. These results are, of course, not strong evidence on the relative impact of the two post-war control programs. Our purpose here is to estimate the shifting pattern of the payroll tax in a "well-specified" wage equation. Thus, the inclusion of the control dummies is justified purely on goodness-of-fit grounds.

18/ The coefficients in the estimated equation are also subject to simultaneous equation bias. Indeed, both $\overset{o}{P}$ and (RU-NRU) are endogenous variables in a simultaneous system determining output, prices and employment. At this stage (along with most other authors), we have chosen to assume this bias can be ignored.

19/ Since the denominator of the effective tax rate appears as part of the dependent variable, the coefficient on the current period tax rate may be subject to negative spurious correlation bias. We did estimate similar equations using the statutory OASDHI tax rate with little change in the estimated lag pattern. We chose to use the effective rate since there appears to be no satisfactory alternative which allows for the inclusion of the taxable maximum in the definition of the payroll tax rate.

20/ The bulk of non-OASDHI social insurance contributions other than unemployment insurance payments are not relevant in an analysis of private sector compensation since they are for government employee programs. One reason for separating OASDHI and unemployment insurance contributions is that backward shifting of the latter may be more difficult since the tax is firm specific. That is, the firm's unemployment insurance tax depends on its own workers' unemployment experience.

21/ The extent of backward shifting depends on the elasticities of labor demand and labor supply. If these elasticities are time dependent, then there is no theoretical reason for expecting a smooth adjustment process. For example, if labor supply is more elastic with respect to a wage change after three years than after one or two years, then, assuming a constant demand elasticity, the amount of backward shifting is less after three years than after two years.

22/ Included among the alternatives were equations using the percent change in the consumer price index ($\overset{o}{\text{CPI}}$) as the price variable. The results including $\overset{o}{\text{CPI}}$ indicated a shifting pattern similar to the one reported in Table 9.

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